

# THE CONSORTIUM OF CELESTIALS: COSMIC OBJECTS EQUITABLE INTERACTIONS

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## Abstract

This speculative design study presents a provocative inquiry into the idea of an equitable society, addressed through the exploration of cosmic scale and celestial object interactions. The issues of injustice occurring in current society are influenced by the lack of access to resources and opportunities, where architecture also plays a part. Using a post-humanist approach, the study speculates on the scale of society, broadening the context of civilisation to develop an equitable society. The study creates a science narrative of a cosmic-scale civilisation as the basis of the architectural scheme between celestial objects in cosmic space that interacts in an equitable way. The narratives inform systems of architectural interactions that are designed to support an equitable life system, including communication, extraction, processing, and distribution of spatial and environmental resources. Five particular scenarios are outlined to demonstrate these interactions, from scenarios of resource exchange, climate calibration, and anticipation of destruction. This study demonstrates an important discussion on how design of an equitable society can be informed by the interactions between cosmic objects, systems, and resources. In doing so, this study introduces new narrative of architecture as a form of extraterrestrial built environment, expanding the current understanding of context and its environmental limitations.

*Keywords: scale, equity, object interactions, cosmic systems*

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## Introduction

Architecture has become a significant contributor to societal inequalities. The segregation of urban spaces, centred around the bourgeoisie and surrounded by proletarian neighbourhoods for city workers, along with the association of specific spatial characteristics with particular social groups, continues to occur repeatedly throughout history (Kivlinieks, 2022). Looking at the history of human civilisation, societal superiority leading to inequality seems almost inevitable. While total equality has been a persistent goal, it remains elusive. In fact, the progress of a society or era is frequently measured by its attainment of equality and justice across political, economic, cultural, and social spheres (Xiaoyun, 2015).

These ideas lead to the central questions of this speculative study, which asks how total equality can be sought through developing civilisation in a broader context. Can an inquiry of architecture in different scales play a key role in promoting a justified universe? These questions evolved into a narrative exploration of achieving an equitable cosmic universe, driven by post-humanist perspectives in understanding the idea of an equitable society.

The exploratory process of this study utilises hand drawings as a key tool for brainstorming and design development. Drawings are used to represent emerging ideas or capture questions raised from the design process, allowing for a more comprehensive and creative approach to narrative approach of architecture.

## Cosmic equity: A post-humanist response to injustice

The subject 'Superman' stated by Nietzsche (1916), illustrated in Figure 1 drawing exploration, is described as an individual who opposes the idea of universal equality. In essence, humans are not equal, which means that every human being has different strengths, weaknesses, and potentials for development (Eternalised, 2022). According to Kassahun and De Luigi (2018), conflict arises not because people are different but because they are not given the opportunity to be different. When a society imposes universal equality, it often results in a superficial form of equality rather than a meaningful one (Xiaoyun, 2015). Focusing on equality then often leads to the presence of injustice.

Justice can be defined as dismantling barriers to resources and opportunities in society through impartial, fair, proper, and reasonable treatment so that all individuals and communities can live full and dignified lives and no harm befalls another (Asal et al., 2022; Legal Information Institute, n.d.). With that in mind, it is almost impossible to nurture all individuals with the same kind of treatment. Equality, despite its noble intentions, has the risk to eliminate individual's characteristics, which is one of the keys to a civilisation's development. On the other hand, equity, is defined as allocating resources in a way that recognises individual characteristics to ensure that each individual has the access to the same level of resources needed (Asal et al., 2022). Therefore, what is truly needed is equity, instead of equality.

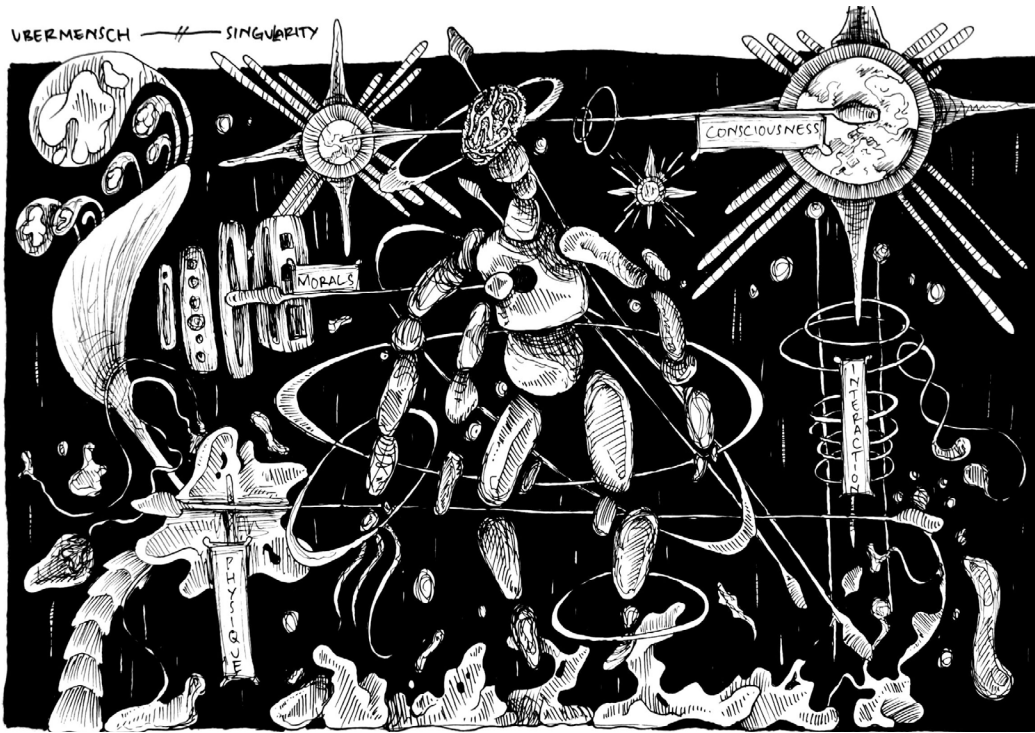


Figure 1. Superman: Questioning total equity (Image by authors)

Post-humanist perspective become relevant in developing an innovative architectural response towards an equitable society. Post-humanism, or post-exclusivism, or post-anthropocentrism, is an empirical philosophical perspective that broadens the context of existence as a way to mediate the diversity of existence (Ferrando, 2013). In post-humanism, there is no hierarchy among living beings, meaning that the concept of civilisation extends beyond humans to include non-humans, all considered rationally (Ferrando, 2013). This perspective encourages the development of a universally equitable civilisation and numerous possibilities for exploration in the evolution of living beings. It would be unjust to overlook the context of individuality for entities beyond humans, which elevates the need to move away from an anthropocentric mindset.

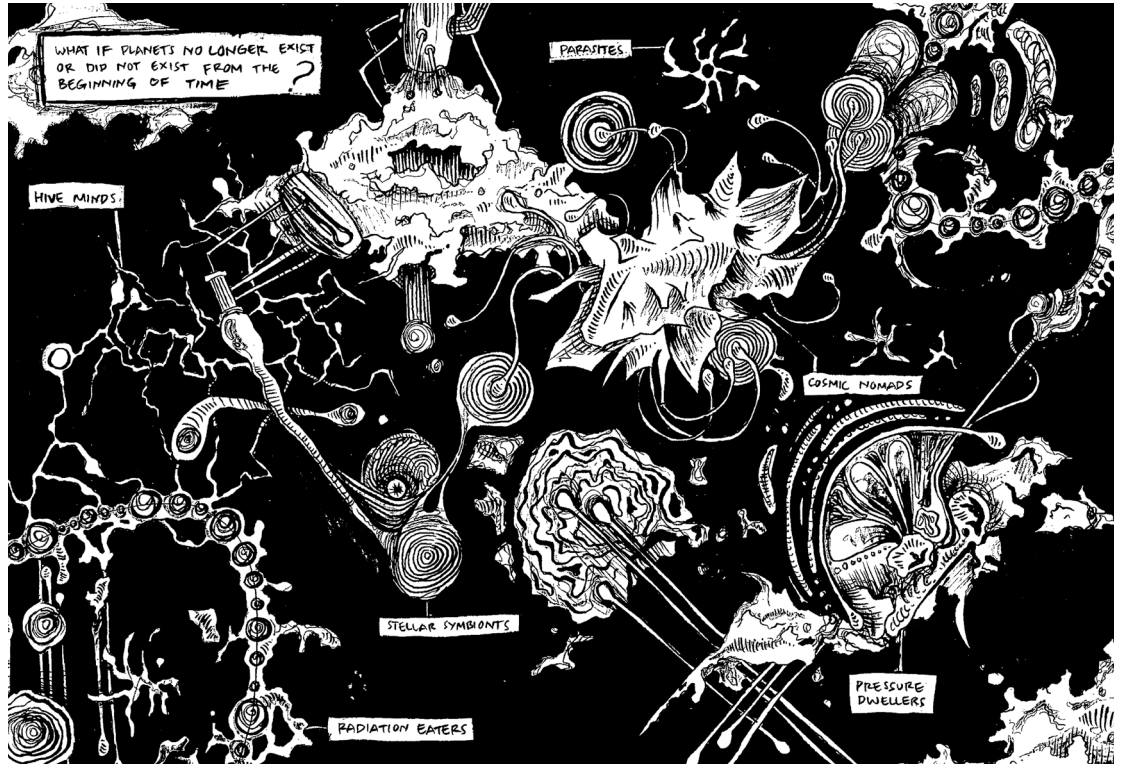
Superiority is a trait that can be attributed to a species in comparison to another species, but also, and crucially, with respect to a certain standard. It thus does not make sense to say that humans are superior to other species tout court. (Monsó, 2019, p. 1)

From the discussion above, it is evident that the human-centred nature of civilisation is a product of human thought, which has historically made humans superior over other species. This fact has triggered further exploration of social interactions beyond human civilisation.

### Expanding the scale of post-humanist civilisation: The cosmic society

Living beings exist on a wide range of scales, and it is possible that humans can better understand themselves by attempting to comprehend various different scales (Ishigami, 2010). The search for balance in equality can be achieved by expanding

the scope of 'civilisation,' including extending it into space. "... one tiny aspect of an object is itself an entire cosmos; this door can symbolise the passage into a new world filled with categories large and small. The miniature is the hiding place of the large" (Bachelard, 1958, as cited in Ishigami, 2010, p. 235). From this statement, exploring other scales becomes crucial in understanding the context of different scales to avoid the stagnation of contemporary society (Kivlinieks, 2022).



Throughout human history, humans have used the knowledge of cosmic space to understand their own civilisation (Figure 2). Elements that make up the universe have been studied as a way to search for human origins (Marchant, 2020). Supporting this statement, Ishigami (2010) also argues that the best depiction of harmony formed from diversity can be seen in space, particularly where diversity of scales is involved. That statement suggests that the scale of the universe or outer space as 'cosmos' hereafter offers harmony, defined as a structure encompassing all matter and energy (Merriam-Webster, n.d.).

Figure 2. Imagining a cosmic society (Image by authors)

Dickens and Ormrod (2007) stated that "...all societies should be considered 'cosmic,' and that special attention should be paid to the cosmic nature of contemporary 'global' society" (p. 2). This quote suggests that the social life we know today should not be limited to human civilisation or life on Earth. In continuation to the previous discussion on posthumanism, the study speculates how the 'society' should be considered on a cosmic scale to truly reach a universal and equitable context.

In developing a broader cosmic context, Tarnas (2006), as cited in Dickens and Ormrod (2007), argues that our understanding of the universe in the modern era needs to be

revised. Modern science defines the universe as an element that is constantly moving, mechanical and purposeless, and governed by force of chance and necessity. Instead, it can be discussed that the cosmos and the cosmic objects within it are not merely a series of mechanical systems, but each can also be considered as an individual entity (Dickens & Ormrod, 2007). Each cosmic object has its own scientific characteristics. Like humans, cosmic objects experience birth and death in a cycle, continuing their existence (Busha et al., 2003). Furthermore, cosmic objects interact with each other, indicating both equality and inequality, such as the existence of gravity and other laws of physics that serve as laws or rules governing the entire cosmos (Hawking, 1988). Cosmic objects also have their own survival needs, such as fulfilling resource requirements to maintain a stable climate and using interactions with other cosmic objects to preserve stability.

This study further speculates on establishing a universal cosmic society or a civilisation on a cosmic scale, consisting of cosmic objects as its subjects and more minor elements as the components of its civilisation (Dickens & Ormrod, 2007). This scenario is increasingly feasible given the advancements in space technology, suggesting that humans and other organisms might eventually inhabit the cosmos beyond Earth.



Weinberg (1972) as cited in Dyson (1979) stated that there are two models of the universe: the open and closed universe. In the concept of an open universe, space and time are limitless variables that will continue indefinitely. Thus, it can be said that while the universe will always have 'ends' to certain things, there will also be 'beginnings' of others, occurring simultaneously. However, beyond the debate over which condition truly exists in the universe, there is also the possibility of turning a closed universe into an open one through the desire to survive as a whole cosmos using technological intervention (Dyson, 1979). In further development of the universe, Nikolai Kardashev (1964) as cited in Galántai (2003) classified civilisations into three types based on their ability to harness energy, which is presented in Figure 3. Kardashev's classification (1964) was limited to the capability of civilisations to utilise energy. This study expands more on such capability by exploring new architectural systems to harness and distribute resources on a cosmic scale towards an equitable cosmic society.

*Figure 3. Drawing Kardashev's (1964) civilisation scale (Image by authors)*

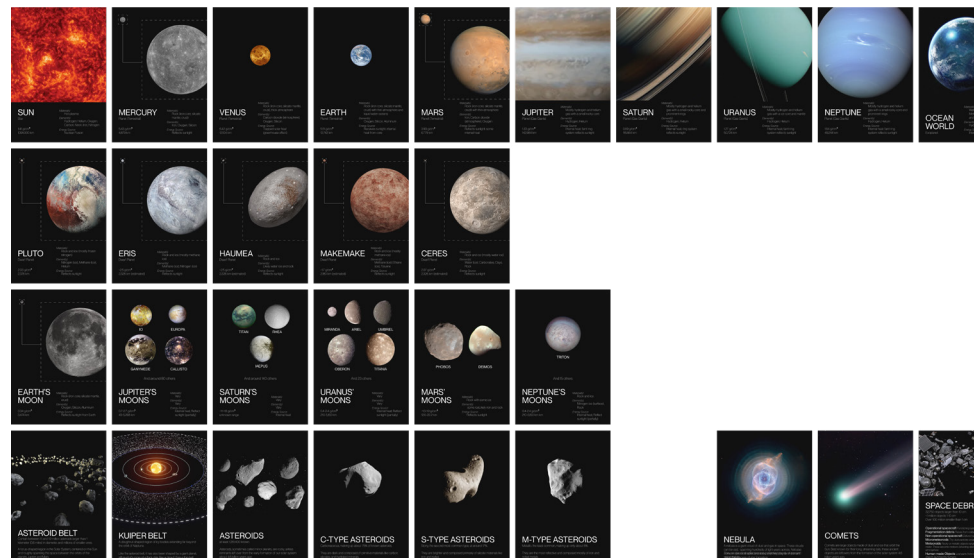
## Cosmic object interactions as a foundation for equitable architecture

Architecture, traditionally understood as the design and construction of buildings, must evolve in the broader context of cosmic society. It should no longer be seen merely as the creation of physical structures but as a dynamic interactive response to the diverse needs of individual entities. Architecture must be redefined as a system of facilities that interacts, adapts, serves, and responds flexibly to their varied demands. Architecture should be designed with adaptability at its core, ensuring it can efficiently accommodate multiple types of operations and functions in response to diverse individual needs. In doing so, architecture becomes a living, responsive entity.

The design exploration of cosmic interactions to develop an equitable architecture in this study is done in several stages. The investigation explores cosmic interactions and diversity and develops cosmic architectural objects. The study then creates a speculative science-fiction narrative to demonstrate a better understanding of how a universally equitable civilisation is achieved.

### Exploring cosmic objects' interactions

An investigation into cosmic objects and interactions between them is important as a deeper understanding is needed of how new cosmic conditions influence the development of different functions of architectural space. The study will also explore potential interactions within a space-based architecture, considering not only object-to-object interactions but also interactions between architectural elements.



This exploration gathers information on hundreds of cosmic objects, which were then categorised into 27 categories of objects within cosmic space, particularly those within our solar system. After categorisation, detailed information about each object was also collected, including diameter, density, position relative to the sun (for those within the solar system),

Figure 4. Cosmic object exploration catalogue (Image by authors)

the materials inside, the constituent elements, and the energy source used. This information was then compiled into a catalogue to be used as a basis for the creation of cosmic objects. Further analysis is done to identify the needs of resources of each object and how it may interact with other objects in various operating system scenarios.

The study highlights that cosmic objects and the cosmos itself are involved in constant interactions, driven by gravity. The gravitational pull creates interactions within the universe, such as the rotation and revolution of planets around a star, collisions between cosmic objects, even activities on a planet. Moreover, gravity affects architectural design, both in terms of space formation and technology, as well as the development of architectural operations. For example, gravitational interactions creates Lagrange points that arise when the gravitational interaction between two cosmic objects occurs (Cornish, 1998). Understanding Lagrange points is crucial as they offer unique spatial characteristics and inform arrangements of cosmic objects for future architectural development. Architecture constructed within Lagrange points will exhibit distinct characteristics and technologies compared to architecture situated outside these points.

The study explores more on these kinds of interactions through investigating other design cases of cosmic architecture. The case studies offer a framework for understanding how architecture must evolve to address the needs of space operations. For example, Dyson Swarm is a hypothetical megastructure designed to harness the sun's energy designed by Freeman Dyson (Smith, 2022). By orbiting the sun with a swarm of solar panel-equipped modules, it aims to offer a decentralised, scalable approach to energy harvesting (Smith, 2022). The spatial arrangement, operational mechanisms, and module size of a Dyson Swarm are not arbitrary choices but essential considerations that will directly impact the sustainability and growth of any cosmic-scaled civilisation.

Another speculative but crucial architectural study is the Stellar Engine, a design project offering a potential solution for ensuring a civilisation's long-term survival. The project's concept envisions the use of a star's energy to create force, allowing civilisations to move entire star systems to avoid cosmic threats (Badescu & Cathcart, 2006). The underlying principle is that advanced civilisations must control the forces of nature at an unprecedented scale. Such a notion of control challenges us to think about architecture not just as structures but as dynamic, civilisation-sustaining operations.

The Modular Artificial-Gravity Orbital Refinery (TOP2-299), designed by NASA, is another example of how space architecture must be inherently operational. The refinery is designed to process materials in low-gravity environments, a function critical to the success of cosmic resource utilisation efforts such as asteroid mining (National Aeronautics and Space Administration, n.d.). The process of asteroid mining is not just a way of seeking alternative sources of materials; it is a critical

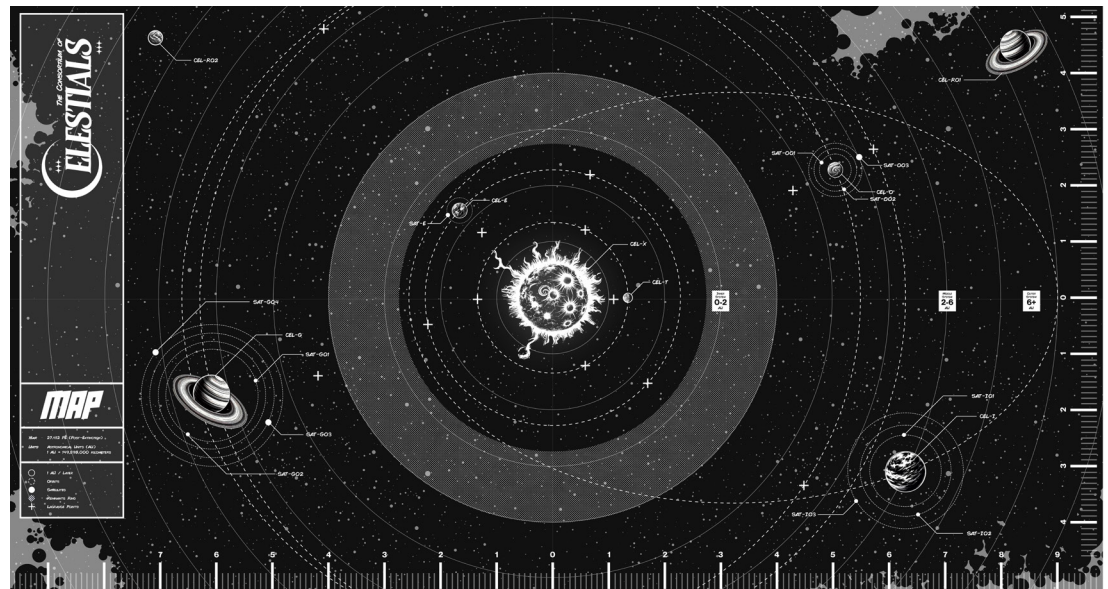
resource-acquiring process that ensures cosmic civilisations can operate. The unique spatial and technological challenges posed by asteroid mining require specialised architectural solutions. NASA's design uses high-strength arms to secure asteroids for resource extraction (Brophy et al., 2012), highlighting the complexities involved. The rotating segments of the refinery create artificial gravity, allowing for more effective resource processing and storage. The spaces are formed based on the flow of resource transportation, raw material storage, processing, and storage of ready-to-use resources, all with a linear flow, thus enabling it to run effectively. These operations reveal the necessity for purpose-built architectures that account for the microgravity environment, rotational forces, and proximity to celestial bodies. Such form of architecture demonstrate the flow of the operation system that interacts with different condition of cosmic objects and the cosmos around them.

These speculative architectures offer necessary concepts and technological ideas for future equitable architecture. Utilising these ideas to address the unique operational needs of interactions between cosmic objects becomes key in developing an equitable cosmic-scaled civilisation.

### **Assembling The Consortium of Celestials**

In relation to studies on cosmic diversity, interactions, and architecture, the study develops a new scenario for creating an equitable, interaction-based architecture. This architectural vision is set within a speculative science-fiction universe called *The Consortium of Celestials*. This speculative science-fiction universe narrative is needed to demonstrate a broader understanding of how architecture is able to support the development of a universally equitable civilisation.

Figure 5. Map of The Consortium of Celestials universe (Image by authors)



The Consortium of Celestials adapts to the existing solar system, but with modifications to enrich the celestial individuals that interact with each other within the cosmos. The celestials



developed within this project include planets and one central star, referred to as CELs, and each of their satellites, referred to as SATs. In addition, the project also includes other cosmic objects, such as comets, referred as Wanderers; asteroids, referred as Remnants; and nebula, referred as Clouds. Those celestials will be the subjects or cosmic individuals within this speculative universe.

A map for the universe, which can be seen in Figure 5, is assembled to help a better understanding of the interactions of cosmic objects within it. A simulation process conducted in Universe Sandbox is done to develop more detailed information for each celestial, namely the mass, density, composition, as well as orbit, which is a consequence of the characteristics of each celestial. Information about each celestial characteristic is compiled in cards (Figure 6) to facilitate mapping in future architectural operations.



### Equitable architecture system making and its interactions within the Consortium

This section discusses the process of developing architectural types necessary to support the operations of a new equitable universe. The Consortium of Celestials is a complex system composed of various architectural components, each with a specific role in maintaining and expanding the system. The operating systems presented in Figure 7 reflect various interactions that might occur in the cosmos based on previous studies, taking into account the diverse types of celestials, needs, and gravitational force. The diverse nature of celestials and the complex range of interactions, from resource exchange to physical interactions. The design of these systems considers the cosmic objects' capacity, needs and operational flow to ensure efficient operations from one object to another within the universe.

Figure 6. Celestials objects information cards (Image by authors)

Eight cosmic architectural objects displayed in Figure 8 are designed as actors with specific roles, dimensions, spatial qualities, and technologies to facilitate the architectural operations effectively. There are four primary architectural operations: communication, resource processing, energy collection and distribution, and exploration, which occur continuously within this system and become the driving force behind the entire system (Figure 9).

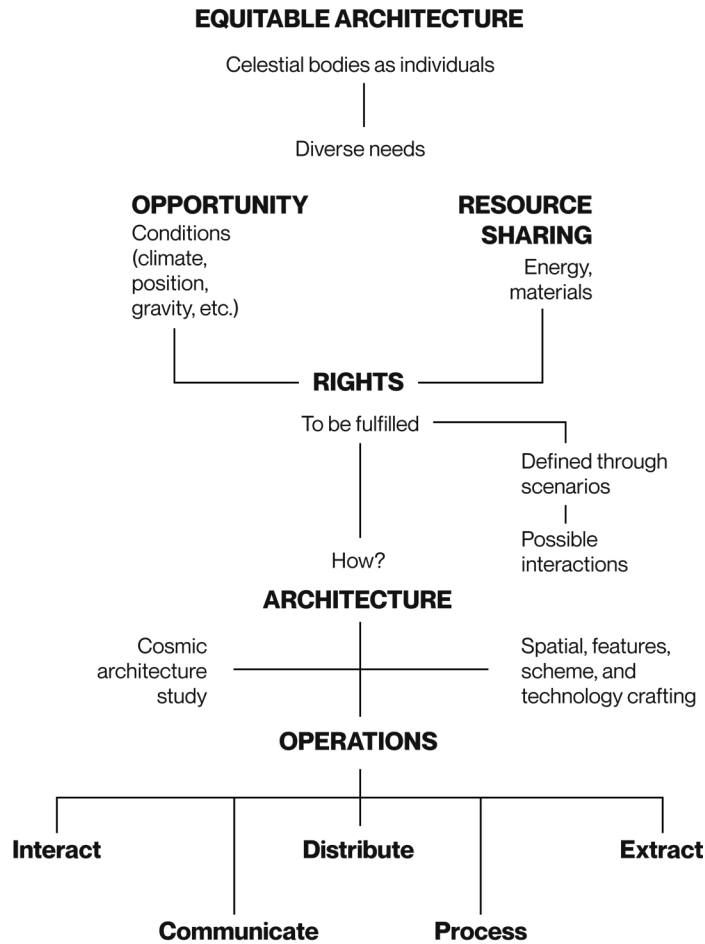


Figure 7. Operating systems of an equitable architecture (Image by authors)

Ark, as the central command ship, oversees all operations, coordinates activities, manages resources, and acts as the headquarters for all other architectures. All communication is also centralised at the Ark as the command centre. The Alto units are stationed on different celestial bodies to address local needs and infrastructure development. These local command centres can operate in both compact and expanded modes to make it easier to reach newly discovered celestials while also making it easier to settle in. Before each operation begins, a report of a potential issue is sent from an Alto to the Ark, which then communicates it to other architectures required to carry out the operation after the Ark's automated system has developed a strategy for solving the issue.

The resource processing operation is carried out by the Mobile Harvesters, the Tethers, the Conveyors, and the Orbital Refineries. The Mobile Harvesters, equipped with mining tools

and storage designed for efficient extraction and transportation, are responsible for extracting raw materials. The Tethers, on the other hand, are designed to capture and control smaller objects using their retractable robotic arms that enable precise movement manipulation to facilitate material extraction. The Conveyors, with their massive cargo capacity, are responsible for transporting resources, materials, and equipment across the Consortium. Finally, the Orbital Refineries act as raw material processing facilities and architectural outposts located at Lagrange points. All of them will collaborate in a series of operations to solve issues throughout the Consortium.

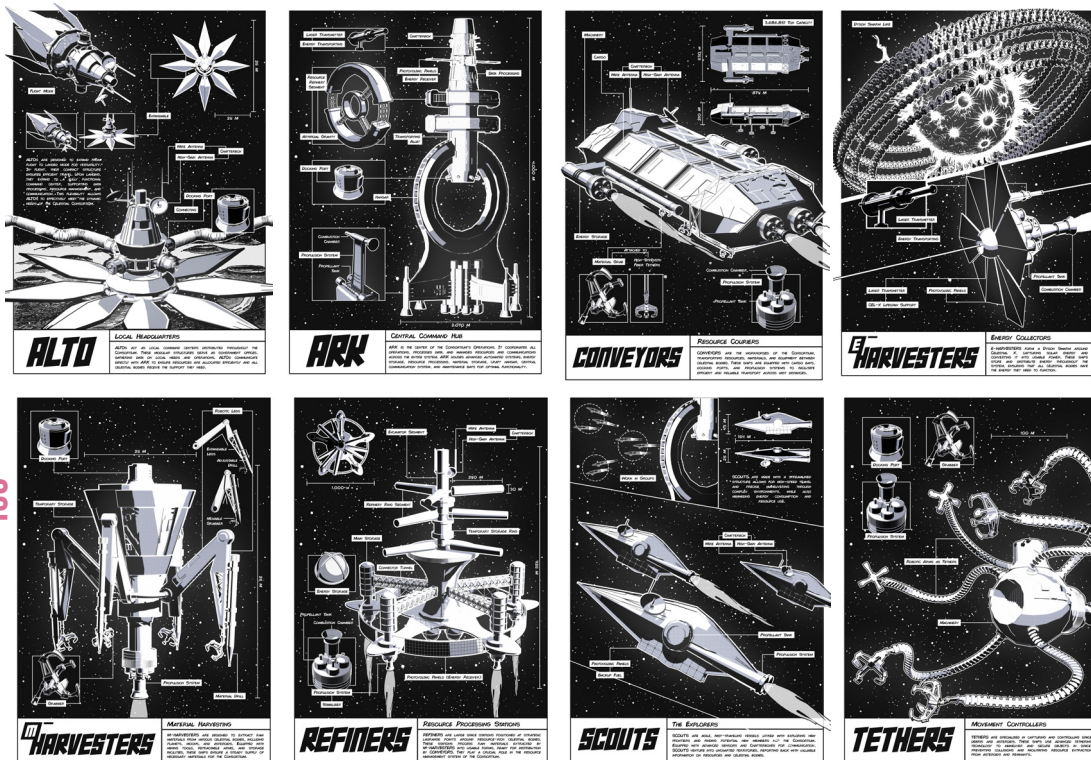


Figure 8. Cosmic architectural objects (Image by authors)

The second main operation, energy collection for the entire Consortium of Celestials, is carried out by the E-Harvesters. The energy collection scheme involves harnessing energy from the CEL-X's radiation and transmitting it to the Ark, using a combination of Dyson Swarm and Stellar Engine technologies to enable harnessing while also extending CEL-X's life span. The energy contained in the Ark is then distributed throughout the system using the same laser transmitting technology towards the Altos.

Lastly, to maintain and expand the ongoing life system in the Consortium, the Scouts will explore various new spaces to find potential new members of the celestials who can join the system. Their design emphasises long-range travel, manoeuvrability, and efficient gravitational utilisation to minimise fuel consumption. Upon finding a new member, an Alto will be sent to the potential member to facilitate operations and meet their needs.

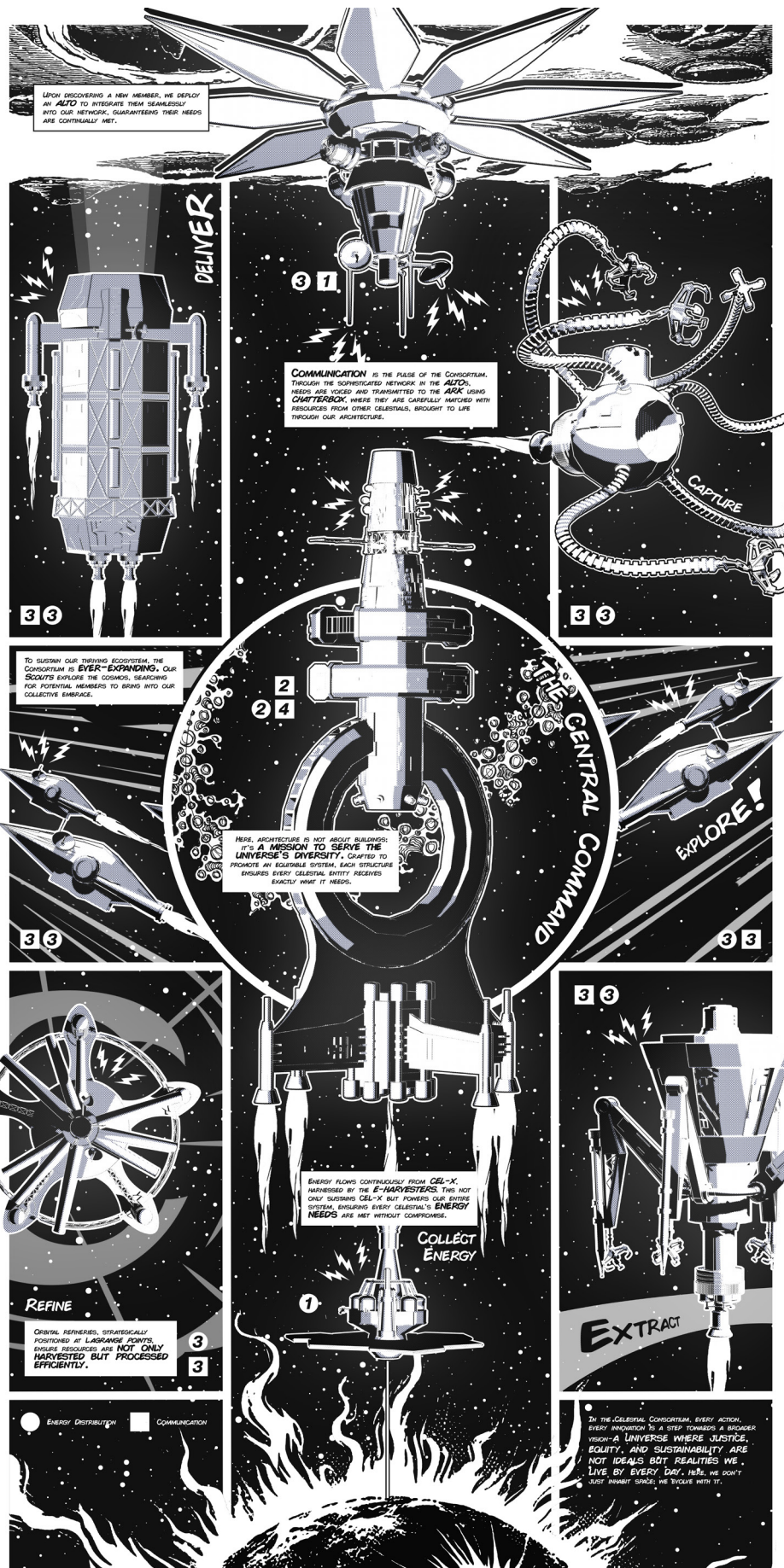
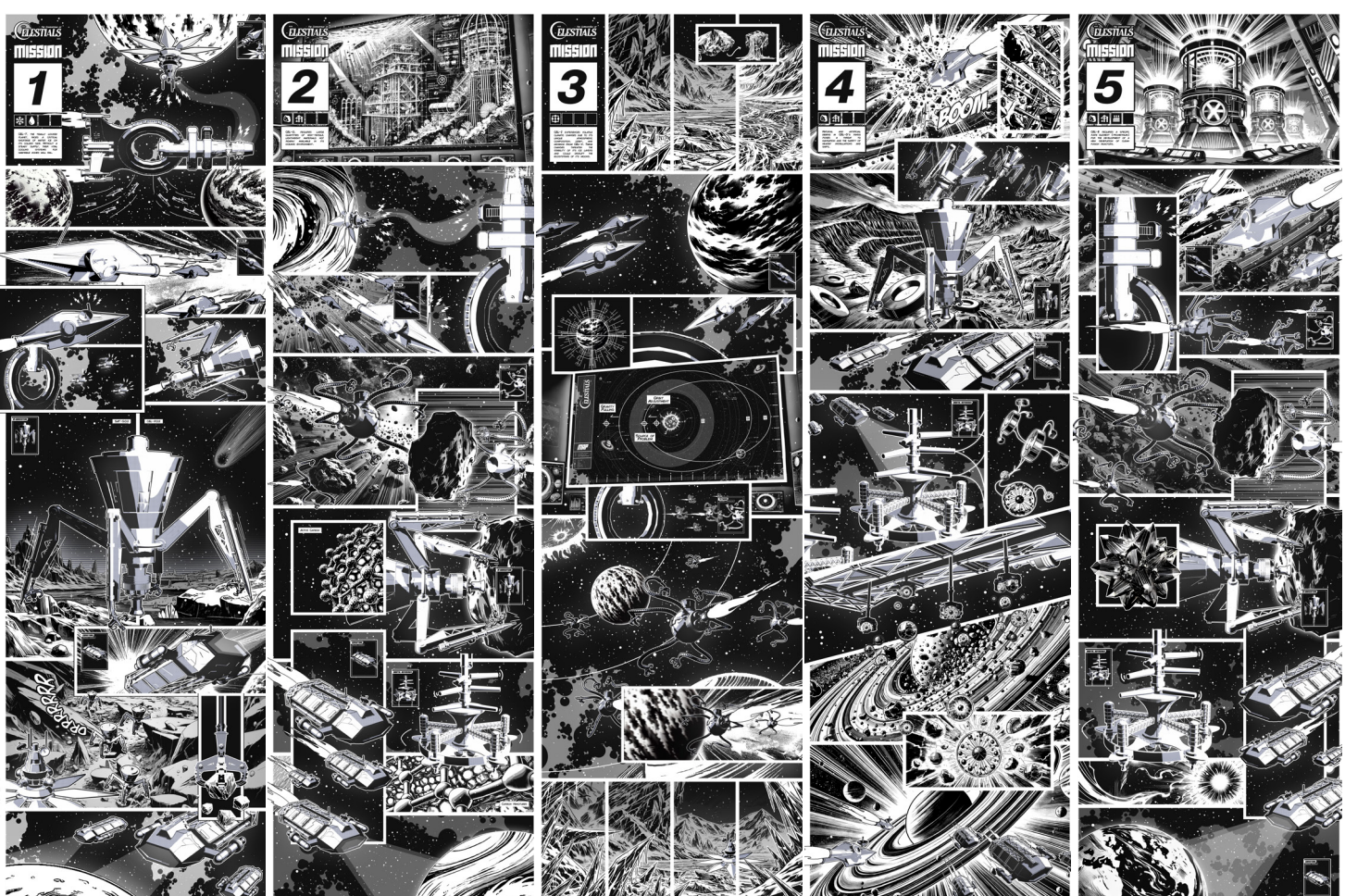


Figure 9. Operational diagram of architectural objects (Image by authors)

The entire system of architectural forms and interactions between them are designed to support the overall operation of the system and sustain an equitable life system. The architectural interactions formed include communication, extraction, processing, and distribution of resources, all of which form interactions between celestials to mutually fulfil needs in achieving equity. These interactions are then demonstrated through five possible interaction scenarios (Figure 10), ranging from the exchange of resources for the development of celestials, climate calibration through celestial interactions, to the anticipation of destruction risks that allow celestials to live longer.



In this speculative science-fiction narrative, the architecture within the Consortium is designed to address the diverse needs of individuals across different celestial bodies. Each structure serves a distinct purpose, ensuring that resources and opportunities are distributed according to what is needed rather than distributed equally. By designing architecture that responds directly to its context, whether it is gravitational conditions, available materials, or unique interactions needed, the Consortium achieves a space where it is possible to respond to every specific need of its inhabitants.

Figure 10 Scenario operation illustration (Image by authors)

The technology integrated into each architectural design reflects this pursuit of equity, from energy-efficient solar harvesting systems to sustainable resource extraction facilities. The spatial qualities of each structure are carefully considered, ensuring accessibility and adaptability to different functions. By combining technology, design, and purpose, the Consortium's architecture upholds the principle that every cosmic individual object, regardless of their location or needs, can thrive within an equitable civilisation.

### **Conclusion**

This design study presents a speculative inquiry into the idea of cosmic scale and celestial object interactions to achieve a form of post-humanist equitable society. The design process of this study began by questioning the need for total equity instead of equality in achieving justice and how architecture plays a role in it. The study explored how an equitable civilisation can be provocatively developed using a post-humanist perspective, broadening the civilisation to a cosmic scale.

The study continues its exploration by investigating the environmental conditions of the cosmos and case studies of cosmic architecture and its various roles in present society. It identifies gravity as an important force that define arrangements of cosmic objects and variety of their characteristics. In addition, the study highlights the various processes and systems that may emerge to access and distribute resources, as well as respond to the different climatic conditions of the cosmos.

As part of a speculative science-fiction narrative, this study presents The Consortium of Celestials as a form of a new cosmic civilisation system. The Consortium takes the form of a solar system containing celestial objects such as planets, satellites, comets, asteroids, and nebulas. Eight cosmic architectural objects are then deployed around these celestial entities, comprising the Ark, the Alto, the Scout, the Mobile Harvesters, the Tethers, the Conveyors, and the Orbital Refineries. These objects then oversee four primary architectural operations in the Consortium: communication, resource processing, energy collection and distribution, and exploration. These operations occur continuously between celestial entities within this equitable universe.

This study expands the architectural discourse that focuses on extraterrestrial environments, which becomes increasingly relevant along with the vast development of technology, the crisis of climate change, and other environmental, societal challenges brought by the increase in the world population. Through various drawings, maps, and catalogues, this study introduces new narratives of architecture that perpetuate equality in a cosmic scale. The creation of The Consortium of Celestials in this study offers a post-humanist redefinition of societal systems that may transcend beyond the human context.

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