Portfolio

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Columbia University

Master of Architecture

The MET:
Decolonization The Mertopolitan Museum of Art

Optional Studio | Columbia University | 2022 Summer
Location: The MET, Manhattan, New York
Instructor: WAI Think Tank

This project takes an anti-colonial perspective to critically analyze the Metropolitan Museum of Art's history and collections. It questions the potential roots of museums in structural oppression and how they perpetuate certain narratives about culture and history. The project highlights the complexities of museums as sites of cultural production and representation, and encourages critical engagement with these institutions.

THE MET

2022

In the new era, no one is an island. Each issue is intricately intertwined with the rest of the world like a tangled thread. Regardless, we need to start somewhere. We argue about politics, about power, about reform, slowly eating away the old and the rotten from the tiniest of places. We can't expect heroes, we can only expect the masses. Choose when you can choose, and speak when you can.
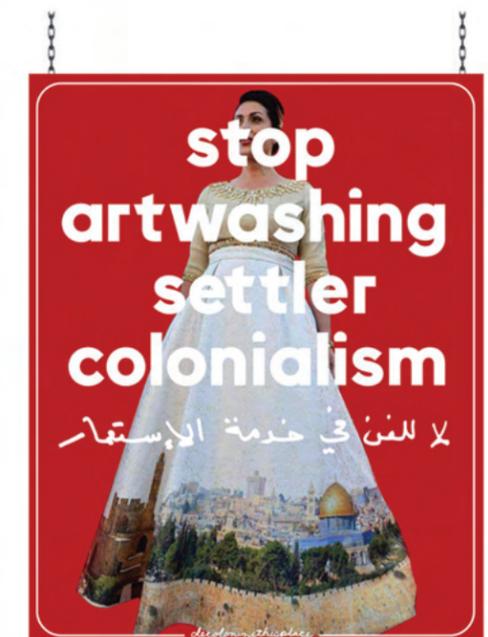
The Metropolitan Museum of Art is a Neoclassical Building. This building was built to symbolize the expectations and responsibilities that The Met was given as a museum. The Met's ego is to be all-encompassing and to achieve mass education with the highest-value art, but it faces both income and pressure and limitations on the number of collections and values.

What I'm talking about in the American Wing section is not just the Westernization of the building itself, but the Westernization of the entire structure and country. Native American culture is only a small subcul-

white culture, which is related to earlier colonial history. In the American Wing, none of the sections we can see about Native people take up the main space, but this subculture is also a cultural category that attracts traffic. So here comes the question of how museums treat subcultures.

DREAM

Do you think what is defined by Western academics has something to do with the West? If there is, then...probably...all need to be removed.

FIN

This project is about how The Met is a Western-focused museum, and discusses some of the possibilities on how to deconstruct its hegemonic structure. The composition of the museum itself is inextricably linked with Western power, and colonial issues and post-colonialism are systemic and structural issues.
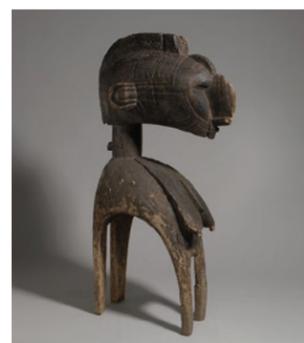
stop artwashing settler colonialism

لا للفن في خدمة الإستعمار
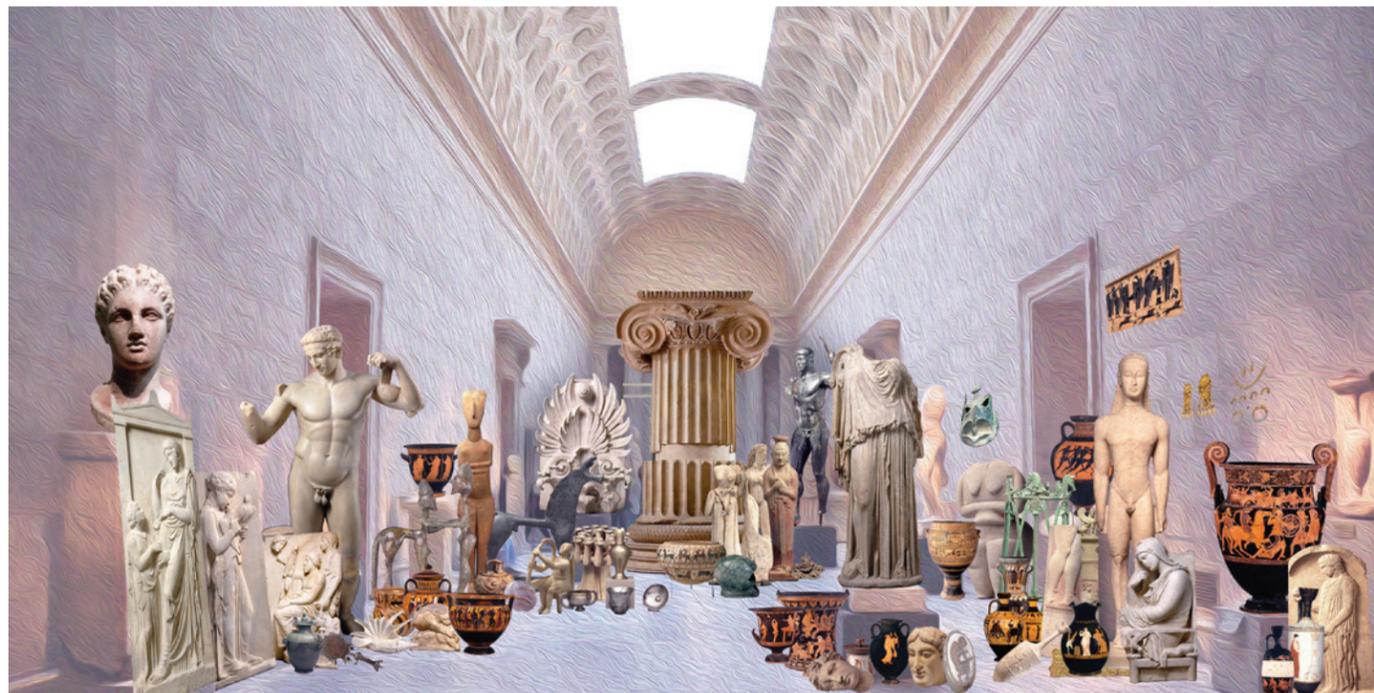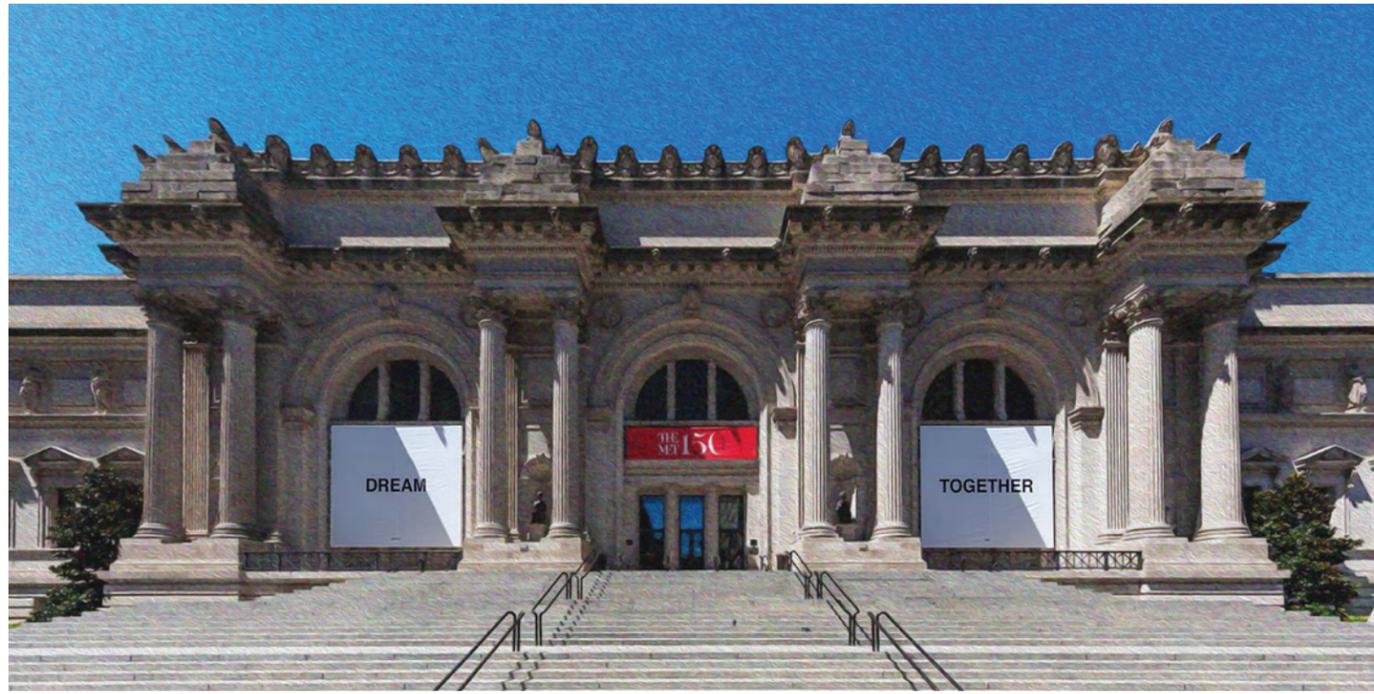
Female in Community:
Female neighborhood in Bronx New York

Optional Studio | Columbia Universiyu | 2022 Fall
Location: Bronx, New York City
Instructor: Byrony Roberts
Team: Ruodi Zhang

Women's labor in the family has been gradually ignored in the past history. They use their time and energy to create more time resources for men, but they are despised in economic production labor. This project is about how to use women to build a women's community to break the long-term oppressive labor environment for women and give them the opportunity to join a social environment where men do not have to exist. Maybe we can't change the fact that women are tied to gender roles for the time being, but we can try to change the family structure, which is the smallest form of ownership, as the first step.

I. Analysis

Women living below the poverty line in the U.S. tend to be single-handedly responsible for household labor and childcare while working. The energy and time he and she need to spend are incalculable, but their lives are not easier. Instead, they need to work twice as hard to make ends meet. In New York, women of childbearing age and women who have given birth face the same problems: living in poverty, lack of health insurance and medical services, and long hours.
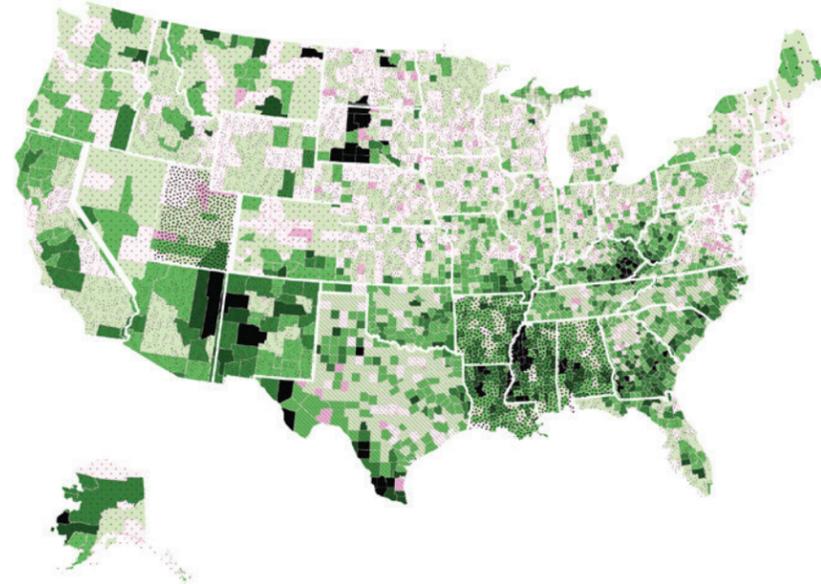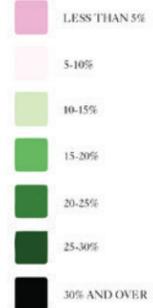
In such an environment, women's life is undoubtedly oppressive. In order to further study the situation of women and break down the hierarchical fortress of feminist theory, I chose the Bronx in New York as the project location.

It has the largest number of poor single mothers in New York, and a relatively large number of women of childbearing age and family units. Women's labor is well illustrated here: they spend time working during the day, and most likely manual work. When you get home, you need to cook, clean the house, take care of the kids, and maybe look after the elderly. Families here often need the help of relatives, and retired women have to join their children's families to help them take care of their children in order to maintain their normal work.

WEEKLY RELIGIOUS SERVICE ATTANDANCE IN USA BY STATE

HIGHEST ATTENDANCE
ABOVE AVERAGE ATTENDANCE
AVERAGE ATTENDANCE
LOWEST ATTENDANCE
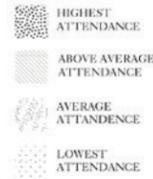
PERCENT OF POPULATION BELOW THE POVERTY LINE IN USA BY COUNTY

LESS THAN 5%
5-10%
10-15%
15-20%
20-25%
25-30%
30% AND OVER

Birthage Female Population

Birthage Female Insurance Coverage Rate

Median Household Income

Abortion Service
- Abortion Clinic
- Hospital
- Planned Parenthood
- Public Health Nonprofit

COST OF CHILD CARE IN USA BY STATES

$ 5000-5999
$ 6000-6999
$ 7000-7999
$ 8000-8999
$ 9000-9999
$ 9000-9999
$ 10000-10999
$ 11000-11999
$ 12000-12999
$ 13000-13999
$ 14000-14999
$ 15000-15999
$ 16000 AND ABOVE

High cost of money for raise a child

https://illumine.app/blog/how-much-childcare-costs-by-state-in-the-usa-in-2022/
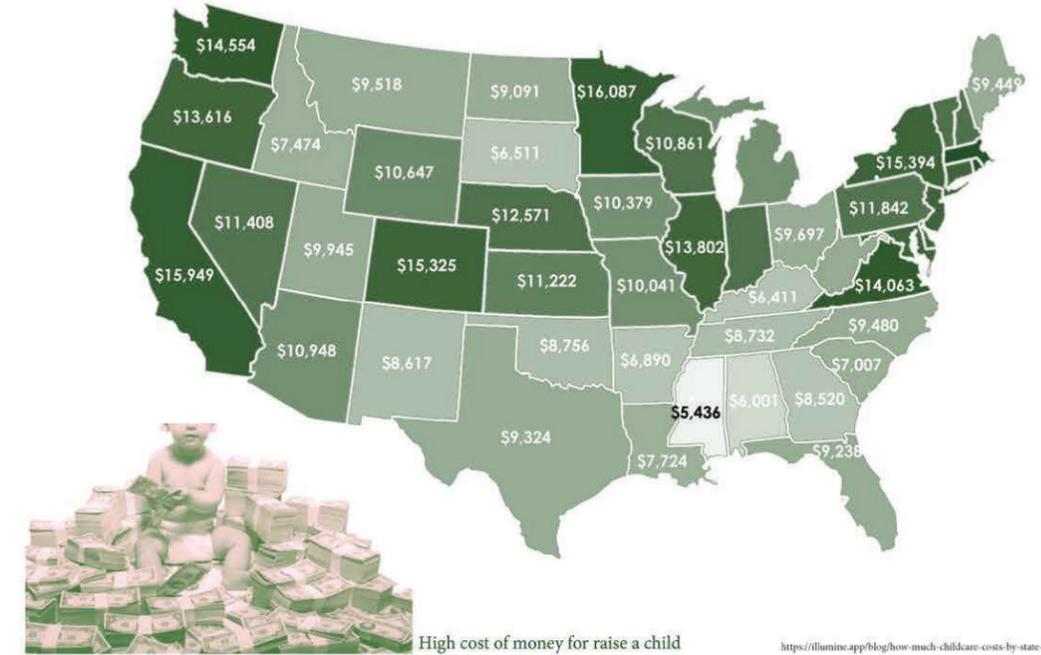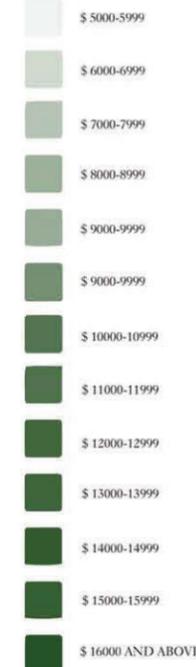
Chan Zhang, Ruodi Zhang

FERTILITY RATES IN USA BY STATE

44.7-54.32%
54.32-63.94%
63.94-73.56%

INFANT MORTALITY RATES IN USA BY STATE

<3.31%
3.31-4.96%
4.96-6.62%
6.62-8.27%
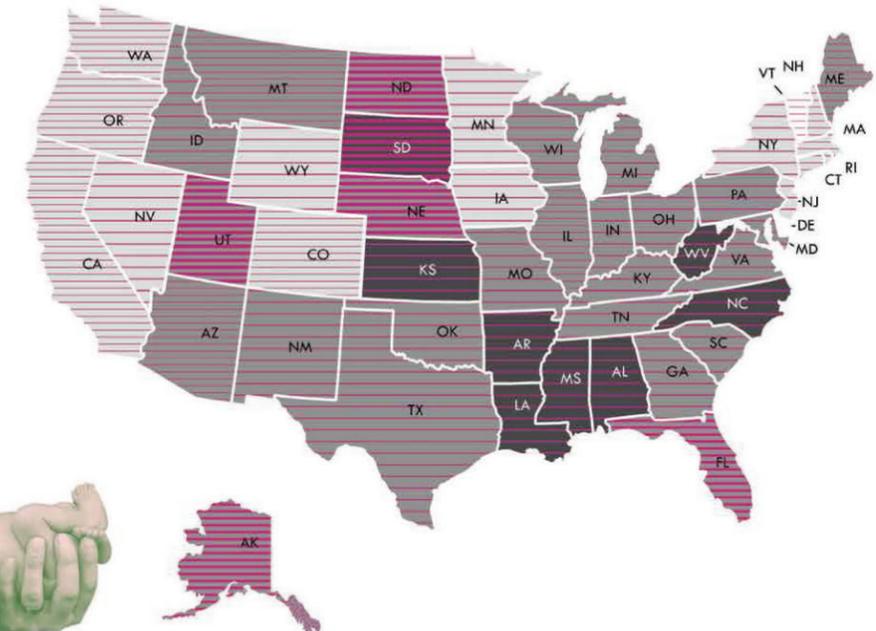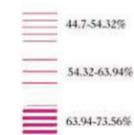
https://www.cdc.gov/nchs/pressroom/sosmap/infant_mortality_rates/infant_mortality.htm
https://www.cdc.gov/nchs/pressroom/sosmap/fertility_rate/fertility_rates.htm

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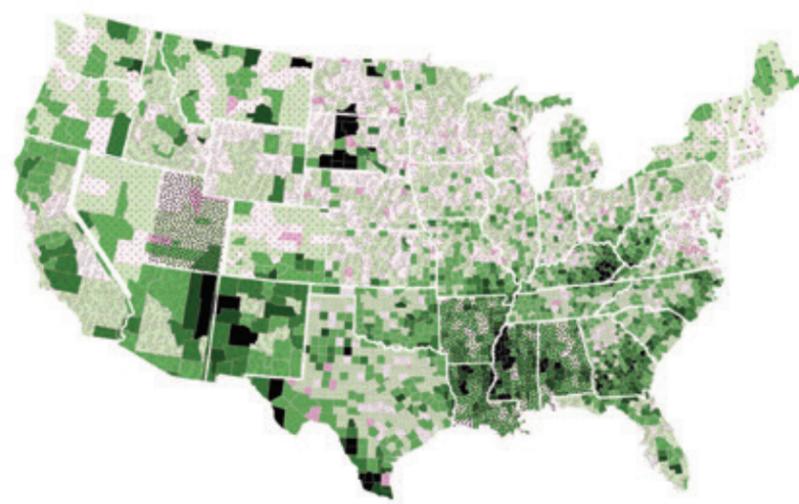
Poverty Rates & Religious Influence
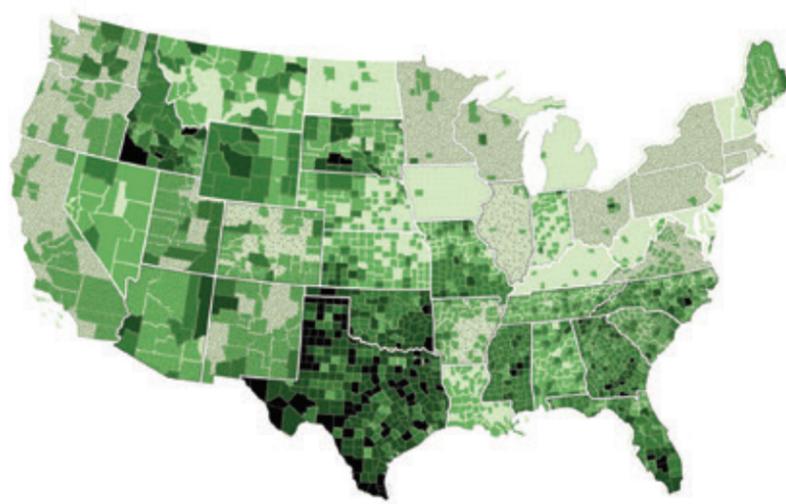
Emergency Contraception & Insurance Coverage
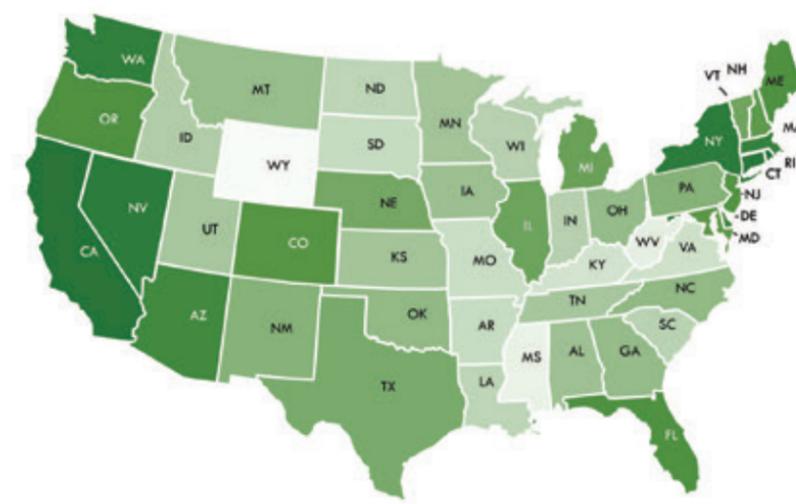
Povider Percentage
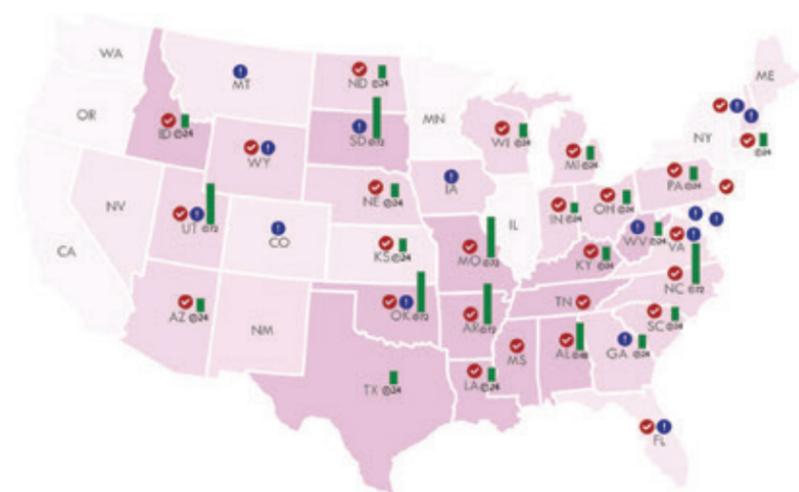
Teenagers Abortion

Distance for Abortion Service

Child Care Dessert

Chan Zhang, Ruodi Zhang
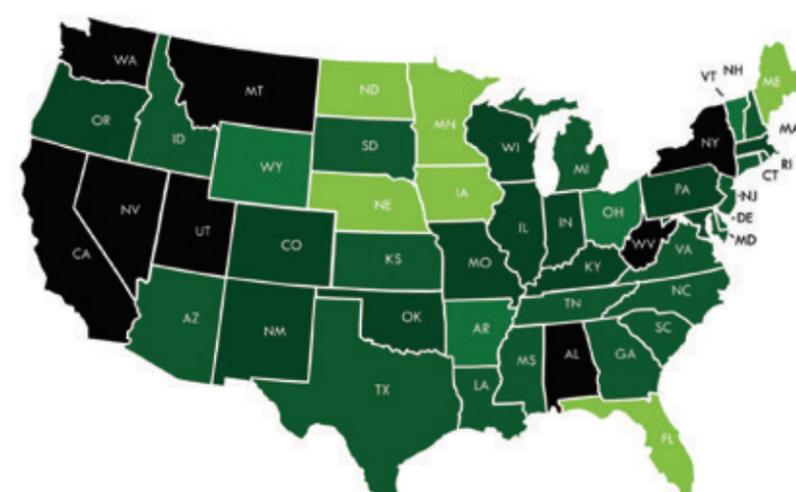
Remembering Gifting Shopping Home Teaching

Household Managing Connecting Suring

Remembering Gifting Shopping Home Teaching

Office Work Farm Work Build Work Sale Work

Household Managing Connecting Suring

Regional Income
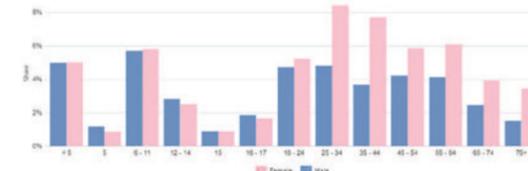
Poverty By Gender
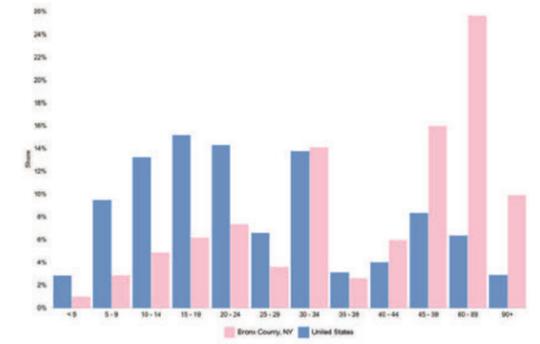
Commute Time
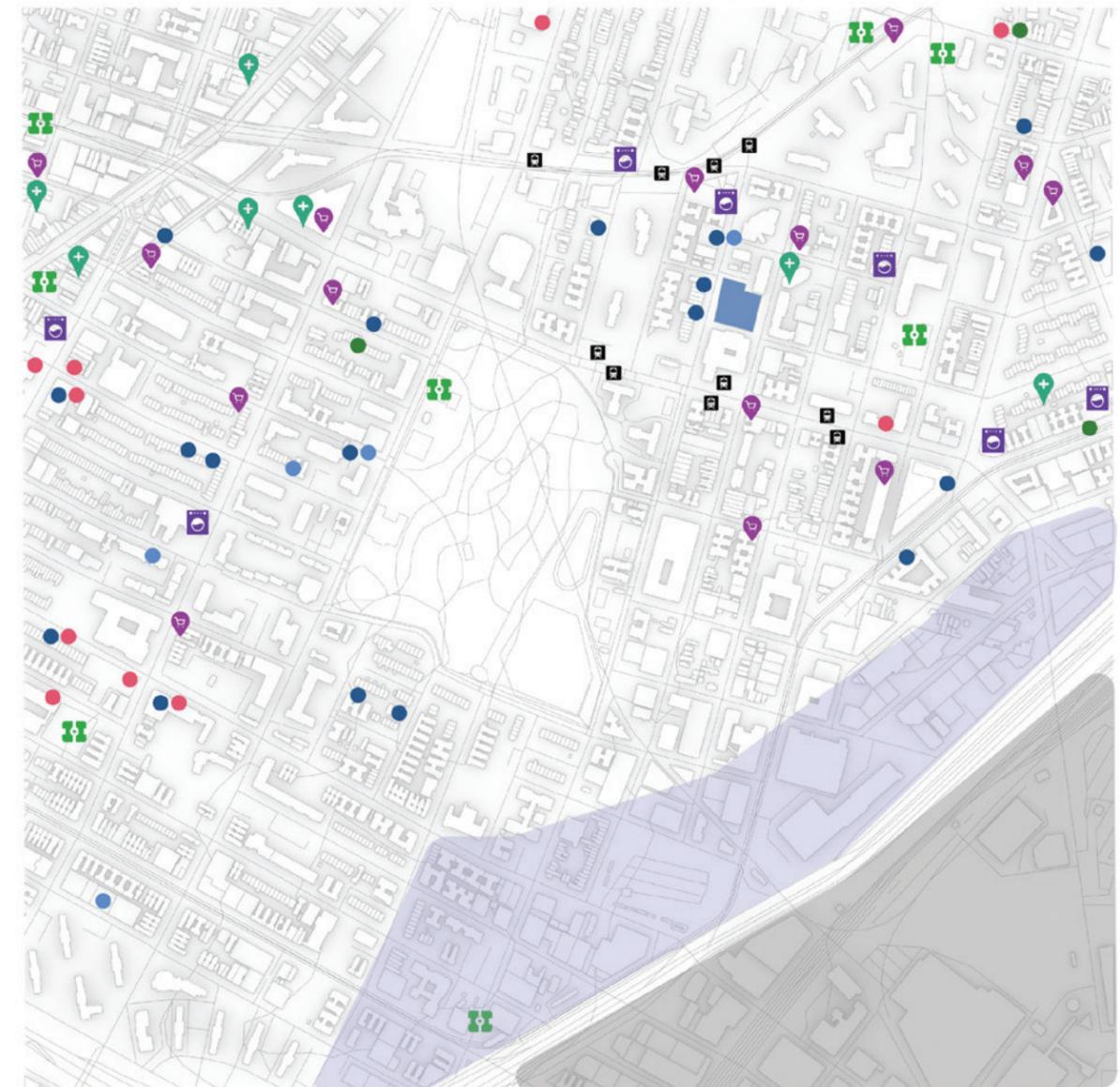
Subway Stati
Day Care
Interest Scho
Women Care
Parks
Markets
Cinics
Laundry
Playground

I. Section

In this project, I designed a total of five parts. From bottom to top, it gradually becomes more private as the floor increases. The largest space is given to the collective kitchen, which allows people to cook together and serve the community voluntarily. As an important part of folk houses, the kitchen has long been criticized as a space that restrains women, and at the same time it is often regarded as a "female area". This facility has more connections with women after automation. Women are portrayed as responsible for the kitchen.

In addition to providing space for public labor, this building uses ramp as the space organizer to divide the space into six floors for convenience. The design of the ramp also provides convenience for mothers who need to take care of children and the elderly, and makes the space safer.

People can move more freely in the space. The ramp blurs the boundaries of the space and at the same time dissolves part of the privacy and the plasticity of the environment, so I added the design of the curtain to the design. In addition to adding some vibes to the space, their biggest role is to ensure the privacy of the small space and play a part of the role of sound insulation.

I wanted to keep the overall environment of the design fresh and gentle, allowing people to find a sense of belonging in the facility. As an important part of increasing social stickiness, this facility needs to provide a comfortable experience. And there is a lack of public spaces in the community that can provide such an atmosphere.
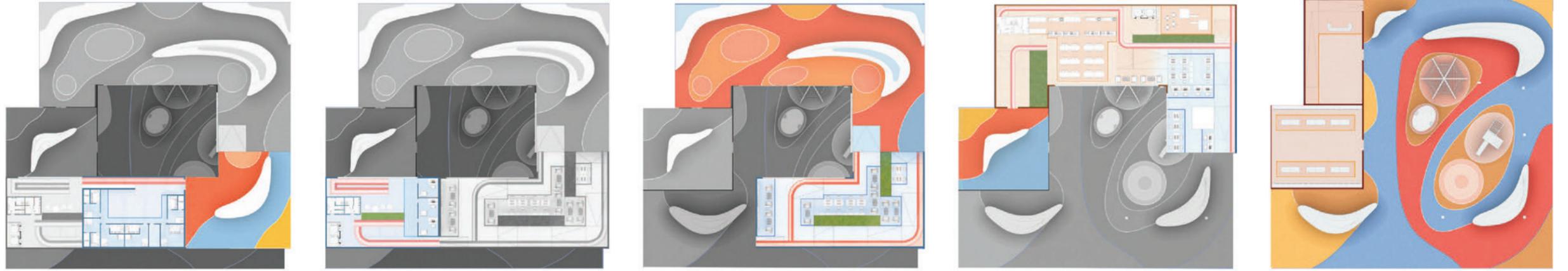
Site Front View
The Playground And Square For All Public

Top View
The Rooftops Are Also Activity Area For Users
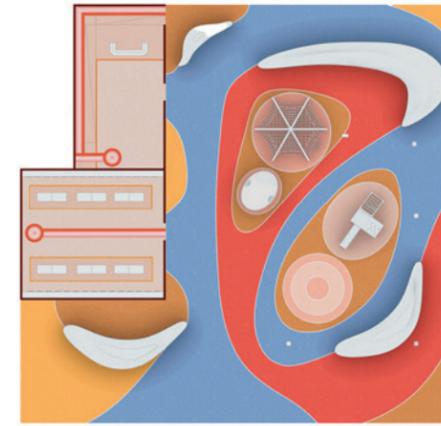
Play Ground Floor
The playground, laundry room and gate

2nd and 3rd Floor
The collective kitchen and interior playground

Fourth Floor
The relaxing area for reading and talking

5th and 6th Floor
The mental care center and temporary living

The role and limitations of the application of Immersive Learning in architectural studio

Ruodi Zhang

Class：ARCHA4504

Professor：Mark Wasiuta

communication between multiple people. However, Immersive Learning has its own problems at this stage. This teaching method transfers part of the reliance on communication to the reliance on equipment, and the current VR and screen projection technology is sti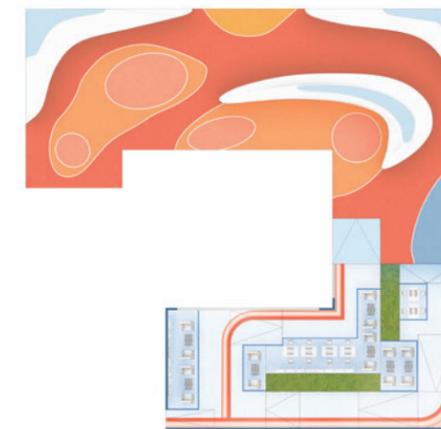ll too rough for design. First of all, any electronic device will cause a part of the visual distortion of the space. Although different visual effects can be achieved by adjusting different lenses, this problem is still not perfectly solved. Second, the available modeling methods are not refined enough for VR modeling. The software's streamlined and detailed handling is not enough to handle complex design needs. And while software provides more visual certainty, it fails to provide olfactory and other sensory experiences. Therefore, such techniques do not allow the design to be completely divorced from the understanding of the designer's personal experience. For screen projection technology, the scale restoration that the screen can achieve is also limited. The height of the device determines the maximum experience scale it can achieve. This limitation makes the user's experience of the jumping-floor design and large-space design incomplete, and it also faces the problem of visual effects being distorted by modeling software. Overall, however, Immersive Learning still offers great potential for architectural education.

Communicate

Communication in architectural education plays a large part in determining the effectiveness of design. Such communication can be summarized as expressing a common understanding and agreement through various descriptions. According to related articles in the 6th International Forum on Engineering Education, the communication between studio teachers and students can be classified into: Individual Critique, Formative Critique, Summative Critique and Group Critique. The communication between students can be classified as: Peer Critique and Panel Discussion. These kinds of communication almost cover most of the formal communication process that a student goes through from the beginning of the semester to the end of the semester. It can be seen here that the communication between students and teachers is more of a nodal nature. They only meet at a certain point in time, and after a certain period of communication, they separate and do things separately until the next point in time. The communication between students is more continuous. The frequency of communication between teammates is very high. In fact, the communication between designers or designer teams is the most, and they are almost each other's sources of information. The teacher's intervention is to give the whole group a fixed feedback from the outside regularly, and make the whole group collect and produce information based on this feedback. These types of communication can be categorized into the following visual modes:
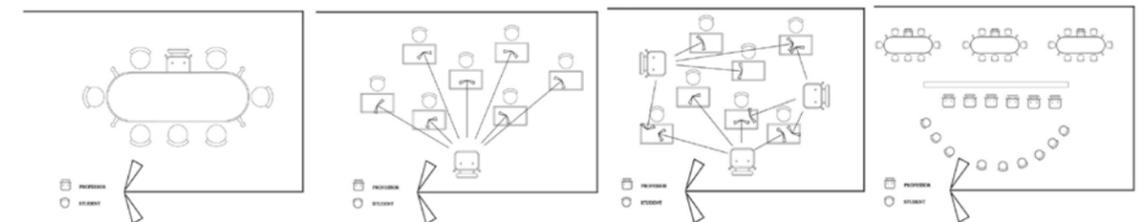

These pictures collectively reflect a problem: the communication in a studio is often fragmented, even in the common communication of the whole studio. Because it relies on a single-location projection device, visual and location effects are unavoidable. If the communication is more complicated to include

experience, experience, visual and language communication, then obviously the common experience provided by a single projection mode is limited. And this limited shared experience creates gaps in understanding for communication and working together.

Immersive Learning

The application of Immersive Learning has gone through a variety of teaching experiments and has a certain amount of data support. First of all, the equipment it includes is actually not complicated, mainly VR equipment and screens. As mentioned before, it mainly includes two modes: the combination of VR and screen projection and surround projection.
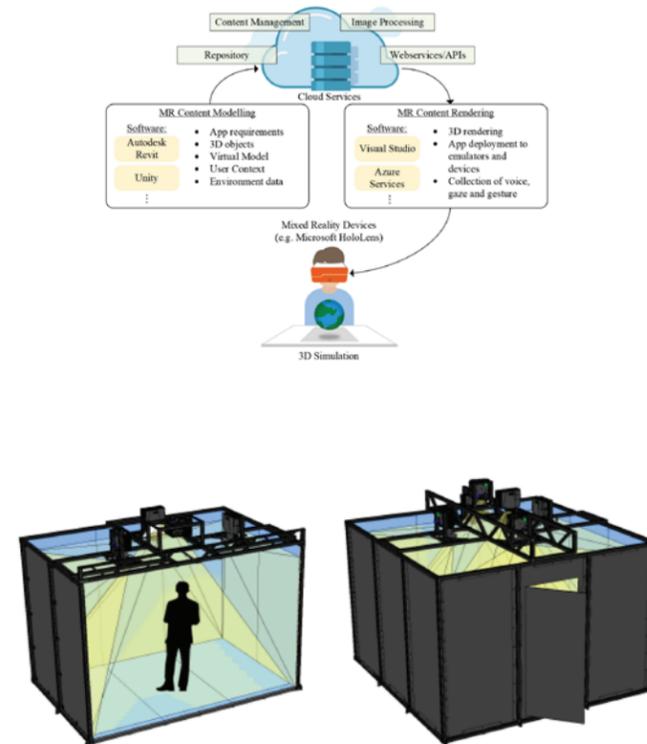
VR and Screen

First we discuss the combination of VR and screen. VR technology has been known for providing a real sense of experience for many years. Users can use the VR headset to see the simulation of the design after modeling, and can also gradually modify the design in the process of using the VR headset. This model is obviously more personal in a sense - VR headsets require a single user. This means that in group assignments and Studio Critiques, the visual experience of teachers and group members is different from that of users. Such a model can easily make the design dualistic, which is to produce a process in which one person is the main operator and other people cooperate. Since the design process is not shareable, it ultimately depends partly on understanding and communication in the design. The advantage of this approach is that scale and scale can be better felt for students who cannot experience the scene in person. Although it is necessary to experience the visual experience of the same project in turn, the design process

will still produce more common experiences in the future. This shared experience can still be shared and exploited. Moreover, even if the visual experience of the VR wearer and other members is different, this feedback is more real-time. The more common expression brought by real-time is beneficial to the common design.

Regarding the results of this teaching mode, we can find the basis in some teaching experiments. One of the experiments came from a junior-level recreation design studio course in an accredited landscape architecture program in the U.S. There were a total of 29 participants in this experiment, including 24 students from a normal landscape project and 5 MLA students . Students participated in two design sessions and were assigned a design project based on the theme of the park. Students used HTC Vive VR headsets and SculptrVR as modeling software during the design process. HTC Vive allows users to implement designs through gestures and operating devices, and complete design operations in SculptrVR. Students were divided into teams and took turns designing a miniature park. When one person is the main designer, others give feedback and communicate through the design status feedback on the screen, and then users make adjustments. According to feedback from this experiment:

> *Consequently students reported they were much more cognizant of their design decisions' spatial impacts, than if they had designed the same project on paper or at a computer screen. Students also reported VR provided them with greater freedom of expression during the ly design, especially to designing on a computer screen. In particular, students felt the HTC Vive' spatial tracking combined the benefits of both 3-D modeling and traditional drawing. Students were able to create 3-D models using SculptrVR by applying traditional drawing gestures, ported as a symbiotic creative relationship between digital and hand design production.*

We can learn that, as expected, the improvement in the design freedom of VR technology is obvious. The design made by the designer in the sense of experience is more authentic. At the same time, what virtual technology actually provides is not a solution, but a platform for experience, a virtual place outside the classroom. This platform allows student participation through an agent to achieve an interaction that cannot be achieved in traditional teaching. This kind of interaction can be regarded as an upgrade of the usual expression in the Studio, because this platform allows students to have real-time critical power, and makes the abstraction in communication become concrete. Representation is less dependent on the designer's self-understanding. At the same time, since technical operations in traditional studios can only be performed on a single computer screen, operations and feedback are more exclusive. Exclusivity is reflected when the design team needs to share each other's results after a series of operations performed by one person. However, in the production process, it is difficult to have a common thinking process due to equipment limitations.

Although co-expression is needed. But it cannot be denied that technology has limitations. In addition to the monotony of VR usage discussed earlier, SculptrVR also has its limitations as a modeling software. The design of this software is similar to some game software, and it can only perform modular simulation based on blocks. First of all, there are limitations in terrain simulation. It is difficult for students to understand terrain such as hills, slopes, and depressions. Therefore, there are limitations in the design of villages or parks that require curves. Secondly, its limitation on design is that it is difficult to reflect its fluency. This includes a potentially more unrealistic perception of elements such as numbers, people, and paths. In the early stage of conceptual design, such a problem is actually harmless, because students are more interested in determining the volume. However, with the deepening of the design, the requirements for precision are gradually increasing. At this time, it is necessary to supplement the equipment in other ways. It's worth mentioning that this model breaks down a barrier of isolation that blurs frequency in communication. Whether it is between teachers and students or between students. Because the teacher's role in this is the same as that of the team members - that is, timely feedback. This kind of feedback avoids the students' personal understanding and makes them spend time in the subjective design later, so that the educator's evaluation is more accurately reflected in the spatial feedback. The timeliness of this experience ensures the speed of progress and efficiency of the work.

Immersive Virtual Environment

Now we can focus on another pattern. The logic of the multi-screen projection mode is to turn a room into a cave, allowing teachers and students to achieve an immersive experience surrounded by surroundings. The main advantage of this model is reflected in the collective feedback. When a studio-based person needs to give feedback on a design, the consistent sense of experience and the magnification of details can make the feedback more authentic and objective. What is experienced on the computer screen is often subjective, because of the limitations of the size and viewing angle of the computer screen, the understanding of space needs to be supplemented by imagination. The same goes for feedback on designs. Teachers may have more experience in imagining space because of their own experience, but this

experience cannot be copied to students. Regarding this teaching mode, we can also pay attention to an experiment.

In a joint experiment, the researchers set up a multi-screen projection room in the school for one semester. This projection mainly relies on multiple projectors and large white walls or screens. This room can be called the Immersive Virtual Environment. Teachers and students can use this room for studio feedback and evaluation. Here the researchers introduce several concepts. The first is about the logic of the project. The researchers believe that learning includes the following three aspects: 1) Social Setting: students, teachers and other participants 2) Classroom Setting: teaching places, teaching buildings and other teaching environments 3) Design Process: the design process of the project designing process. The intersection of these three is called Telos, which is a process in which students continue to achieve their design goals under the influence of these three.
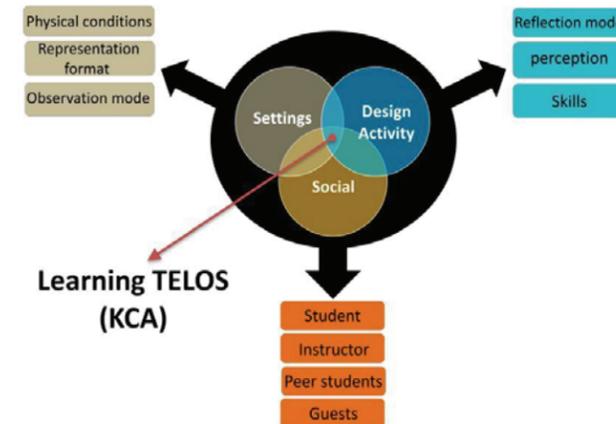
The process of continuous design adjustments by students based on feedback requires the perceptions of all participants. As previously described, experience and imagination of the space are required. Students' feedback in design communication depends on a fixed time node, but the feedback time is obviously insufficient compared with the huge design time. Maybe the one-week design process has only a few minutes of feedback time, which may result in only one or two feedbacks in the design process, which cannot cover all the progress in the design process. Especially in the more refined description of the space in the later stage of the project, the feedback received on details is more one-sided. In the process of collaborative design, even team members will face the situation of insufficient communication time for details. In fact, part of this is due to the inability to respond to a specific problem, because the spatial imagination of detailed problems is more subjective, and it is difficult to see whether it is suitable for a certain space from the computer screen.

In this experiment, the students were divided into four groups, two of which were paired and the other two were just one person. According to the experimental results, the two-person team chose to conduct projects in IVE more than 70% of the time, while the two individual projects were 70% and 11% respectively. The obvious group projects can rely more on this model, while the individual project options have more variety. According to the data, the frequency of feedback and integration of design activities performed in the IVE environment is much higher than in the Studio. This mainly means that what

students feel in the environment can be more efficiently transformed into ideas for adjusting the design, and it is easier to summarize different opinions and views in the design. Clearly, the role of the IVE in the feedback and integration of ideas can illustrate its contribution to the collective design. In a design where communication is the primary means of feedback and information exchange, IVE provides a more ideal environment for communication. This not only makes the design more concrete, but also makes the feedback more flexible. Limbs and scales are better demonstrated when a group of members communicates in IVE. The design focuses on the relationship between people and space, as well as activities of people in the space. These can be demonstrated directly in the IVE. Such experiences can provide a strong commonality for design understanding.
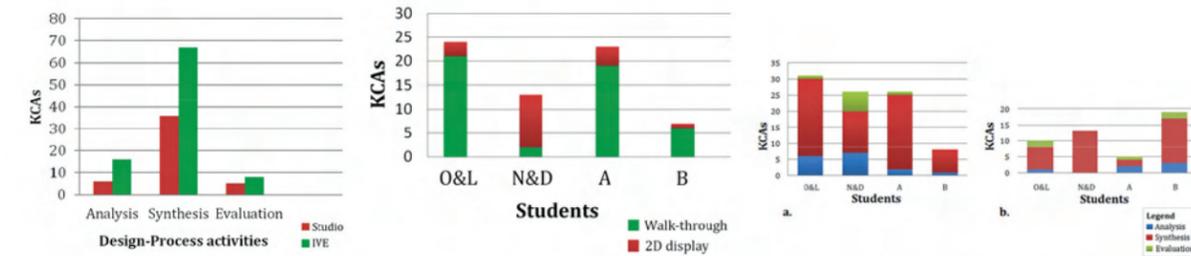
In addition, IVE has also improved the sociability involved. Design members often contain different personalities and expressions. In the Studio, due to the limitation of physical space, it is often impossible for everyone to express a design. According to experiments, students who are not dominant in personality or technology in the IVE teaching model can also gain some advantages in expression through the leadership of team members. Social attributes determine how many people's opinions in a group can be adopted and integrated in the design, so the more individuals participate in the design feedback, the more opinions the design receives. On the basis of providing a concrete space, this kind of sociality can be improved without personal expression habits and technical habits. Studios often mean more intimate exchanges and more personal explorations, but also exclusivity. And IVE can't completely replace the role of Studio, but can serve as a good complement to make up for the shortcomings of the studio's communication mode.

From a critical point of view, such a model is also limited. The first is the limitation of space. An IVE can only accommodate the experience of one project, so it is difficult to allow all students to use the IVE for a long time. This also means that communication in IVE also has a time node and is limited. As for whether such a feedback time can solve the large and small problems in the huge amount of personal design time,

this is an unknown question. Also, IVE is very dependent on the size of the venue. Schools generally do not have a particularly large site for IVE, so in fact, the students' perception mode also depends on how well the scale of the project involved fits with the scale of the IVE space. For details, issues such as layer height and width IVE can provide a good visual experience. But this is not the case for large-scale spaces. In fact, students cannot experience a large-scale design environment one-to-one, similar to the jump space of a museum or the first floor of a large activity center, so the feedback and conclusions drawn will not be completely accurate. In addition, such devices often require users to learn some additional operations, and also have their disadvantages, such as difficulty in finding a suitable projection angle and turning the spatial angle, and do not have the flexibility of VR equipment.

Conclusion

Communication and exchanges are inevitable in the process of architectural design, which is a very important process in design. However, the process of communication relies heavily on subjective understanding and imagination. Design is a complex process of information acquisition and feedback. Inaccurate understanding of information and feedback often leads to different design results and makes design less efficient. If more common experience and concreteness can be added to the communication to bridge the uncertainty of subjective understanding, the design efficiency can be improved to a certain extent and the design can be closer to the goal. With the help of virtual technology, teachers and students can get rid of the exclusivity of Studio communication to a certain extent. This exclusivity can be summed up as a limited combination of three uncertainties: space, technology, and participants. The virtual environment can create a wider traffic space, making communication and communication a common process. Through VR equipment, the team can carry out implementation design and real-time feedback. This has a great effect in the communication stage in the early stage of design. In terms of understanding of scale and scale, designers can more easily obtain real experience and judgment. The IVE environment is highly efficient for information integration, which can help teachers and students to better complete design feedback and adapt different viewpoints in group work. Such features undoubtedly have great development potential in future education. With the advancement of virtual technology, the current limitations can be further broken, providing more help for creating a virtual common space.

At the same time, virtual technology has its limitations. First of all, on the device, the technology at this stage cannot fully realize the sharing of experience and visual fidelity. Therefore, designers cannot fully trust the visual effects brought about by technology. Understanding of space and scale still relies on experience and imagination, but to a lesser extent. Moreover, this teaching mode requires a special space to be completed. Such a space is difficult to be shared by many students, and often only a single project design can be carried out. This makes it still limited in how long it can provide feedback to a school student, and cannot be relied upon as a frequent communication.

Reference :

Maii Emam, Dina Taha, Zeyad ElSayad, Collaborative pedagogy in architectural design studio: A case study in applying
    collaborative design, Alexandria Engineering Journal, Volume 58, Issue 1, 2019, Pages 163-170, ISSN 1110-0168,
    https://doi.org/10.1016/j.aej.2018.03.005.

Nangkula Utaberta, Badiossadat Hassanpour, Aisyah Nur Handryant, Adi Irfan Che Ani, Upgrading
    Education Architecture by Redefining Critique Session in Design Studio, Procedia - Social and Behavioral Sciences,
    Volume 102, 2013, Pages 42-47, ISSN 1877-0428,
    https://doi.org/10.1016/j.sbspro.2013.10.711.

M. Soliman and C. Guetl, "Intelligent Pedagogical Agents in immersive virtual learning environments: A
    review," The 33rd International Convention MIPRO, 2010, pp. 827-832.
    https://ieeexplore.ieee.org/document/5533534

Sleipness and Rasmus Ole. "IMPACTS OF IMMERSIVE VIRTUAL REALITY ON THREE-
    DIMENSIONAL DESIGN PROCESSES: OPPORTUNITIES AND CONSTRAINTS FOR LANDSCAPE
    ARCHITECTURE STUDIO PEDAGOGY." (2017).
    https://www.semanticscholar.org/paper/IMPACTS-OF-IMMERSIVE-VIRTUAL-REALITY-ON-THREE-AND-Sleipness
    -Ole/c6e60dd1509c1a14ea0e3a3d8e3297eb30eb95d4

Ummihusna, Annisa, and Mohd Zairul. "Investigating Immersive Learning Technology Intervention in Architecture Education: A
    Systematic Literature Review." *Journal of Applied Research in Higher Education* 14, no. 1 (2021): 264–81.
    https://doi.org/10.1108/jarhe-08-2020-0279.

Sopher, Hadas, Dafna Fisher Gewirtzman, and Yehuda E. Kalay. "Going Immersive in a Community of Learners? Assessment of
    Design Processes in a Multi-Setting Architecture Studio." *British Journal of Educational Technology* 50, no. 5 (2019):
    2109–28. https://doi.org/10.1111/bjet.12857.

Sopher, Hadas & Kalay, Yehuda & Fisher-Gewirtzman, Dafna. (2017). Why Immersive? Using an Immersive Virtual
    Environment in Architectural Education.
    https://www.researchgate.net/publication/319955676_Why_Immersive_Using_an_Immersive_Virtual_Environment_in_
    Architectural_Education

Mavridou, M. (2012). Perception of Three-Dimensional Urban Scale in an Immersive Virtual Environment. Environment and
    Planning B: Planning and Design, 39(1), 33–47. https://doi.org/10.1068/b34049

Banou, S., & Tahsiri, M. (2021). Catalyst pedagogies and the pandemic displacement of architectural education. Charrette, 7(1),
    1-13https://uwe-repository.worktribe.com/output/7638462/catalyst-pedagogies-and-the-pandemic-displacement-of-archite
    ctural-education

Research on Women's Care Space Based on Socialist Feminism and Ecological Feminism

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Class : ARCHA6885

Socialist feminism and ecological feminism can be said to overlap in some respects. Their attitudes toward capitalism are similar. The former is more concerned with the social value of women's roles and the roles they can play, while the latter is more inclined to emphasize the central position of women in the ecosystem. (Mellor, 2009) These two refute the male hegemonic position belief through different directions and discourses. According to Mellor, male and female are constructed concepts. The role women are portrayed in, their reproductive function, and their social role binding are not necessary. It is just a concept created by patriarchy. The biological sex of being male does not affect its role as a female. The mother's function is not the same as being a good wife and mother and being a husband and a child. Therefore, in terms of mapping and inclusiveness of user functions, the space we created can provide women with a defunctionalized caring space.

History

1. Plantation period

There is a special period in history, and the role of women in this period can be said to be an example of the direct domination of power over gender roles. Black women are an even more striking example of plantation-era female profiles that can be temporarily reduced to class-classic characters. Firstly, on the exploited side of the economic system, women are responsible for basic labor in the fields and housework, which are not valued as much as men's labor skills (Dixon, 1997). In contrast, the value of economic output directly affects gender roles the value of. It can be seen that the gender value system has basically been established during this period. It is very special that women's reproductive value was directly related to economic interests at that time. During the era of apartheid and the slave trade, newborns meant materialized enslaved people that could later be converted into money and measured by the value of labor output. The reproductive function and family are tied to women, which is an extreme case of their objectification. In the war environment in 1950 and the subsequent abolitionist struggle, men

further deepened the concept of "masculinity," physical strength and fighting became a representative of temperament, and it was also a stereotype that was deepened in gender roles. Many families were separated during the war, and women made up some men's duties due to social needs. Gender roles at this time were ambiguous, and women's contributions during this period became evidence of the power of women that feminists often cite. I have no intention of opposing this point, I just want to further point out that in fact this kind of contribution is still behind men, and when men cannot fulfill their gender functions, women fill in the vacancy and embody their own value. It can be said to be a kind of allocation, a kind of social command of gender roles.

2. Automation period

Automation takes a large part of domestic labor. With the development of science and technology after World War II, "scientific" labor methods were used as a sales gimmick. I do not want to deny the convenience of technology with love, but it furthers the social trend from the ecology concept on the issue of gender structure. It situates gender roles in a series of mechanical tasks at the expense of their natural responsibilities. The Electrified Farm was sold as an idealized concept at the 1939 New York World's Fair. (Rovang, 2015) The designers at the time were proud and self-righteous. However, this unintentional imprisonment did provide a breeding ground for gender differentiation in the future. The concept used in automating the home is to use machinery to reduce women's labor time, yet it also assumes that women should do all the work. (Graziano, Trogal, 2021)

Automation is an important revolution of the last century. In the vision of the 20th century, the degree of modernization once became representative of a country's strength. In government propaganda, modernization means a new era. The convenience and productivity improvement brought by laying power pipelines is a huge temptation for everyone. According to Rovang's description:

With their design of the farm, Harrison & Fouilhoux architecturally reconfigured the family farm to incorporate ideals of industrial production, progressive farming, and electrical modernization. The sponsors of the Electrified Farm envisaged a makeover not only of the farm but of the farm family as well Embedded in the design of the exhibit was the implicit argument that in order to benefit from a newly rationalized farm, the farm family would have to adopt professionalizing, urbanizing traits to match.

At this time, the replanning and definition of agricultural labor brought about by electrification were recognized by feminists at that time. The convenience of its publicity can liberate women from heavy labor. In Reformation, such liberation means freedom. Women will have more of their free time, and opportunities to enjoy life. And farm labor can be done more easily. Urban fantasies were brought into the farm mixed with urban fantasies, and most accepted the offer after hesitation. However, male engineers and those in power use this propaganda to implicitly draw a stricter line between husband, wife, and children. And the architectural space is more and more inclined to this social structure. Although household appliances are more regarded as a kind of family property, the meaning of gender roles deserves a deeper study. (Meintjes, 2001)

First of all, we can take the automation of the kitchen as an example. In feminist theory, the kitchen is a critical target. Women's labor and obviously more around the kitchen. The automation process mainly focuses on shortening labor hours and therefore compresses the kitchen within a limited range. A revolution in architectural modernization accompanies this automated process. (Graziano, Trogal, 2021) After the popularization of electrification in rural America, the structure of residential buildings began to change. Bright streets, bright lights, and convenient living structures began attracting more people, and architectural spaces changed accordingly. The kitchen is placed among the piles of appliances in a way that is based on the calculation of the shortest flow of labor. This space is so often delineated as a women's place because the unspoken message of the advocacy for this is that women should be in charge of all this labor. These labor and spatial structures constitute almost all elements of the modern critique of the family structure. Hiding Behind the seemingly convenient life is actually a large-scale work adjustment, which is the redistribution of gender labor. In the long run, increasing women's labor increases more time and resources for men. (Graziano, Trogal, 2021) In the 1939 brochure, a classic scene means that women and their husbands sit leisurely in a courtyard with a modern landscape and enjoy afternoon tea. And behind this scene, the labor required by the two is different. Although taken broadly, automation may seem sweeping and unifying. They are still gendered and economically classed. First, for electrified farms, purchasing greenhouses and agricultural equipment is a large initial expense, and farmers often need to make choices when purchasing. As of now, those laborers directly related to economic income and efficiency will always receive more attention. Therefore, peasant families often choose to give priority to the purchase of agricultural equipment. Then this is an obvious conflict. The priority of automation is always the needs of social production, while the labor convenience of women is placed after this. Naturally, women did not benefit from modernization for long, but they still saved men more time through domestic labor. It undoubtedly adds to the patriarchal system and further exploits women.

Another example is the laundry room right next to the kitchen. The laundry room has received no less feminist critique than the kitchen. On a slightly different note, laundry means sanitary ware. After a high degree of mechanization, the only automatic sanitary appliances commonly used in households are still washing machines and dryers for a long time. Women still laboriously clean bathtubs and floors with their hands. Male engineers did not consider hot water, soap, and rags. According to Meintjes' article description, although people are concerned about the capabilities of washing machines, the discussion is more around one issue: using washing machines makes husbands think they are lazy. The information revealed here is that in a specific family relationship, women serve men in marriage. The reflection produced by the sanitary ware is a requirement for the female image of the family. Their older generation requires them to be simple and hardworking and to put it more directly and cruelly. They are not allowed to dress themselves up. Beauty and refinement are used as opposites to virtue, and what is

more, they mean sloppy and lazy. (Meintjes, 2001) What is shown here is not only the oppression brought about by economic priority but also the oppression from the social level. Stereotypes of women in society have not disappeared with modernization. They have always existed and are rooted in women's self-worth and are reflected in women's attitudes toward themselves and other women. However, the paradox is that many families have purchased washing machines, and women still use tubs to complete the task. On the one hand, it is because of the shackles of their ideas, and on the other hand, they need symbols of strength and comfort that mechanization and modernization imply. So far, I have described a somewhat ironic situation in which automation does not quite do what it claims to do on a realistic level but instead overlays the labor that women are still doing to a more invisible status in the wake of false prosperity.

In summary, women's roles and functions have been further strengthened in the mechanization process, and modernization may, at some level, give an excuse to further make women's labor invisible. The role of architecture in this is complex. At the beginning of the twentieth century, architecture was exhibited as a vision and a catalyst for modern society. The world landscape changes not with man's needs but with a capitalist society's needs. In the same way, gender roles are gradually solidified with the deepening of social capitalization, and women are more deeply involved in the hidden process of social reproduction. This development process is undoubtedly contrary to socialism and ecology. Correlating reproductive functions with social roles is not a given. It is a form of capitalist exploitation.

3. 21st Century

Questions about women are inevitable in a capitalist society. Complex social institutions constitute a complex prison, and scholars have attempted to discuss various solutions through critiques from various perspectives. After the 21st century, with the improvement of feminist awareness in all walks of life, the exploration of the concept of female space in the field of architecture has been driven. Designers began to focus on women's space, and put forward a series of practical theories. It is more of a theoretical point

that is mentioned before discussing methods. Both socialist feminism and ecological feminism have contributed to this.

Socialist feminism evolved on the basis of the socialist theory of Marx and Engels. Feminism in the 21st century pays more attention to women's economic status. Women are already in the vortex of capitalism, so it is impossible to ignore this part when talking about solutions. Socialist women's rights mainly believe that women's labor should be included in the salary settlement system, and corresponding benefits should be improved. In other words, feminists are keen to propose a production method that replaces masculinity, so that women can obtain their due status in social production. Marx's version of socialism, which needs to be improved, does not explain why male and female power structures are not interchangeable. And this can be concluded that men have more means of production, and in essence have a more direct relationship with economic behavior (Brenner, 2014). Therefore, if it is necessary to change the current situation, it is necessary to directly enable women to complement the broken male responsibilities in social labor. This is regarded as an opportunity to change the roles' segregation between men and women.

For ecological feminism, what it emphasizes is the status of women in ecological relations. Women are supposed to play a central, pivotal role in the ecology. As far as motherhood is concerned, women are the essence of ecological inheritance and continuation, and they are a role that is not inferior to men in the laws of nature. Therefore, ecological feminism emphasizes the need to return to the relationship between man and ecology and rethink the rules of human beings and human society in order to reshape gender relations. However, this theory has been attacked on two grounds. One is to criticize the weakness of ecological feminism from the perspective of deep ecology, because it cannot completely shake the suppression brought about by mechanization, but seeks a compromise and concession. The second is that it does not deeply involve social production and economic activities, so it can be called unrealistic or essentialism. (Mellor, 2009) However, the theory of women as reproductive and emotional hubs

mentioned in this theory overlaps with socialist feminism in some directions. Socialist theory emphasizes the role of women in social reproduction, and the process of social reproduction includes care, dependence, and emotional relationships expressed and maintained based on women's labor. Invisible labor is increasingly mentioned by feminists, and the social behaviors contained in this labor largely include the maintenance of family and kinship. And this role can overlap with the theory of women as pivots in ecology.

For architecture, the concern has always been the question of what kind of space is provided for users. In the two theories mentioned before, the function of women can be divided into three parts. The first is the function of reproduction. This physiological function has a certain connection with the attachment relationship as the second part. The instinct of caring and education that comes with motherhood cannot be completely separated from conception. Dependency is termed gender roles tied to reproductive function in more complex social structures is the third part to be discussed. This part is based on the extension of the second part. This natural dependence is forced to integrate with the social division of labor. The discussion of architectural space is often more based on the premise of the third part. It is also for this reason that the spaces provided by architecture in the past were largely gendered. Now that we've described some examples from history, it's time to discuss how this can be imagined for the twenty-first century. According to the article written by Moebus and Harrison: "As Harvey insists, referring to Henri Lefebvre, 'the right to the city' is the "right to change ourselves by changing the city" (2013, 4). In this provocation, we Situate a performative agency which positions agency vis-à-vis the power structures and the normative social and economic relations that shape our everyday lives." (Moebus, Harrison, 2019)

Regarding how society can provide a space for revising gender roles, one can first refer to the description of caring spaces mentioned in the article of Moebus and Harrison. If space under capitalism is a product of mixed functions and gender roles, then caring space is a social public resource. According to the definition in the text: In line with Ruivenkamp and Hilton, we "generally avoid the focus on commons as

shared resources and rather perceive commons as the creation of new forms of sociality, as new collective practices of living, working, thinking, feeling and imagining that act against the contemporary capitalist forms of producing and consuming (variously enclosing) the commonwealth". (Moebus, Harrison, 2019) This means that the plan expects a public ownership system of space use. This relies on a willingness to co-design, to explore new social situations through active creation. This view is based on an assumption of common will and presupposes that public resources will yield to such will. The article mentions a laboratory called Common (s) Lab, which explores the concept of community activities on mutual care and common existence. Most of these activities are interactive or creative projects. These activities can actually be partly attributed to a kind of social role-playing, and their roots can be similar to the essence of drama, that is, to experience a life different from one's own. (Moebus, Harrison, 2019) In an ecology-derived experiment on Star Citizen, people in a small town in Australia who voluntarily participated in the experiment played different social class roles, and in the experiment people were indeed described as able to achieve understanding And empathy, but this willingness eventually diminishes after returning to society—in the sociocultural environment. Therefore, it is indeed feasible to achieve the convergence of group intentions with small interactive projects and architectural spaces, provided that certain groups are kept in the same atmosphere for a long time.

Another theory focuses on the adjustment of residential structures. At present, many feminists have proposed the concept of collective labor to dissolve the invisible labor that is isolated and closed to women caused by capitalism. Collective Kitchen is a great example. Scandinavia experienced a collective housing experiment in 1997. The project design includes a central kitchen, employing staff to provide services to reduce household labor, and apartment units for people of different ages and physical conditions. (Vestbro, 1997) Of course this project is class-oriented, but it is a declaration of war on patriarchy and social reproduction in the early architectural space. Communal labor, or the place of communal labor, was seen as the key to opening up the family structure. The invisible labor can be visualized through the collective form, and the single and separated labor process is digested and

reorganized into group, social and mutual assistance. What this program has in common with the previous one is that it is cultivated and accelerated through different forms of collective spatial composition. From this perspective, collective consciousness is indeed a very important concept. When the concept of collective is introduced when the building plays its guiding and accommodating functions, the structure of the current office, family and public places may all undergo changes.

Conclusion

Finally, it can be concluded that historically capitalism has formed a gender binary differentiation along with the growing strength of mechanism in the process of development. In it both women and ecology are seen as objects and exploited for capital. This kind of inequality is also reflected in the progress of architecture in reality, that is, the architectural space has gradually formed a gendered means to maintain the division of gender roles. As a result, architectural space is largely gendered. In order to meet the needs of the capital world, architecture, especially residential buildings, has gradually evolved into a product that oppresses women more strongly and participates in the process of social reproduction. The social reproduction in the capitalist world is an indispensable part of maintaining social operation, and a large part of this requires women to complete it in a form of invisible labor. This invisible labor makes women need to give up their energy and time to provide time resources for men. At the same time, the production tools of the capitalist world are in the hands of men, and patriarchy has thus become a byproduct of capitalism. Although the patriarchal system and the capitalist system are actually two systems, and some of them converge and also conflict with each other, the constraints they have on women today are undeniable.

During the development of mechanization, the transformation of social concepts in the era of automation took advantage of the convenience of technological development. This change is reflected in architecture, which means that domestic work is handed over to women through technology and propaganda, and the

reproductive function is more deeply tied to women's gender responsibilities. From the perspective of ecology, women have a deeper connection with the emotional part of society, including caring, dependence and kinship links. As an important part of social reproduction and a basic unit in the capitalist system, the family is maintained by relying on women's emotional labor. Emotional labor is often overlooked because it does not directly contribute to social production and economic output. From the perspective of socialist feminism, it is unrealistic to simply talk about social ecology. The current economic situation must be taken into consideration by the feminist movement. Therefore, the plan proposed by feminists is to allow women to gradually replace part of the patriarchal system in social production and control the means of production. At the same time, resources, including appropriate subsidies and support, are provided to women based on the principle of egalitarianism. At the same time, breaking out of closed family structures was brought into the conversation. The idea of women's communities and Collective Labor has been extensively researched.

The response that architecture can make to this can be divided into two parts. The first is the most direct change in family structure. This change depends on the space provided by the building, so the design of women's co-living often appears in feminist research in the 21st century, including communalization and labor concentration. The main role of these programs is to make women more free from the shackles of the family and weaken the impact of single-family relationships. From the perspective of socialist feminism, this kind of change can enable women's organizations to have more influence in society, and make invisible labor included in the generally accepted definition of labor. This move can pave the way for what feminists are fighting for to pay women for labor and fight for women's welfare. At the same time, solidarity and organization can make the women's movement stronger. From the perspective of ecological feminism, women can strengthen their independent ecological status through organization, so that the dispersed female functions can be fully reflected. The fact that motherhood can be more legitimately recognized may prevent women from continuing to be tied down to differentiated female responsibilities in future movements. The binding of reproductive functions to female roles is not

necessary, it is a means of restraint in capitalist society. Therefore architecture can provide black space for

this organization.

From another direction, the optimization of public space is also a frequently proposed solution. Public

space is often directly linked to social consciousness, and architectural space is both a reflection and

guidance of consciousness to a certain extent. Therefore, small-scale continuous interactive activities in

the existing public space can be used as a means of cultivating social awareness. Such campaigns have

their limitations, as they need to be maintained over the long term to ensure their effectiveness. Another

change mode is a little more complicated. This requires the designer to have sufficient relevant social

awareness to ensure women's activity space in the design. First of all, we need to gradually eliminate the

requirements of calmness and rationality in modernization, and gradually move closer to emotional

requirements. Because the current office space is still dominated by masculinity. This is mainly due to the

fact that after men mastered the means of production in the early stage, they shaped the male role into a

more suitable image for work, and used this as a standard to demand the characteristics of the office.

Therefore, to remove this deep-rooted thinking mode, we can start with the design of office space.

Another consideration is the privacy women need in public places. Including women's needs in

breastfeeding and childcare and women's needs for separate and more private public space. Creating

spaces that are safe for women is necessary at a time when women can still experience violence and

harassment in public spaces. This ensures that women remain active in their social participation. In

summary, the task of architecture in the feminist revolution is to give timely feedback and guide changes

in the status of women.

Reference:

BOYS, JOS. "Is There a Feminist Analysis of Architecture?" *Built Environment (1978-)* 10, no. 1 (1984): 25–34.
http://www.jstor.org/stable/23286005.
Hayden, Dolores. "What Would a Non-Sexist City Be Like? Speculations on Housing, Urban Design, and Human
Work" *The University of Chicago 1980* Volume 5, Number S3
https://www.journals.uchicago.edu/doi/10.1086/495718
KhosraviShakib, Mohammad. "Marxist feminism and postmodernism" *Journal of Language and Culture* Vol.1(3). pp.
28-34, November, 2010
http://www.academicjournals.org/JLC
Moebus, Katharina, and Melissa Harrison. "CARING FOR THE COMMON AND CARING IN COMMON: TOWARDS
AN EXPANDED ARCHITECTURE/DESIGN PRACTICE." Nordes Conference , 2019.
https://www.academia.edu/39390755/CARING_FOR_THE_COMMON_AND_CARING_IN_COMMON_TOWARDS
_AN_EXPANDED_ARCHITECTURE_DESIGN_PRACTICE
Brenner, Johanna. "21st Century Socialist-Feminism" *Feminism and New Socialisms*, August,2014
https://socialiststudies.com/index.php/sss/article/view/23486
Haqsaleh, Afied Dien; Ashadi, Ashadi. "STUDY OF FEMINISM ARCHITECTURE CONCEPT IN MUSEUM
BUILDING "The Solomon R Guggenheim Museum in America US " *Journal of Development and Integrated
Engineering (JoDIE)*, Vol 1, No 1 (2021).
https://ejournal.upi.edu/index.php/JoDiE/article/view/34217
Bhavnani, K.-K., & Coulson, M. (1986). Transforming Socialist-Feminism: The Challenge of Racism. Feminist Review,
23(1), 81–92.
https://doi.org/10.1057/fr.1986.21
Vestbro, Dick Urban. "COLLECTIVE HOUSING IN SCANDINAVIA — HOW FEMINISM REVISED A MODERNIST
EXPERIMENT." *Journal of Architectural and Planning Research* 14, no. 4 (1997): 329–42.
http://www.jstor.org/stable/43030435.
Meintjes, H. (2001). 'Washing Machines Make Lazy Women': Domestic Appliances and the Negotiation of Women's Propriety
in Soweto. Journal of Material Culture, 6(3), 345–363.
https://doi.org/10.1177/135918350100600304
Clegg, Claude A. 2000. "Mistresses and slaves: Plantation women in south carolina, 1830-1880" by
marli F. weiner (book review). *Journal of Women's History* 11, (4) (Winter): 176,
http://ezproxy.cul.columbia.edu/login?url=https://www.proquest.com/scholarly-journals/mistresses-slaves-plantation-w
omen-south-carolina/docview/1300160489/se-2 (accessed December 20, 2022).
Dixon, C. (1997). *Perfecting the family: antislavery marriages in nineteenth-century America*. University of Massachusetts Press.
https://researchers.mq.edu.au/en/publications/perfecting-the-family-antislavery-marriages-in-nineteenth-century
Sarah Rovang. "Envisioning the Future of Modern Farming: The Electrified Farm at the 1939 New York World's Fair." *Journal
of the Society of Architectural Historians* 74, no. 2 (2015): 201–22.
https://doi.org/10.1525/jsah.2015.74.2.201.
Graziano, Valeria, and Kim Trogal. "On Domestic Fantasies and Anti-work Politics: A Feminist History of
Complicating Automation." *Theory & Event* 24, no. 4 (2021): 1130-1149.
doi:10.1353/tae.2021.0062.
Fraser, Nancy. "7. Behind Marx's Hidden Abode: For an Expanded Conception of Capitalism". *Critical Theory
in Critical Times: Transforming the Global Political and Economic Order*, edited by Penelope Deutscher and Cristina
Lafont, New York Chichester, West Sussex: Columbia University Press, 2017, pp. 141-159.
https://doi.org/10.7312/deut18150-009
Berry, Daina Ramey. Review of Closer to Freedom: Enslaved Women and Everyday Resistance in
the Plantation South. *Civil War History* 52, no. 2 (2006): 187-188. doi:10.1353/cwh.2006.0014.

Mellor, Mary. "Eco-Feminism and Eco-Socialism: Dilemmas of Essentialism and Materialism*." *Capitalism Nature Socialism* 3,
no. 2 (1992): 43–62. https://doi.org/10.1080/10455759209358486.
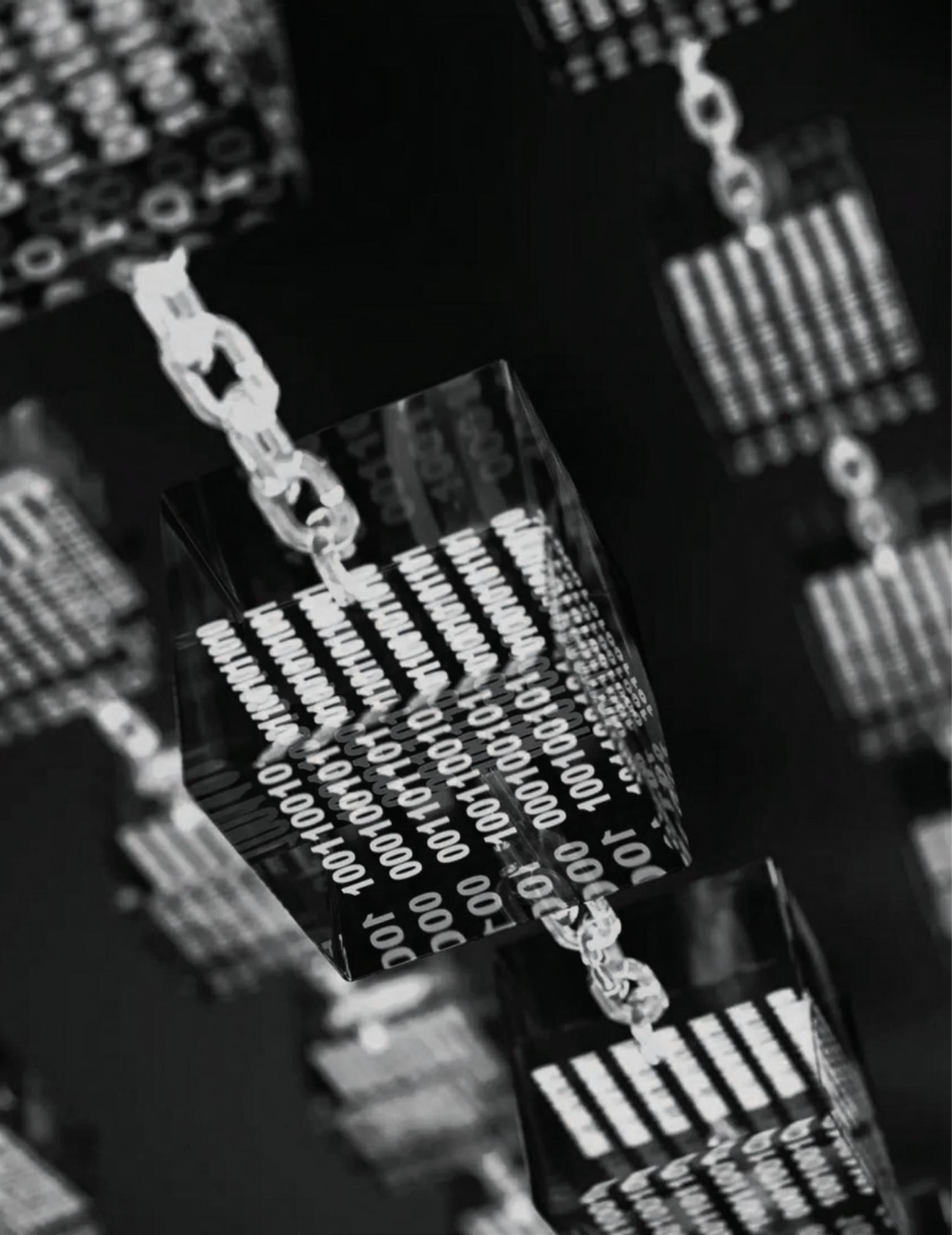
What Is Next:
Systematic Transparancy, truck stop.

Optional Studio | Columbia University | 2023 Spring
Location: Worldwide | Localess
Instructor:Michael Bell

The project aims to explore the potential for a tool that utilizes data collection to increase data transparancy and decentralize data authority. By combining truck transportation networks and blockchain technology, new tools can be created that integrate well with supply chains and other industries. This enables individuals to independently seek out information without relying on authoritative institutions for information output, empowering them to uphold their own beliefs.

HIGH And LOW

public adopt a concept

The concept becomes "HIGH" when public accept the value. And others become "LOW"

HIGH And LOW

public adopt a concept

The concept becomes "HIGH" when public accept the value. And others become "LOW"

HIGH And LOW

Solar Penal and Jinko Solar
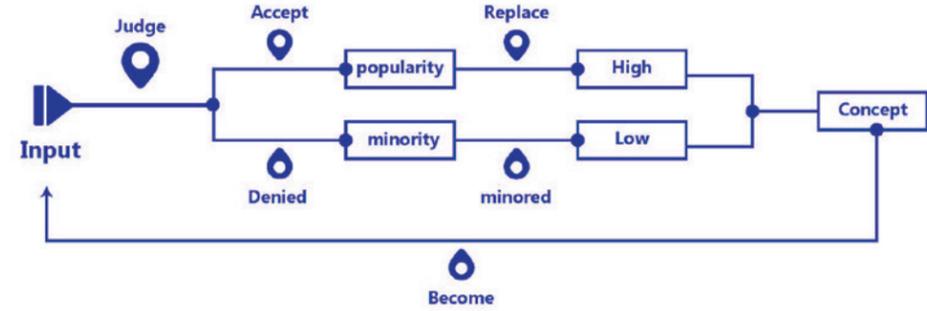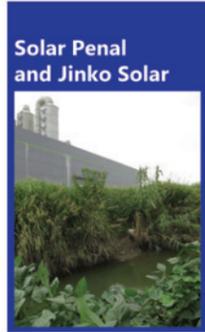
public adopt a concept

The concept becomes "HIGH" when public accept the value. And others become "LOW"
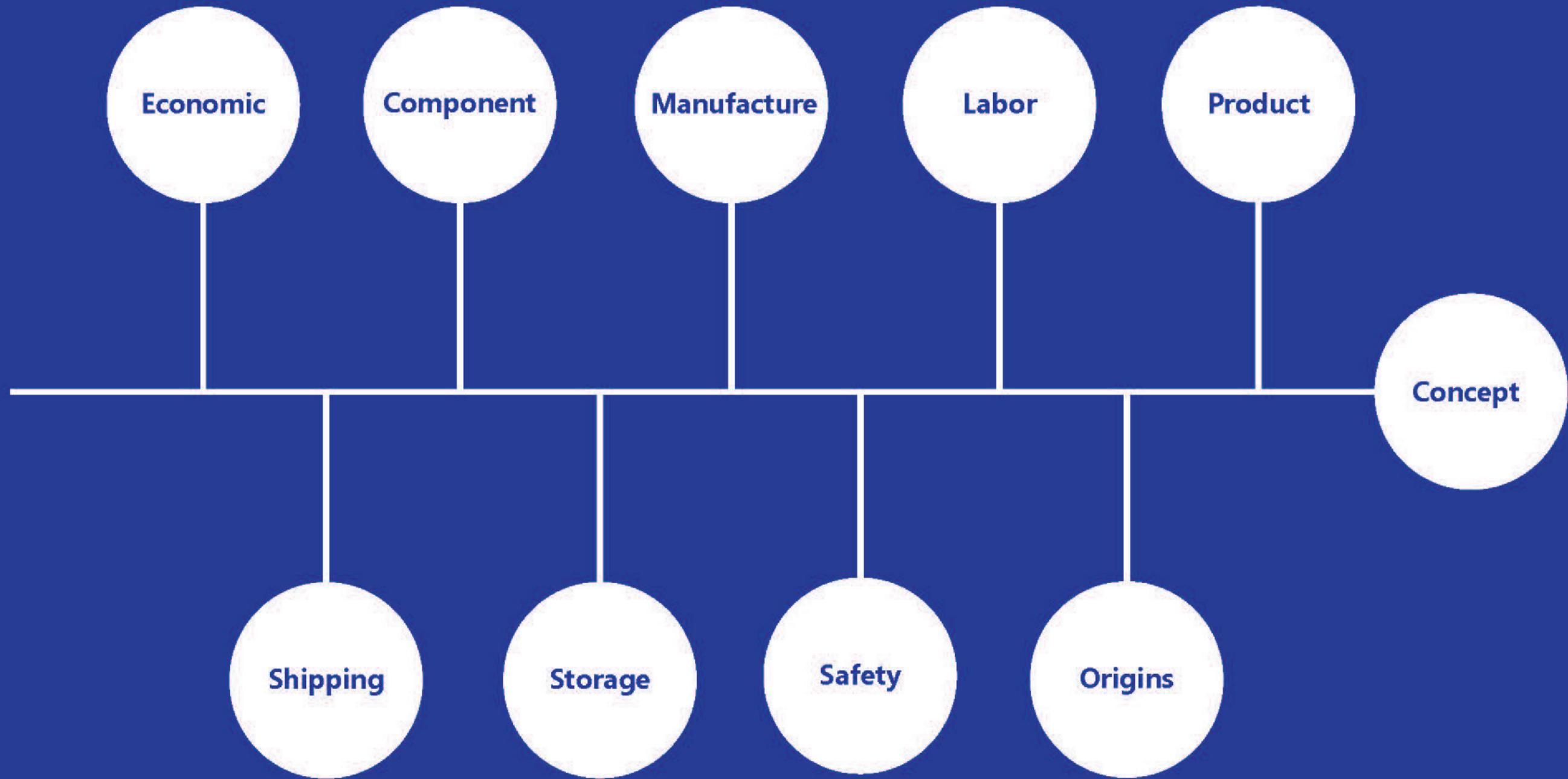
Transportation
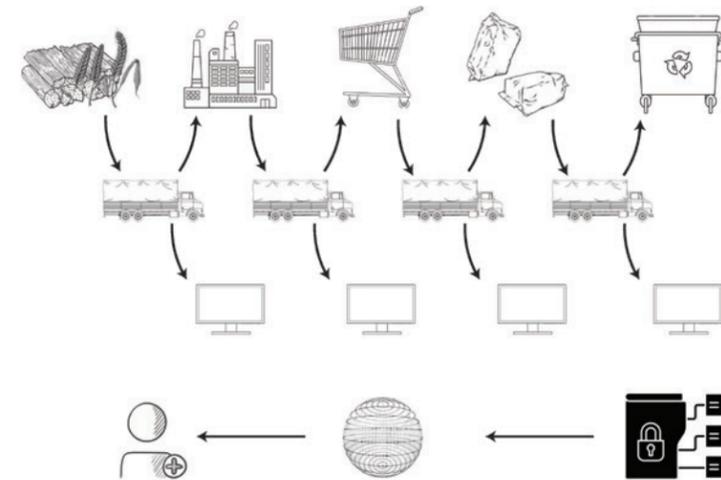
Blockchain and Shipping

The way blockchain secure information and connect data creates a possibility

Concept

Predictable
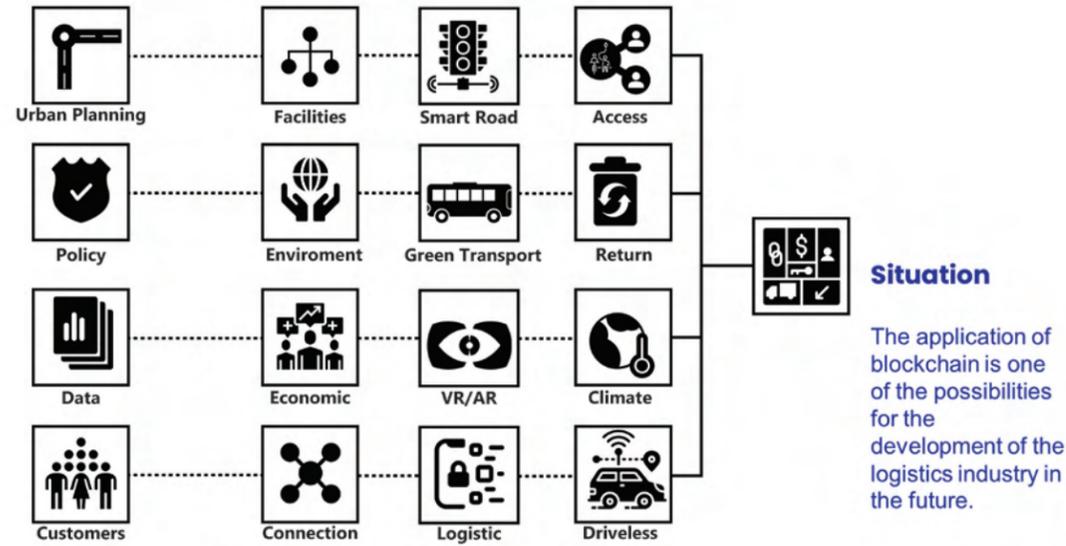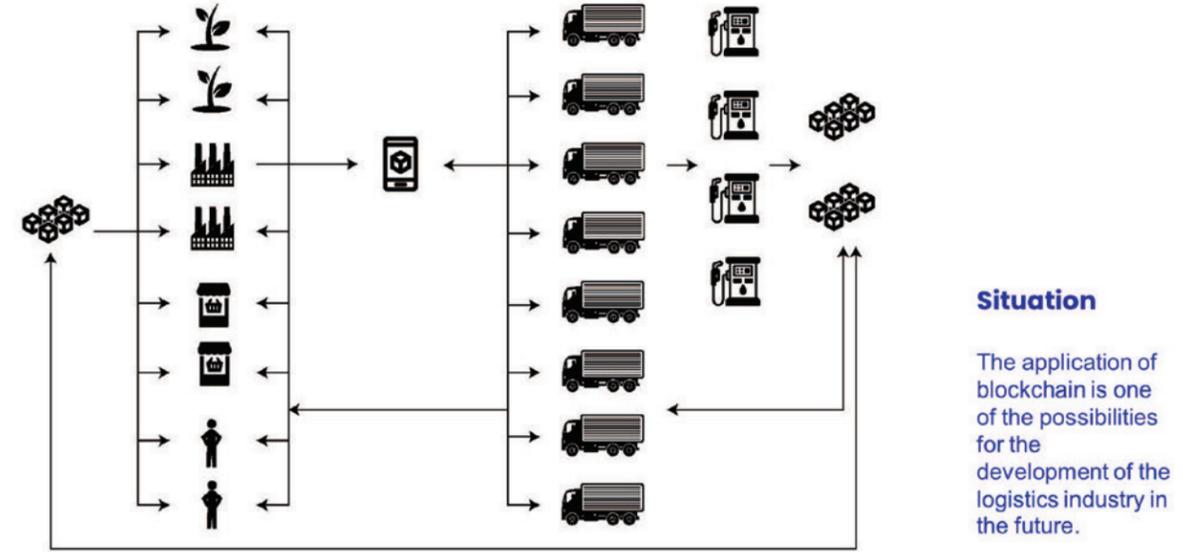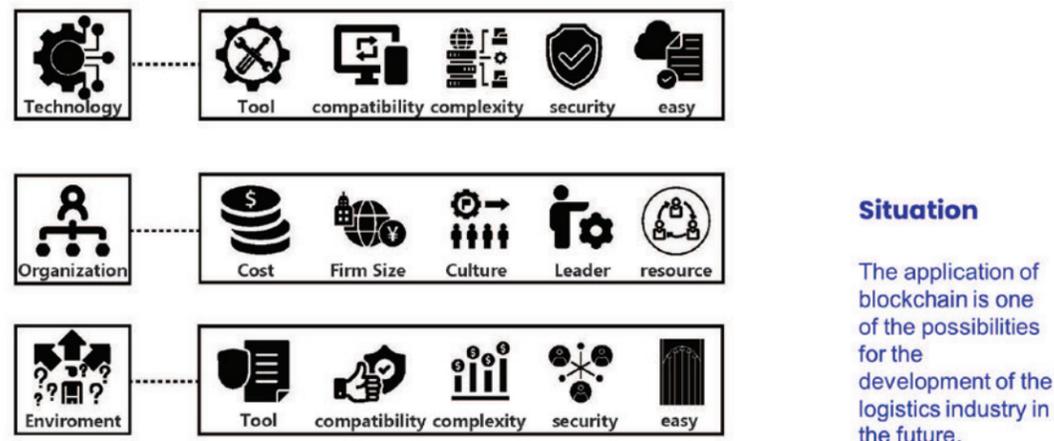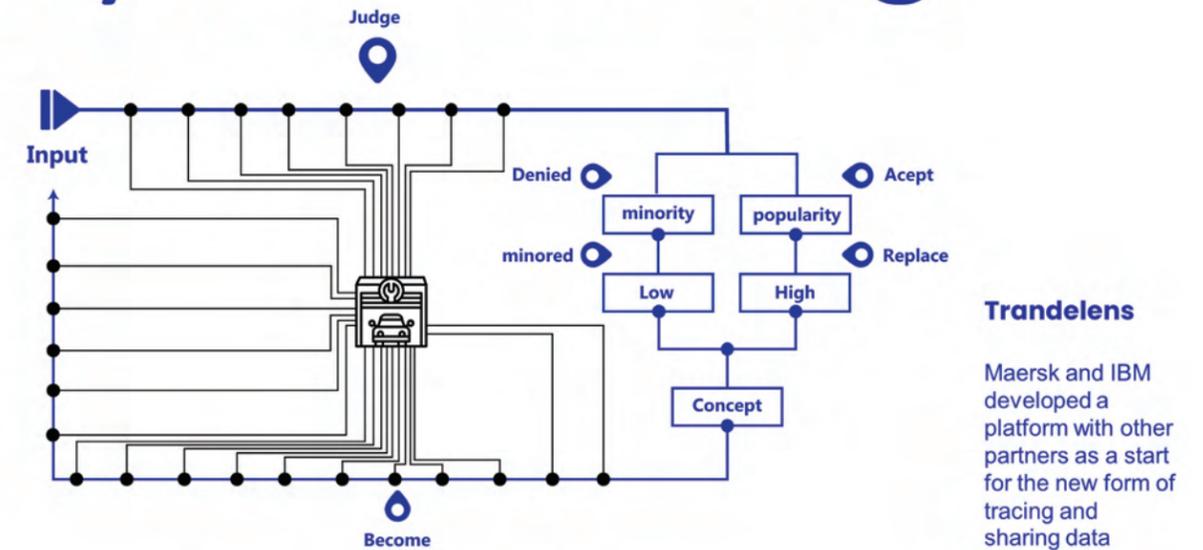

Urban Planning · **Facilities** · **Smart Road** · **Access**
Policy · **Enviroment** · **Green Transport** · **Return**
Data · **Economic** · **VR/AR** · **Climate**
Customers · **Connection** · **Logistic** · **Driveless**

Situation

The application of blockchain is one of the possibilities for the development of the logistics industry in the future.

Predictable

Situation

The application of blockchain is one of the possibilities for the development of the logistics industry in the future.

Predictable

Technology · **Tool** · **compatibility** · **complexity** · **security** · **easy**
Organization · **Cost** · **Firm Size** · **Culture** · **Leader** · **resource**
Enviroment · **Tool** · **compatibility** · **complexity** · **security** · **easy**

Situation

The application of blockchain is one of the possibilities for the development of the logistics industry in the future.

System Building

Judge

Input

Denied · Acept
minority · popularity
minored · Replace
Low · High

Concept

Become

Trandelens

Maersk and IBM developed a platform with other partners as a start for the new form of tracing and sharing data

POWER TOOLS

Jelisa R. Blumberg
Spring 2023

BALLROOM REVOLUTION

"We're a new dance group now, but soon we'll become a **house**," said Miss Slim Jim, the oldest and chosen mother of the group.

Historians call the 1920s a **"period of pleasure,"** not only because of the thriving economy, but also because there was **a place for everyone to express themselves unapologetically**

'PARIS IS BURNING.
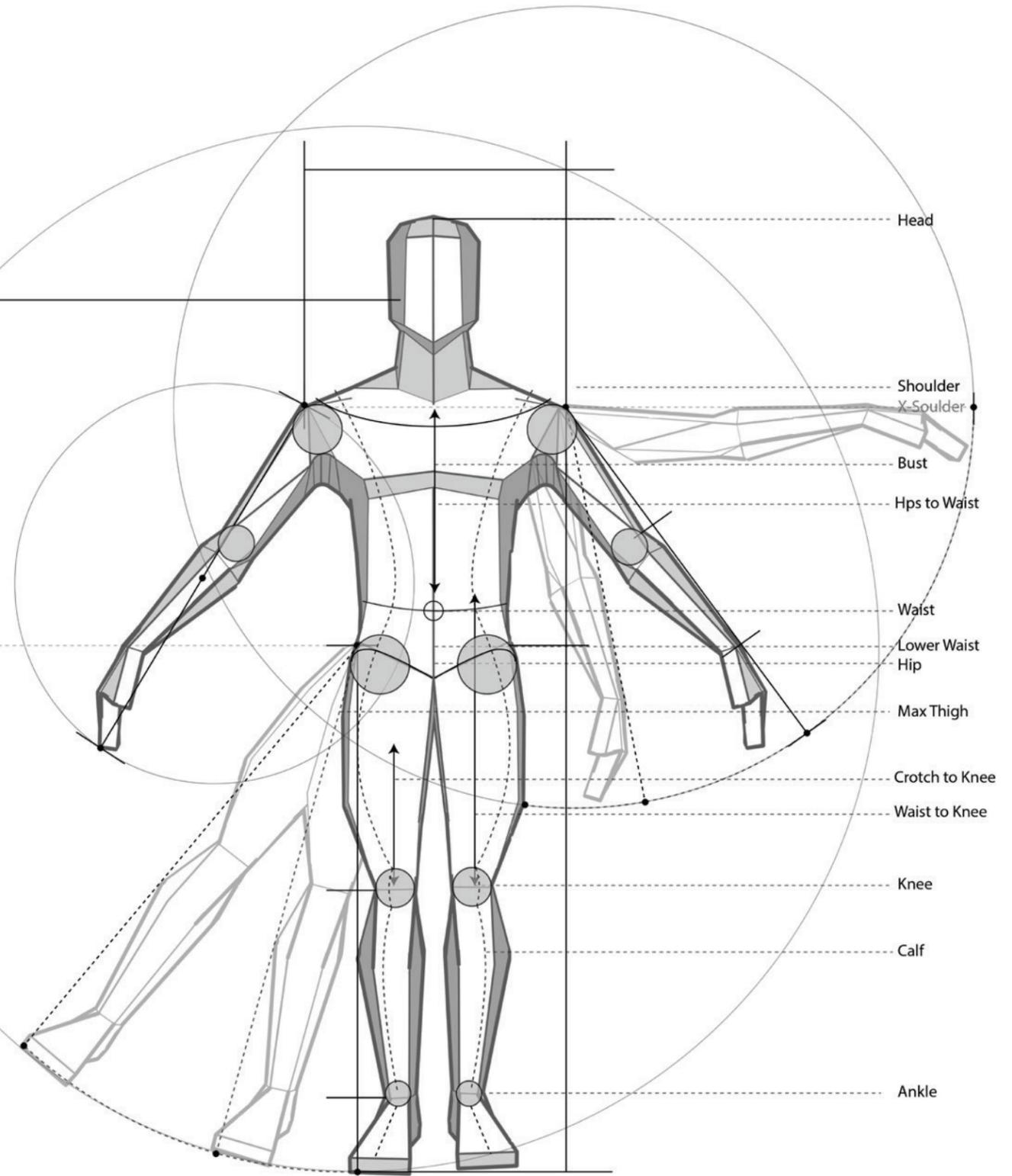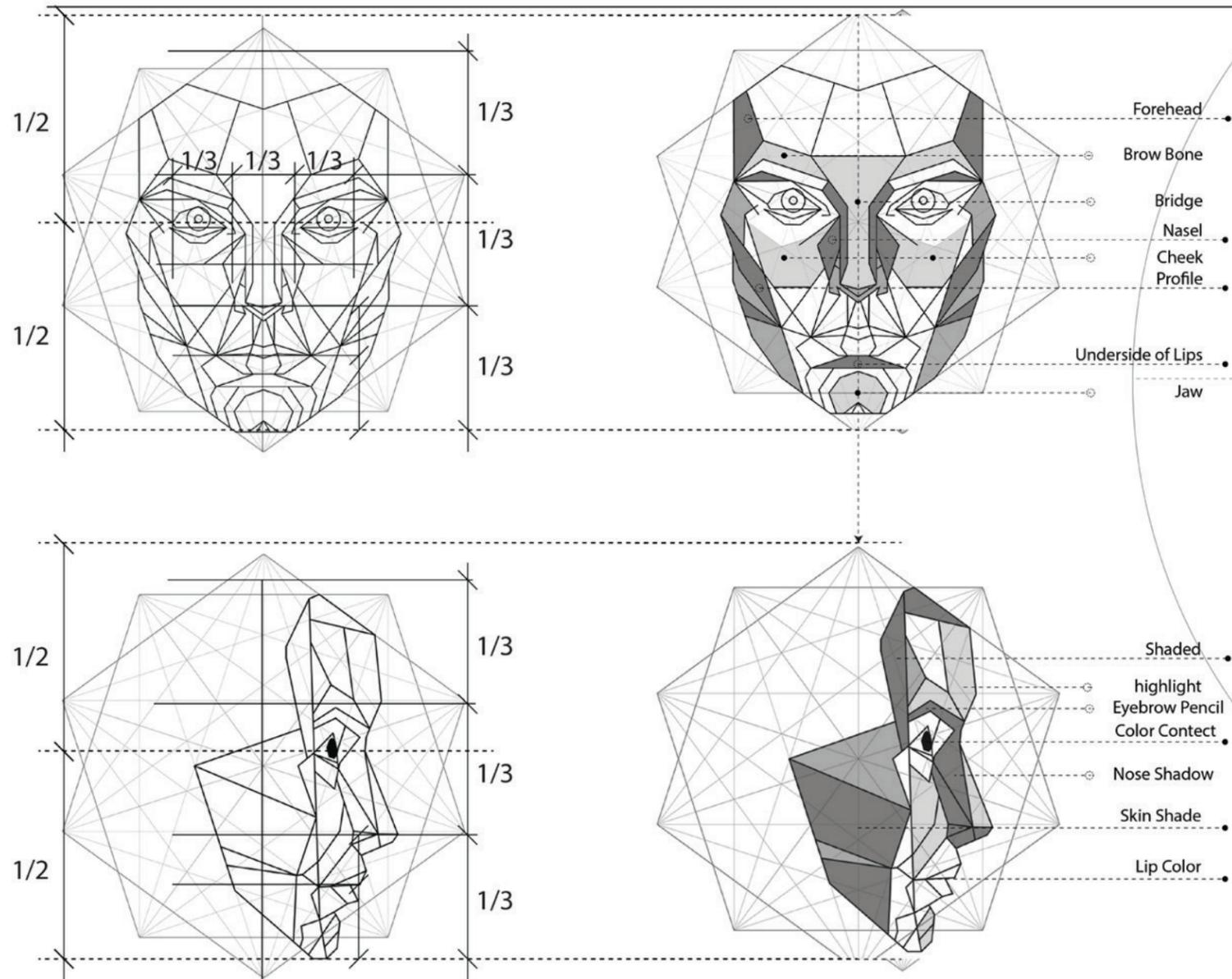
"a racially and economically diverse audience,"

"strangest and gaudiest of Harlem spectacles,"

Prizes would be given out for most beautiful gown and **"most**

HUMAN BODY ANALYSIS

Head

1/2   1/3

1/3 1/3 1/3

1/2   1/3

1/2   1/3

Forehead
Brow Bone
Bridge
Nasel
Cheek
Profile

Underside of Lips
Jaw

1/2   1/3

1/2   1/3

Shaded
highlight
Eyebrow Pencil
Color Contect
Nose Shadow
Skin Shade
Lip Color

Shoulder
X-Soulder
Bust
Hps to Waist

Waist
Lower Waist
Hip
Max Thigh

Crotch to Knee
Waist to Knee

Knee

Calf

Ankle

THE FASHION GALLERY OF CHELSEA DISTRICT

Ruodi Zhang
Carbon Analysis

The goal of this project is to comprehend the carbon footprint of buildings by analyzing the material composition process. To achieve this, I selected a mixed-use project with both commercial and residential components as the basis for analysis and incorporated relevant data for accurate calculations.
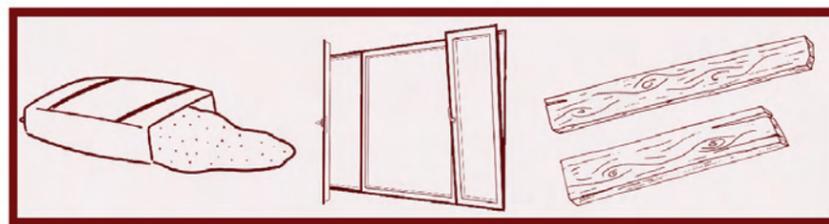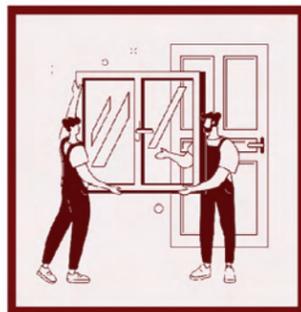
WOOD

WOOD

① Plaster for Interior
② Wood for floors and walls
③ Concrete for Facade and walls
④ Triple glass panels

CEMENT
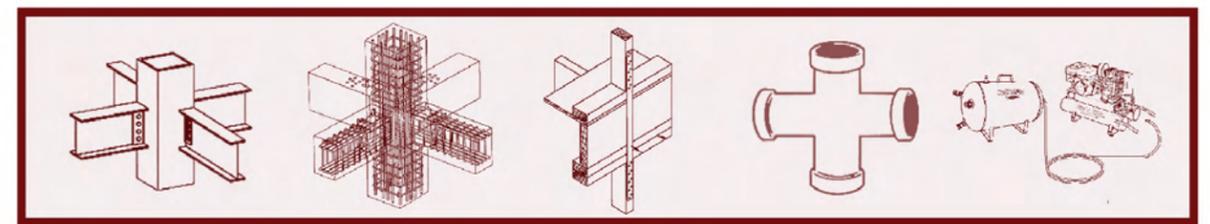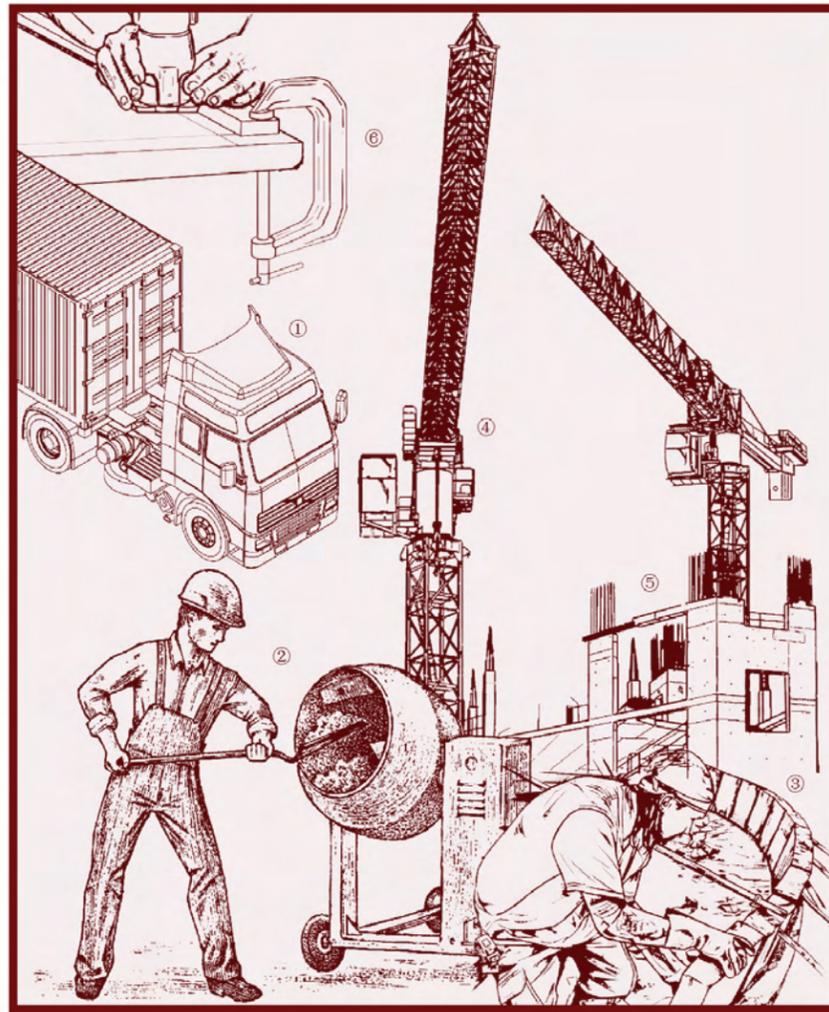
GLASS

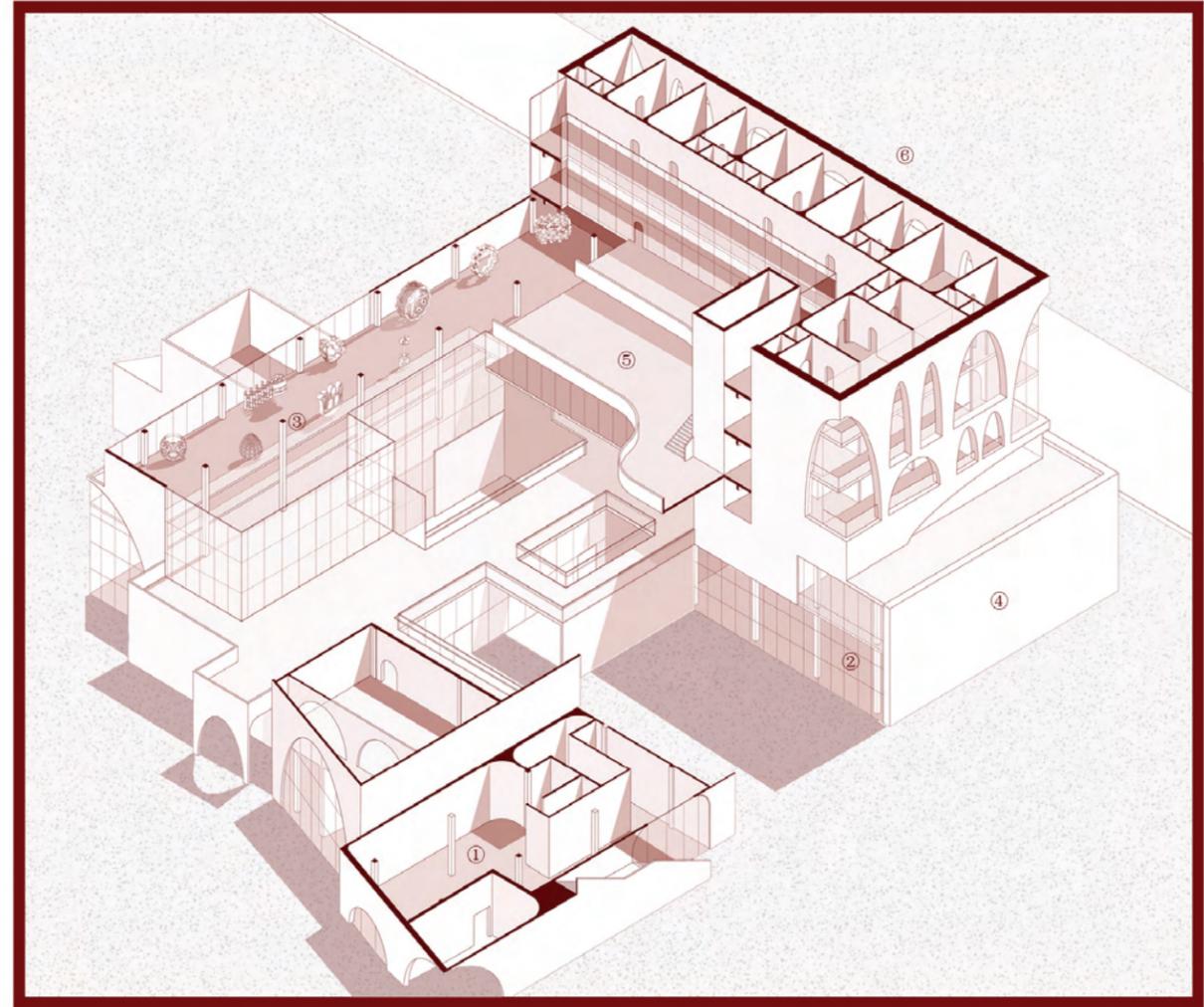① Transportation of materials and facilities
② Preparing process of materials
③ Constructing the structure required
④ Large Construction with machines
⑤ Installation of required product
⑥ Installation of facade and interior

① Concrete pave for first floor
② Glasses for lower floor and curve glass
③ Interior concrete floor
④ Light concrete facade
⑤ Cantilever concrete platform
⑥ Interior wall and details

GROUND LEVEL EXITING DIAGRAM

HIGHLINE LEVEL EXITING DIAGRAM

LEVEL 03 EXITING DIAGRAM

LEVEL 04 EXITING DIAGRAM

LEVEL 06 EXITING DIAGRAM

LEVEL 06 EXITING DIAGRAM

SUMMER
solar
analysis

WINTER
solar
analysis

MATERIAL CARBON
PROJECT RESULTS

BUILDERS FOR CLIMATE ACTION — BEAM

PROJECT INFORMATION

Project Name	Fashion Gallery of Chelsea Distri	Construction Year	
Design Firm(s)	Ruodi Zhang & Zhaoyue Chen	Number of Bedrooms	
Engineering Firm(s)	N/A	Stories Above Grade	6
Builder / Developer	N/A		
Development Project	N/A	**CONDITIONED AREA**	
Street Address	N/A	Above Grade	11660 m²
City	New York	Below Grade	245 m²
Province / State	New York	Total	11905 m²
Country	United States		
		GROSS AREA	
Building Type	Mixed use	Excluding Garage	11905 m²
Construction Type	New Construction	Garage	0 m²
Project Stage	Design Development	Total	11905 m²

MATERIAL CARBON EMISSIONS BY SECTION

Section	kg CO₂e	
Footings & Slabs	1,690	kg CO₂e
Foundation Walls	58,658	kg CO₂e
Structural Elements	266,286	kg CO₂e
Exterior Walls	289,658	kg CO₂e
Party Walls	280,318	kg CO₂e
Exterior Wall Cladding	33,833	kg CO₂e
Windows	470,498	kg CO₂e
Interior Walls	33,494	kg CO₂e
Floors	445,778	kg CO₂e
Ceilings	25,154	kg CO₂e
Roof	67,428	kg CO₂e
Garage	0	kg CO₂e
NET TOTAL	**1,972,794**	kg CO₂e

MCE (kg CO₂e)   0 — 475,000

MATERIAL CARBON RESULTS

	MCE		MCI (Conditioned)	
Net Project Emissions	1,972,794	kg CO₂e	166	kg CO₂e/m²

MCI by Area Type	Metric	Imperial
Total Area	165.7	33.9
Conditioned Area	165.7	33.9
	kg CO₂e/m²	lb CO₂e/ft²

Storing	Great	Good	Avg	High

≤-100   0   100   200   300≤

C-Neg	BPM	BAM	MCM	HCM

BfCA Reporting Conventions

MCE: Material Carbon Emissions (net total)

MCI: Material Carbon Intensity (MCE per unit area)

HIGHEST CARBON MATERIAL APPLICATIONS

SECTION	kg CO₂e	MATERIAL
Windows	470,498	Window - triple pane / Vinyl frame / BfCA Study [U
Structural Elements	151,466	Structural Steel / Square HSS / 8 x 8 x 1/4" / AISC
Floors	142,528	Glued Laminated Timber (Glulam) / AWC & CWC /
Floors	137,588	Hardwood flooring / Action Floor Systems / 3/4" /
Floors	133,185	Cement board / 5/8" (16 mm) / Durock with EdgeC
Exterior Walls	132,886	Concrete - 2501-3000 psi, 20-29% Fly Ash / NRMC
Party Walls	129,750	Concrete - 2501-3000 psi, 20-29% Fly Ash / NRMC
Structural Elements	114,820	Structural Steel / Wide Flange / W250x33 (US W1C
Exterior Walls	71,611	SIP panel - R30 8.25" - EPS 7.25" @ R4/in. core, 2
Exterior Walls	69,878	EPS FOAM ICF R-23, 2 Sheets of 2.75"@R4/in., we

LOWEST CARBON MATERIAL APPLICATIONS

SECTION	kg CO₂e	MATERIAL
Footings & Slabs	0	Concrete - 2501-3000 psi, 40-49% FA/SL mix / NRI
Footings & Slabs	0	XPS foam board / DuPont / Styrofoam / HFC-fillec
Foundation Walls	0	Concrete - 2501-3000 psi, 20-29% Fly Ash / NRMC