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Programming Sustainable Urban Nodes for Spontaneous, Intensive Urban Environments

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Abstract. Urban development nowadays, not only in Poland but also throughout the world, is an important issue for planners, municipal authorities and residents themselves. New structures generated in spontaneous urban and suburban areas constitute randomly scattered seeds of excessive residential and little commercial functions which therein appear more often as temporary or even ephemeral installations emerging where it is temporarily needed. The more important special services are provided rarely. Correct thinking about creating cities involves simultaneous thinking on providing different basic functions required by local communities, but at the same time recognizing temporal fluctuations and distinction on what kind of amenities have to be provided in particular area permanently (such as e.g. medical care, preventive services and schools), with others retaining its mobile, non-formal character. An even greater problem is a restoration of urban structures in the areas affected by natural disasters or leftover areas being previously war zones, where similar deficits have significantly higher impact being potential cause of higher toll in human lives, if no functional nodes providing essential functions survived. The Ariadne's Thread is a research project which proposes infrastructure and nodes for such urban areas. It develops new framework for creating nodes not only aimed at fulfilling basic needs of people but achieving social integration and build stability for fragile communities. The aim of the paper is to describe the process of identification of a relationship between needs of the inhabitants and both programmatic and ideological approach to Ariadne's Thread (AT) node giving ultimately its architectural interpretation. The paper will introduce the process of recognition of local needs, the interpretive and/or participatory mechanisms of establishing the node as a response to this recognition containing conceptual programming, socio-cultural programming, and functional programming (services). Then, the aspect of permanence or temporality will be addressed to determine the choice of appropriate technologies used in order to convey programmatic assertions into physical solutions. The nodes are meant to be as lightweight installments in the area as possible, but at the same time as durable and of good quality as to support positive social effects and reinforce building social capital in the area. The author believe that this emergency-based AT node scenario can be extrapolated to unbalanced housing areas being the result of urban sprawl, after being only slightly adjusted to local standards. But the main goal is to allow for efficient interventions in areas in dire needs and poor environments with limited resources or limited funds.

1. Introduction

In the era of rapid and intensive development of cities, it is important to develop methods and techniques to create tissues to meet the needs of people living in this area. Nowadays in Poland, rapidly emerging

new urban tissues are disorganized, often lacking in functions, most often involving education, cultural centres and special services, while overthrowing less important functions such as shopping centres. Most often, this is the lack of facilities of special units, which are inadequate. The same applies to education. The overwhelming demand for commercial and service functions is noticeable. Considering this problem, the author starting point for the research is to develop a requirement for newly emerging urban tissues in areas beyond the local borders.

Research conducted by the author aims to diagnose the relations between the needs of the inhabitants of fragment of the urban area and concentrated in certain important point program of functional urban node and its architectural interpretation with recognizing temporal fluctuations and distinction on what kind of amenities have to be provided in particular area permanently. In author's opinion, it is important to find the functional dependence of the urban area by the management of research in the meta layer, as a result of which will be laid programming method of urbanized environment. The final implementation will be preceded by evidence of effectiveness conducted, and then will be proposed mechanisms for creating urban node.

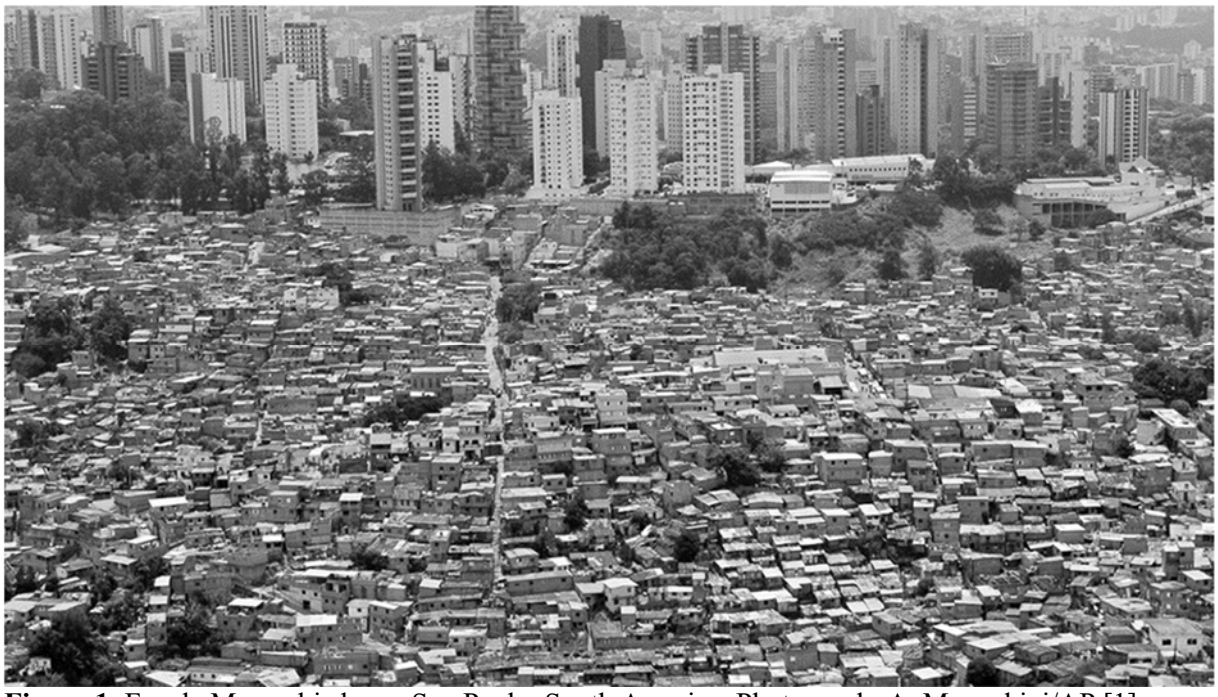

Figure 1: Favela Morumbi slums, Sao Paulo, South America. Photograph: A. Meneghini/AP [1]

By developing new urbanization issues, the author examines cases such as areas of rapid development, areas devastated by slums, areas affected by natural disasters, and areas being subject to war. By creating programming schemes for urban areas with such extreme needs, it is possible to work out the mechanisms of their creation by narrowing the factors affecting their shape.

2. The Ariadne's Thread.

The issue of creating urban nodes and their methods of programming is part of the Ariadne's Thread research. This research project proposes infrastructure and nodes for urban areas such as areas affected by natural disasters or leftover areas being previously war zones. It develops new framework for creating nodes not only aimed at fulfilling basic needs of people but achieving social integration and build stability for fragile communities.

Ariadne's Thread research is a pilot project, with its first stage focused on the attempt to integrate four main urban systems: signage system, urban lighting, local telecommunication facilitating devices, and security system components [2]. The project assumes the implications for the previously described

urbanized areas with low interference in space, but with an extensive program of autonomous mechanisms. The components that make up Ariadne's Thread are centrally patched editing points, that is: PLN - permanent local node (a privileged location, central for an area, optimally, the best site for location of PLN would allow to host the majority or all emergency / municipal units assuming 5 to 10 minutes reaction time, depending on specific requirements and health and safety analyses), BoO - base of operations (local or a central base of operations in which all events and occurrences may be monitored and reactions directed), ATH - Ariadne's Thread Hub (integrated local infrastructural center composed of PLN, BoO, and additional seats of local service and emergency units), and also pylon (basic device, a structure containing basic interactive components of the system) and cluster (group of pylons operating within a particular area) [2].

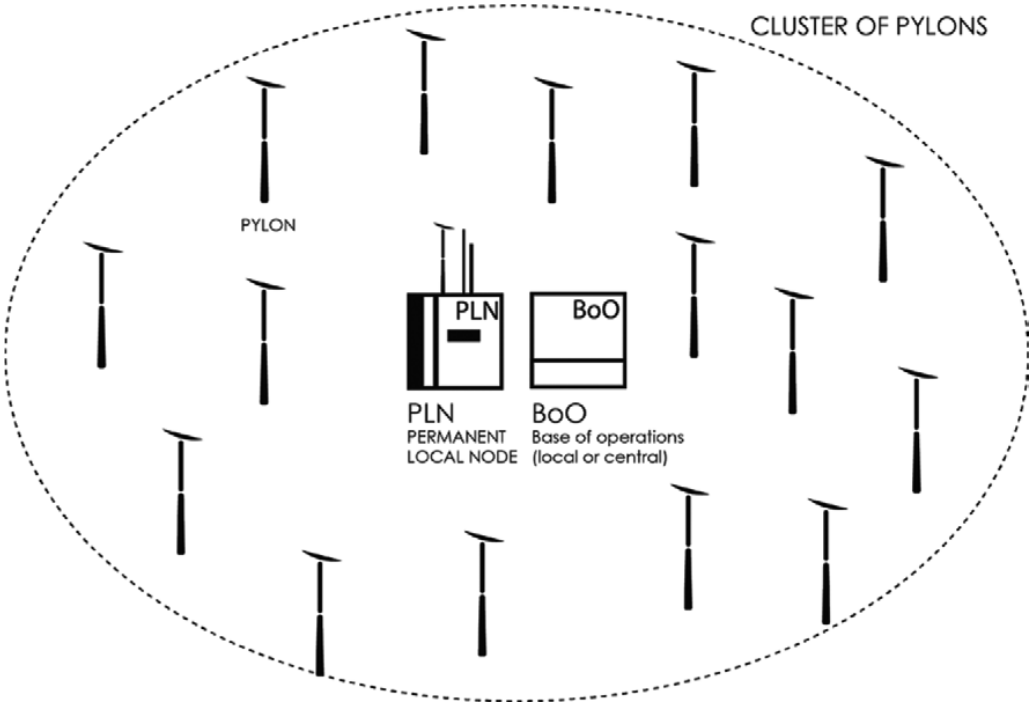

Figure 2: Simple structure of Ariadne's thread system, [2]

In research introduced in this article, author presents the assumptions for creating the Base of Operations and indicates the methodologies and mechanisms that will guide further its design. The main aim of conducted research is to describe the process of identification of a relationship between needs of the inhabitants and both programmatic and ideological approach to Ariadne's Thread (AT) node giving ultimately its architectural interpretation.

3. Programming and meta-designing

Assumptions to the urban node allow for its programming in the meta layer where the main focus is on finding dependencies and developing mechanisms for their analysis and use to create the urban node model. In his article, Barełkowski pointed out, that: „Meta-design accompanies designing. That allows to focus intellectual effort on searching for assumptions and the choice of the correct methodology, indicating internal criteria of the task and self-evaluation of them by the architect, or sometimes third parties. The primary aim of meta-design is developing self-consciousness of the project-maker in terms of principles, consequences of activities, mechanisms and tools used in the process, and the area of interdisciplinary events between the project-maker, branch specialist or other specialists, whose necessary involvement in the projects connected with urbanized environment is more and more noticed" [3].

The methodology developed by the author to create mechanisms for the creation of urban nodes is based on a matrix of interrelated jigsaws, however, with the possibility of using the entire pool or parts thereof depending on the condition of the area concerned, more precisely from existing infrastructure or degradation of the area covered by the study. Depending on data output, the adapted data pool to create a city node will be different. In the author's opinion, ordering these criteria will create an operating mechanism that will be a specific matrix for urban node programming, i.e. for the Ariadne's Thread project, the proposed Base of Operations.

Essential data for the creation of the mechanism will be the statistical data of the service, ie data on the time of reaching the type of aid unit examined, and the maximum possible and effective reach of the aid. The analysis includes data from distributed units in Europe, allowing for comparison of standards as further research will be needed to make the Base of Operations mechanism a universally applicable mechanism for application anywhere in Europe, and later throughout the world.

Another important element of creating an urban node's programming mechanism will be the recognition of the deficiencies of a given site. The output of this analysis will be the recognition for a given area of infrastructure saturation in the form of education, market, commerce, business and, of course, special services. The tools to determine these needs will be not only statistical and exploratory statistics, but also the method of social participation, where inhabitants of the indicated area will be interested in identifying the shortcomings of the area, highlighting their specific needs in the area, and suggesting opportunities, and, in their opinion, the most effective solution and the vision of improving the urbanized space in which they live.

Conjunctioning the analytical method of statistical data and the participant component will allow for the theoretical programming of the urban node.

It is undeniable that in the 1960s the United States, the Netherlands, the United Kingdom, Russia and Germany were attempting to reorganize their services using mathematical methods using computer technology. It shows how important the improvement of the system of special services is, and what potential is based on mathematical and computerized methods. The above-mentioned research resulted in the creation of a CIS-KOMAS program by Russian scientists, which aimed at automatic forecasting and strategic management of rescue actions [4]. This program is currently widely used in many states for fire departments and emergency services. However, this system does not apply to police services, as would be required in Base of Operations. At the same time, the author intends to try, apart from creating the mechanism of urban node programming, to recognize the problem of creating social relations in newly created structures. However, discovering the mechanisms for creating these relationships, organizing space for meeting needs, not only in the necessary layers, i.e. security and order, but also happiness and correct interpersonal relationships is foreseen at a later stage by the researcher.

4. Urban node

As a result of the adopted methodology, the author suggests programming the node using the previously tested output data and concludes that each Base of Operation should contain each category of special services. However, depending on the location, they may constitute one conglomerate, and in more spacious areas of larger settlements - separate units. At the same time, the arrival time for smaller units should not be more than 5 minutes, and for larger - 10 minutes.

The categorization of the functions of the urban node programmed in the study provides for the division of these functions into two categories. The first group of functions will be the basic program, unchangeable, i.e. universal functions, which include special services, namely the fire department, police (municipal police) and emergency services. The variable in this category will be specialized units that will be tailored to the specifics of the development area. For example, in the area affected by a catastrophe, such as an earthquake, mandatory will be specialized rescue units, specialized machinery and equipment for debris removal, or assistance with locating people trapped under debris. The above elements are an additional, contextual, but community-independent function. Therefore, the second category will consist of participant-dependent functions and functions dependent on variables such as

the thickness / absorbability of the developed area, which will allow to identify local needs according to the needs of local residents.

An additional element relevant for urban node programming and the Base of Operation will be the principle of its functioning when events occur that exceed its performance capabilities, or those requiring rapid emergency interventions such as terrorist attacks or large impact radius accidents, which will require co-operation of different units or support the additional larger units. It will be necessary to develop cross-linking of urban nodes by developing mechanisms for linking them to airports, helicopter landing sites and important external entities. The following table summarizes the above criteria and categorization of the function of the programmed urban node.

Table 1. Criteria and categorization of function

Function	Basic Program	Additional/ Contextual Programs	Social Participation Program	Program Depending on absorbability
F1.	Fire department			
F2.	Police			
F3.	Emergency			
F4.		e.g. Rescue Unites		
F5.		e.g. Counter Terrorist		
F6.			Cultural center	Cultural center
F7.			Education	Education
F8.			Social care	Social care
F9.				Clinics
F10.				Business
F11.			Trade center	Trade center
F12.			Recreation	Recreation

On the basis of such selected output and programming assumptions, the author establishes a possible urban node program in which the core will be a Base of Operation consisting of a police unit, fire department, and emergency unit of one emergency number and concentrated at one point of the complex. This database will be housed in first-aid services such as specialist doctors, clinics, successive schools and culture centres, and finally trade centres and other services.

5. Conclusions

Designing the urban node system is a widely studied issue worldwide. This does not apply to heavily urbanized areas with rapid, often uncontrolled development. Areas affected by armed conflicts or the problem of slum formation generate the need for intervention. In her own research, the author seeks to

find such dependencies, by which it will be possible to develop a mechanism that works in arbitrary tissue, however, with the emphasis on creating the right social relationships and shaping not only a structure functioning as a combination of the needs of security and order but also as a fully functioning urban tissue.

The ability to fit the developer's urban node programming based on its basic Base of Operation unit is shown in the following picture. In the center of urban node there is located BoO containing police unit (P), fire department (F), and emergency unit (E). Further support services (sS) are located in the form of clinics, hospitals or schools, but also functions that are the foundations of cultural and social relations. The programmed urban node will close with the additional functions (Af) consisting on trade centres, business centres and recreation.

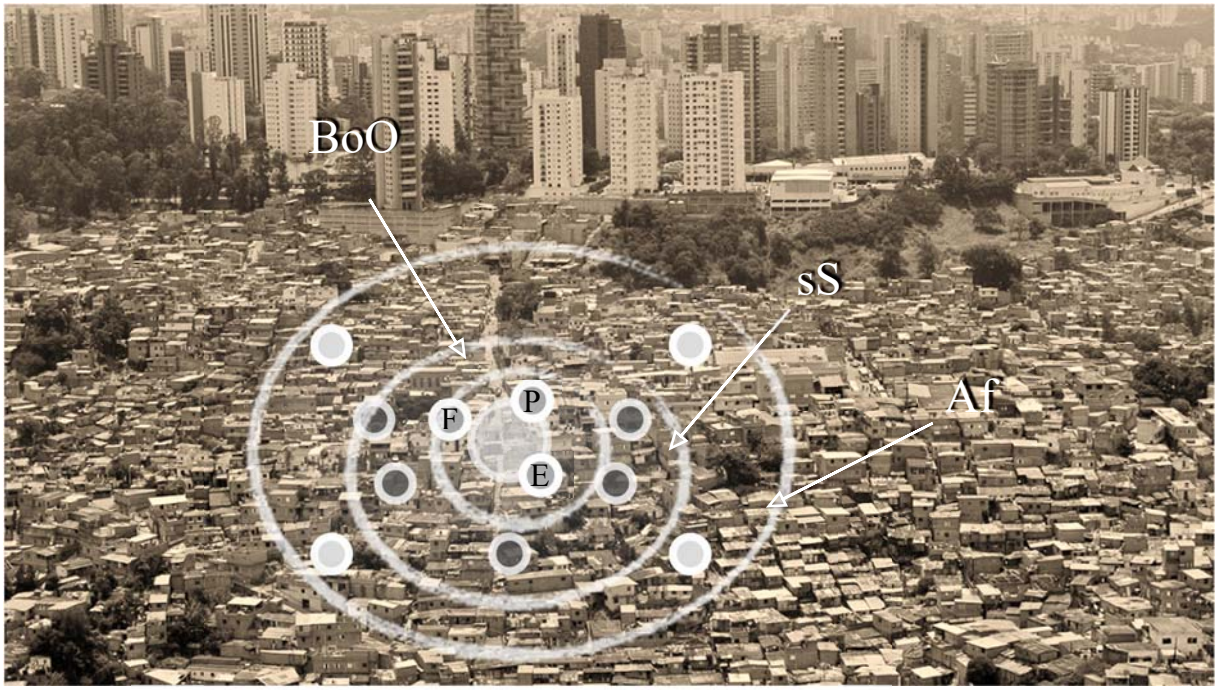

Figure 3: Urban node proposal in Favela Morumbi slums, Sao Paulo, South America.

However, for the purpose of further research, which raises the issue of architectural interpretation of the accepted urban design methodology and material adjustment for the existing area, depending on the degree of land degradation or the degree of disorder (city sprawl), the author puts forward a thesis, that in environment with high levels of degradation, as in the picture above, the planned urban node should be either a temporary solution that is aligned with the existing structure, or a permanent solution that is the nucleus and new guidelines for the area or a modular solution that is easy to reprogram, modify, or relocate.

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