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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. which is then 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 digitizing 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.

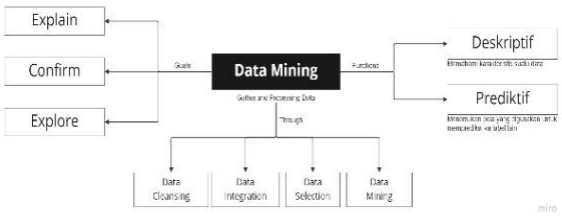
2. LITERATURE

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 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.



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

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4.2 Tracing as a data exploring method

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4.3 Reading big data patterns as keywords for design development

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4.4

4.1. Fish Movement Mapping Data as a Keyword Programming Search

Motion is a change or transition of position from one place to another. According to Delphie (2006) motion is our tool to be able to move from one relationship to another so that space becomes ours. The above opinion is supported by Utama (2012) motion is a change in body position in space or concerning other body parts. With this it can be concluded that motion is a change in

the position of a body part in space from one place to another, resulting in a transition.

Living things carry out both active and passive moving activities. This collection of several movements is called a movement, which means having a pattern. In the context of the traditional market, humans move to fulfill their needs, look for places with the goods/food they need, and try to get these objects. This movement has a pattern, namely

Figure 1: Atlantic Salmon Route

with the aim of getting food, and moving from one place to another. This article tries to identify the movement patterns that are formed through the movement of animals, namely through animal migration (salmon).

The big data process begins with collecting data in the form of schematic drawings regarding migration directions and migration locations for salmon spread throughout the world.

In the Atlantic Ocean, most of the movement of salmon moves from freshwater waters of Canada to the sea between Canada and Greenland.

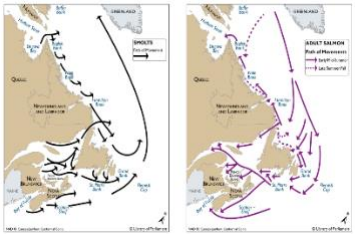

Figure 2: Salmon Movement from Canada to Greenland

This Atlantic salmon is also found in the Baltic Sea which is located near Sweden.

Then other types of salmon, namely Pacific salmon, mostly move from the Alaskan coast to the Pacific Ocean.

Figure 3: Salmon Movement in Baltic Sea

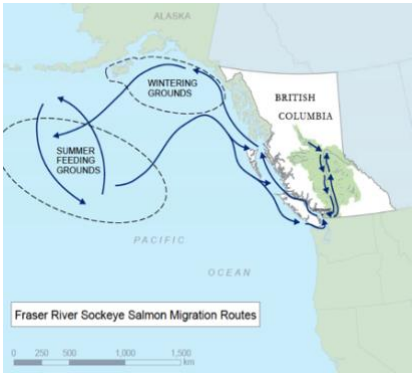

Figure 4: Movement of Salmon Leaving the Coast of Alaska

A small portion of salmon also occurs around the Bering Sea.

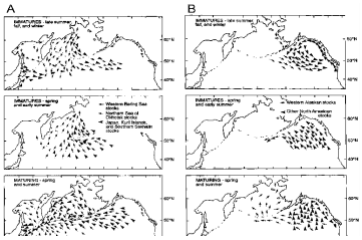

Figure 5: Salmon around the Bering Sea

The schematic image data that has been obtained is then mapped to obtain data that can be used for the next stage, namely tracing the direction of fish movement in the image by drawing the main lines. The data obtained after going through the selection stage amounted to 25 schematic drawings of salmon migration movements.

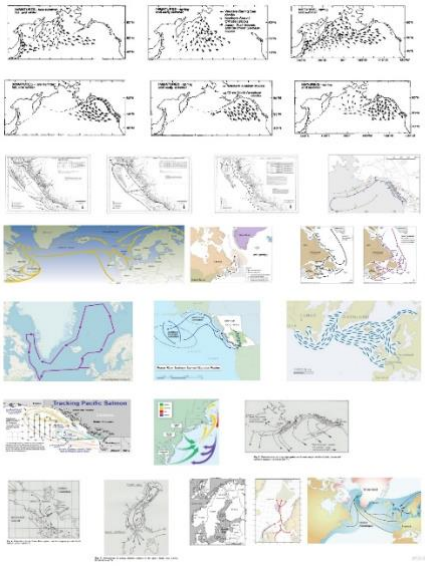

Figure 6: Mapping Data of the Movement of Salmon

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.

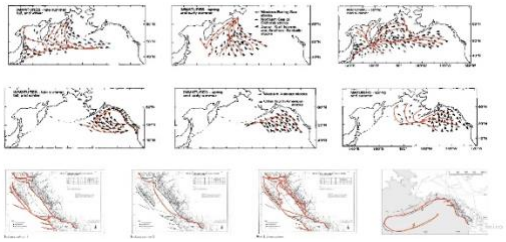

Figure 7: Tracing Part 1

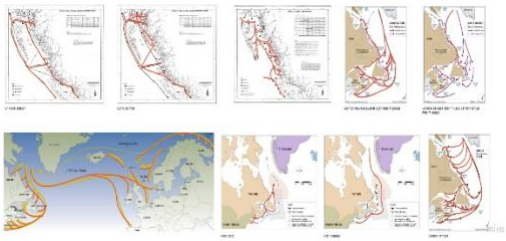

Figure 9: Tracing Part 2

Figure 10: Tracing Part 3

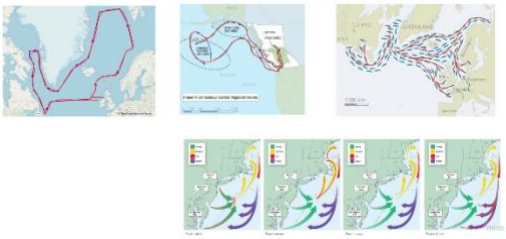

Figure 11: Tracing Part 4

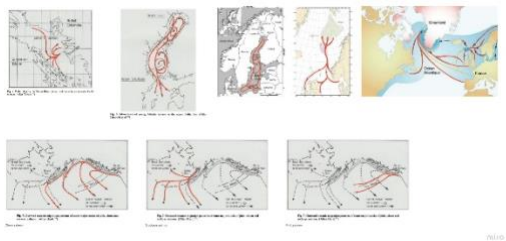

Figure 12: Tracing Part 5

The combination of these lines then derives the pattern and shape of the migratory movements of the salmon. Migration carried out by salmon turns out to have a form that resembles the shape of human circulation (mapping). The data obtained is then classified based on the form of human circulation, namely spread, merge, circular, linear, and assembling.

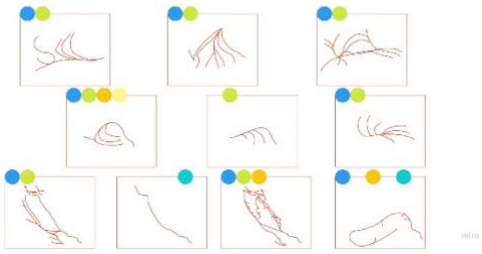

Figure 13: Tracing Result Part 1

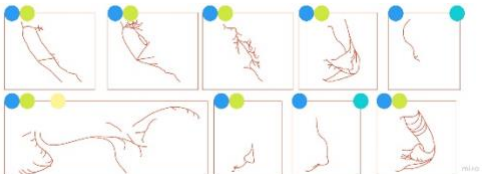

Figure 14: Tracing Result Part 2

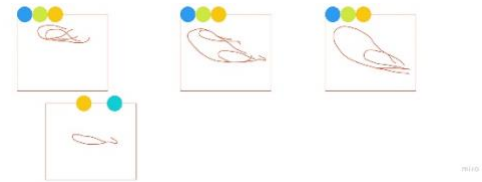

Figure 15: Tracing Result Part 3

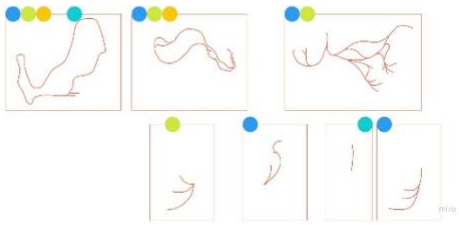

Figure 16: Tracing Result Part 4

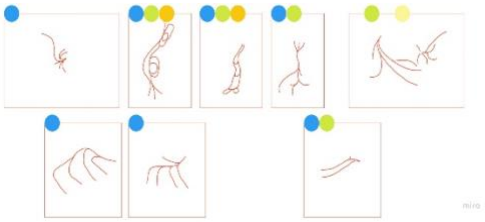

Figure 17: Tracing Result Part 5

Spread	32/38
Merge	27/38
Circular	11/38
Linear	7/38
Assembling	3/38

Figure 18: Forms Recap

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. From the results of this data it can be concluded from the order that appears most often to the least that appears, namely spreading, converging, circular, linear, and converging.

4.2. Compilation of a Keyword-Based Circulation System As a Result of Mapping and Tracing Data

The next step is to process the shapes and patterns that have been found through tracing fish movements, namely conducting precedent surgery using the data that has been found. Precedent in architecture is a method of assessing architecture that covers three aspects in depth, namely conceptual aspects, programmatic aspects, and formal aspects (OP Siregar, 2011). Architectural precedents can identify patterns and themes that previously existed, and now have the opportunity to help create new forms or architectural designs for the next generation.

The precedent used for this traditional market building is the Municipal Market of Famalicão. This market is located in the south of the City of Famalicão, Portugal, with an area of approximately 3,747 m². This market was completely renovated and will resume operations in 2021. The architect of this market is Rui Mendes Ribeiro who is the Council of the Department of Architecture from the City of Famalicão.

Figure 19: Municipal Market of Famalicão

After obtaining the precedent data, then a mapping of human circulation was carried out on the precedent plan and tried to examine the mapping based on the types of forms that had been found in fish migration.

Figure 20: Circulation Mapping on Precedent

The form of circulation that occurs in precedent buildings has a different function for each form.

Figure 21: The Function of the Circulation Form that Appears in the Precedent

The function of this form of circulation can be taken into consideration when later wanting to place spatial positions on the site, especially in the market area.

After dissecting the precedent building by using its form of movement, another aspect was found that influenced the placement of space and the ventilation that occurred in it. These aspects are solid void and opening. The solid void precedent building itself has a ratio of solid area (40.9%), semi-solid area (46.5%), and void area (12.6%).

Figure 22: Allocation of Solid-voids to Precedent

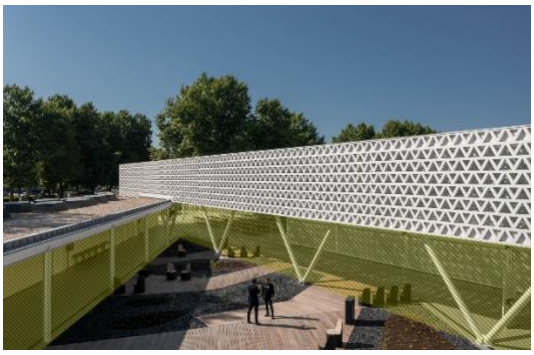

Figure 23: Large Opening on Building

The semi-solid area has the highest percentage because the building is the building with the largest (semi-solid) market area. Followed by a solid area consisting of a lavatory and management room, and a void area which is a public space. The second aspect is the opening. There are quite several openings in precedent buildings with quite large sizes. This relates to the purpose of the building, which is to create a market with better hygienic conditions.

Figure 24: Large Opening on Building

The market area is the area with the most openings. Openings in the market area can reduce the feeling of dampness, due to high intensity air circulation through these openings. These openings also create a broad impression due to the lack of clear boundaries shown in each room. Borders and meeting solid-void areas also determine the atmosphere formed in intersecting rooms (semi-solid-void junctions). The meeting between the semi solid and void areas creates a faint boundary between the two areas.

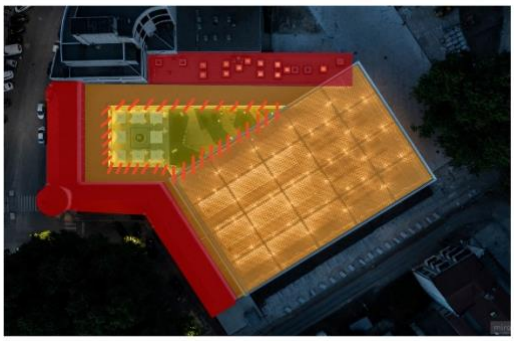

Figure 24: Semi-solid Border with Void

This faint boundary created a difference in the atmospheres between one another. This means that visitors are aware that they have left an area but without clear boundaries from that area (example of clear boundaries, namely walls).

After dissecting building precedents using data on the form of movement and getting new keywords, namely solid void, and opening, the next step is to make a program for traditional market building designs that will be made. The program created contains an agenda and ideas. From all the precedent data that has been obtained, it is concluded that the agenda in designing this traditional market is to create a market that has a different atmosphere in each room, which can be felt by various visitors alike. From the agenda, the idea used to achieve the agenda is to design the market using a circulation pattern (spreading, merging, circular, linear, assembling) and create an atmosphere through a combination of solid-voids and openings.

5. CONCLUSION

This article shows that big data can be applied as a basis for designing traditional market buildings. Processing landscape data in this case, especially in this article, namely the movement of fish using collecting and tracing produces a circulation pattern that can be used as a basis for developing circulation in traditional market buildings. Salmon movement data patterns and the forms of movement that appear show a separate function for each shape.

This article demonstrates by applying keywords found from landscape data and precedent search results, obtaining solid-void and opening data that influence the atmosphere within. Development of keywords obtained from landscape data searches and precedent search results can be used as a basis for compiling programming in design, these findings can develop an architectural design approach.

6. REFERENCES