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Fish Movement Mapping as a Basis for Programming Circulation Systems in Traditional Market Building

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This article explores the use of big data in the preparation of architectural programs, especially in the programming the circulation in the case of traditional market buildings. Current technological developments require movement in all aspects to follow and adapt to various information processes and allow reading and use of the data as a consideration for decision-making, one of which is in the field of architecture. Using big data has begun to develop as a component in compiling and designing architectural programming, but just a few discussed how to read big data as a guide for the development of a circulation system in a building. This article examines the potential for developing a circulation system based on big data. This article attempts to explore various types of data related to a fish movement which are then read from the data used as keywords in the preparation of the circulation system. This article is not in the position of seeing big data as a prediction, but as a description, so it is not fixated on data attachment and the architectural program to be developed. The method used is to collect various data from the internet and some literature. Then to get the results of data reading carried out the method but as a description so that it is not fixated on data attachment and the architecture program to be developed. The method used is to collect various data from the internet and some literature. Then to get the results of data reading carried out the method but as a description so that it is not fixated on data attachment and the architecture program to be developed. Then to get the results of the data reading carried out the method tracing each fish movement mapping data. Then the tracing results are analyzed with in-depth interpretation. The findings in this article show that reading big data, especially reading fish movements, finding the patterns: (1) spreading (2) merging (3) rotating (4) linear (5) gathering. This pattern used further as a keyword for developing a circulation system in the traditional market building. The development of the circulation system is carried out by focusing on the patterns that are present in the collected big data. This article can add insight into architectural programming approaches, especially the use of big data as a design basis.

Keywords: Big data, fish movement mapping, circulation system, architectural programming

1. INTRODUCTION

Data is one of the aspects considered in an architectural design. Reading the environmental context as a database is an important aspect of compiling an architectural program (White, 2013). The data starts with reading the context, then makes it into a visual note until a site analysis is carried out showing that data is an integral part of architectural design (Crowe & Laseau, 1986; White, 2013). The development of technology makes data easier to obtain, especially online and becomes a collection of data known as big data. The mention of big data arises because of all the data that can be easily obtained in the current era. Big data is not only a product of the development of social science and information technology, but also an inevitable trend of industrial development combining various data, and using it for measurable development (Kitchin, 2014; Ma et al., 2021). This article looks at the opportunity to use

big data as a basis for compiling architectural programs.

Knowledge related to any information is increasingly open, this shows that the data revolution is taking place (Kitchin, 2014) and has the potential as a basis for speculation about how the environment will be built in the future (Burry, 2020). Big data is expected to be a form of digitized data that can show how spaces are perceived by users through reading social media (Atmodiwirjo et al., 2019). In architectural discourse, the use of big data has begun to be carried out by various architects and planners. This is a currently developing discourse, especially in relation to the preparation of architectural programs that take big data into account. By using big data as the basis for architectural design, it means that every step considers data as the basis for the architecture.

The use of big data as a component in compiling and designing architectural programming has been widely discussed in architectural discourse, but not much has been discussed as a guideline for the development of a circulation system in a building. This paper attempts to discuss the use of big data in relation to architectural programming with a focus on circulation. The case study taken is to arrange a market building that prioritizes movement circulation. This article tries to explore various types of data related to fish movements which are then read from the data used as keywords in the preparation of the circulation system. This article is not in a position to see big data as a prediction, but as a description so that it is not fixated on data attachment and the architectural program to be developed.

2. LITERATURE

Big data can be understood as a process of making conventional database systems easier to read by a wider audience (Dumbill, 2013). The process of technological development leads to more information and this triggers a transition to new ways to generate, organize, store, analyze and interpret data (Kitchin, 2014). In architecture, the use of big data cannot be directly used as reading material from context, analysis of existing data is important in the field of architecture (Burry, 2020; Dumbill, 2013). The ability of an architect to read and utilize data as a basis for compiling architectural programs and also as a basis for compiling architectural forms.

Various discourses related to big data in architecture have been widely discussed in relation to smart cities (Caird & Hallett, 2019; Cody & Day, 2015; Virkkala et al., 2017); landscape data (Atmodiwirjo et al., 2019; Li et al., 2022; Speranza, 2016); and analytical methods (Burry, 2020; Johanes, 2021). The process of reading big data is an important part of what is done to fulfill the purpose of using data in the architectural design process. Using big data in the architectural design process allows for further development considering the data obtained is more valid and measurable (Ma et al., 2021). The big data method can be used for three things, namely explaining, confirming, and exploring. This paper uses big data in the exploring stage.

The role of big data in other architectures can function as a descriptive function or a predictive function (Burry, 2020; Jeble et al., 2016; Mikalef et al., 2019). First, big data has a descriptive function, which is a function to understand more about the observed data. By carrying out the big data process, it is expected to be able to understand the behavior of data. The behavioral data can then be used to determine the characteristics of the observed data. By using the descriptive function of big data, a hidden pattern will be found in the data which if the pattern repeats, can be classified as a characteristic of the data. The second is predictive function, meaning that the big data process will later find a certain pattern of data that comes from the variables in the data. This pattern can then be used to predict other variables whose characteristics are unknown. By doing this type of function, it is the same as doing predictive analysis. The predictive function can also make it easier for users who need accurate predictions to carry out a process.

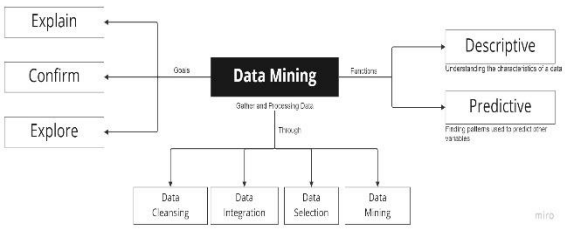

Figure 1: Data mining diagram

This paper explores data by describing data as part of compiling architectural programs, especially those related to movement. Through the architectural design process that is carried out, data is placed at the beginning as part of the exploration of reading data patterns that can be used in design development. Especially the movement or circulation system which has been compiled based on predictions and literature studies. In this paper, we try to develop a circulation system based on the results of digital data patterns that are not directly related to architectural functions. This has the potential to open up opportunities to produce rich architectures that are not tied to a single data.

This paper focuses on tracing the movement of salmon recorded by digital data and can be read as a data landscape to be traced and mapped as a basis for finding keywords. These keywords are then used as the basis for the development of an architectural circulation system in a building. This article is not in the position of seeing big data as a prediction, but as a description, so it is not fixed on data attachments and the architectural program to be developed.

3. METHODOLOGY

The method used is qualitative research by collecting various data from the internet and some literature. Then to get the results of the data reading, carried out the method of tracing each fish movement map data. Data collection is done by mapping various data related to the movement of salmon and performing analysis by tracing any data obtained to obtain patterns of movement patterns.

The results of the analysis are in the form of keywords which are then used to compile various forms of circulation systems. In addition, the keywords obtained are also used as a perspective in exploring precedent studies. This article uses traditional market buildings as a case study to develop a circulation system based on these keywords.

4. DISCUSSION

4.1 Big data exploration: Fish movement

Movement is a change or transition of position from one place to another. Movement is our tool to be able to move from one activity to another, these form a passage territory (Paramita & Schneider, 2018). This shows that a movement can create a different spatiality in the same place (Harani et al., 2021). Movement is one of the aspects to be considered in designing a building. How a space can be connected, separated, united, and spread can be arranged by considering the movement of its users. This paper attempts to compile an architectural program that prioritizes movement as its programming basis.

This paper believes the collection of several movements has a pattern. Based on reading landscape data, this paper tries to trace the movement of recorded salmon. This article tries to identify the movement patterns that are formed through the movement of animals through salmon migration. The collecting data process begins with sorting data in the form of schematic drawings regarding migration directions and migration locations for salmon spread throughout the world. Data is collected by searching through the internet and from several literacies. The habitat of salmon is divided into two locations, the Atlantic Ocean and the Pacific Ocean.

Data collection exploration is done by collecting all the information related to the movement of salmon, then reading the pattern. This data collection is carried out by opening the web which shows a map of the movement of salmon, specifically showing the movement of salmon from one season to another. This data search is done by typing keywords on Google, the keyword used is "salmon movement". From these keywords appear several maps.

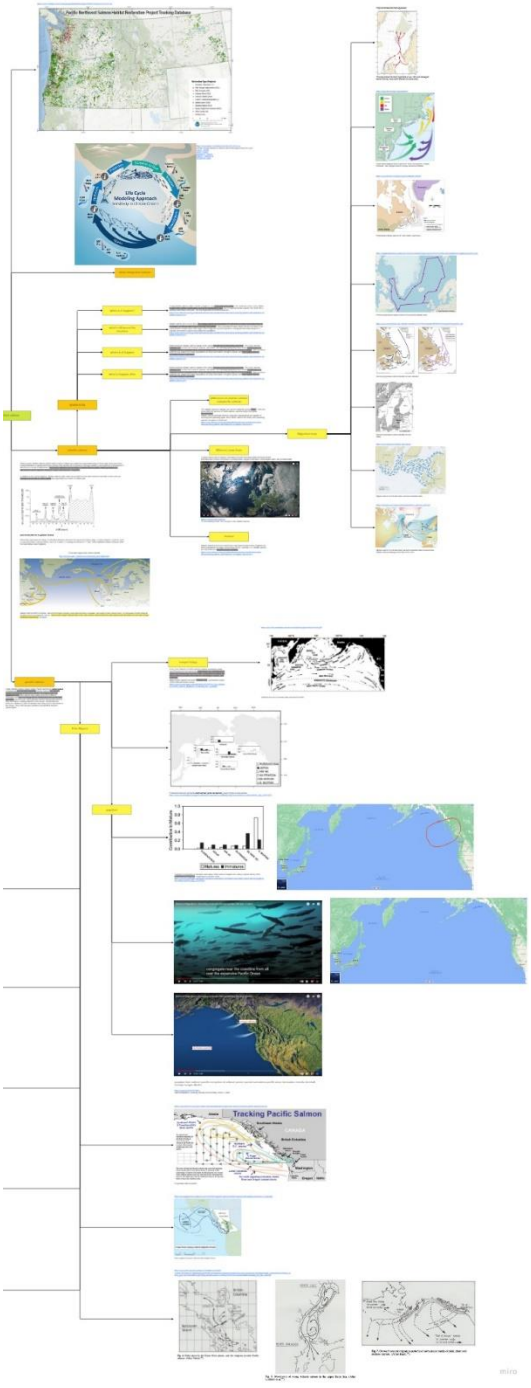

Figure 2: Salmon movement exploration result

Data exploration focuses on maps of salmon movements, and 39 maps are obtained that can specifically show the movement of salmon around the world. The results of this exploration are then cataloged based on the type of salmon to make it easier to read the pattern. Catalogs are also made based on data sources to make it easier to read patterns from the data.

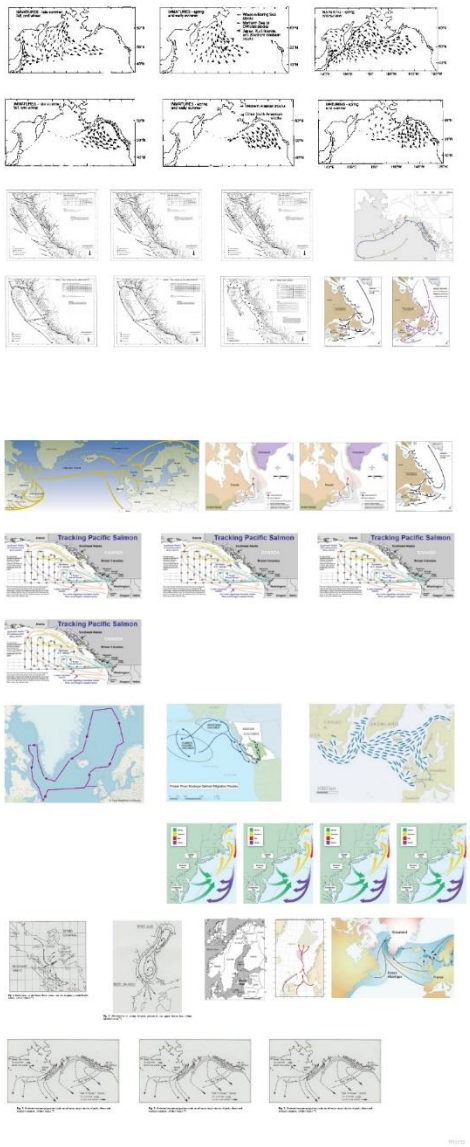

Figure 3: The result classified by habitat

Figure 2 showing in the Atlantic Ocean, most of the movement of salmon moves from the freshwater waters of Canada to the sea between Canada and Greenland. This salmon is also found in the Baltic Sea which is located near Sweden. The other types of salmon, namely Pacific salmon, mostly move from the Alaskan coast to the Pacific Ocean. A small portion of salmon also occurs around the Bering Sea. The following discussion will explain how to trace the movement of the data obtained.

4.2 Tracing as a data exploring method

The big data reading method used in this article is as a description with a focus on pattern reading. This method is carried out as part of the exploration as one of the expansions of the discussion of big data in architecture. So far, big data in architecture has been used more for prediction, in this article we try to explore the tracing method as a basis for programming.

The method used to explore fish movement is by tracing all the main lines on the map data obtained. This method is carried out to read the movement patterns of fish to get keywords that often appear and can be used as a basis for developing movement-based programming. The data obtained after going through the selection stage amounted to 39 schematic drawings of salmon migration movements, then further explored. From the selected schematic data, tracing is then carried out in the form of drawing the main lines of the direction of movement which consists of the direction of departure and the direction of return. The combination of these lines then derives the pattern and shape of the migratory movements of the salmon.

The data obtained is then classified as circulation, namely spread, merge, circular, linear, and assembling. From the data that has been carried out by the tracing process, then the number of each shape is recorded to conclude which form of motion appears most often and is used in this salmon migration. From a total of 38 schematic photos, the data obtained were 32 spreading motion shapes, then 27 merge motion shapes, 11 circular motion shapes, followed by 7 linear motion shapes, and the least were 3 assembling motion shapes. The results is the most dominant is pattern spreading, and the least is converging, in the following order: spreading, converging, circular, linear, and converging

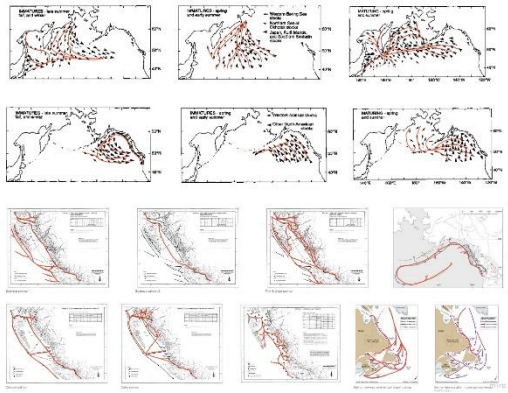

Figure 4: Tracing method

Figure 3 shows that the tracing method, especially on the main line of the salmon movement map, is done by redrawing it over the map image obtained. This tracing is one of the methods that prioritize the accuracy of tracing through photo media. This requires patience and accuracy because the lines produced must be precise with the existing photo data. The following discussion will explain how to read the exploration results through tracing.

4.3 Reading big data patterns as keywords for design development

Reading the results of tracing map photos is done by separating the photos and the results of line tracing, this aims to show the shape of the movement. The reading of the tracing results is carried out in each image and then analyzed and read the shape of the pattern. The tracing results are arranged randomly, this is aimed at phasing in the reading of the results. Based on the tracing results, five main keywords appear, as mentioned in the previous sub-chapter, namely spreading, converging, circular, linear, and converging.

Each keyword is coded in the form of a color, to distinguish the appearance of the keyword in each tracing result. The code is then presented in each tracing result image to find out in detail the pattern that continues and how often the keywords appear in each image. At this stage it shows that in one image different keywords can appear, the process of zooming in on images becomes important to see in more detail. The keyword results that appear are then tabled based on their number and shape.

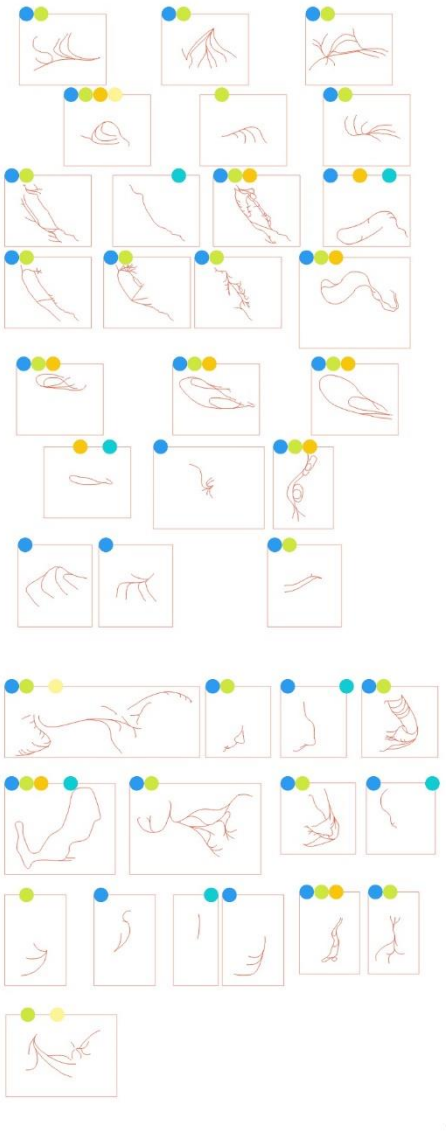

Figure 5: Tracing results

Figure 4 shows 38 images of meta tracing results that describe salmon movement patterns. The pattern gives rise to five main keywords that are repeated. The resulting patterns are different in each movement, but can indicate that the same keywords can be generated from different movements. This can be one of the bases in exploring programming based on the keywords found.

4.4 Exploring keywords as the basis of programming

As previously mentioned, the search results from this big data will be used as the basis for programming development in market buildings. This section will provide an example of a form of big data exploration results as a basis for developing market building designs.

The application of keywords as a design development starts from making several random shape probabilities on the site. The random shape is a combination of straight lines and curved lines. Each random shape is then divided into three areas, namely solid, semi-solid, and void areas. The probability of the shape of the building on the site is then drawn from the general circulation line. These lines indicate the entrance to the site and the main circulation of the random building shape that has been drawn. The shape of the line is drawn using the shape of the movement of the salmon that has previously been traced.

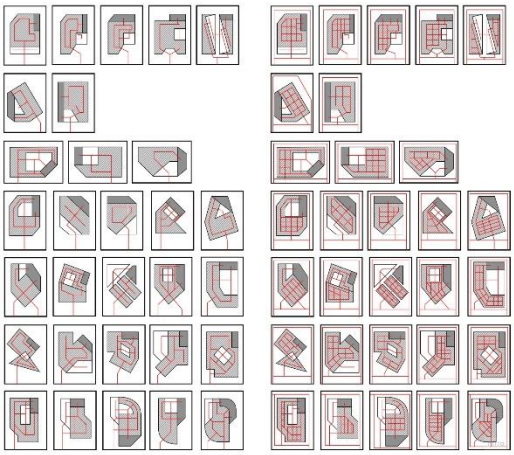

Figure 6: Drawing the circulation

After drawing the general circulation, then the detailed circulation is drawn. This detailed circulation description is intended to obtain a spatial plot of traditional market buildings. Detailed circulation shows the entrance and exit on the site and a more detailed circulation inside the building. After drawing the lines on the building, then the placement of space/space plots in the building is carried out, which consists of a parking area, loading dock, wet kiosk, dry kiosk, service, outdoor sitting, and semi-outdoor sitting. The forms that have been drawn circulation lines are selected based on the accessibility of the room. The accessibility of the building-reach in question is that circulation on the site must be able to reach every side of the building. Creating access to this traditional market also considers access for visitors who can choose and go directly to their destination without having to pass through an area first. From the data selection process, then three forms were obtained.

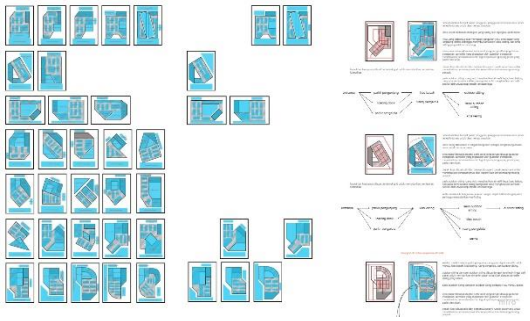

Figure 7: Building form selection process

From the three forms and their circulation, then human circulation is mapped according to their needs. then the final data is obtained in the state of the most efficient form. From the explanation above, it can be concluded that the program of this design case has an agenda, namely creating a market that has a different atmosphere in each room, which can be felt by various kinds of visitors. The atmosphere that wants to be created is calm, exclusive, spacious, and private. To achieve this agenda, ideas that can be realized are designing markets using circulation patterns (spread, merge, circular, linear, and gathering) and creating an atmosphere through a combination of solid voids and openings.

This exploration is a form of developing keywords generated through searching big data in architectural discourse, this can be further developed to show various potentials of big data in the development of architectural designs.

5. CONCLUSION

The findings in this article show that reading big data, especially reading fish movements, finds patterns: (1) spreading (2) combining (3) rotating (4) linear (5) gathering. which is then used further as a keyword for the development of a circulation system in traditional market buildings. The development of the circulation system is carried out by focusing on the existing patterns in the collected big data.

This article shows that big data can be a basis for designing architectural programming. The position of big data is not as a prediction but as a database that is explored to get keywords as a basis for developing architectural programming. Another finding in this article is that the tracing method is a way of exploring the results of the data found, the data used in this article focuses on map photos. This opens up various other opportunities in big data exploration methods, especially in architectural discourse.

This article also shows that the development of keywords as a basis for compiling architectural programming opens up various opportunities that can produce the most effective designs. Thus. this article shows that using big data as a basis for compiling architectural programs can enrich the resulting designs. Big data is not only a basis for predicting and describing existing data, but can generate a pattern that can produce keywords as a basis for developing architectural programming.

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