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CONTINUOUS INTERIOR SPACE ARCHITECTURE
AN OMNI-ORIENTATIONAL ARCHIVE OF INTERFACES

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THESIS ADVISORY GROUP:
DISSIMULATING MATTER
EVERSOLE | MAC NAMARA | LARSEN
Contention

This thesis speculates a changed relationship between bodies and information access, mediated by an omni-orientable, continuous spatial information-interface. The closed world of the spacecraft is a digiphysical reality where these two spatial experiences are utterly entangled such that a person's movements and engagement with and within this space is defined by the two simultaneously.

In preference of depth and specificity of the thesis, this work is not focused on the mechanics or engineering of a spacecraft. But instead it focuses on the spatial and experiential environment, augmented with information.
Through the production of an archival interface for research and design, we enable the exploration of complex interconnectivity between objects and systems within nonorientable space. This concept of the interconnectivity of things is drawn primarily from Benjamin Bratton’s Stack. Bratton argues that the human world is a mega-structure of somewhat distinct layers: the Earth, City, Address, Cloud, Interface, and User layers. While Bratton’s description allows for the intertwining of these layers, we argue that it is an incomplete model of a reality where human occupation has expanded into outer space.

First, the Stack model imagines a world in which everything is so deeply interconnected that any division between individuals, institutions, and even countries is fabricated. But in a world threatened by nuclear war at the drop of a hat, and where poverty, refugees, and protests are so common they hardly draw attention, these divisions are very real: the border is back, if it ever actually left. At the same time as the spacecraft is absolutely connected to the Earth through its information production, it is also an island unto itself, to use Ariella Azoulay’s terminology.

This dual nature means a few different things for space exploration, both on Earth and in the space habitat itself. Questions of who lives in this habitat (city? colony?) and how connected the habitat will be to our terrestrial “Spaceship Earth” arise in every imagined scenario from science fiction novels to studies performed by organizations like NASA. This makes it vital for us as designers of outer space habitation to understand and contend with these already complex relationships as they become displaced and altered by a new spatial reality. This new spatial reality is another primary reason why the Stack model is incomplete. A stack requires directionality, it has a top and a bottom and no matter how much interplay there is between layers, there is still division and striation. The Stack doesn’t work with nonorientation: neither the nonorientation of outer space, nor that of multiplicitous societies divided by material and immaterial borders. In an age perhaps defined by space exploration and technological advances, these borders include everything from walls, to the distance of space occupation, and censored access to information.

**Nonorientation is one of the defining factors of the vacuum of space.**

Because the spacetime of outer space is post-Cartesian and omnidirectional, we, meaning designers and thinkers, haven’t established a singular, clear representational method. Any diagrammatic representation or textual explanation relies on metaphors and derivative symbols. In response to this lack of specificity and clarity in representation, our design tool produces an archive which leverages this strange spatial reality for design.
Since a space station is a machine that is always on and vital to the survival of its inhabitants, it is also a space which requires complex interface between humans and machines. And as technology rapidly advances, it also rapidly diminishes: computers changed from the size of a room, to that of a desk, and now practically to the palm of our hand. The physical interaction between human and machine therefore has also changed, guided by skeuomorphic design to retain some reference to the physical past. Now, when the human is placed within a spatial machine, such as a spacecraft interior, the human’s relationship with technology needs to change even more drastically to accommodate vastly different movements and gestures. Furthermore, the non-orientability of this spacecraft as habitable machine adds even more possibilities for the interaction of human and machine in physical space.

We say physical space because there also exists simultaneously the overlaid virtual space, the digital reality of an interior-as-machine. This virtual reality is just as “real” as the physical because as Slavoj Zizek describes “by the mirage of “virtual reality,” the “true” reality itself is posited as a semblance of itself, as a pure symbolic construct.” This virtual space is not exactly a new phenomenon. As the internet of things has become a more ubiquitous system, the virtual information space has become less distinct from the physical reality. Space exploration, due to its limitations on scale and mass, can take advantage of this virtual space to augment the human sensory experience. This simultaneity of physical and virtual space produces a new digiphysical materiality, one that this project explores and designs.

Another primary aspect of the human-machine interface that this project seeks to take advantage of is the feedback loop between user and machine. As Janet Vertesi describes in Seeing Like a Rover, both human and machine adapt to one another through their interaction. During the process of NASA engineers and scientists learning to coordinate Mars rover missions, scientists not only anthropomorphized the machine but also attempted to make their reality work the same way as the rovers. Some of them pinned up the images taken by the rover around their cubicles and used their rolling chairs to explore their newly-formed environments. This adaptation on the human side allowed the human users to understand and communicate with the machine and thus better employ the rover’s functionality.
There are numerous ways in which someone might read and understand these layers and relationships, especially in the format of the tool. This is intentional as the tool is meant to be used for design, it is meant to be manipulated, understood, updated, and re-understood.

Each layer and sublayer can be categorized in multiple different ways as a means to compare across worlds.

This work began with a study of relationships between closed worlds of objects, moments, environments and the larger infrastructural and sociocultural systems they interact with in the digophysical landscape.

These broader theoretical ideas are derived from Benjamin Bratton’s concept of The Stack: an accidental megastructure formed by global-scale computing where everything is interconnected. These relationships are defined by the layers of the stack: User, Interface, Address, City, Cloud, and Earth. But in this layering and by taking this stance, Bratton’s ideas have a direction, they have a gravity.
Although these systems are beyond the visibility of the naked eye, they have spatial implications on the domestic space and the city, the archive allows these spatial implications to be explored.

Connections can be drawn between this layer and the above layers which talk about trucking and transportation infrastructure.
THE CODE

Contains urban and landscape scale graphic information: Public activities, transportation, infrastructure, etc.

HIGHLINE
- Plant Species
- Instagrammable spots
- Signal Coverage
- Railway Infrastructures

SUNBATHING
- Outdoor Park
- Picnic Food
- Instagrammable
- Waste Management

GLOBAL SHIPPING
- Customized Ads
- Ground Shipping
- Distribution
- Oversea Route
- Door-to-Door

APPALACHIAN TRAIL
- Government
- Consumer Objects
- Environmental Control
- Enclosure
- Power Grid
THE CODE

OBJECT / INTERIOR

Contains object-scale graphic information:
Domestic environment, working area, devices, etc.

COMPUTER LAB
Monitors / Mobile Signals / Electricity Cables
Undersea Cable / Optical Fiber

INTERNATIONAL SPACE STATION
Life Support / Research Labs / Data Transmission
Solar Panel / Satellite Orbits / Governments

TRAFFIC LIGHT
Traffic Intersection / News / Emissions
Transportation Systems / Energy Consumption

SMART LIGHT POLE
Traffic Intersection / Face Recognition
Personal GPS / Surveillance / Traffic Data
An overview of the augmented reality application interface and functionalities.

The first function of the app is to decode the worlds through the machinic eye of the AR lens. The AR lens views the worlds and segments the photo using tracking points to know which world is which. The tool then decodes this world through the translation of the world from a polar coordinate system embodying omni-directionality into the Cartesian coordinate system seen below.

Through this translation, the worlds are also animated to allow the user to envision the relationships more clearly.
We continued to experiment with the ways in which information could be unrolled and extracted from these spheroidal worlds through a series of animations.

In trying to define these interacting worlds, we returned to Bratton, breaking down the spheroidal worlds into their constituent layers to interlace across worlds and examine their potential relationships. This representation, however, falls into the same gravity well as Bratton’s concepts, and it therefore struggles to engage with the spatial and sensorial digophysical reality of the spacecraft we envision.
When light projection takes over the dark interior exhibition space, the spacial experience becomes immersive immediately. However, the users lose the opportunity to experience the spatial quality of the materialized space. Our project aims to create sensory-spacial experience in physical and virtual space simultaneously, through a digiphysical materiality. This will expand upon existing experiments in media arts and installation.

Refik Anadol, Machine Hallucination

Sunshine - Earth Room, an immersive environment on a space station to simulate earth-like experiences

Solaris - An astronaut suggests hanging paper from the air vents to block out the machine noise

Kike Aranibar, Machine Hibernation
The project largely relies on technology. What we want to investigate is not merely the interactions between individual human body and the machine.

We are more interested in how human bodies adapt themselves to the machine; And through the digital tools, how multiple users interact with each other.
To re-emphasize the importance of physical materiality, the project rethinks the sectional quality of the space. Forms, surfaces and scales of the exhibition space are not eliminated by the introduction of virtual space. The physical-spatial quality of the space contributes to the omni-orientation envisioned. Human-body gestures, number of users and interaction between user-machine and user-user are shaped by the physical space as much as the digital interface.
Display screens, projectors, cellphones, and headsets are some of the current interfaces of virtual space. Designed by different service providers, they bring users different user experience. Some are more immersive, some are easier to interact with, some allow more users to participate at one time. Our project takes them as opportunities to create different spatial experience, and to initiate different types of interactions for productive and design purposes.

REFERENCE

MULTI-INTERFACE

The Sprawl - Metahaven

Closed Worlds - Lydia Kallipoliti
To create an omni-orientational quality of a physical space on Earth, we change the orientation that human bodies are already familiar to. However, relationship between human bodies and the space are maintained. Omni-orientation is different from dis-orientation or non-orientation. Orientation between users and users, users and interfaces, users and space will be redefined.
TOPOLOGICAL SURFACE

A series of diagrams of modules or elements of the continuous topological surface which connect in different ways to produce the whole, complex environment.
Experimentation on the user experience of the continuous interface environment.
INSTALLATION
ANALOG

Screenshots from the use and experience of the installation environment.

EXPERIENCE

This installation was used as an analog environment to explore the spatial qualities of the digophysical reality we were designing. While the installation we produced was incredibly insightful for the project, we had intended to produce a second iteration of the environment which would be more reminiscent of the designed environment and highly interactive and immersive.

As we shifted towards fully digital work for the remainder of the semester, this installation was still a useful test and helps to orient the viewer within the later environment.
Examples of Hololens gestural interaction

Through the digital interfaces implementation, a user is able to more thoroughly interact with the information and have various scales of interaction.

Through the use of human gestures, the machinic eye reads and responds to user intent. These gestures allow the user to move elements within the tool, manipulate the 3D spatialized information archive, and much more.

This test uses Unity with a Leap Motion Controller.
A single user’s personal experience with the interface is defined by small-scale gestures. This is an intimate experience with the environment and it can be highly immersive.

Experiencing the environment with another user results in a fight for surface space where perspectives are challenged. Two users may merge perspectives through mutually agreeing gestures to lessen the disruption caused by multiple users.
Multiple users within the space affect the information in the space as their augmented perspective moves to accommodate their gestures. The scale of these gestures are larger, incorporating the full body or entire limbs.

This environment goes beyond the continuous surface-interface: the information pulls away from the web-structure of the surface to manipulate the space and enrich the human experience.

The following images and animations represent the environment in first person perspective, as it is augmented for one user accessing the archive by exploring the interface environment. All of the augmentation is perspective-based and user specific, leading to a conflict of realities when there is more than one user in the archive interface.
When there are multiple users of this interface environment, there exists a disruption between the users’ perspectives. This disruption reveals the existence of the structure of the continuous surface.

This challenges the digophysical environment, allowing the users to maintain navigability, a sense of stasis wherein users can orient themselves to their reality.
GLOSSARY

A
Access : the concept of information control and availability
Agency : subjectivity in terms of individual or collective action
Augmentation : additional virtual or digital information and features adapted to a physical materiality to produce a more rich and complex experience
Archive : a collection of accessible information, in this case also a spatial experience

B
Borders : divisions, drawn from Territories: Islands, Camps And Other Forms of Utopia
Closed Worlds : systems which require minimal external inputs to function
Digital Landscape : the fabric of an environment which is born from digital information and characteristics

C
Closed Worlds : systems which require minimal external inputs to function

D
Digital Landscape : the fabric of an environment which is born from digital information and characteristics
Nonorientable : omnidirectional, unable to be understood or used in a singular orientation

E
(Im)materiality
Information : processed data which can be readily understood

I
Infrastructures : both physical and digital systems which support the human world and experience
Interface : the mediated interaction between a (usually human) subject and some information processor (computer or machine), n. the physical space of object which mediates the aforementioned relationship
Internet of Things : the concept that all subjects and objects are interconnected by the digital network of data production

J
Stack : concept drawn from Benjamin Bratton which argues that the human world can be understood as a series of multifaceted layers which interact to produce an accidental mega-structure
Systems : both large and small, complex relational mechanics which enable new functionalities, these can be infrastructural or conceptual

T
Tool : an object or system which functions to assist a (human) subject with a specific task

U
V
W
X
Y
Z

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