Second-order cybernetics in architecture: theoretical relevance to the concept of Posi in Palopo City

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Abstract. The lack of form and meaning of buildings is a challenge for the theory and development of architecture. This study examines the relevance of cybernetics theory to the concept of Posi. The center (Posi) is the representation of the axis of equilibrium of space. The Posi concept is a local theory that is the result of the dissertation research findings on the old city space and historic building space in Palopo City. This study uses the content analysis method. Data collection and analysis process carried out qualitatively. The research paradigm obeys a rationalistic framework. The results of the study show that the concept of Posi is the axis of the system of spatial order. The second-order cybernetics of Heinz von Foerster relates to the concept of Posi. The position of the Posi concept as a concept of a self-organizing system.

Understanding the macrocosm space system can be a paradigm in the formation of microspace in a design process. This study has implications for the development of an architecture that is built from local theory and is strengthened by the grand multidisciplinary theory of science for architecture and urban space.

1. Introduction

The main setting in I La Galigo writes place names such as Boting langiq (kingdom of heaven), Buriq Liu (kingdom under the sea), Alé Kawaq (middle world / human place) [1]. Sawerigading becomes the central figure. The contents of Sureq I La Galigo are relevant to the names of the current Palopo city communities [2]. Thus archeological researchers found the division of city space into three parts, thus indicating the link between the division of Palopo city space with the place setting in I La Galigo. Not only does macro-scale space have layers of space, but even the micro-scale space also forms the hierarchy of space. The dissertation research found a local theory of the old Palopo city space [3].

Meanwhile, the urban planning process by planners cannot regulate directly on aspects of architecture, economics, politics, and others [4]. The problems of Palopo city are the basic selection for a concept of Posi because there is a meaning of space in it. Posi is a center, and it is a metaphor. Posi is not only as a sign of the urban spatial system but also as a symbol of the regularity of urban space. Cybernetics is a theory about systems that can reinforce systems rationally represented by Posi. The concept of Posi can be interpreted as a network axis built from the study of interaction for urban space users. The concept shows the regularity of urban space in controlling the order for the next built environment. The importance of second-order cybernetics theory is to analyze the concept of Posi as a result of the concept of self-organizing urban space users. Theory of cybernetics in architecture was developed by Gordon Pask. It makes architecture responsive to the environment [5].
Likewise in the design, Granville proposes the conceptual construction that not only underlies all the design processes but also underlies the way of thinking and working as a human activity fundamental. The redesign of the Palopo mayor office was carried out in order to make an integrated system in the office building, and to enhance community service efficiency [6]. On the other hand, the redesign process is not based on theories review about systems for design process in architecture. Therefore, this study intends to explore the basic theories about systems in cybernetics, particularly for its application in architecture and urban space. Building placement and spatial planning are based on its function and its relation to other buildings and other spaces. Palopo City is formed by the interrelationship of buildings among Luwu's palace, Jami Mosque, Marketplace and Alun-alun, then it becomes an embryo of the city [7]. The latest paradigm for inactive processes is derived from the design paradigm in second-order cybernetics and a breakthrough for third-order cybernetics [8]. Previously, Glanville connects design, user and construction in a second order cybernetics study as an open and ongoing process [9]. While this study contains the openness of cybernetics as a system theory that analyzes the spatial structure of Palopo city.

2. Cybernetics theory
Steermanship is a Greek word for mention before cybernetics, then cybernetics was more widely known in 1940 as the science of goal-oriented control [10]. A mathematician from MIT, named Norbert Wiener, he was a scientist who popularized the first-order cybernetic theory until the late 1950s. Since cybernetics was known as the 'observed system', until the 1970s, cybernetics experienced a paradigm shift to an 'observing system'. The observed system is known as the first-order cybernetics system, while the observing system is known as the second-order cybernetics. As observing science, cybernetics cannot be released from humans as its object. Second-order cybernetics is built from a hybrid between organisms and machines [11], or humans and machines, hereinafter referred to as cyborgs, while information theory underlies a hybrid between humans and machines.

Heinz von Foerster is known as a second-order cybernetics scientist. Foerster observed himself as part of the system, but before that, he was an observer of the system [12]. Two concepts of networking in cybernetics were coined by Foerster. Generalized receptors are the same as generators (figure 1), likewise, the receptor matrix (a) is the same as effector matrix (b) which has the same property (figure 2). Based on the concept of the network, which is observing the system, then Foerster shifts the paradigm towards the observed system, so it is more towards the social control system. In tune with this shift, Sociocybernetics emerged in social science and proved that cybernetics is positioned as a transdisciplinary science in uniting sociology, anthropology, sociology, and cybernetics approaches in architectural design and theory.

![Figure 1. The network concept in cybernetics: Network without feedback.](image1)
![Figure 2. The network concept in cybernetics: Cascade of action network.](image2)
Ranulph Glanville is a scientist who researches the relationship between design and cybernetics. Glanville stressed that the design process depicted was not only based on concept construction but also based on human activities as a way of working and thinking [13]. In cybernetics, the process carried out by Aalto is an artificial intelligence that can combine machine performance in human-made intelligence. Computer graphics systems produce three-dimensional images and the design process is analogous to feedback controls that are recognized by cybernetics. The aspects of interaction, feedback, and simulation as cybernetic concepts need to be rethought in order to better understand aesthetic awareness [14]. The architect or designer makes information and measures of client performance as the main basis in determining the criteria for the concept and planning of an object of design. Also, a client must adjust the performance criteria that have been prepared by the designer or architect. Thus, between the client and the architect, a feedback relationship occurs, and this becomes an important aspect of cybernetics theory. Glanville explains about the feedback between clients and architects based on the theory of conversation from Gordon Pask [15].

3. Research methods
This study applies to the rationalistic paradigm. By applying the rationalistic paradigm, the researcher can interpret the results of previous studies [16]. This paradigm departs from a theoretical framework that is formulated from the thinking of experts and well-known theories. There is a problem and the potential of each theory so that it is further developed. With the application of rationalistic, researchers build rational logic and objective empirical. Likewise in the analysis phase, the researcher applies objective rational synthesis. The philosophy underlying rationalistic thinking is the philosophy of rationalism.

The process of collecting data was done qualitatively. Data obtained from secondary data relevant to the research topic. Researchers conducted unitization of textual explanations of second-order cybernetics experts. The operational concept was obtained from cybernetics experts who then carried out an analysis of the design, spatial concepts, and building architecture processes with cybernetics approaches. Text data were analyzed by the content analysis method. The content analysis process used semantic content analysis, which is a procedure that classifies signs according to their meaning [17]. The content analysis research design followed the detailed steps in Krippendorff, namely: conducting data formation, unitization process, sample determination, recording, data reduction, inference withdrawal, and analysis. The data selection was done purposively. Thus, the data has an association of information with further data which will become verification data.

Data analysis was carried out in two stages. The first stage is a construction terminology, philosophy, and concepts towards cybernetics. In this stage, the analysis is conducted in a complete explanation framework of the substance of cybernetics in general and cybernetics in architecture. In the second stage, researchers verify the concept of Posi by using cybernetics substances that have been constructed in the first stage. The analysis process is carried out by conducting dialogues between theories of cybernetics and the forming the concept of Posi. Researchers discover the reinforcing facts about cybernetics in architecture and urban space, specifically in the case of old Palopo urban space.

4. Analysis and discussion
4.1. Culture as a social control system occupies the highest position in Cybernetics theory
Second-order cybernetics theory emphasizes the interrelations of humans in the control system. Humans become the object of system observation. The cybernetics theory from Parson contains a hierarchy of social control systems in an element of society. For the cybernetics approach in design, Laurens explained that culture occupies the highest level in the social system (figure 3). In line with Murphy's statement, namely: "Nevertheless, it cannot be ignored that Parsons viewed his systemic hierarchy as providing an unquestionable source of social control. Using Tillichian terminology, he understood the highest levels of his system (occupied by culture) as outlining an ‘Ultimate Reality’ for substantiating social existence” [18].
Social control theory is relevant to the spatial layer in Palopo. The cultural aspects of Luwu occupy the highest position in carrying out social control. The cultural entity in Luwu civilization is proven by the existence of the *Sureq I La Galigo*. Social groups in the customary environment are guided by cultural markers contained in *Sureq I La Galigo*. The three layers of space are the reality of the concept of urban space. An area is a system which means that an area is part of a large territory and cannot be separated from other regions. The concept is similar to Roger Trancik's theory of linkage in urban design theory. In system theory, there are interactions of all elements both intra environmental elements and inter environmental elements. Likewise, with cultural buildings, artifacts are not only the final product of a process. The designer discusses a process for modification. The final product of conversation is sketches, drawings, and perspectives that result from mutual goals and investments.

4.2. Theory of signs in the urban space system

The building forms the old city space of Palopo. Three important buildings that make up the city are read as signs. The relationship between one building with another building shows the syntactic meaning in semiotic science. The level of meaning of the sign is done so that the space system can know. The semiotic theory includes syntactic, semantic, and pragmatic meanings. Third, the meaning of the object plays a role in the exploration process of sub-system connectionism. One element of the *Posi* concept is the interconnection between urban space and among buildings. The structure of urban space is divided into three part, namely the upper space (*tana tekko*), the middle space (*lalebbata*), and the lower space (*tana bangkala*) (figure 6). Likewise, the Luwu region structure is divided into three traditional powers, namely *Malangke*, Palopo, and *Kamanre* (figure 5). In the 18th and 19th centuries, landscaping and several buildings showed Gordon Pask's complexity and Glanville's ambiguity that were not in conflict with each other [19]. That was due to the merging and arrangement of buildings luxuriously and formally. Performative systems that include architectural improvements are caused by elements of the built environment. While in the city of Palopo, the concept of *Posi* (center) verifies the syntactic meaning that shows the relationship between buildings in synchronous time. Multiple buildings unite in the same context of time and conditions (figure 4). On the other hand, individual users of buildings interpret the occupied cultural heritage buildings. They emphasized the relationship between their residential buildings with other important buildings. The pragmatic meaning is shown by the significance of the building in improving the quality of the surrounding environment.

In the semiotic paradigm, buildings are read as signs. Charles Sander Pierce played a role in strengthening phenomenology in the form of modern logic and science and eliminating the separation between phenomenology and science. As part of cognitive science, semiotics need to include phenomenology and interpretation theory. Thus, communication science can be achieved as part of interdisciplinary science. The development of semiotic methods leading to the reading of buildings by building users, the process of the development of the science of signs called ethno-semiotics. In harmony with second-order cybernetics, the paradigm shift was experienced by humans as objects of system
observation. Customary leaders understand the simple space system but have a complexity of functions in ecological balance.

The concept of ecological information from Bateson distinguishes cybernetics as a transdisciplinary theory [20]. Transdisciplinary integration in the form of biosemiotics towards progress by including all living systems. This type of humanistic and hermeneutical knowledge system describes living organisms. Individual experiences about space, their ability to read signs, the role of visitors and users of space, all become part of cognitive science. Universal phenomena can be contemplated in terms of phenomenology while metaphysical knowledge is understood from the aspect of cosmology. In cybernetics, natural phenomena are understood using the concept of metaphors. Like the American architects named Elizabeth Diller and Ricardo Sci-fi Dio applying the concept of metaphor to the physical world. The design is called Blur Building. Some natural elements that are applied are water, mist, fine dew, and sound. The water pressure is regulated so that it produces fine mist and dew.

![Figure 5. Regional space connectivity system for Luwu culture.](image1)
![Figure 6. Space connectivity system in the urban space structure of Palopo.](image2)

Someone making a program of space has indirectly applied cybernetics theory. Cybernetic concepts show the interrelationship between space into a unified whole. Implicitly, the relationship of one space to another contains cybernetic features. Likewise, a process of actualizing models and drawings comes from something abstract. In the abstract to the actual process, there is not only a unidirectional process but also a two-way process. Gordon Pask making the process in the theory of conversion. The topicality of models and images allows the process of conversation with abstract representations. That happens because they can share spatial properties.

5. Conclusion

The philosophy of Talcott Parson's social system is verified because the culture of the people in the city space plays a very vital role in the formation of urban space. The cosmology of Luwu space is a fundamental culture understood by traditional leaders. The social stratification layer is known because it occupies the middle of the city which is considered as a sanctified space. Individuals in social groups are bound in the normative tradition. Culture as the highest element of the social control system in cybernetics theory. The theory was verified in the old town of Palopo. Cybernetics theory has a specific scope in architecture. Second-order cybernetics shows the role of humans in observing space systems. The relevance of order cybernetics to the macro-space system is found in the local theory building of Palopo city space. The structure of urban space is represented by the concept of Posti being the axis of the spatial order system. Heinz von Foerster's second-order cybernetics as a grand theory system
provides a strong foundation for positive concepts. Comprehensively, interdisciplinary science underlies the paradigm of this research so that it is derived from a positive concept. Further considerations for trends in the cyber era as evidence of the importance of control systems for humans in the virtual era. Human individuals are required by natural phenomena to be reactive to meet the needs controlled by machines.

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