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Edutainment Aquarium Facility Planning with Functionalism Approach in Deli Serdang

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Abstract. The ocean is home to many kinds of aquatic species. The state of the sea is currently on the verge of declining because of the waste thrown into it. There has to be a sanctuary to retain the population of the sea animals, such as the aquarium facility. This facility will also inform the public—especially children—about the kinds of species still available today, just like a zoo. With the functionalism architecture approach, the facility is expected to be durable in the long run and more accessible since everything is based on function. This study uses qualitative methods, meaning all the precedents data are from comparative studies, field studies (surveying the site), and theories from books. The result of this study is the implementation of Functionalism Architecture that prioritized usability in the design of edutainment aquarium buildings. Projects with similar functions or methods can use this study as a precedent.

Keywords: aquarium, design, education, entertainment, functionalism

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1 Introduction

Indonesia is a vast archipelago located in South East Asia. Based on the data, the ratio between the land and the waters of Indonesia is 2:3. With 5.8 million kilometer square of water, Indonesia has a diverse number of aquatic species. By this fact, as a maritime country, Indonesia has the authority to manage biological resources that have been set on an agreement of United Nations Convention on the Law of the Sea (UNCLOS) 1982, which stated, "*The sovereignty of an archipelagic State extends to the waters enclosed by the archipelagic baselines drawn in accordance with article 47, described as archipelagic waters, regardless of their depth or distance from the coast*" [1].

Sumatera is the second biggest island in Indonesia. With also the longest coastline, the aquatic species dwelling in it are on Sumatera's authority. Those species need to be carefully managed;

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otherwise, the issue will negatively impact the environment in the long term. To manage that issue, several facilities are needed to help preserve the marine animals as well as to provide the younger generation with education on the importance of preserving the marine environment and its inhabitants. One of them is the aquarium facility that will likely help a lot for marine life management in Indonesia, especially in Sumatera Island. Therefore, it is important to design an edutainment aquarium facility that can accommodate educational and conservation purposes in North Sumatera.

The water ecosystem in Indonesia is currently on a critical status. From 2017 until 2020, there have been 21 cases of destruction of coral reefs [2]. Shipwrecks caused these destructions. Aside from the wreckage, Indonesia was ranked the most polluted country in which plastic waste ends up in the ocean—second to India [3] —, and there were also reports of an oil spill in Indonesia's water. These things caused these animals to be endangered, such as Dugong, whale shark, Maxima clam, manta ray, sawfish, dolphin, whale, and turtle [4].

To save the water ecosystem and provide education and entertainment in Sumatera Island—especially North Sumatera—the writer is interested in planning for Deli Serdang Aquarium, a project with a functionalism architecture approach addressed for everyone who wishes to learn and become aware. This study aims to design an aquarium facility that can accommodate educational and recreational purposes by applying the principles of functionalism architecture.

2 Literature Reviews

The aquarium building—also known as oceanarium—has the function of education, recreation, and conservation located in one site. The building's main selling point is the exhibition full of fishes in many shapes and colors. Oceanarium can also include animal attractions as an additional selling point. Aquatic animal

Based on the Minister of Forestry of Indonesia's article, oceanarium falls under the '*Taman satwa*' (animal park) category. Criteria for an animal park are [5]: (1) The collections of animals conserved have to be at least 2 (two) classes, endangered or not, and based on the Convention of International Trade on Endangered Species (CITES) of flora and fauna; (2) Site of minimum 2-hectare; (3) Availability of sufficient water and food; (4) Has at least the means of animal maintenance, such as maintenance cage, nurture cage, quarantine cage, breeding cage, weaning cage, and others to support animal management; (5) Has management office and means of management; (6) Staff (vet, biologist, conservationist, curator, nurse, and security).

While the site requirements (based on comparative studies and regulations) for oceanarium planning need to be near bodies of water, be it river or sea. This is because, in its operation, the oceanarium needs a continuous water supply. The minimum size of the site must be 1 hectare and easy access for any vehicle. The site should also be considered close to any other buildings

that can support the oceanarium's operation. It needs to be sufficient in infrastructures such as road, electricity, clean water, telephone line, and lastly, it should be located near docks or airports (to ease the transport of fish).

To sum up functionalism architecture, it is fundamentally the principle that buildings should be designed based on the purpose and function of the building. Functionalism architecture is derived from the word "function." This notion was once a famous word by Louis Henry Sullivan; "*form follows function*" in the early 20th century. Thus, functionalism architecture was born. The theoretical articulation of functionalism architecture in buildings can be traced back to the Vitruvius triad, that is, "*utilitas, firmitas,* and *venustas*" [6].

Peter Gossel and Gabriele Leuthauser (2001) stated that the look of functionalism architecture is [7]: has a raw and robust geometric mass, has an international style, 'less is more', no ornaments should be present other than to support the building's function, the materials of the building are being shown as it is, the usage of steel, glass, and concrete are found, and has a monotone colors (black, gray, white).

This study used two buildings that applied the functionalism architecture approach in their design. The first one is the Mora River Aquarium by PROMONTORIO Architects. Finished in 2006, this aquarium is located in Mora, a small municipality in the Northern Alentejo region [8].

The building (as seen in Figure 1) applied all functionalism approaches previously mentioned and its main function as an oceanarium. Its main shape is derived from a big rectangular block. With the repetition shapes like a fish gill, the ornament serves as a function; to minimize the amount of sunlight entering the building.

Figure 1 Mora River Aquarium
(Source: https://www.archdaily.com/4921/mora-river-aquarium-promontorio-architecture [8])

The next building in the figure 2 is the Antalya Aquarium. Designed by Bahadir Kul Architects, this building was finished in 2012 in Antalya, Turkey. The wavy wall and windows serve as a mark that the building has a function related to water. With the white as a base color and warm blue tones as the accent color, even the people only passing by can immediately know the function of the building [9].

Figure 2 Antalya Aquarium
(Source: https://www.archdaily.com/477163/antalya-aquarium-bahadir-kul-architects [9])

These buildings applied functionalism architecture principles such as having functional ornaments, a firm mass shape, form that follows function, using modern building material (steel, glass, concrete). They also applied monotone main color with a blue accent color to emphasize the function. These principles of functionalism architecture need to be applied in the design of the Deli Serdang Aquarium.

3 Research Methods

The method applied in this study is the qualitative method. Ali and Yusof (2011) stated, “Any investigation which does not make use of statistical procedures is called “qualitative” nowadays as if this were a quality label in itself” [14]. The data collection methods included the site survey, literature studies on functionalism architecture, and aquarium building standards. The data collected were analyzed to come up with several design concepts, then these design concepts were used as the basis for the final design of Deli Serdang Aquarium. The design process can be described in the following paragraph.

Firstly, the site chosen is being analyzed for its potentials and problems, indoor and outdoor. When the problems and possibilities are all set, the next thing is to create a problem-solving concept and maximize the potentials with the approach of functionalism architecture. Lastly, this study's result includes applying the functionalism approach in an aquarium building in the exterior and interior.

4 Result and Discussion

This study aims to design Deli Serdang Aquarium with a functionalism architecture approach. The name is chosen that way because it will be easier to remember for the visitors. Deli Serdang indicates the location of the building, while Aquarium indicates the function that this building holds. The site of Deli Serdang Aquarium is located on Batang Kuis Regency, which has met all the necessary site requirements, as seen in figure 3.

Figure 3 Location of The Site on Batang Kuis Regency, Deli Serdang
(Source: Google Maps [13])

Several potentials in this site are as such: many potentials and supporting buildings; the Sports Center Deli Serdang plan area, Kuala Namu International Airport, Wing Hotel, Prime Plaza Hotel, and Exit toll Kuala Namu – Tebing Tinggi, located near a body of water (Belumai River), the road that accessed the site is the primary collector, a very strategic place, and the quality of the road is great (no potholes, but vehicles are running at high speed).

The size of the site taken is 23,750 m2 or 2,37 hectares. The building's base coefficient (KDB), green space coefficient (KDH), floor coefficient (KLB), and building's borderline (GSB) will be analyzed below.

KDB = 70% x Total Size

= 70% x 23,750 = 16,625 m^2

KDH = 30% x Site Size

= 30% x 23,750 = 7,125 m^2

The floor coefficient based on *Kawasan Keselamatan Operasi Penerbangan* (Area of Flight Safety) is at a maximum of 9.

GSB = ½ n + 1; while n is the width of the road surrounding the site

= ½ 8 + 1 = 5 meter

The analysis of the views will be described in the figure 4. The left and right view of the site is more potential than the front view.

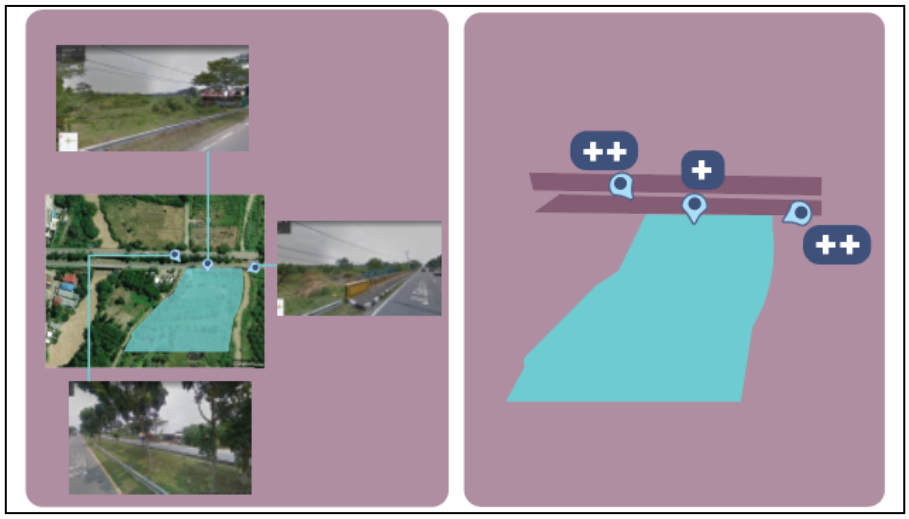


Figure 4 View of The Surrounding Area

From there, the next step is to analyze the zoning suitable for the site. There were 2 (two) alternatives, but this one was chosen because it offers more advantages than the other. This building's facade will face the main road, while the perpendicular walls will face the road that leads from Medan and Kuala Namu. The walls then will be painted with murals and signage (this will be shown later in exterior perspectives) to mark the building for the people passing by.

After the outdoor zoning, the mass will be defined. Applying the "form follows function" and firm mass shape, the rough composition (shown with yellow in Figure 5) will be how the shape of the aquariums and the size affect the whole building mass. Thus, the rectangular shape is chosen (see Figure 6).

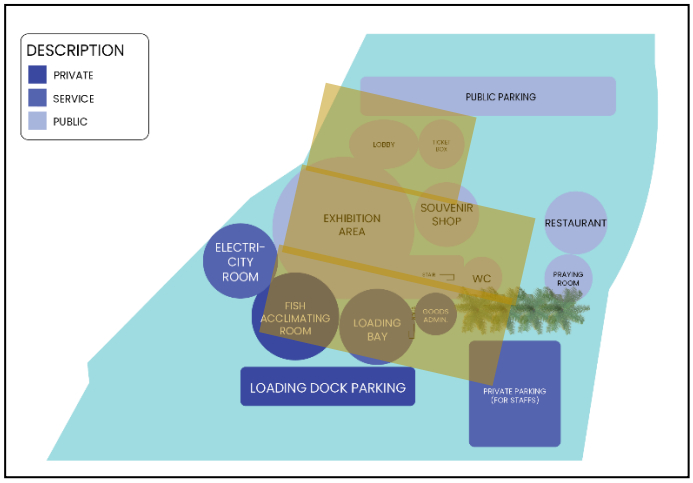


Figure 5 Zoning

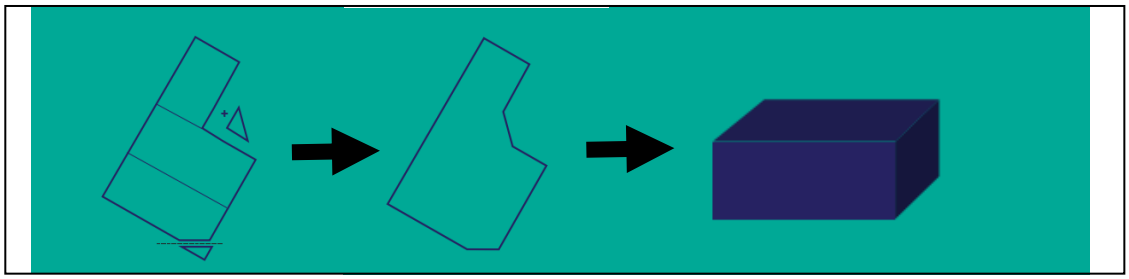


Figure 6 Mass Composition

The result of the design process will be described here. First, the ground plan and second-floor plan will look like the figure below. Visitors will park their vehicle first in the parking lot area. After that, the first place they'll head is the outdoor lobby and then the ticketing box [10]. Visitors can enter the exhibition after buying the admission ticket. After the exhibition, visitors can go upstairs to the second floor or exit the building from the souvenir store [11]. Separated from the building is the restaurant [12]. There is also a pop-up of the souvenir store for some people who forgot to buy souvenirs and cannot get back inside. Visitors can also access the wetland since it's open for the public to enjoy the river.

As seen in figure 7 (b), the second-floor plan consists of rooms such as the deep-sea fish taxidermy exhibition, auditorium, library, and management offices [15]. Visitors can access all the rooms, except the management offices and the library which can only be accessed with permission first.

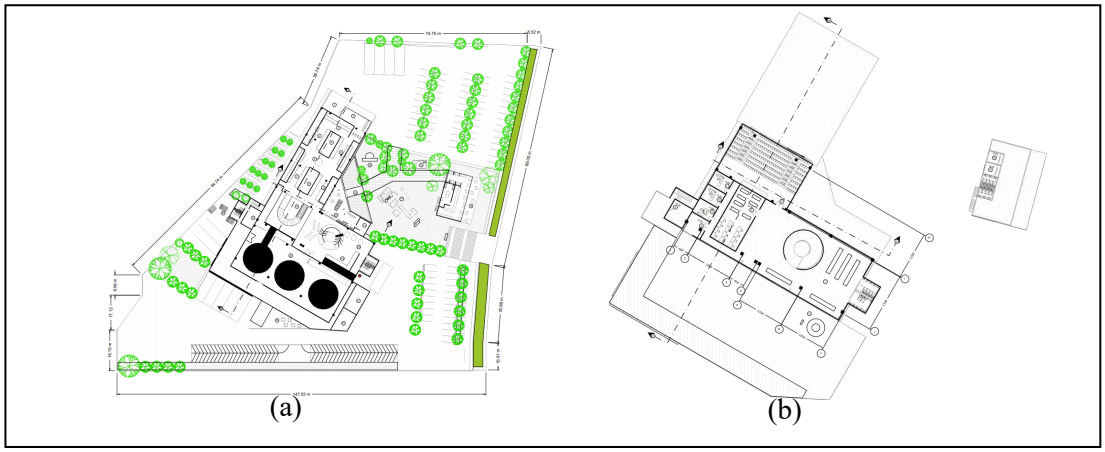
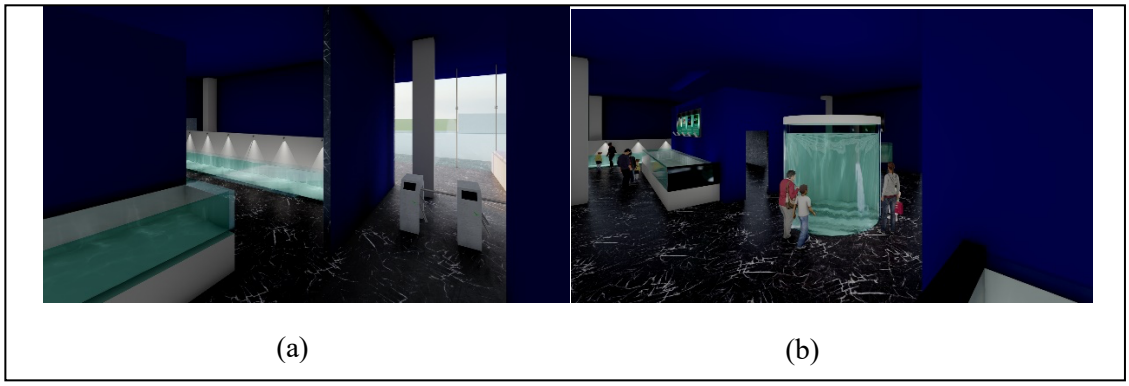


Figure 7 (a) Ground Plan, (b) Second-Floor Plan

The analysis consists of concepts that apply the principles of functionalism architecture to the site. For example, this interior applies the principle of "form follows function." The shape and size of the aquarium displays define the room they sit. The color used for the interior is dark blue to enhance the dramatic underwater effect and to highlight the fish exhibited, as shown in the figure 8.



(a) (b)

Figure 8 (a) Interior of The Exhibition Area From The Entrance, (b) Interior of Piranha Exhibition

The educational function is accommodated with the infographic board above the aquariums with the lamps to ease the reading (Figure 9).

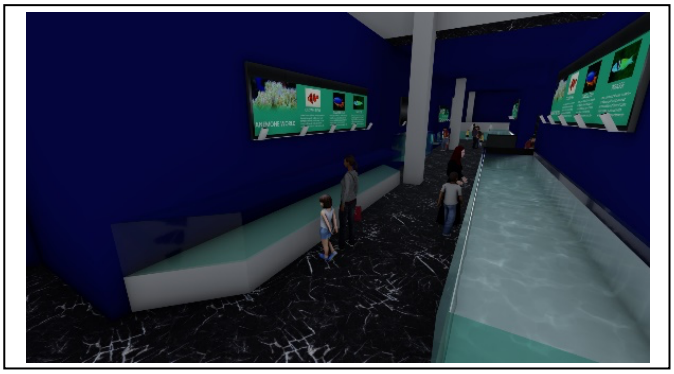


Figure 9 Infographic Board Placement

There is also a souvenir store for the visitors as their last destination before exiting the building. The store is located near the stair. The souvenir store will sell various items such as t-shirts, dolls, hats, toys, and tools as the memento of Deli Serdang Aquarium. The interior can be seen in the figure 10.

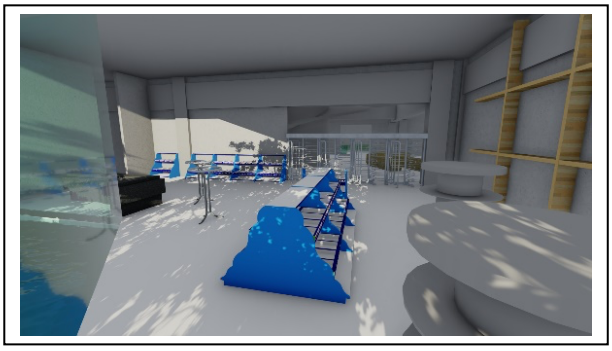
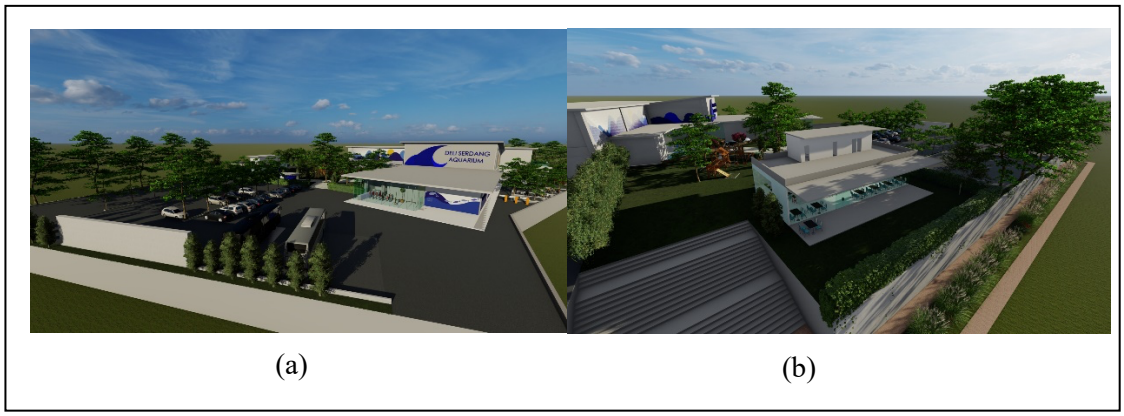


Figure 10 Souvenir Store

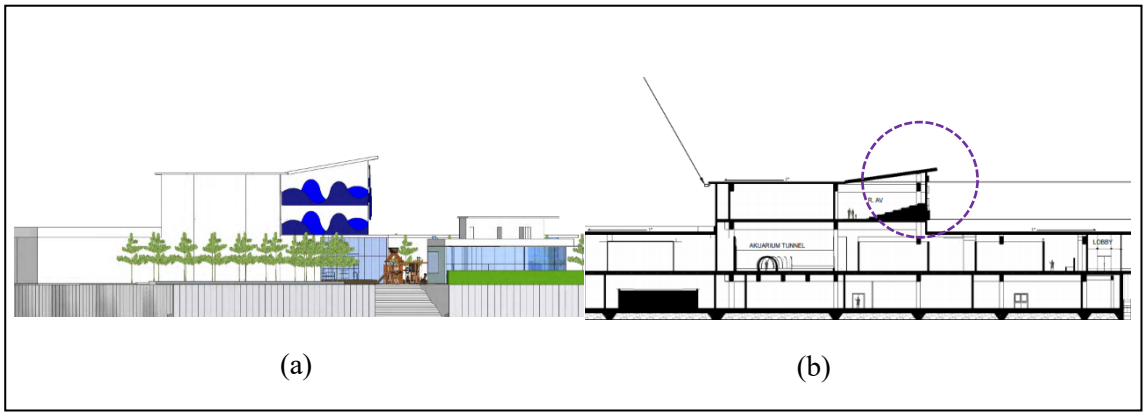
As for the facade, the primary color used is concrete white; it then added some of the blue hues in the form of waves and marine animals to emphasize the functionality of this building (Figure 11). For the mass, the main shape used is rectilinear because of the shape of aquariums inside.



(a) (b)

Figure 11 (a) Aerial View of The Front Facade, (b) Side View of The Building With Restaurant

There is also a slight tilt on the roof because it serves as an audiovisual room modeled like a cinema (Figure 12).



(a) (b)

Figure 12 (a) East Facade, (b) Cross-Section of The Building

There is a small diagonal cut of the building in the service area (Figure 13, shown with the red dashed circle) for staff working here to access their specialized parking lot.

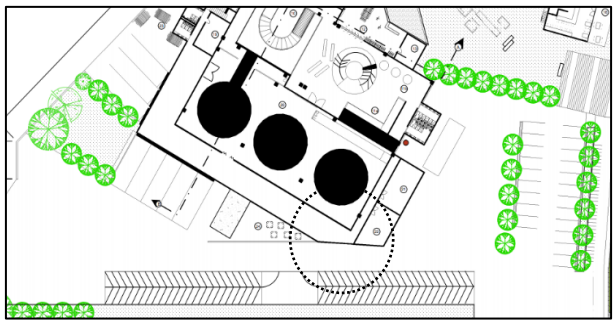


Figure 13 Diagonal Cut of The Service Area

As for the ecological problem, the east of the site (near the river) will become a wetland (see Figure 14). This wetland also serves as a part of the recreational activities in the building design. The site location has been elevated, and the wetland is also designed with low-maintenance plants to restore soil absorption to prevent flooding.

Figure 14 Public Space Wetland

5 Conclusions

The oceanarium has a function to accommodate aquatic lives as well as educational and entertainment means. For North Sumatera and Sumatera Island, the planning for this oceanarium project is important given that there is no building that holds this function up until now. Oceanarium is very important to educate people, especially children, to raise awareness of how important it is to take care of aquatic animals.

The planning for the oceanarium in this study is based on literature and comparative studies, and a field study. The writer applied the functionalism approach, which is closely related to the Vitruvian triad into the design, such as the accent color (*venustas*), the construction suitable for the building (*firmitas*), and the suitability between the primary function and its technical function (*utilitas*), into the chosen site with its advantages and disadvantages. Alongside the Vitruvian triad, this study also applies other principles of functionalism architecture, such as firm mass shape and form, which follows the function.

This study can be used for future reference of similar projects. This project also shows that a building must be functional with the functionalism approach while not ignoring aesthetics. The building is also low in its facade's maintenance as only a few ornaments need to be taken care of.

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