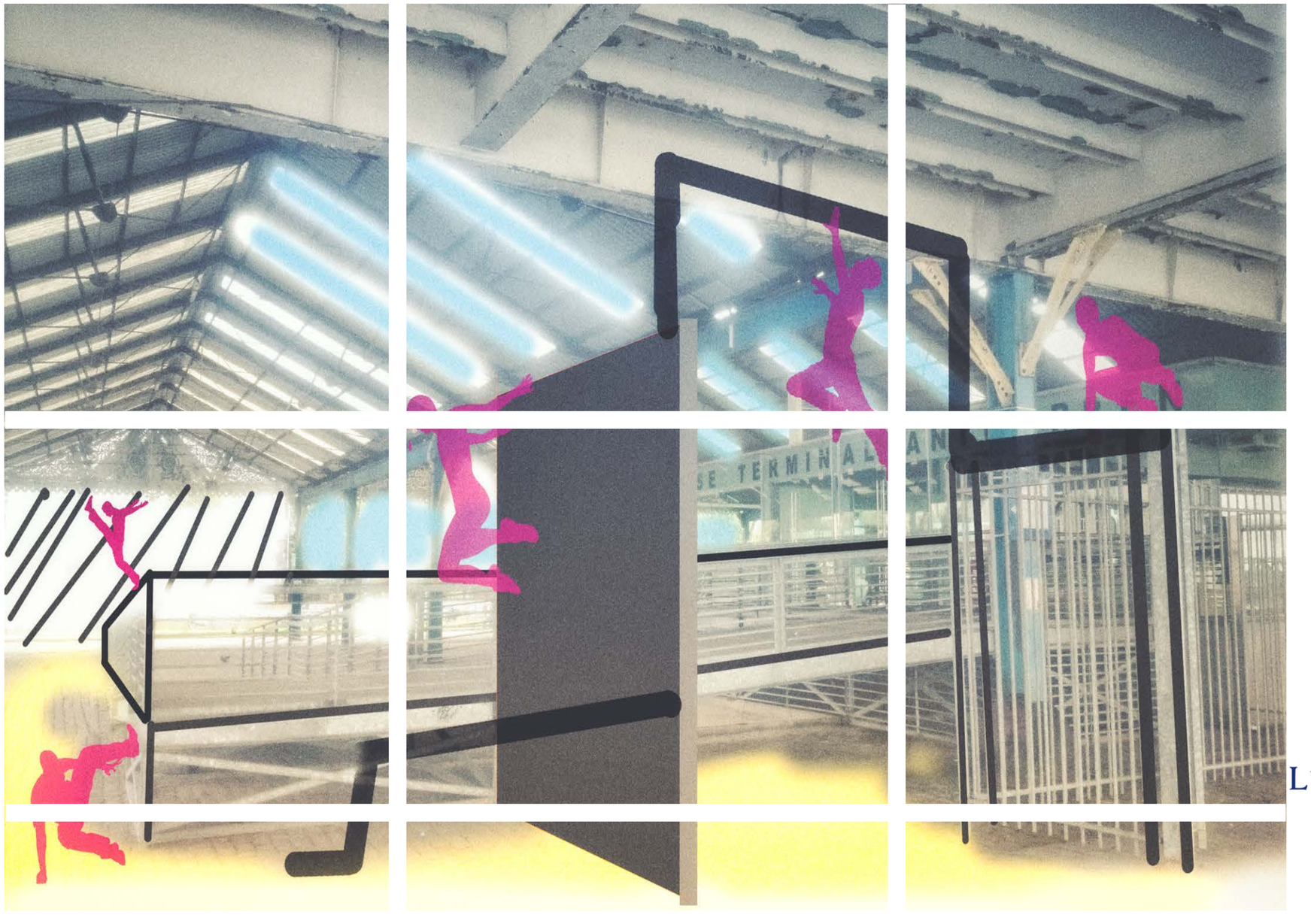
[Playlstation

Experimental case study on how to design a modern adventure playground using 3D printing and Recycled materials.



AAHM0: Degree Project in Architecture, LTH 2018/2019

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Summary

[Play]station

"Is experimental case study on how to design a modern adventure playground using 3D printing and Recycled materials, as a way of integrating minor newcomers".

Background
European countries, and of course Sweden, have received a large number of asylum seekers in recent years. Those newcomers need integration within their new society. Most of them are children and teenagers. Those minors can be a great can be a great contribution to the country if they are well integrated. This can't be achieved without active participation and social interaction between the *indigenous people* and the newcomers.

At first, I thought that designing a housing project can be the solution until I came across a book called "Adventure Playground" by Arvid Bengtsson. It talks about the problem of conventional playground designs in Europe after the World War II. The author preferentially introduced the concept of a playground for teenagers who will partially build it and run it by themselves. He also gave examples from various places all over Europe including Sweden.
Hence, I decided to design a modern concept of playground - inspired by this book- where both the indigenous and the refugee teenagers/children can make their own play area and explore things together. This platform is what I call [Play]station.

The Concept
[Play]station is a youth building with an indoor play area to accommodate activities with the purpose of empowering teenagers. It encourages both the physical and the artistic activities. [Play]station provides an adaptable space as well as recyclable materials that are useful for building many shapes including, but not limited to, Parkour tracks (or any type of play tracks), art gallery, and many other possibilities. Children use 3D printing and various manual skills to build their own games.

Methodology
In [Play]station, games are made from the trash materials (bottles, wood sheets, …). These materials are transformed into many possibilities using 3D printed connectors. Participants will have will have the complete freedom to design their games. This freedom helps them gaining self-perception and social skills. It could be viewed as an efficient way of integration of refugees for being able to turn them into democratic citizens, who can think independently, can be responsible and capable of showing tolerance towards others, and have the courage to defend their own convictions.

I chose a centrally located storage building in Nyhamn Malmö as the site of my case study for the playground. Being an interior play area is more convenient than exterior one due to weather conditions. Moreover, this site is advantageous for the purpose because of its wide area and the presence of many doors and windows.

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Background

Figure 1. Children playing (source: Arvid bengtsson)

Refugee problem

European countries, and of course Sweden, have received a large number of asylum seekers in recent years. Those newcomers need integration within their new society. Most of them are children and teenagers[1] and those minors can pose a great contribution to the country if they are well integrated. This goal cannot be achieved without active participation and social interaction between the indigenous people and the newcomers.

Nowadays, it is very popular to talk about refugees from the negative point of view considering them as a burden. The common belief is that they are poor and helpless people and the best way of helping them is by giving aid or charity. My opinion is that these people mostly need to work and interact with the society, and with the help of indigenous people, rapid integration and best exploitation of their potentials will be achieved. This will help them have a positive effect in the society. Social interaction requires sharing of ideas and activities that may be obstructed by the cultural and linguistic barriers. Playing, as a universal language that all people can speak, could overcome these barriers and be a good way to facilitate this interaction, especially for minors. *(Figure 3)*

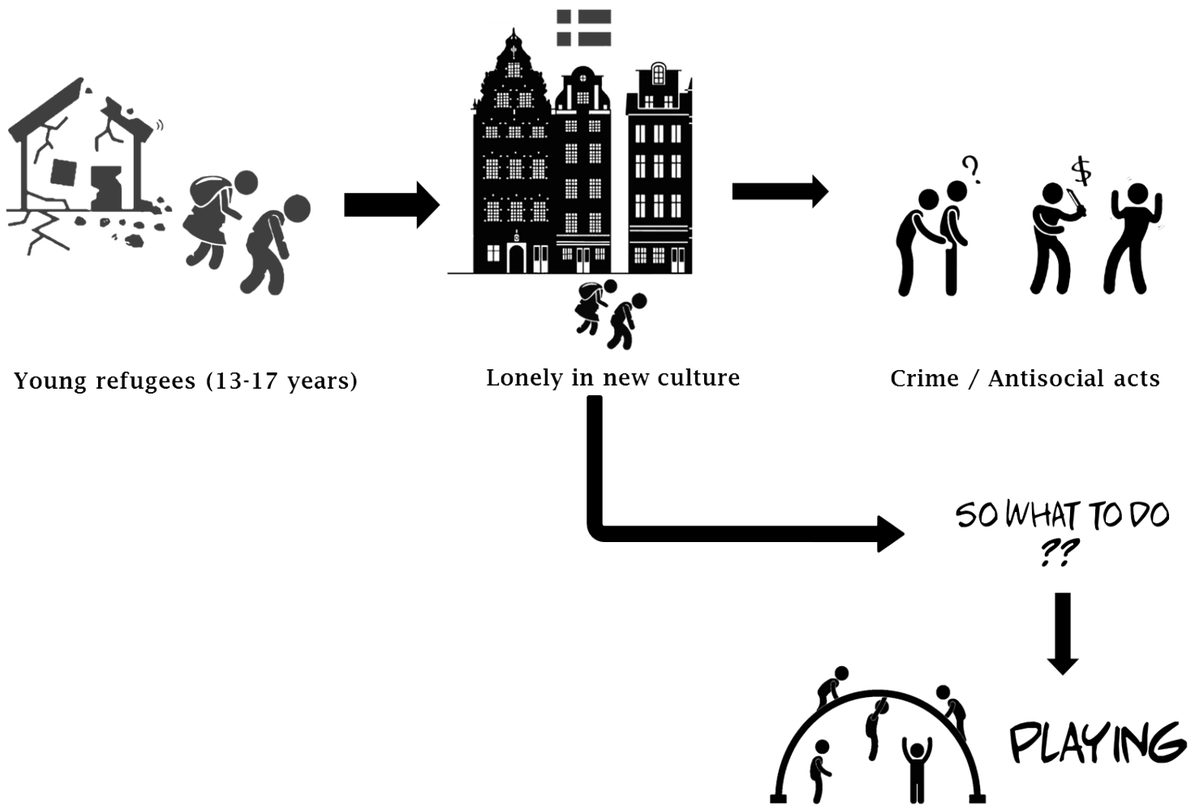


Figure 3. Integration through playing

Figure 2. Migrant children in Tärnsjö (source: Rightedition news)

TARGET GROUP

Sweden is one of the largest refugee-receiving countries within EU region. Data derived from the Swedish Migration Agency "migrationsverket" revealed that 83 % of the total refugees received in the last 12 years came within a six-years period from 2012 to 2017, where 55% (35,369) came in 2015 alone and mostly from Afghanistan. The percentages of unaccompanied minors (UAM) are 22% in 2015, 8% in 2016, and 5% in 2017 with an average of about 12%.[1]

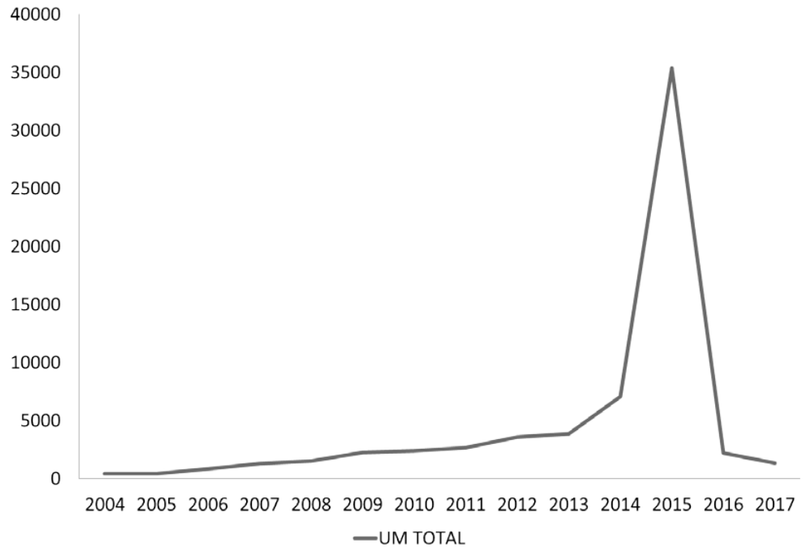


Figure 4. Total number of unaccompanied minors (UAM)

The majority (93%) of them are in the age group of 13-17 years (43% in the group of 13-15 years and 50% in the group of 16-17 years) and 90% are boys. Below the age of 13, gender distribution is nearly equal.[1] *This means that, in about 4 to 8 years those teenagers will become adults, hence, requiring preparation for their new society. In addition, these unaccompanied lonely minors that are living in a new culture with no guidance are mostly vulnerable to be dragged into criminal or antisocial acts. These facts stimulated me to target this age group (13 -17 years).*

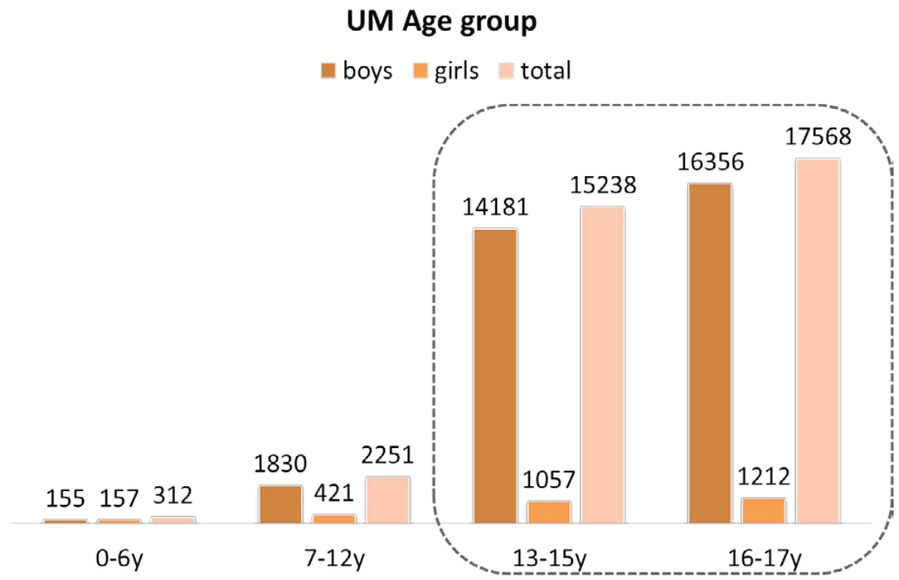


Figure 5. Age grouping of unaccompanied minors (UAM)

Main idea : Idea development

At first, I thought that designing a housing project where we can mix between housing and playing at the same place might be the solution. However, this idea has proved to be impractical due to many reasons. First, the UAM do not lack shelters, because housing is already available for them as a responsibility of each municipality (although, most of these projects are outside cities and isolated from the rest of the society).[1] Second, building regulations are very strict when it comes to housing, and fulfilling them might limit me to certain approaches that are outside the scope of my interest. Third, in my research, I wanted to focus on the use of the recyclable trash materials for the purpose of sustainability, a goal that is very hard to be achieved within the limitations of housing regulations. *(Figure 6)*

So, I returned back to my original focus of interest that is, designing for teenagers UAM who lack knowledge and interaction with the new society due to their isolated areas of residence. To achieve the goal of integration, I chose to focus only on playing as a chance of interaction between refugees and indigenous children, and in a relatively care-free area outside their own closed and separated environments.

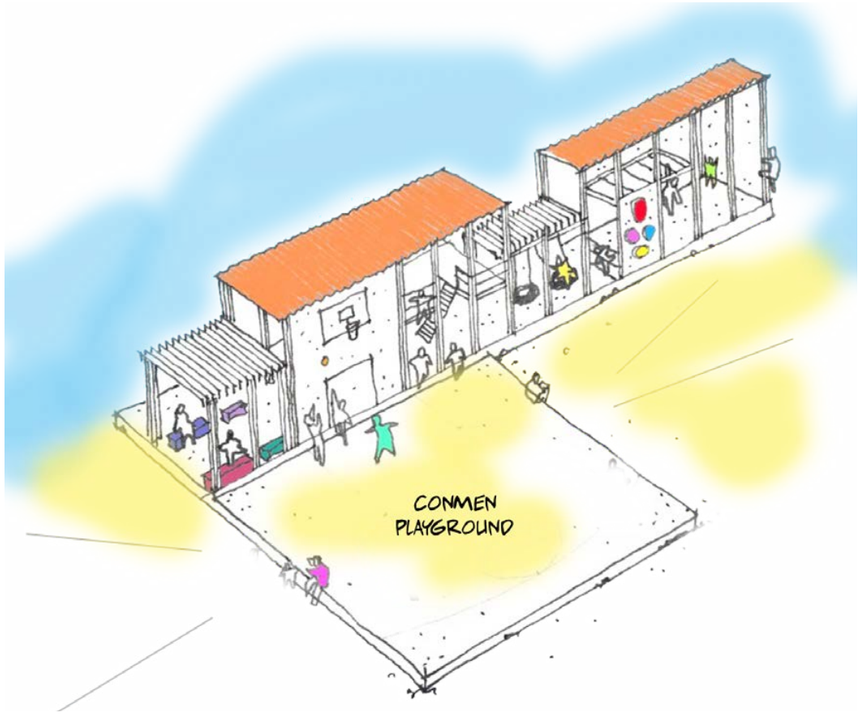


Figure 6. Old design proposal mixing housing with playgrounds

Main target

My main target is to challenge teenager's capabilities of building their play area that requires learning of certain skills; and results in increasing their self-confidence as a way of empowerment. The relatively care-free area provides a better chance of interaction and exchange of information beside manual and high mental skills between participants. Raising their capabilities is expected to provide them a better chance for future employment.

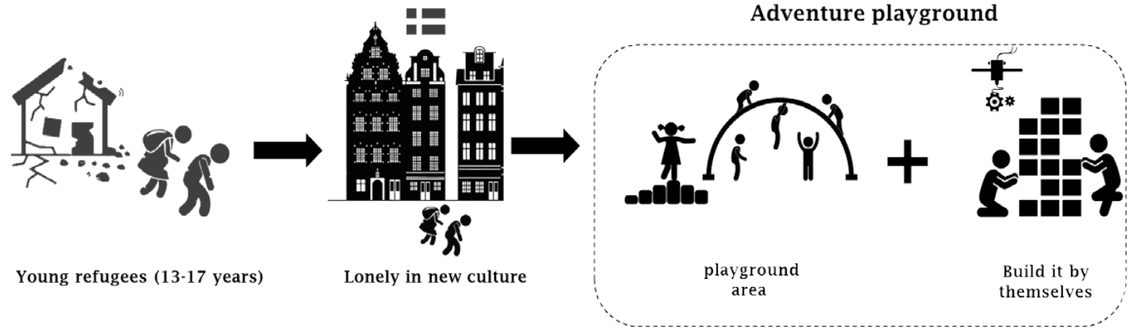


Figure 7. Main target

Adventure playground

I came across a book called “Adventure Playground” by Arvid Bengtsson in which heavy criticism of the traditional playground concept was presented. It described how playgrounds has turned into boring places for children due to the use of pre-designed equipment (slides, swings,…), in addition to its design that can restrict the natural desire of children to explore and test the world. The book also offered another alternative for play areas called “adventure playground” where teenagers can partially build their own games and organize the playground by themselves. Many examples from places all over Europe were also provided within the book.[2]

.

It is also worth mentioning the quote of Lady Allen of Hurtwood, an English landscape architect, about the role of these playgrounds in the post-World War II period.

> ***“The junk playground is made into a narrative for postwar reconstruction, as a Healing Process in which the physical and psychological damage of the war are to be playfully cured”*** *Lady Allen of Hurtwood*[3]

Figure 8. Junk playground (source: la voiture fondue)

Figure 9. Interior adventure playground (source: Arvid bengtsson)

What is adventure playground, why ?

The idea of "adventure playgrounds" is frequently defined in contrast to "playing fields". Playing fields are the contemporary-design playgrounds made by adult architects; they are traditionally equipped play areas containing adult-made rigid play-structures such as swings, slides, and climbing bars.

Junk playground

Carl Theodor Sørensen, a Danish landscape architect, noticed that children preferred to play everywhere rather than the playgrounds he designed. In 1931, he was inspired by the sight of children playing in a construction site. Therefore, he imagined a "junk playground" where children could dream and imagine their reality, then create and shape it. His aim was to let children living in cities enjoy the same playing opportunities that children living in rural areas enjoyed. During the German occupation in 1940th, the first "junk playground" was set up by the Workers Cooperative Housing Association in Emdrup, Denmark.[2] *In those difficult times, the importance of play areas emerged as a way of preventing the so-called rough Danish youth from being drifted into marginality and criminal acts. This could be achieved by occupying them in constructive play, giving them self-confidence to rebuild their country, and to reinstate a sense of community. In the post-World War II, it was very natural that children occupied bombarded sites turning them into playgrounds.*[2, 4]

Adventure playground

This movement began to gain popularity after the English landscape architect "*Lady Allen of Hurtwood"* who visited "Emdrup, junk playground" during the German occupation of the city during World War II. The term and concept of "adventure playground" began after she returned back to London and changing its name from "junk playground "to "adventure playground".The sites were not typical playgrounds, but rather empty public spaces full of resources and waste materials for children to build, create, and mold their own gaming environment free from any types of restrictions regarding the games, the shapes or how they play in it.[2]

Nowadays this movement suffers from some finical challenges and many playgrounds are being shut down or sold in the UK.[5] However, it is still found in many places in Denmark, the UK, US, and Canada where children still have the experience to play with junk and do their own game.

Adventure playground

Figure 10. The NottingHill adventure playground in Faraday Road. Photograph: Daily Mail/Rex/Shutterstock

Playing fields

Figure 11. Kilfinane Community Playground, Kilfinane,Ireland

EXAMPLE PROJECTS

Emdrup playground (Skrammellegepladsen), (Copenhagen Denmark)

Idea

The original prototype of the adventure playground was designed by 'Carl Theodor Sørensen' in 1943, as part of a social housing project in Emdrup, Copenhagen. At first there was no agenda about what to do in the place, but the main activities were digging out holes in the ground and building houses. Children were provided materials and real tools, and with nearly no guidance children were very successful and happy. Over the time, the activities were changing according to the children's demand.[2, 4]

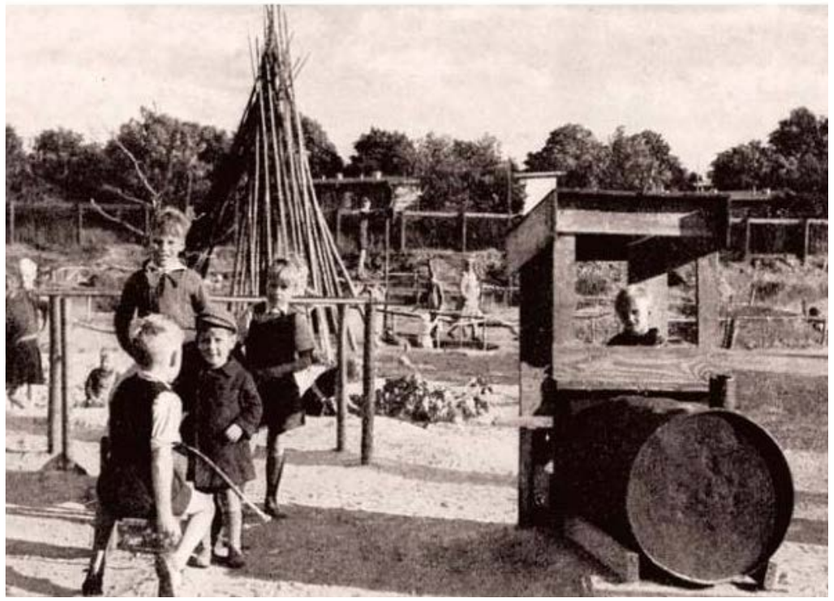


Figure 12. Self-directed children's play (source: skrammellegepladsen i emdrup)

How it is turned

The free self-directed children's play remained till the beginning of 1960th. Since then, diminishing of the construction areas, reduction of the diversity of scrap and construction materials and the addition of prebuilt structures have been occurred.
A range of activities has been added including basketball, soccer, PlayStation in a club-house on the site, theatre productions, and vegetable and flower gardening. In addition, pre-programmed events have been introduced such as the Skrammel Olympics and Cake and Bread Baking days. Meanwhile, efforts to segregate children by age and to transform Emdrup into a conventional playground have met with opposition from play advocates. As a deviation from the junk playground idea, playworkers (Danish: pædagoger) and assistant playworkers (Danish: pædagog-medhjælpere) were introduced to facilitate play and provide playing ideas. Paedagogs also facilitate meetings with the Parental Board of the recreational facility that houses the Emdrup Skrammellegepladsen.[4]

Figure 13. Emdrup playground today (source: Københavns Kommune)

Figure 14. Playworker organizing the children play, Emdrup – junk playground (Skrammellegepladsen) (source: Københavns Kommune)

“The Land” playground (In Wales, UK)

The Land playground is one of the few that still follows the original idea of adventure playgrounds where children are allowed to design their own games and styles. Some safety is ensured by employing workers who classify junk and make sure it is safe without restricting children to a play type. It is operated by the Association of Voluntary Organizations in Wales, UK, and it has been in operation since 2011. It is open for children and young people from five to sixteen years of age. Children have the freedom to do whatever they like under the supervision of around 12 play-workers. Those adults only suggest games and provide guidance if needed, without any intervention in children’s game play.[6]

At first sight you observe the chaotic layout, which is the main characteristic of adventure playgrounds. The Land consists of a fenced play-area with a brook running through it. Everywhere you see piles of pallets, car tires, wheelbarrows, ladders, fishing nets, various hammers, ropes, and punch bags. This messy layout gives the freedom to be creative. There is no specified activity in that playground and children can invent whatever they want.[6] *Although this is beneficial for individual creativity, it does not encourage team work which is highly needed nowadays.*

Figure 15. Playing with junk in Land playground (source: The land documentary)

Figure 16. The chaotic layout of the land playground,wales (source: The land documentary)

Figure 17. Playing activities (source: The land documentary)

Principles of adventure playgrounds

Playgrounds are all designed to do the same things, which are to help children develop their abilities, use up excess energy, and keep them off the streets. After my research in the topic, I have deduced the principles of the adventure playground that are summarized as follows: [2, 6, 7]

01 Freedom to play

Adventure playgrounds, in contrast to traditional playgrounds, enhance and encourage children's own play rather than restricting or shaping it from outside. Traditional playgrounds stick children to the repetitive motions of the slides or swings, and once the child reaches the technical limits of the equipment, he feels bored and either stops playing or tries to stretch those limits, hence, resorting to what we call "the act of vandalism" to overcome boredom.

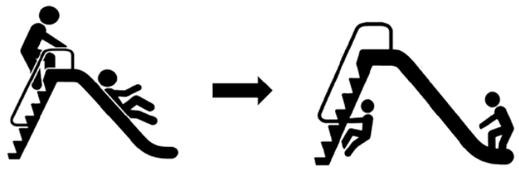


Figure 18. Freedom to play

02 Freedom of program

No theme, all children can play whatever they like. Adventure playgrounds have no ready-made play equipment or a predetermined agenda for what should take place. Rather, children introduce joy and meaning to the playground through their own actions of experimenting, making, and destroying, which are in harmony with the true nature of children and their way of playing. Moreover, it provides much pleasurable and meaningful experiences than the traditional playgrounds.

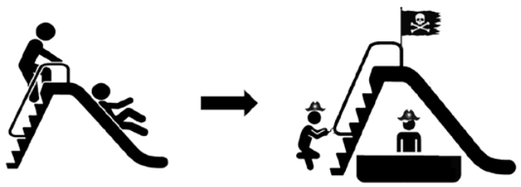


Figure 19. Freedom of program

03 Freedom to design

Children are involved in designing the playgrounds, thinking of weird structures and further adapting them by tacking on extra elements. This is done through a group participatory work managed by volunteer play leaders. Although the notion of freedom to design is usually mentioned, it is very hard to be practically achieved or experimented.

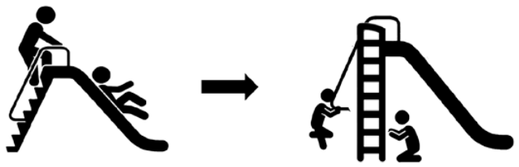


Figure 20. Freedom to design

04 Exposing children to risk

Children must experiment the real field, with real tools. Playgrounds are places where children can challenge themselves and test their capabilities with complete freedom. This teaches them personal responsibility, makes them more confident in real life, and it is simply a more pleasurable way of playing.

"Better a broken bone than a broken spirit" *said Lady Allen.*

05 Use of the environment

Using junk and recycling them into games is environmentally friendly, albeit making adventure playgrounds appear chaotic and unclean in contrast to "sterile" traditional playgrounds. In reality children prefer the dumps of rough wood and the piles of bricks rather than the ordinary playing area. That difference comes from the philosophy of play in the traditional playgrounds in which the equipment determines the activity by engaging children into pleasurable bodily activities that are essentially kinetic. However, in adventure playgrounds the meaning and the use of the equipment (that is the available materials) is determined by the children themselves, and the pleasure it induces comes out of the mystery and imagination of the environment (feed child mind and body); that's why the rubble of the bombarded sites after World War II were very suitable as play areas where children played with old cars, boxes and timber.

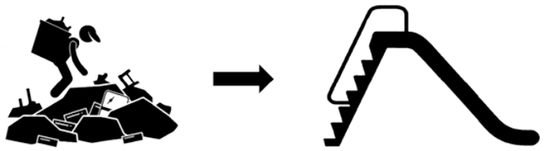


Figure 21. Use of the environment

THE DECLINE OF THE IDEA IN MODERN DAYS

Nowadays, there is a big decline in the idea of "adventure playground". Governments are now cutting funds for these playgrounds. A number of the UK's oldest adventure playgrounds are at risk of closing, and many of them have turned back to ordinary play areas with slides and swings. This decline is attributed to many factors:[5,7]

01 No more freedom of design or imagine

The freedom of design is taken away from children, keeping only the use of junk materials thus, removing the essence of the idea, that is, the "imagination" at play that should come out of the child not of the architect.

Due to modernity and standardization of things, modern societies have taken the right to shape children's play from the outside to achieve social, educational and political goals.

02 No longer encouraged to take risks

Due to the modern lifestyle, today's parents are more protective and more aware of their kids' health and sanitation and the concept of adventure playgrounds appear dangerous and unsanitary.

Today, there are few true adventure playgrounds left, but occasionally another is built that follows all the essential tenets, such as the "land playground" in ***wales****, designed on the ideas of local kids.*

The majority of today's "adventure playgrounds" are produced by specialist manufacturers and merely designed to look simple and safe, The values of children's safety and health have taken a higher priority that watered down the adventure playground movement in the 1980th and 90th.

Figure 22. Blue playground kit (source: imagination playground company)

03 Digital technology

Children of today are more and more attached to technology and the game concepts have evolved far beyond the concepts of the past. After certain age, children prefer to stay at home rather than going to the parks because ordinary play areas don't feed their imagination or mind.

04 No more funding

Many of the playgrounds which emerged in English cities after World War II are now facing the danger of closing their door because investing in youth is no longer a priority in the governments' agenda. It is well noticed from literature that cities are becoming increasingly hostile to children making them out of public spaces and not welcomed on the street.[5]

Figure 23. Children in Leicester protest against the closure of the Highfields adventure playground

Research concept

In light of the previous chapter and inspired by the ideas of adventure playgrounds, my new concept of play areas emerges to serve teenagers, as older age group, using the modern technology available for all. In these places, teenagers can make their own play areas and explore things together in a relatively care-free environment.

“This platform is what I call **[Play]station”**

My main target is to challenge teenager’s capabilities of building their play area that requires learning of certain skills; and results in increasing their self-confidence as a way of empowerment. The relatively care-free area provides a better chance of interaction and exchange of information beside manual and high mental skills between participants. Raising their capabilities is expected to provide them a better chance for future employment.

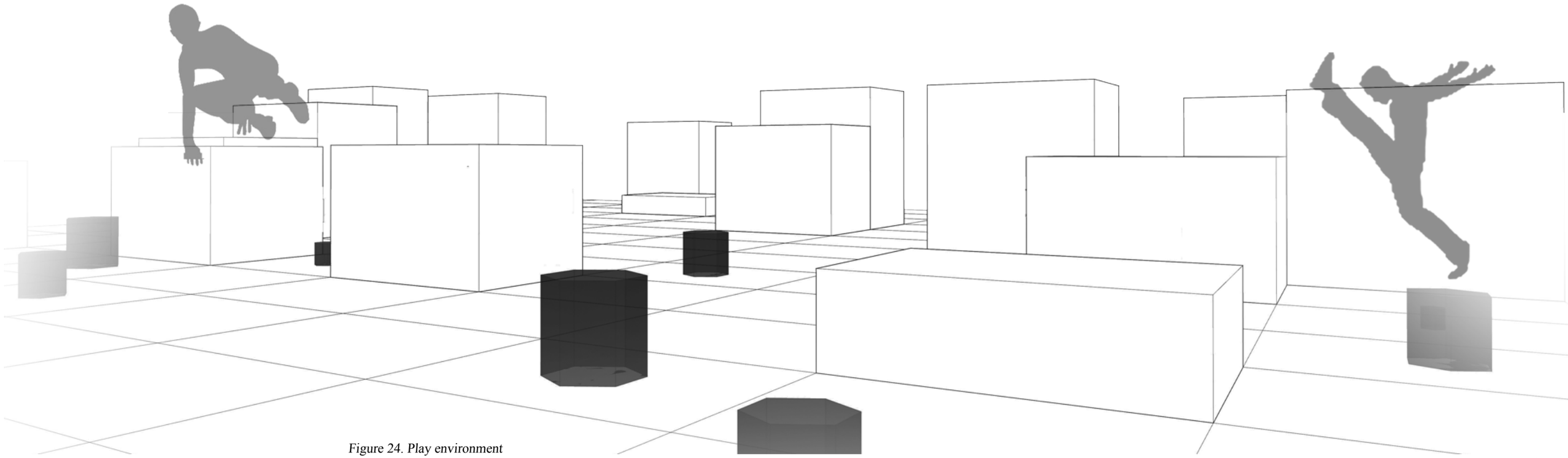


Figure 24. Play environment

[Play]station principles

*Although **[Play]station** is founded on the same concepts of "Adventure playground ", this research provides a newer insight regarding the concept of playing taking into consideration the points of criticisms that was directed to the original adventure playground. Moreover, it deals with the problem of minor refugees using playing as a way of their social integration. Following are the principles of **[Play]station.***

01 Freedom of design (in shapes and things)

Children are involved in designing the playgrounds, thinking of weird structures and further adapting them by tacking on extra elements. This is done by using digital technology as a tool. Then the design is used, fabricated, and tested in reality.

This facility is not offered in any of the ordinary adventure playgrounds, as this research is targeting a wider range of age that includes teenagers who can understand technology and apply it. They can also share ideas and provide guidance for the younger children.

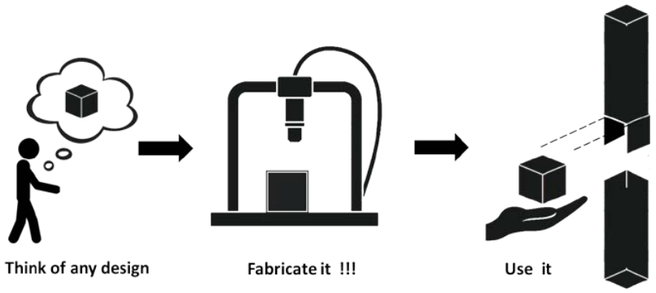


Figure 25. Freedom of design in [Play]station

02 Use of technology

Achieved by teaching teenagers the software skills and digital scripting in a simple way that enable them to design a variety of shapes within the same theme, or even innovate another theme.

Today's children rely heavily on technology, isolating themselves from the real world and rarely discovering it. On the contrary, my [Play]station uses digital technology to shape reality. This use of technology motivates children to innovatively build their manual and artistic skills rather than diminishing them.

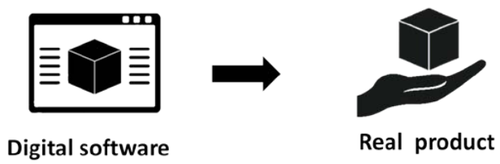


Figure 26. Using digital tools to design

03 Taking limited risk

I have considered the point of criticism of the original adventure playground regarding exposing children to risky and unhygienic conditions with little or no supervision. Therefore, trained instructors will be hired to make sure of the safety of the materials and tools used and to train children on safety measures.

Figure 27. Presence of trained instructors

04 Integration tool

[Play]station could be an integration tool through the mix between refugee and indigenous in performing a common activity. Children with different backgrounds being in the same place and doing the same activities enhance the experience of each other.

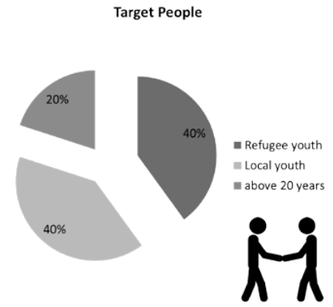


Figure 28. Target group percentages

05 Has an agreed upon (theme) activity

[Play]station has an agreed upon specific activity theme that can be followed. This specific activity is changeable from time to time according to the imagination of participants. Within this theme there is a variety of design options that enable this shaping. As a guidance, a small design catalogue is offered to the participants to stimulate their minds.

Adding a theme activity may appear as a restriction of the freedom of design. However, this freedom is fulfilled as participants can innovate various shapes and vote for what to implement. Besides, determining a theme will encourage team work and group play. This point is highly required for the integration of minor refugees because it provides the chance of interaction and exchange of skills between indigenous and refugee children. However,individualistic play could also be fulfilled through making artistic shapes or small projects

Figure 29. Participants do a common activity

06 Use of environment

The use of recyclable materials and turning them into play.

Figure 30. Use of environment

PROGRAM OF [PLAY]STATION

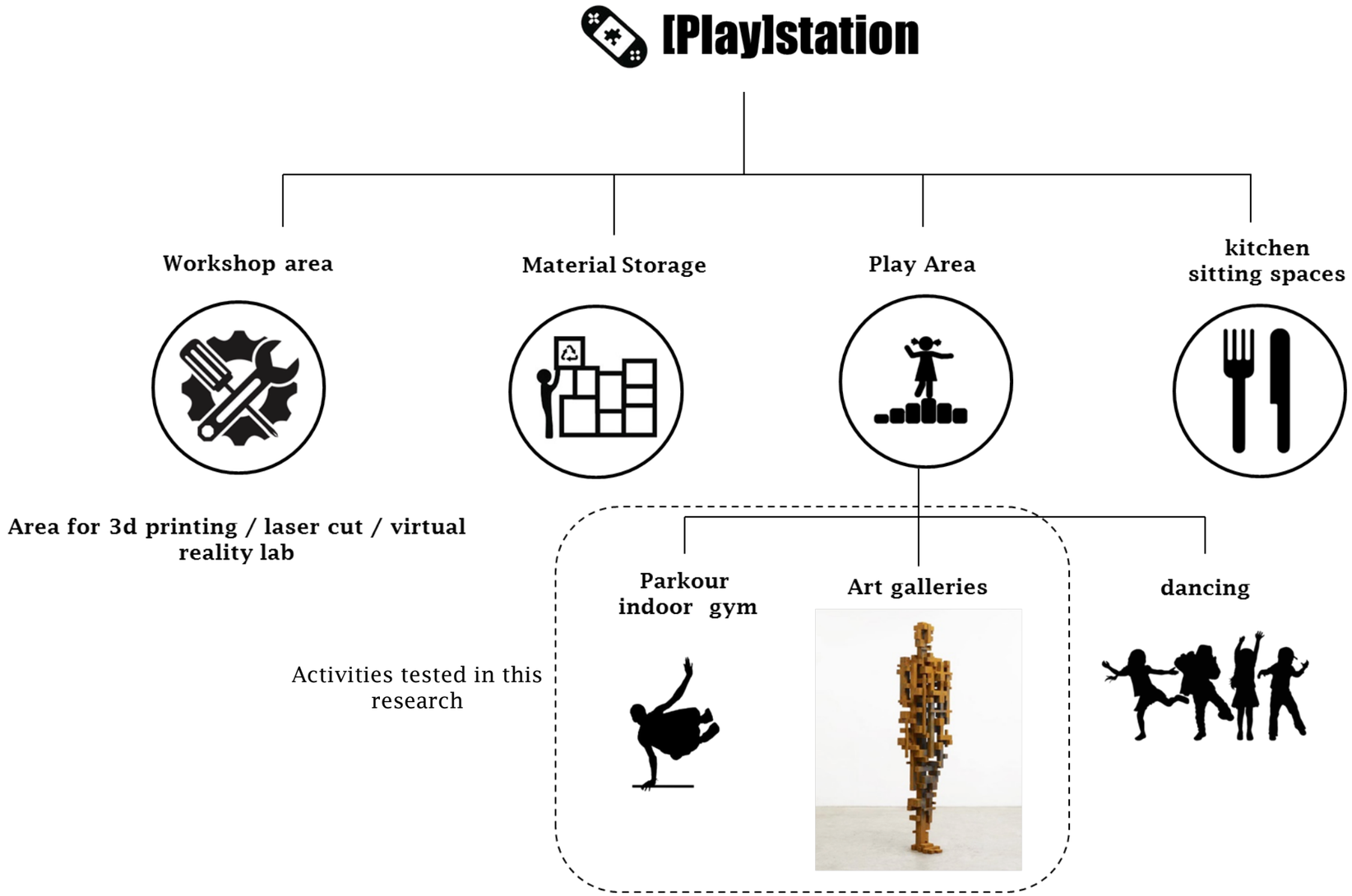


Figure 31. Program of [Play]station

Building program:

[Play]station *is a youth building with an indoor playground to accommodating activities with the purpose of empowering teenagers. It deals with the physical, mental, and artistic aspects of human development and needs. [Play]station provides an adaptable space as well as recyclable materials that are useful for building many shapes including, but not limited to, Parkour tracks (or any type of play tracks), dancing floor, or art gallery. Children use 3D printing and various manual skills to build their own games.*

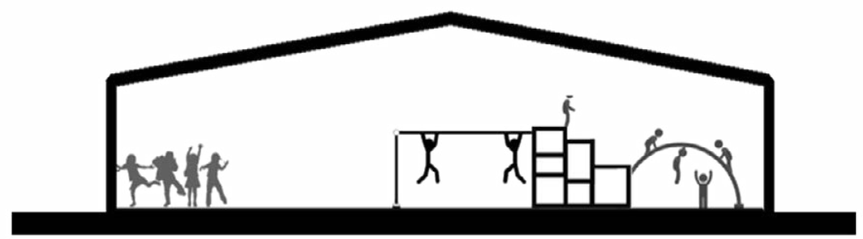


Figure 32. [Play]station as indoor space

How it is done ?

Role of participants

It is expected that they will arrange themselves, according to their capabilities that is usually related to age, into: Older group responsible for organizing, scripting and workshop activities,and younger group helping in workshop and in testing the forms.

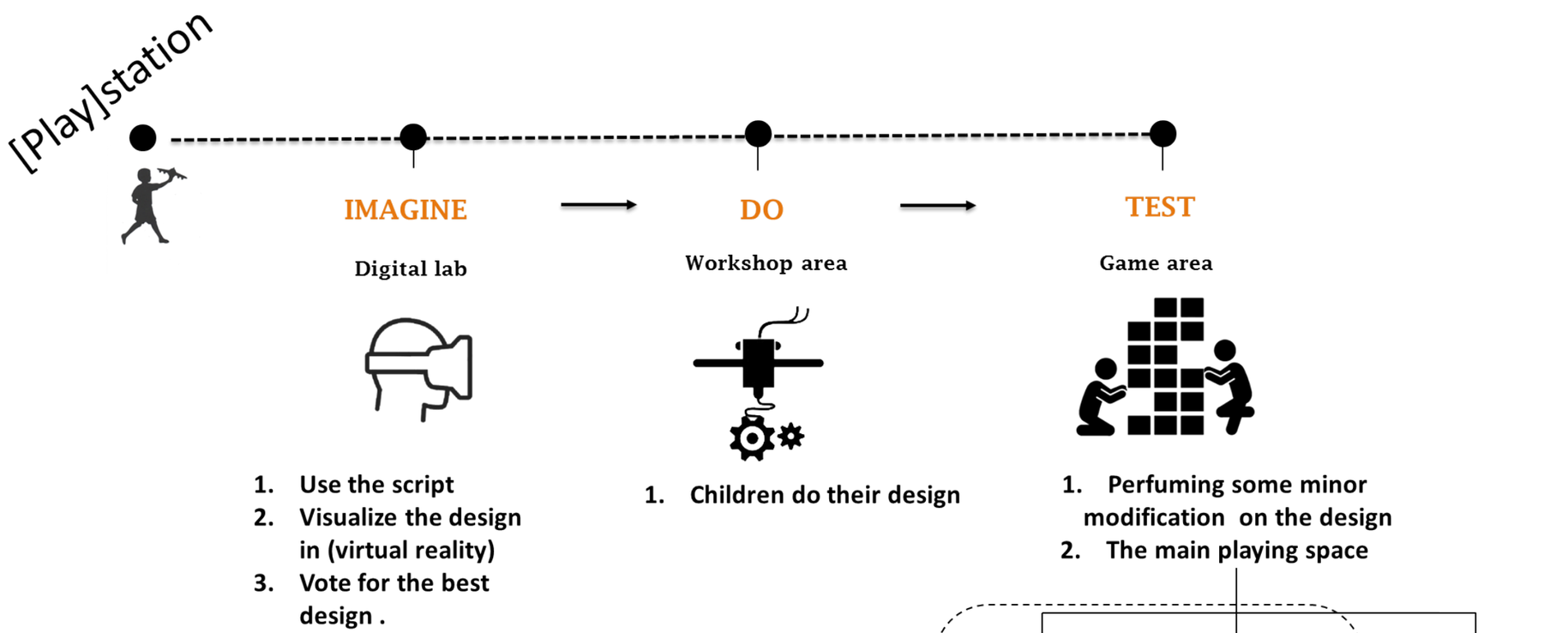


Figure 33. *[Play]station operation plan*

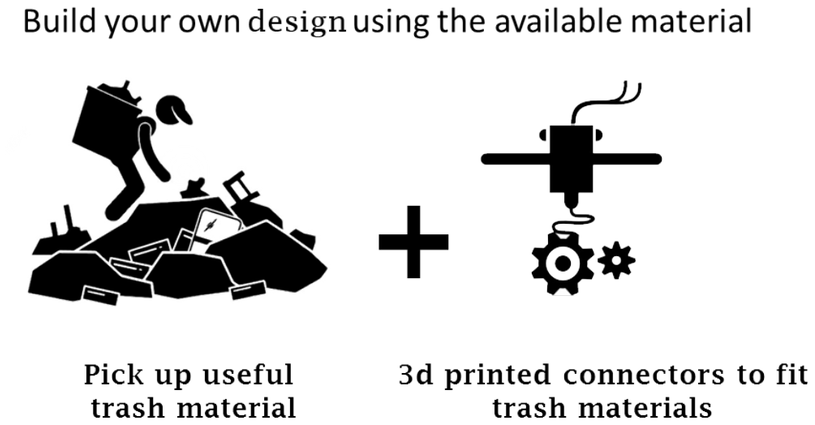


Figure 34. *[Play]station material idea*

Research concept

The [Play]station workers

[Play]station requires a group of workers to successfully operate it.

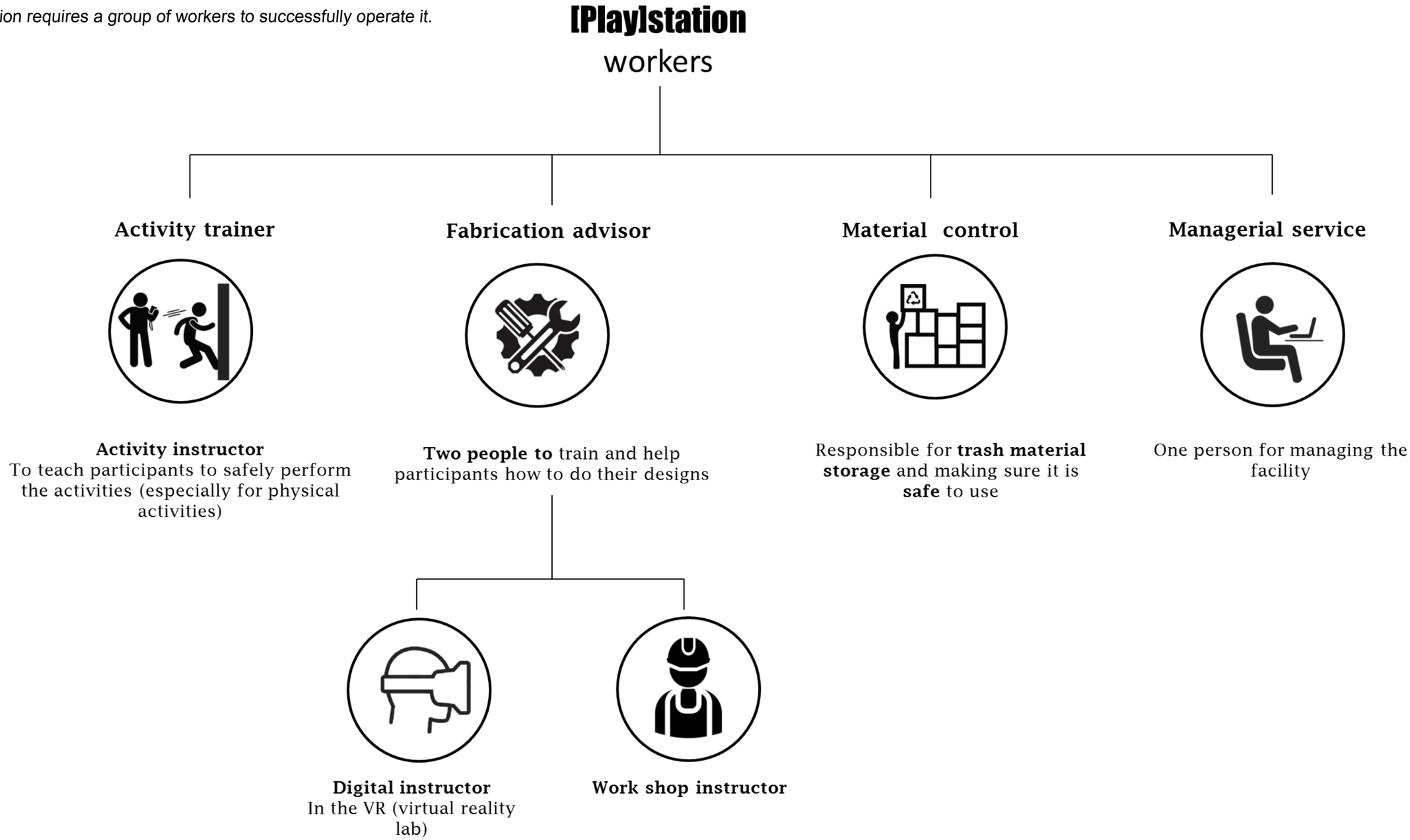


Figure 35. *[Play]station workers*

The group of workers in [Play]station does not have play-makers who tells the children what to play. Play-makers here will be from the participants themselves. Being one of them and a little bit more experienced, the play-maker will not be much cleverer than his/her peers. They are all experimenting together, hence, they have the complete authority over their play.

The unsupervised play allows adults to gain insight into children's mind. It also helps children gain self-perception and social skills. It could be viewed as an efficient way of integration of the newcomers for being able to turn them into democratic citizens, who can think independently, be responsible and capable of showing tolerance towards others, and have the courage to defend their own convictions.

Parkour as an application example

What is Parkour?

Parkour is the sport of jumping on obstacles with movements that resemble those of gymnastics and acrobatics. The aim of this game is to get from one point to another in a complex environment, without assistive equipment and in the fastest and most efficient way possible.

Parkour includes running, climbing, swinging, vaulting, jumping, rolling and crawling movement, beside other movements according to the practitioner's personal style. Parkour activities can be practiced alone or with others and it can be carried out practically anywhere.

Figure 36. Crawley parkour park in London (source:crawley parkour)

Movements:

There is no typical list of "moves" in parkour, it depends on the personal preference and style but there is a fundamental set of moves that includes:

01 Precision

Jumping and landing accurately with the feet on small or narrow obstacles

Figure 37. Precision

02 Using the wall

Running towards a high wall and then jumping and pushing off the wall with a foot to reach the top of the wall

Figure 38. Using the wall

03 Rolling motion

Using a rolling motion to help absorb impacts from larger drops.

Figure 39. Rolling motion

04 Hanging

Moving from a position hanging from a wall-top or ledge, to standing on the top or over to the other side.

Figure 40. Hanging

05 Vaulting over obstacles

Figure 41. Vaulting over obstacles

Parkour Philosophy

Parkour is a state of mind rather than a set of movements as it is all about overcoming and adapting to mental and emotional obstacles as well as physical barriers. Consequently, it enhances self-confidence and critical thinking skills that allow one to overcome fear, pain, and everyday physical and mental obstacles.

Parkour involves seeing one's environment in a new way and imagining the potential for navigating it by moving around, across, though, over and under its features. It is particularly suitable for the new comer children and teenagers as it teaches them to touch the environment and interact with it, instead of being afraid and sheltered by it.

Figure 42. Storage building,Nyhamn malmo ,Taken by:Hany elhassany

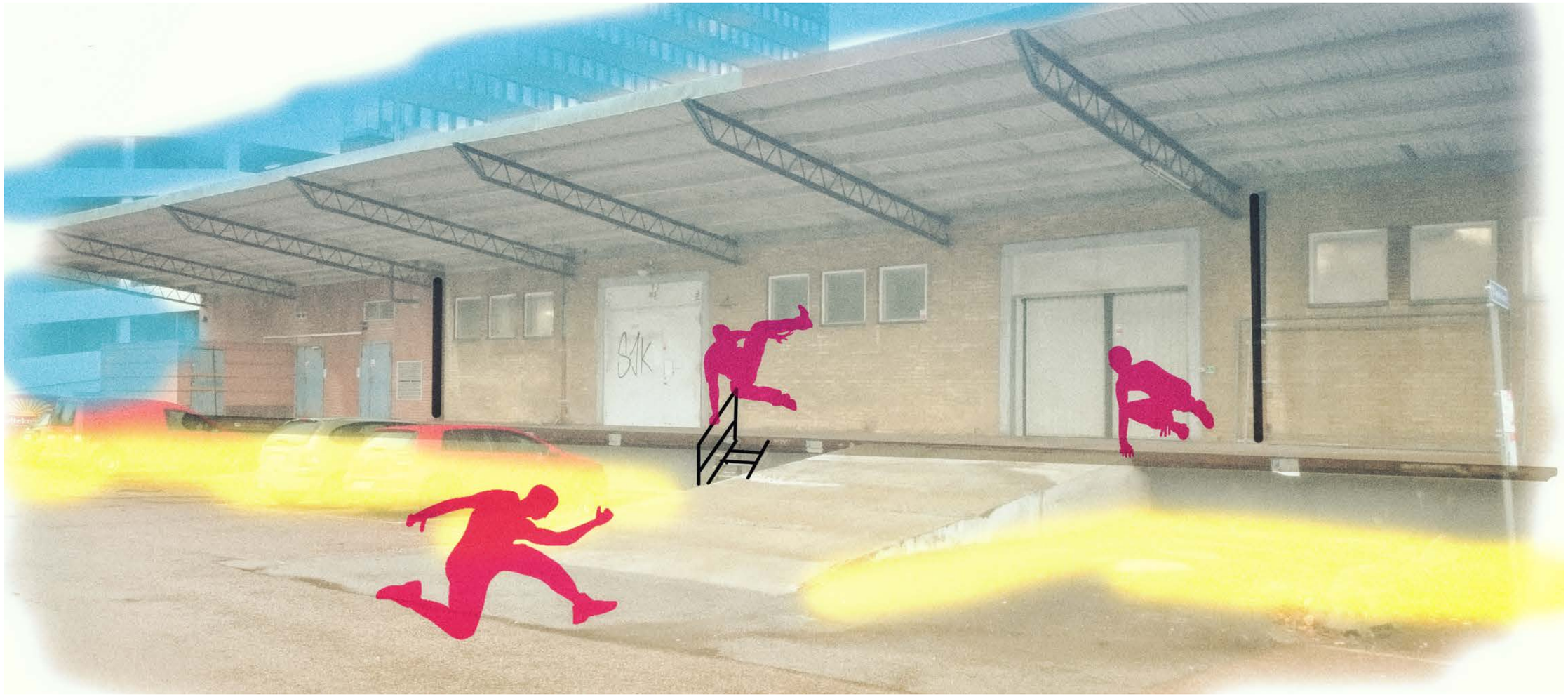
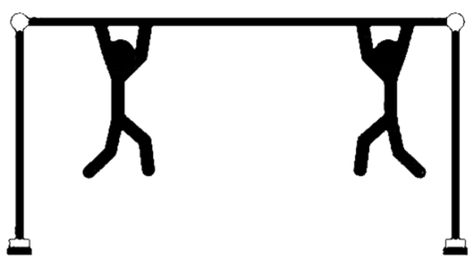


Figure 43. Storage building,Nyhamn Malmö (after using the Parkout Philosophy)

Why Parkour? (as an example)

1. *Interviews with a number of children asking them about their preferred methods of spending their leisure time, revealed that sports and various physical activities were put at the top of their priority list. Therefore, I chose the Parkour track as the first example for themes of [Play]station, being very suitable not only as a physical activity that makes use of their energy, but also as a state of mind that enhances critical thinking and help overcoming emotional obstacles.*
2. *Unlike other sports, Parkour is suitable for various age groups as it is more about playful and fun producing movements.*
3. *It produces a very rich environment that can be used for other playing possibilities*



Ninja Warrior parties

Paintball arena

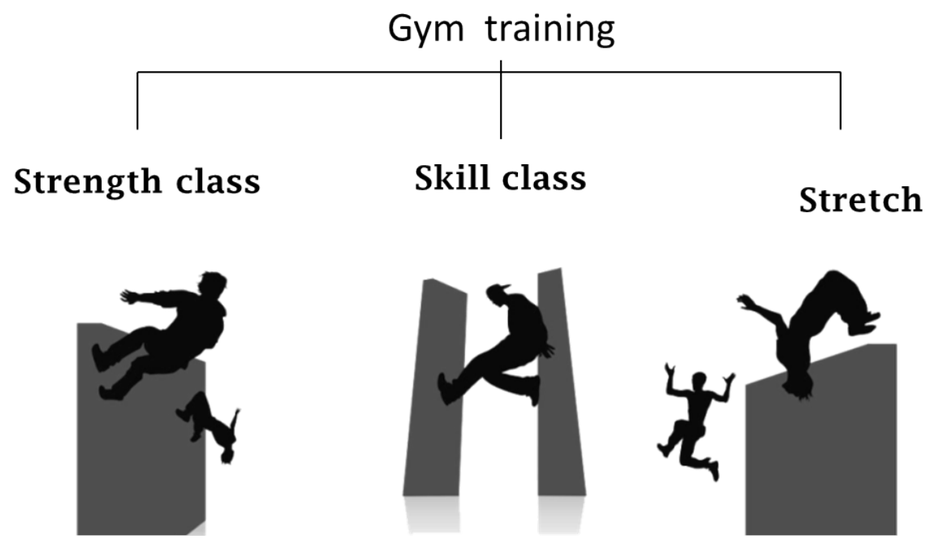


Figure 44. Some of Parkour space playing possibilities

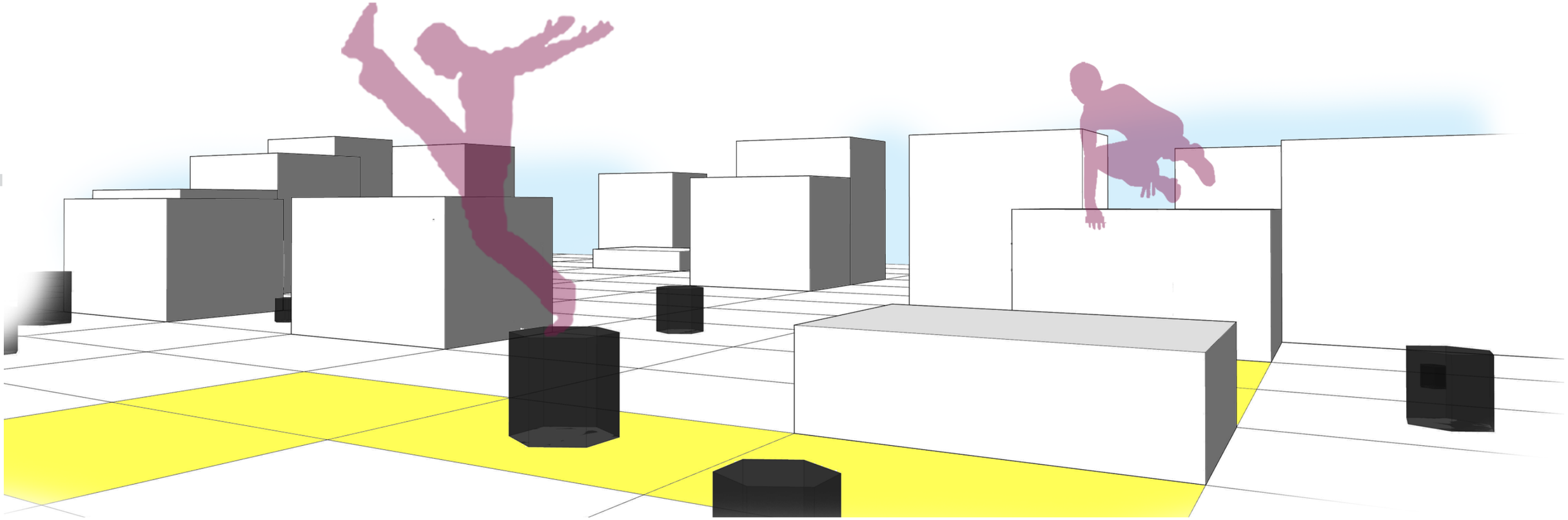


Figure 45. Parkour space

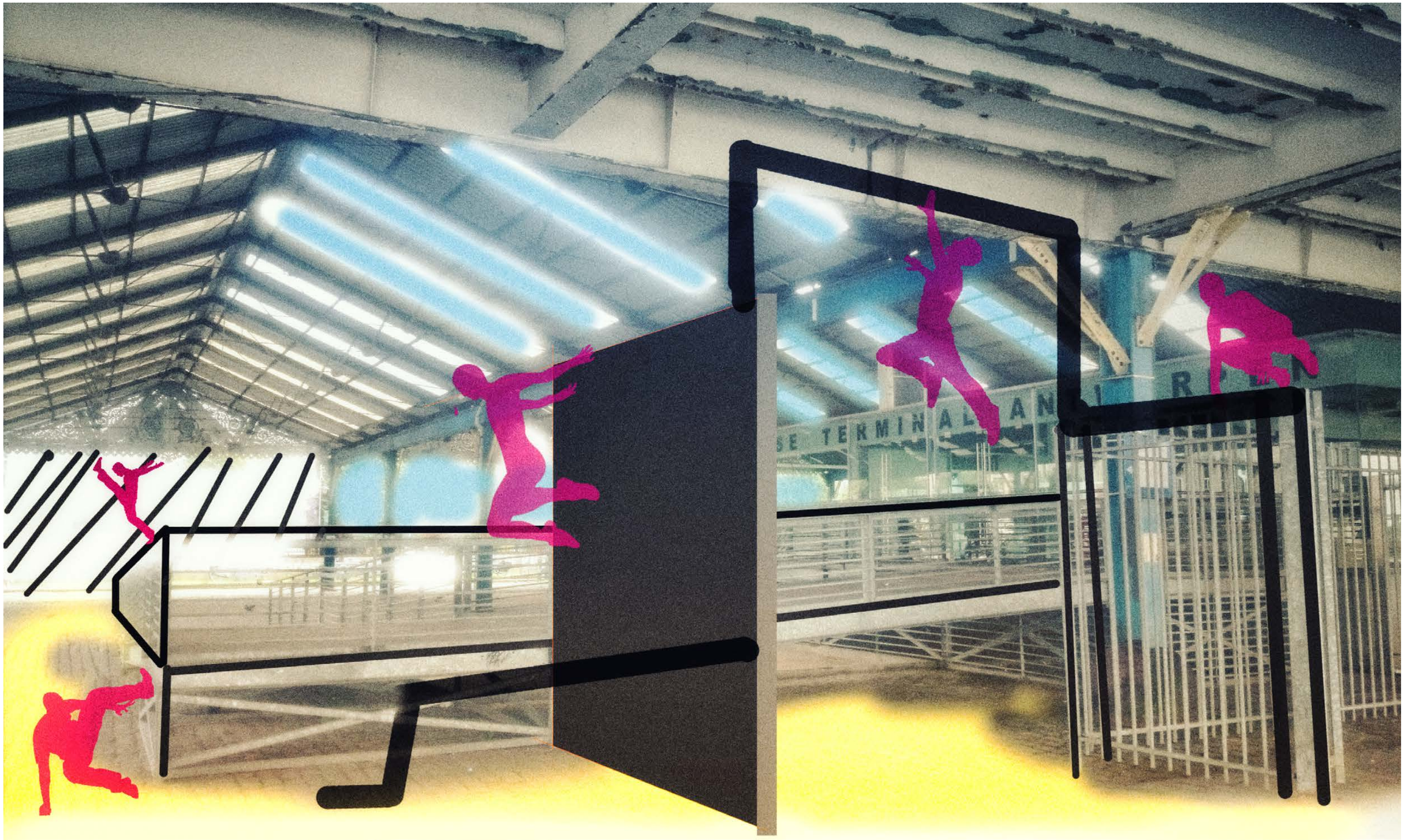


Figure 46. Parkour space

Methodology: Exploration

In **“[Play]station”**, games are made from the trash materials (bottles, wood sheets, …) that will be transformed into different forms using 3D printed connectors. Parametric design logic (aggregation) was used as an assembly tool for making parkour tracks and artistic shapes as possible examples.

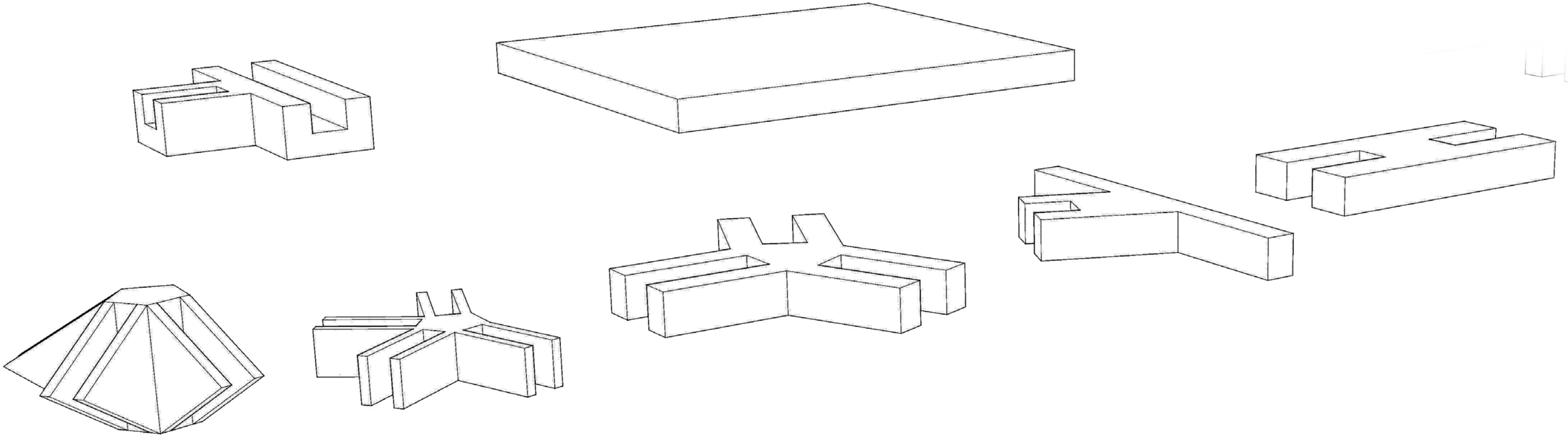


Figure 47. Showing some designs of 3D printed connectors

SEARCHING FOR A REFERENCE IDEA

Searching for design examples that can ensure the freedom of design while providing some structure stability, I was inspired by many references:

Nimsis" Kullaberg, Skåne[9]

It has a wild structures constructed from wooden logs found in nature (driftwood, branches,…) .The work is illegally placed near Kullaberg natural reserve from 1980, and from that day it has been one of the main attractions in the area. Although it is illegally built, it represents a type of spontaneous art, which is one of the applicable approaches in [Play] station project area.

Figure 48. Wild structures from wood

Figure 49. 'Nimsis' 2010 in Kullaberg, Skåne (source: Nimis)

Blockhuk (Polyomino 3), Jose Sanchez

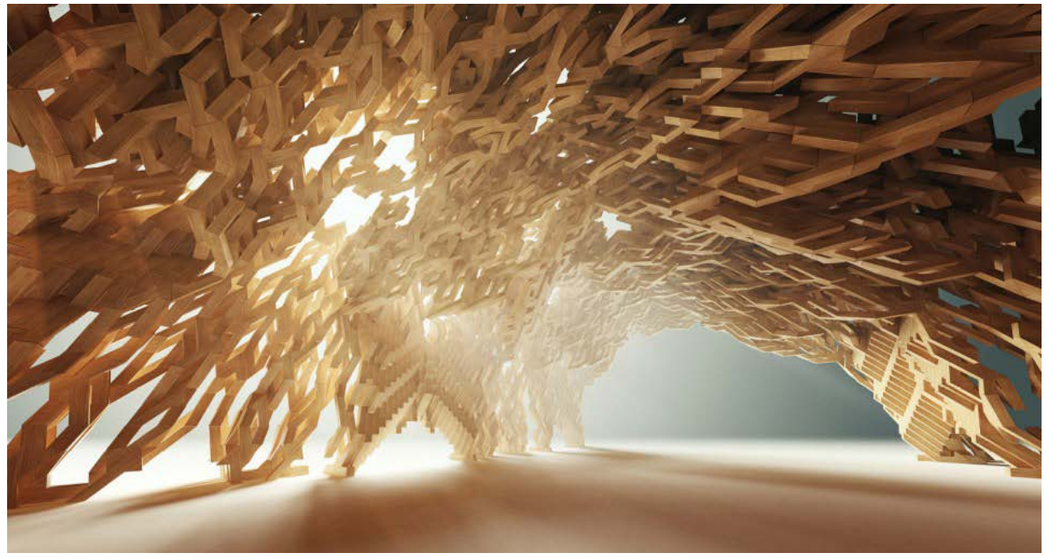


Figure 50. Polyomino III spaces formed from assembly of one design unit (source: plethora-project)

Figure 51. Assembly of one unit to form complex shapes (source: plethora-project)

Bloom, Jose Sanchez

The “Bloom” project by Jose Shanchez got my attention as it provides the freedom of design. Only one unit can build the game place with the opportunity to create multiple different structures

Figure 52. Bloom (source: plethora-project)

Figure 53. Children are free to design their games (source: plethora-project)

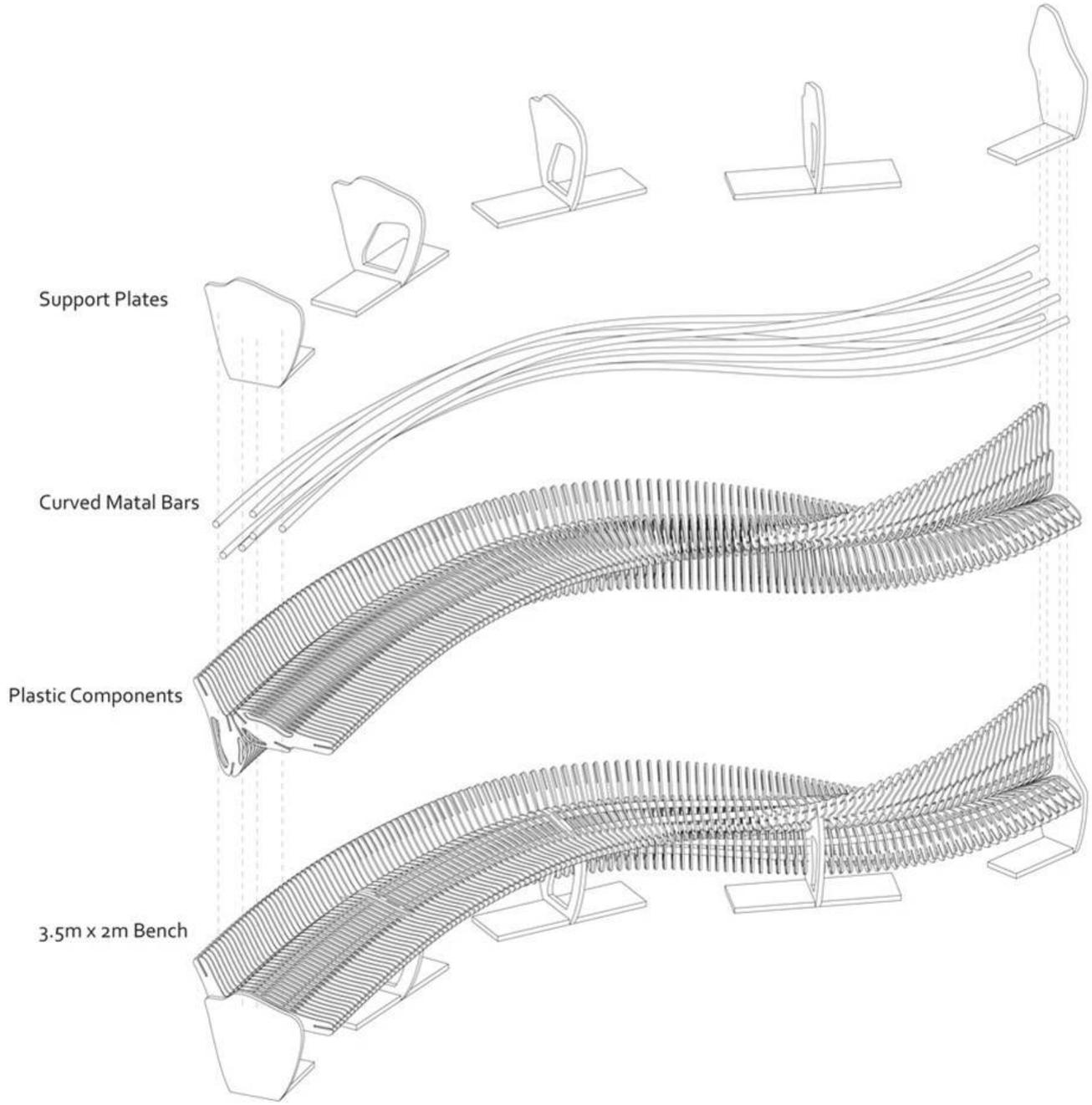


Figure 54. Details of the unit (source: plethora-project)

MAIN IDEA

In **"[Play]station"**, games are made from the trash materials (bottles, wood sheets, …) that will be transformed into different forms using 3D printed connectors. Parametric design logic (aggregation) was used as an assembly tool for this process

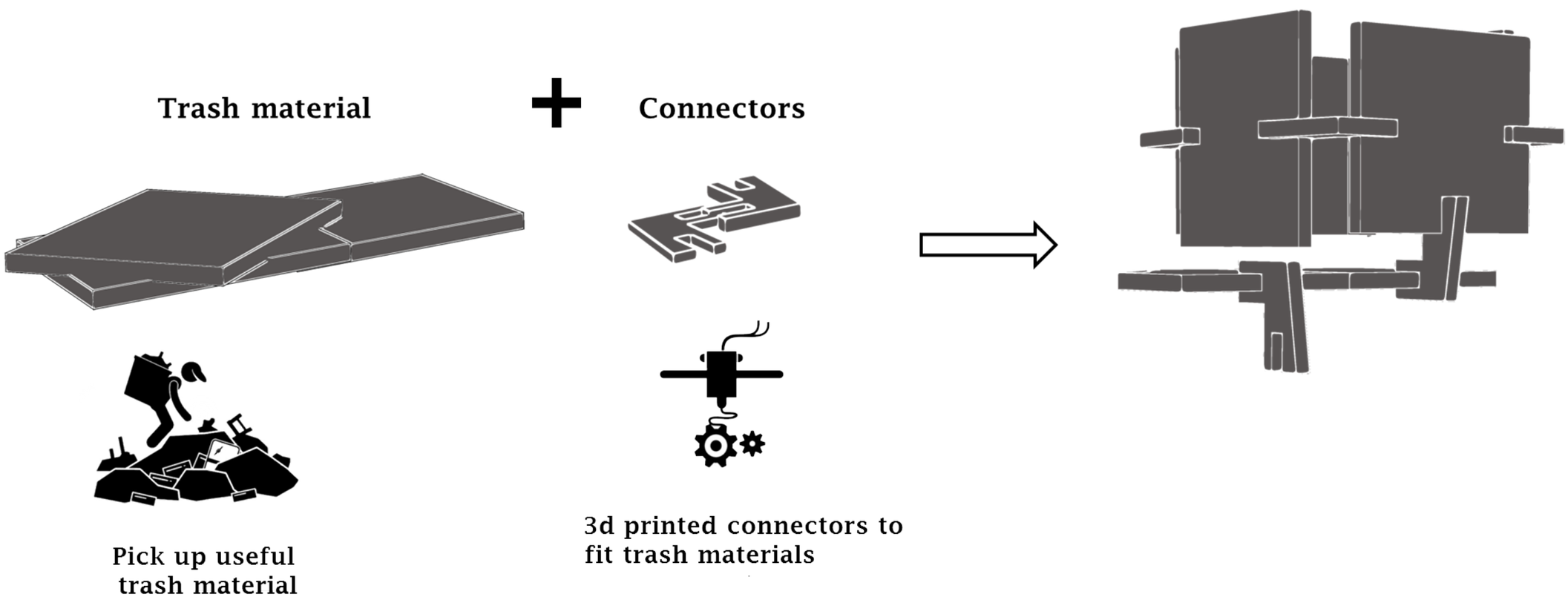
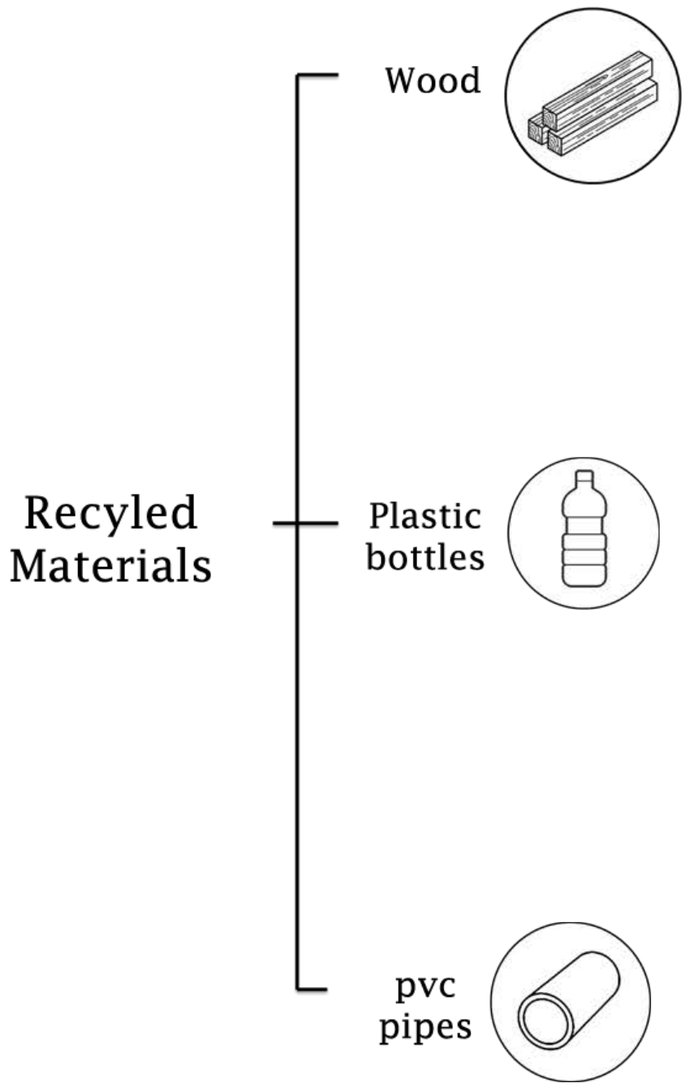


Figure 55. Fabrication Main idea

Site visit (what trash)

Out of the materials available in Lund recycle centre, I chose to deal with are wood sheets, as it is the most abundant material and plastic bottles, because of its standardized shapes. PVC pipes could also be used.



Wood bars

Wood sheets
[Thickness of the majority is 0.5" (1.27 cm) or 1" (2.54 cm)]

Broken kitchen cupboards

Shwepes 1 L bottle

500 ML plastic bottle

Upvc pipes

Figure 56. Materials from recycle centre visit

MATERIAL CLASSIFICATION

I have classified materials according to shapes as follows:

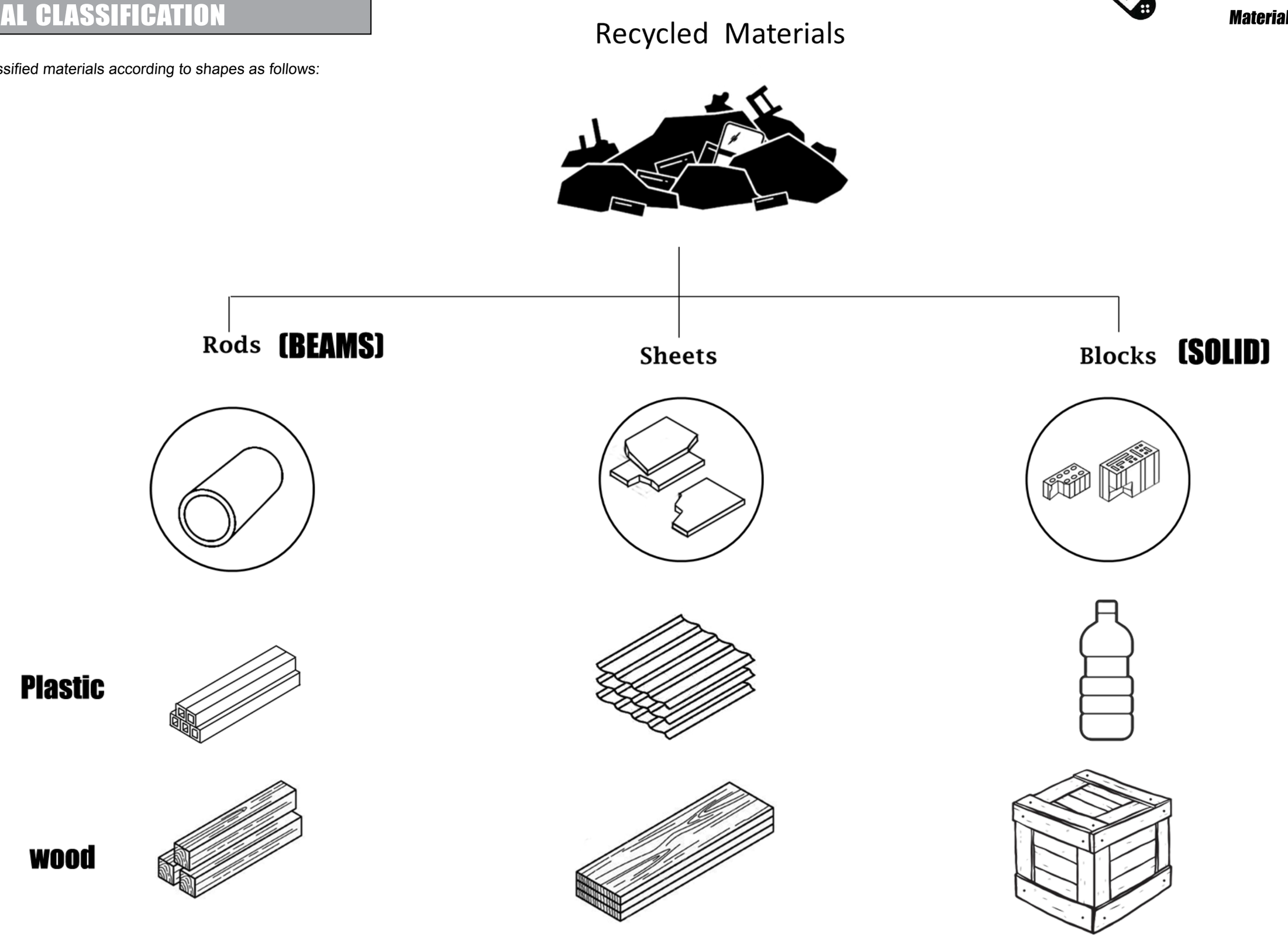
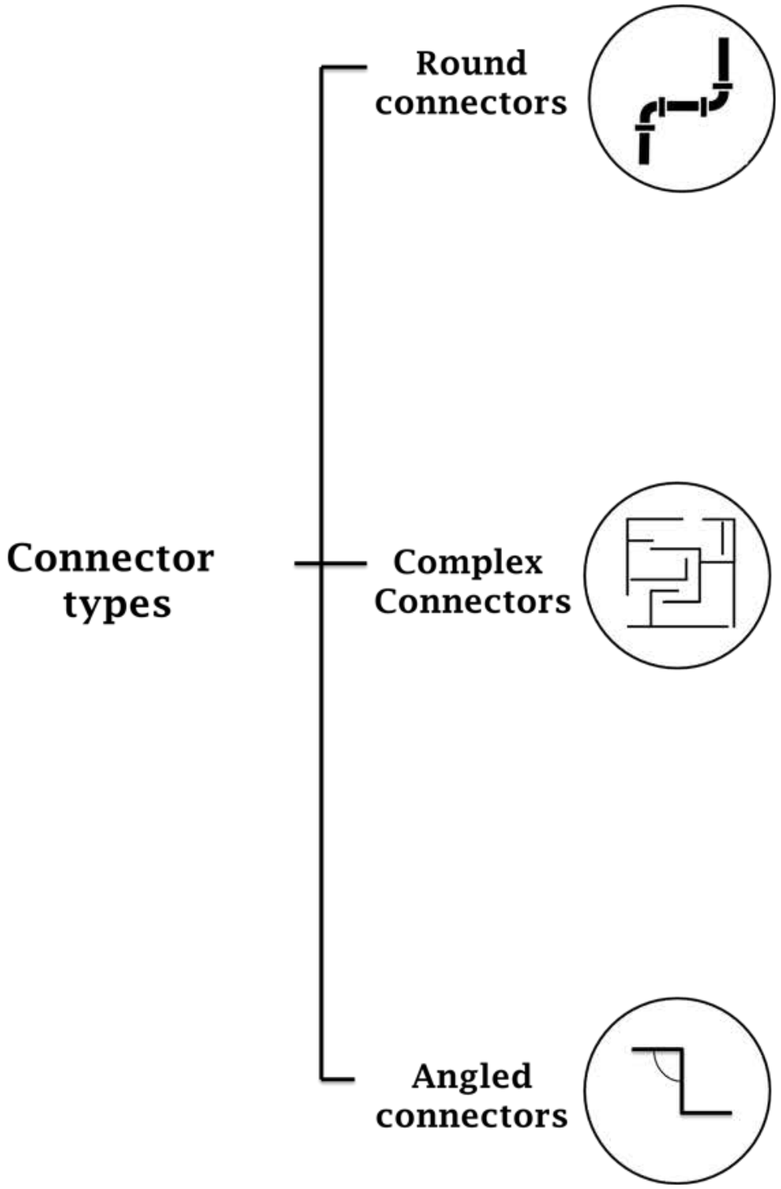


Figure 57. Material classification

CONNECTORS

Connector shape study:

Connectors are the main key to bind different trash materials, so I studied different connector types and classified them according to their usage as follows :



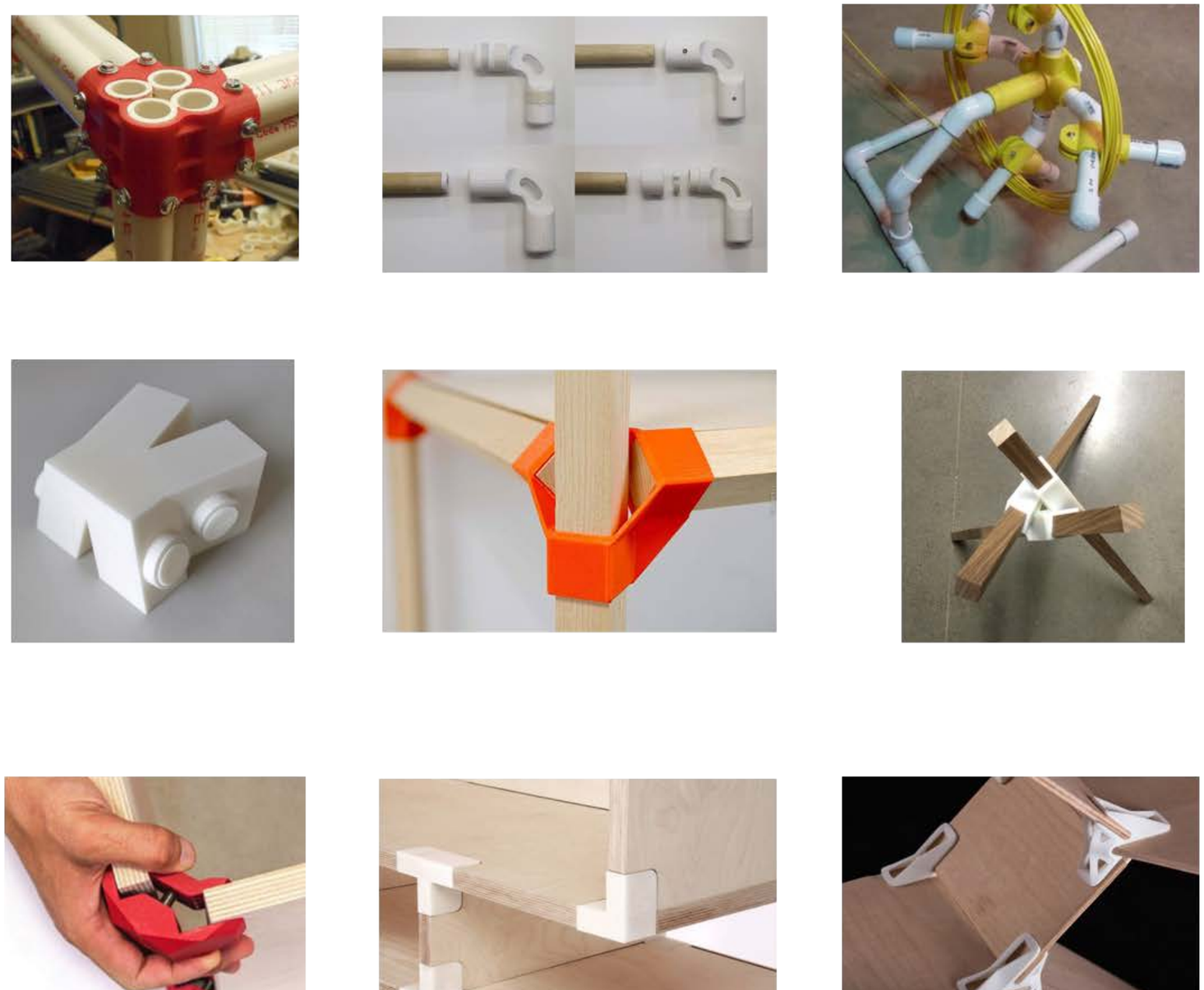


Figure 58. Connector shape study (inspired by furniture design approaches)

Connector axis study:

Connector axis study was performed to find out the suitable connectors for various building structures

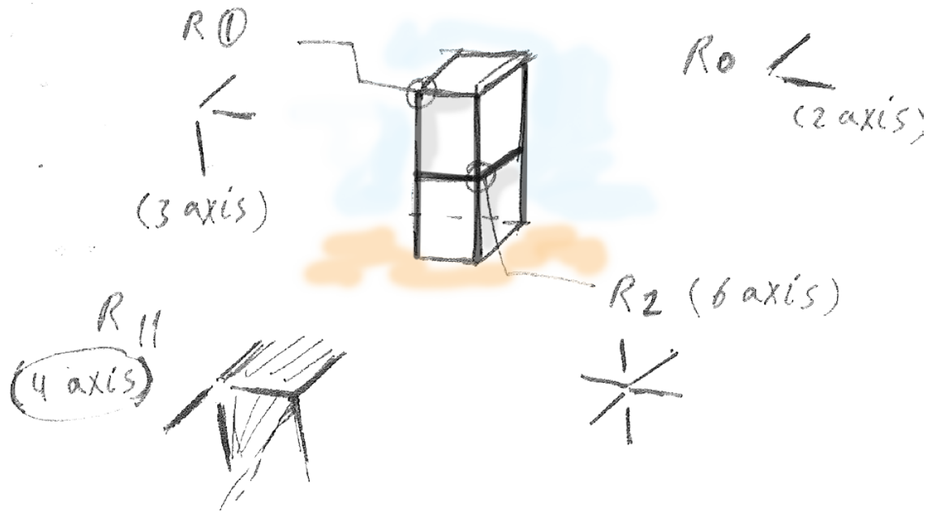


Figure 59. Rectangular structures connector axis study

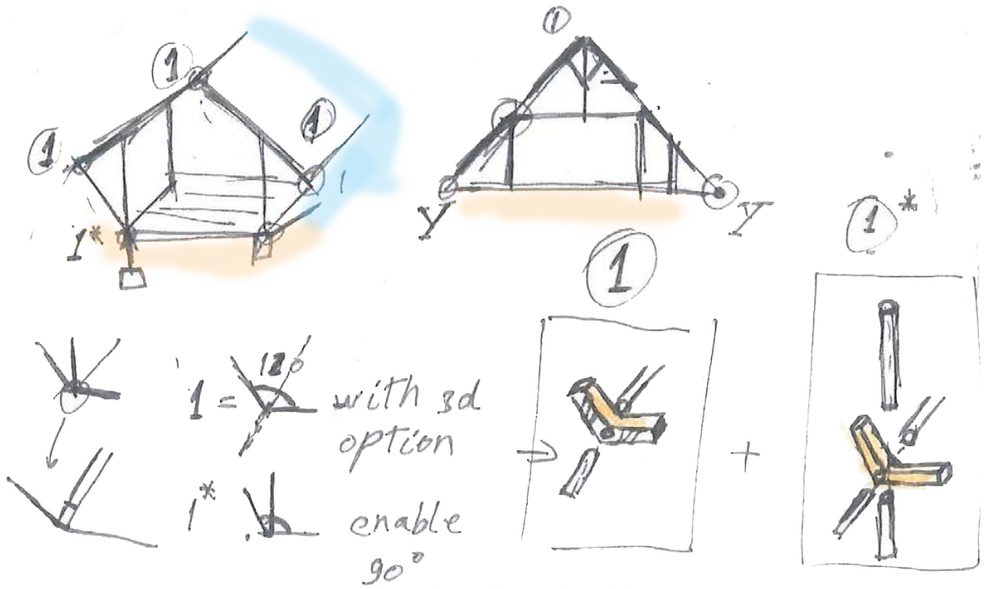


Figure 61. Making angles with connector

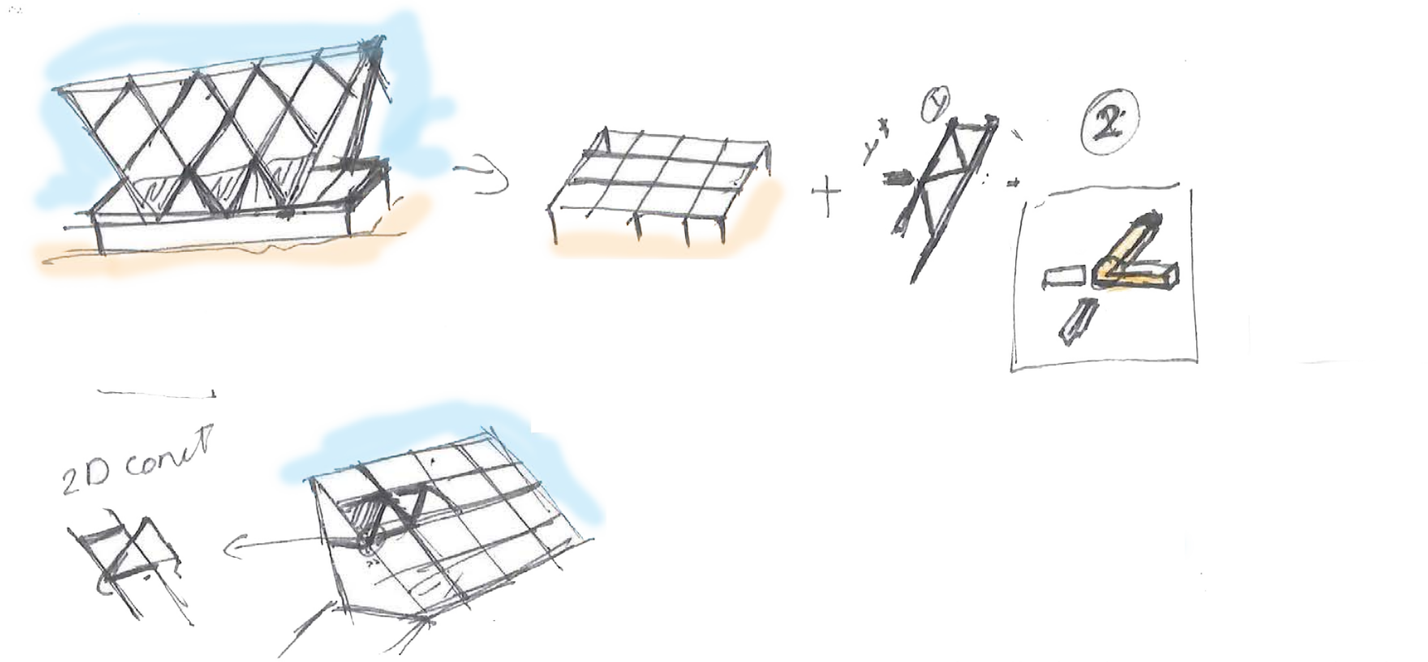


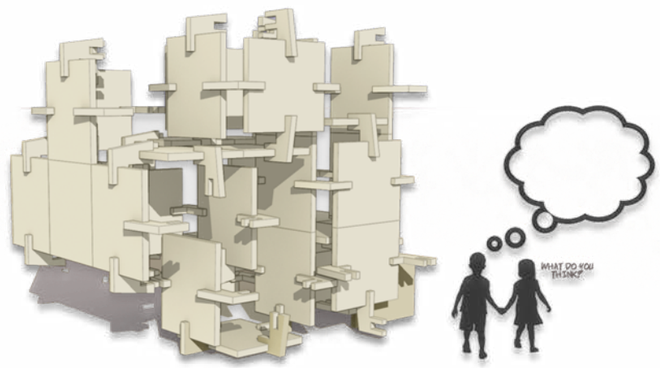
Figure 60. Triangular structures connector axis study

Design Catalogue (Imagine)

Using digital scripting enables assembly of junk material to make different forms according to the designer preference. These forms (parkour obstacles) can be experienced in virtual reality.

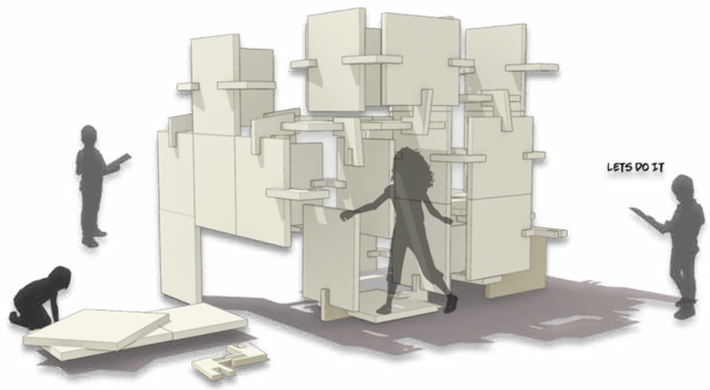
IMAGINE

Idea from VR



DO

Children do their design



TEST

Test & play

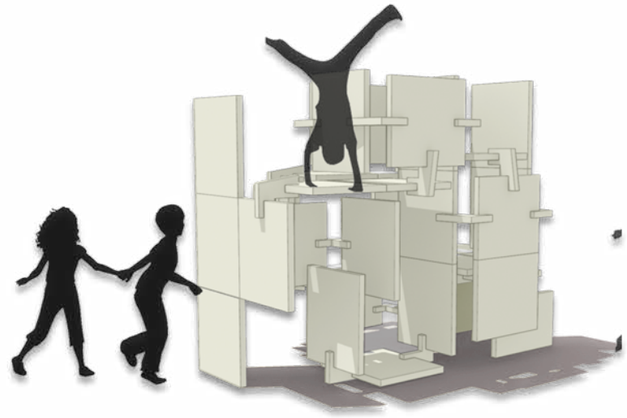


Figure 62. Fabrication process stages (Imagine)

DIGITAL SCRIPTING

Why scripting?

Digital scripting is required to enable making various connectors with creative designs.

1. *This is particularly needed to adapt for the available recycled materials that come with different shapes and cross-sections.*

2. *The designed products can also be visualized in virtual reality*

Aggregation script (experiment)

Digital script can assemble junk material (in form of sheets, solid, rods) with different connectors according to according to easily controllable rules,then observing the outcome.

Experiment with one unit

Figure 63. Aggregation of 1 unit in 2D

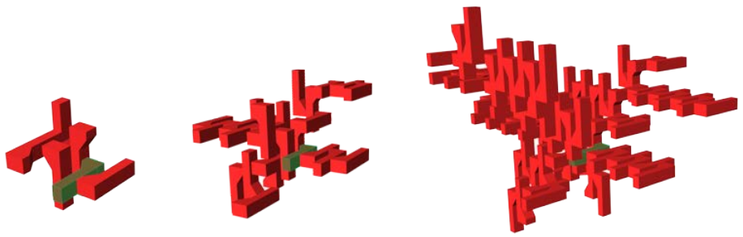


Figure 64. Aggregation of 1 unit in 3D

Experiment with 2 units (MATERIAL / CONNECTOR)

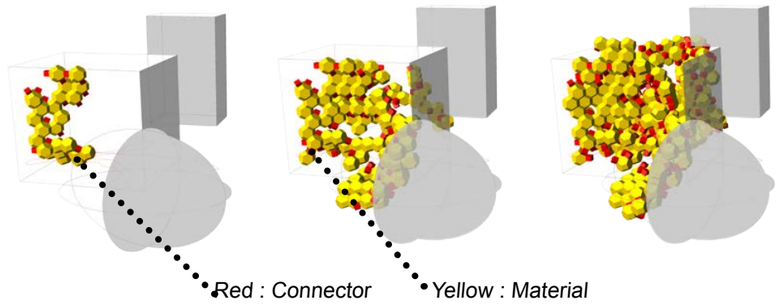


Figure 65. Aggregation in predefined form

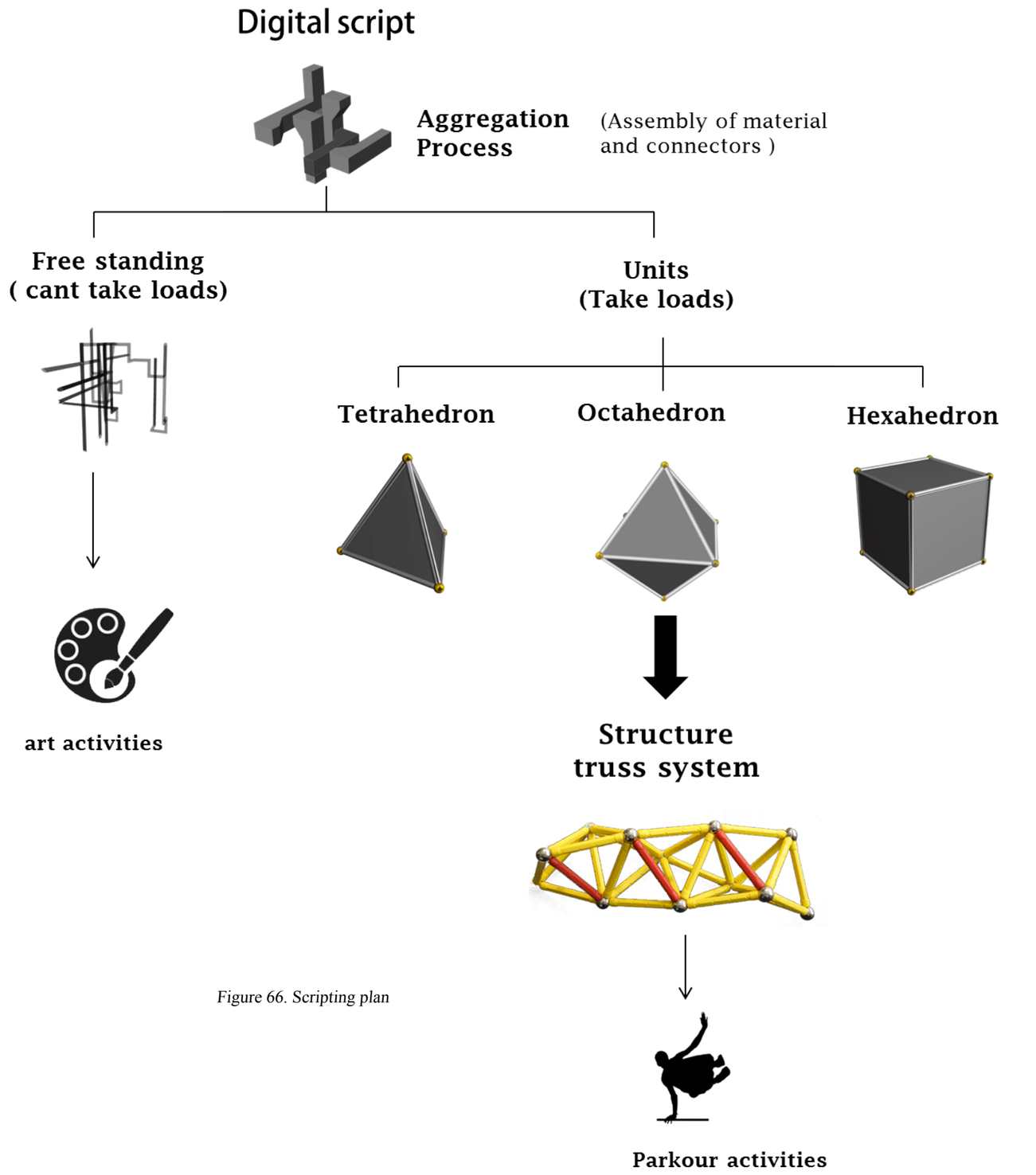
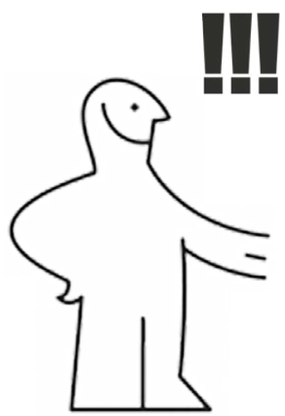
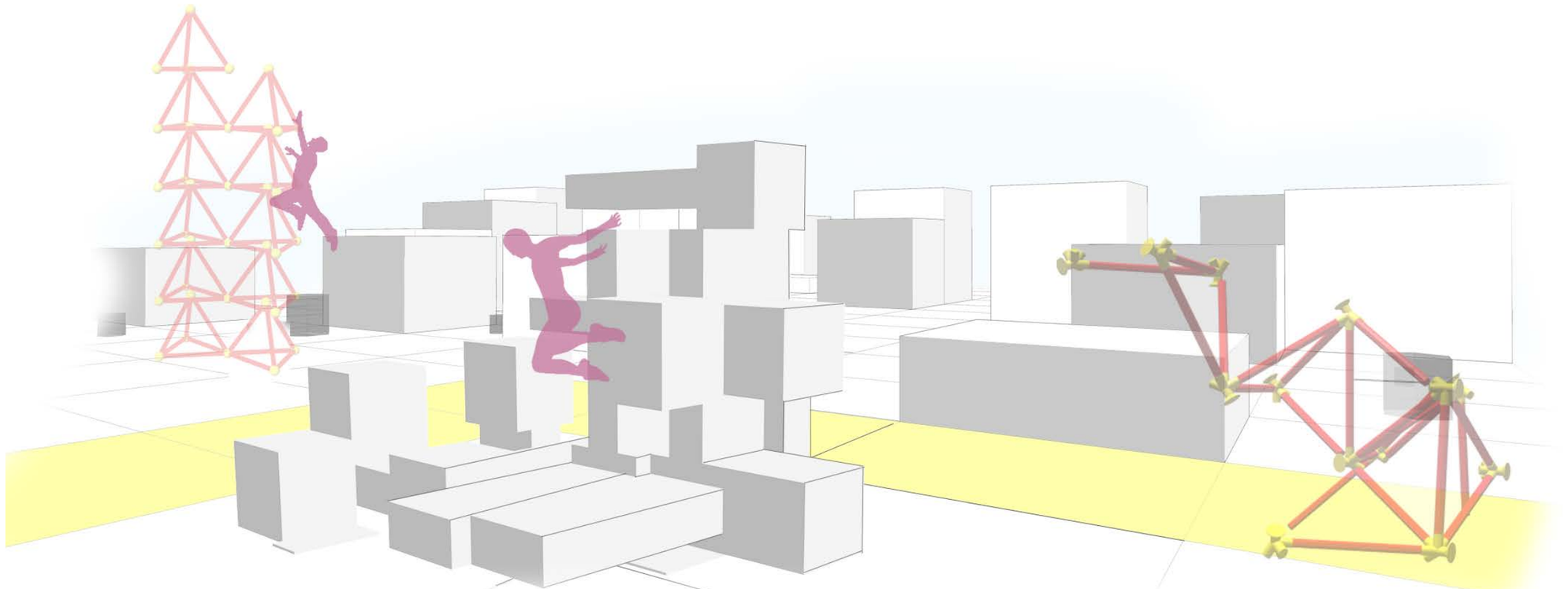


Figure 66. Scripting plan

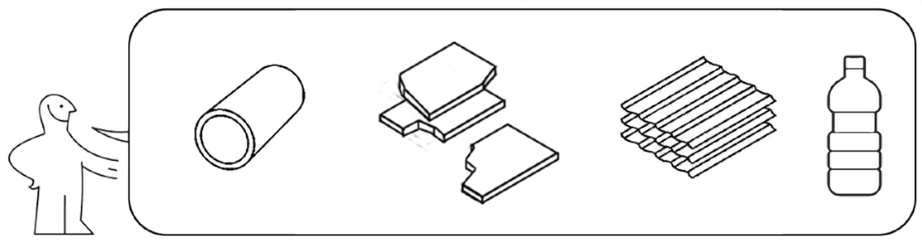
Instruction manual





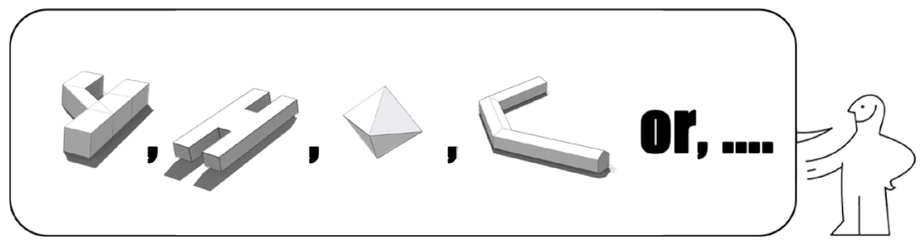
1 Decide the **material type** (Sheet, Stick, Block).

Various materials can be used. The research focused on recycled wood, plastic bottles, and plastic pipes

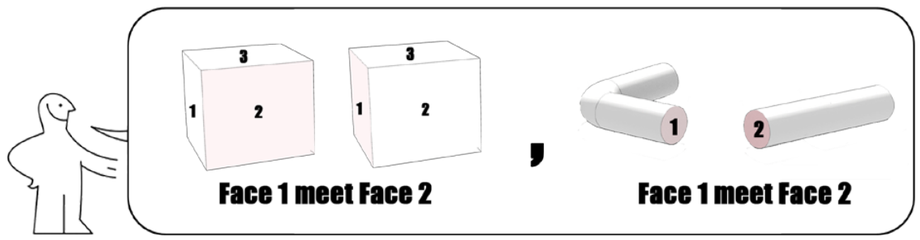


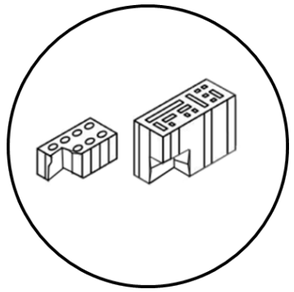
2 Design the shape of the **connector.**

Connectors can be designed in any shape, then drawn on any 3D design software.



3 Decide **connection rules** and faces to connect





Experiments with solids

Structure integrity

Unpredictable forms

Structure integrity: *The ability to hold structure weight loads.*

Unpredictable: *The ability to produce chaotic shapes,the scripting process is affected to some extent by randomness;same rules can produce different forms .This is potentially a good thing for making artistic forms*

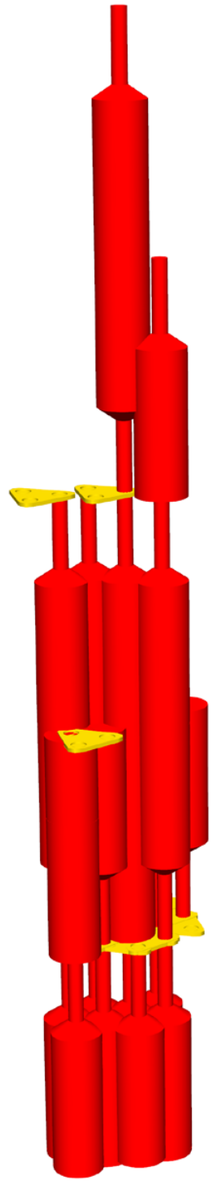


Figure 67. Aggregation with bottles

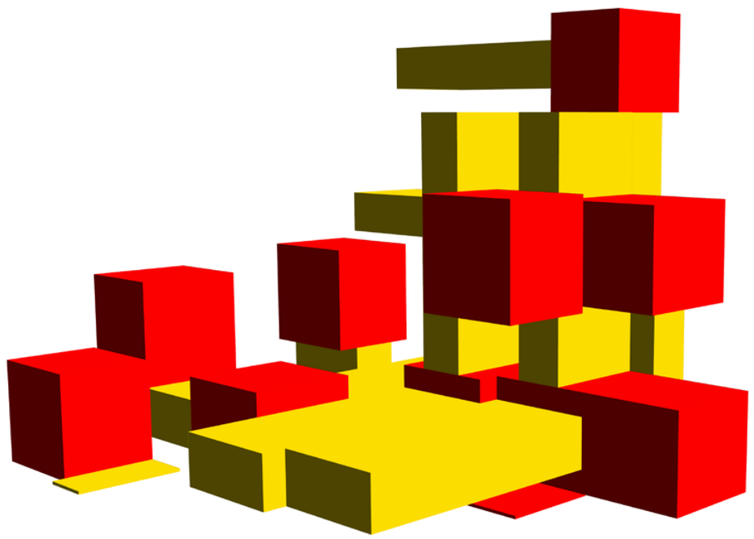


Figure 68. Aggregation with two boxes

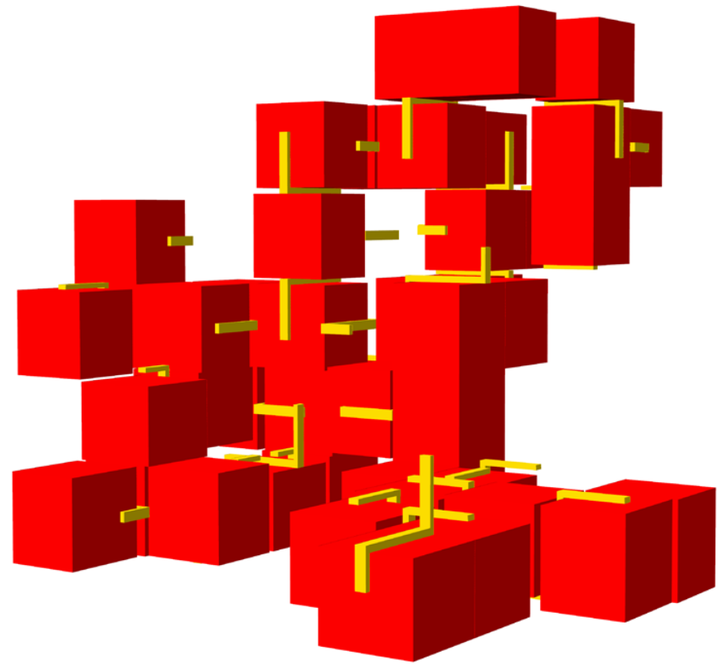


Figure 69. Aggregation of box with an angled connector

SCRIPT WORK

Assembly with 2 boxes

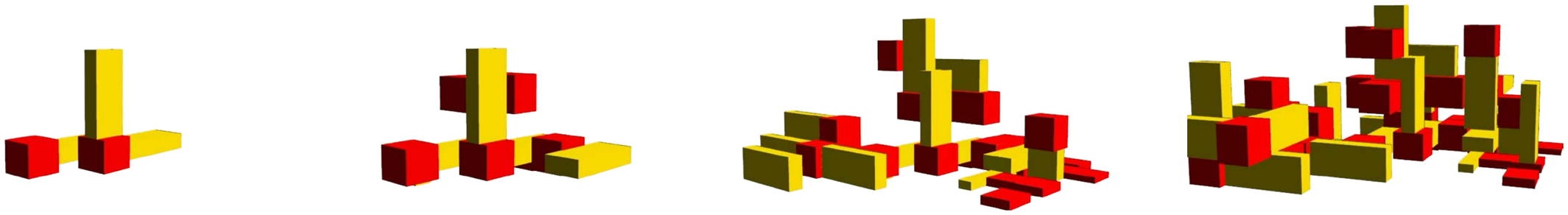


Figure 70. The grasshopper digital script doing Assembly with 2 boxes

Assembly in Predefined form

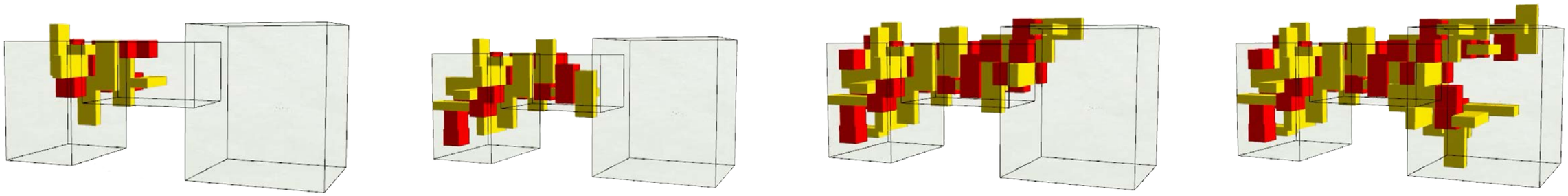
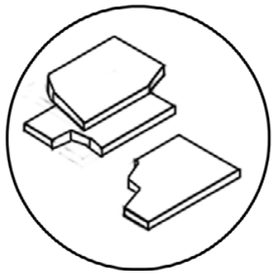


Figure 71. The grasshopper digital script doing Assembly in Predefined form with 2 boxes



Experiments with sheets

Structure integrity

Unpredictable forms

Structure integrity: *The ability to hold structure weight loads.*

Unpredictable: *The ability to produce chaotic shapes,the scripting process is affected to some extent by randomness;same rules can produce different forms .This is potentially a good thing for making artistic forms*

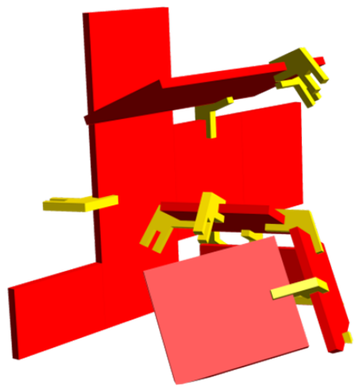
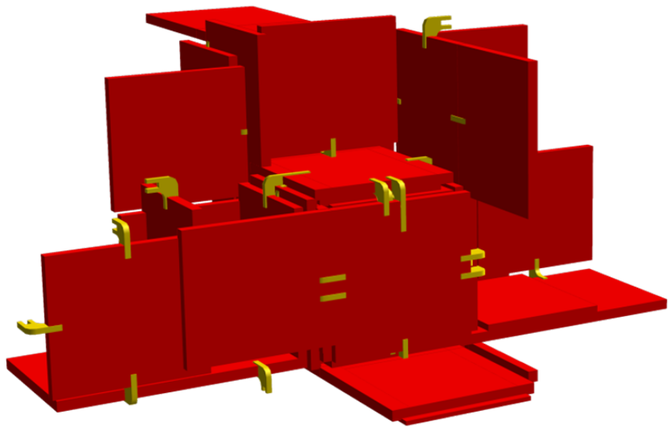
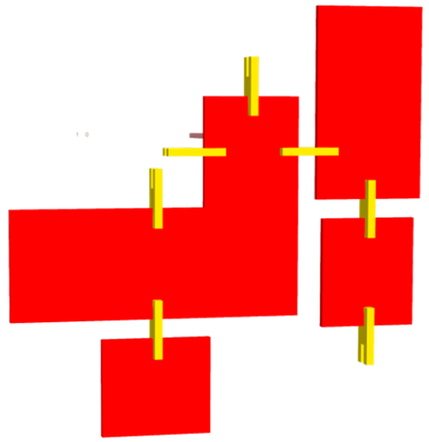
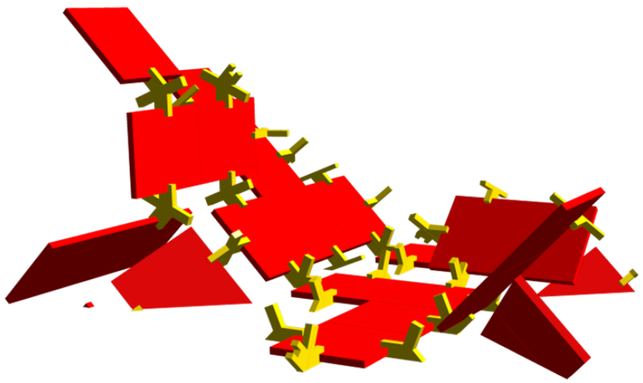
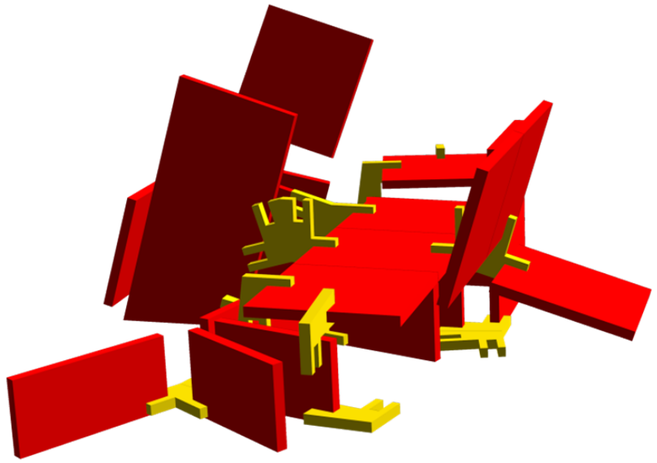
		
Assembly with angled connector	*Assembly with right angled connector*	*Assembly with “H” shaped connector*
		
Assembly with angled connector	*Assembly with angled connector*	*Assembly with triangular sheets*

Figure 72. *Experiments with sheets*

SCRIPT WORK

Rectangular sheets assembly

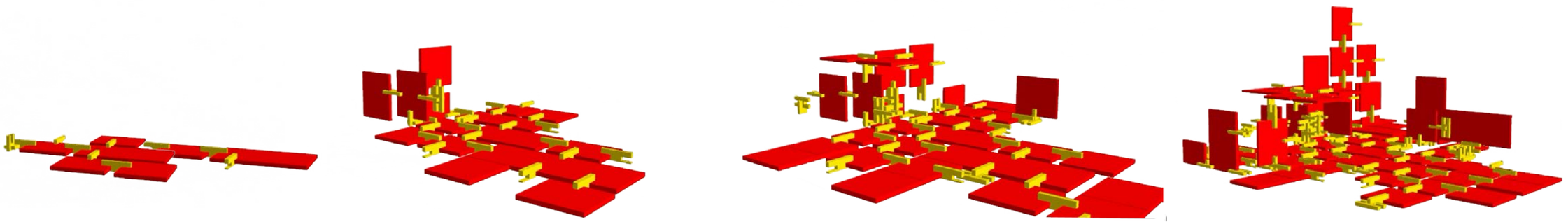


Figure 73. The grasshopper digital script doing Rectangular sheets assembly

Triangular sheets assembly

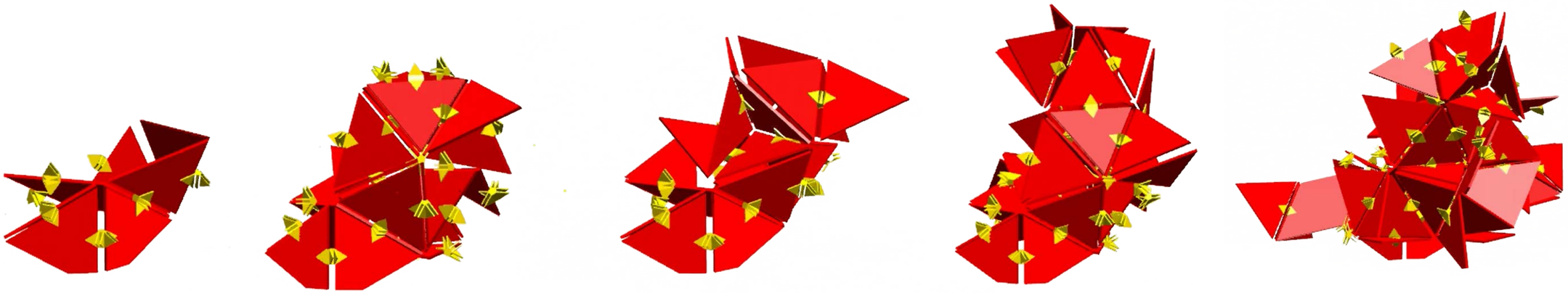


Figure 74. The grasshopper digital script doing Triangular sheets assembly

Changing assembly rules

Case 1:

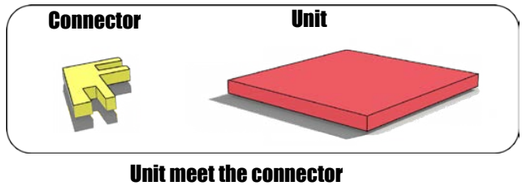


Figure 75. The grasshopper digital script doing assembly

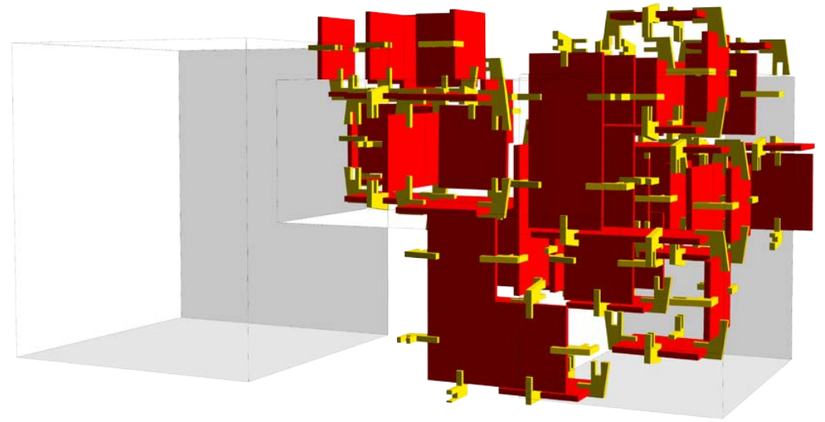


Figure 76. The final design

Case 2:

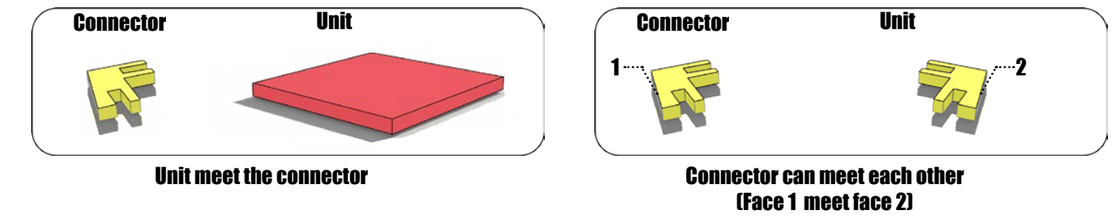


Figure 77. The grasshopper digital script doing assembly

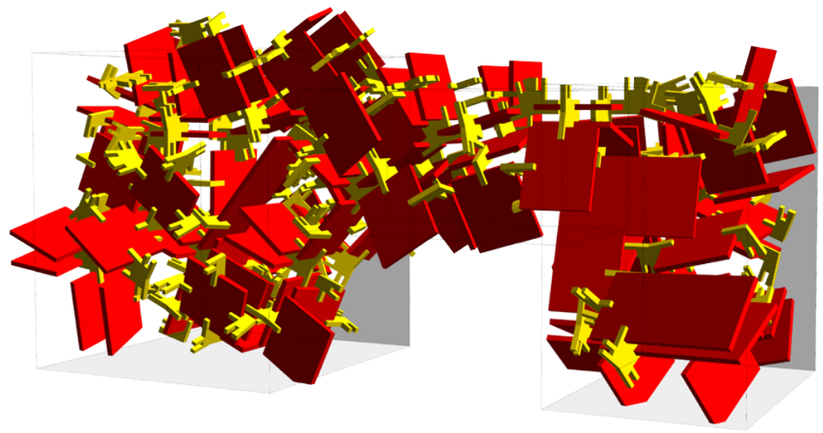
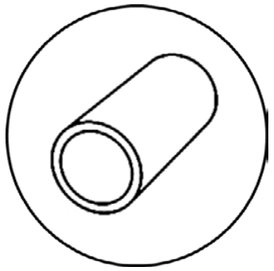


Figure 78. The final design



Experiments with beams (free form)

Structure integrity

Unpredictable forms

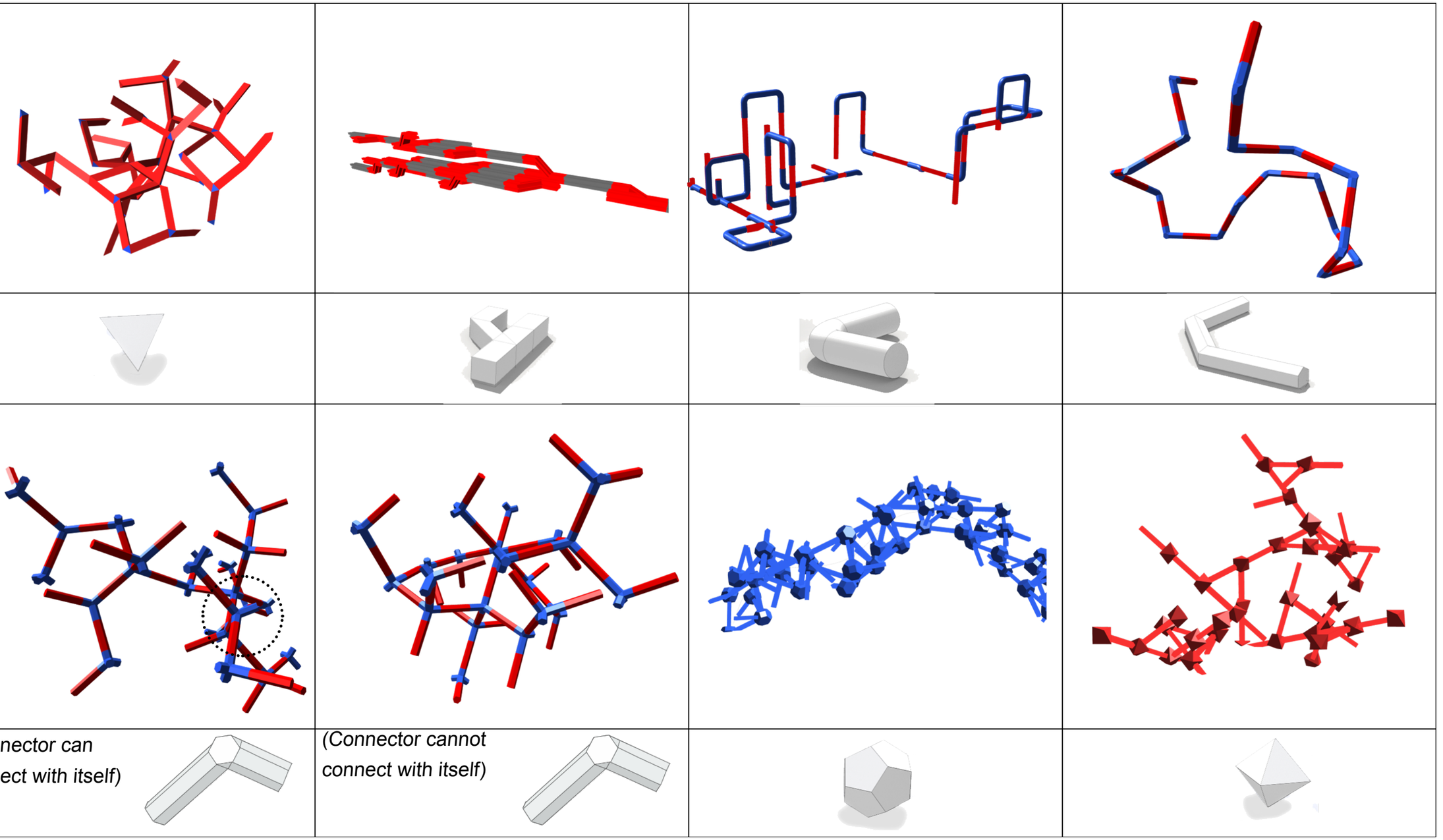
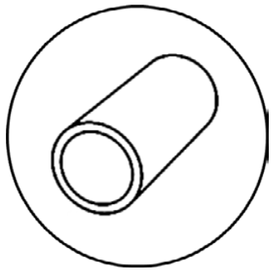


Figure 79. Experiments with beams (free form)



Experiments with beams (truss form)

Structure integrity

Unpredictable forms

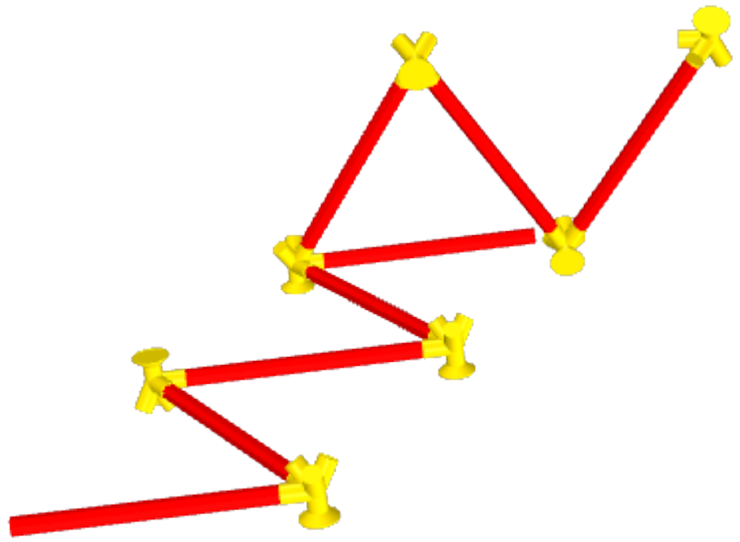


Figure 81. Truss assembly incomplete

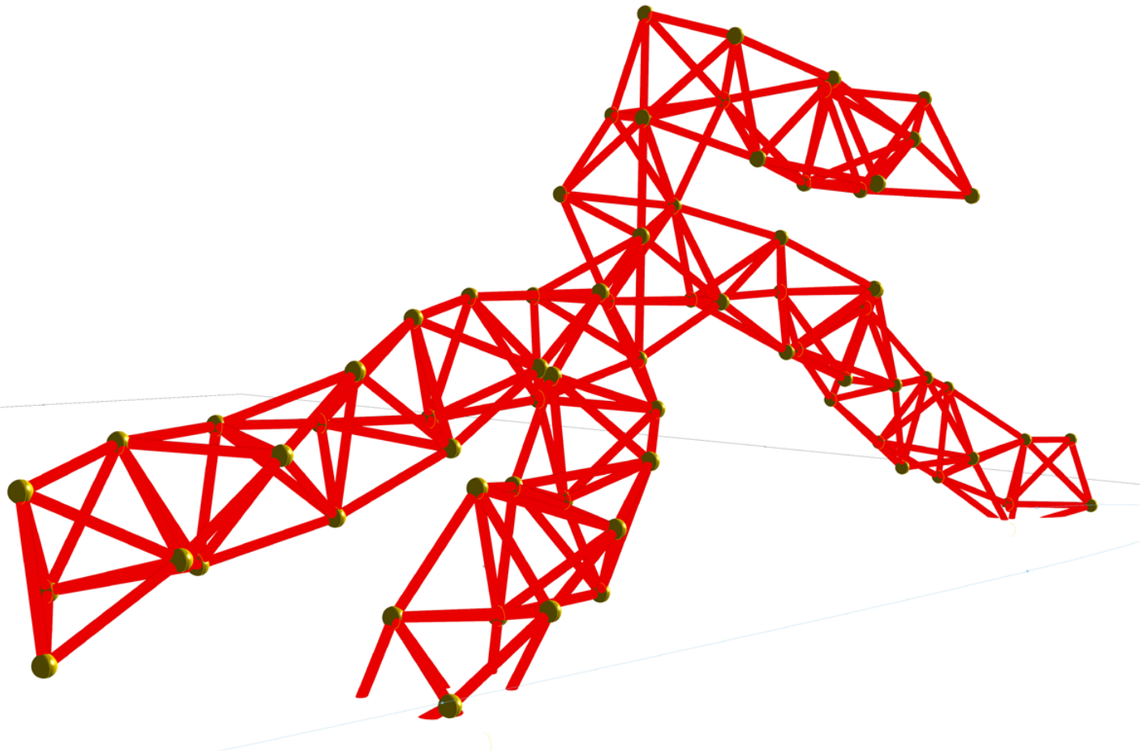


Figure 80. Truss example 1

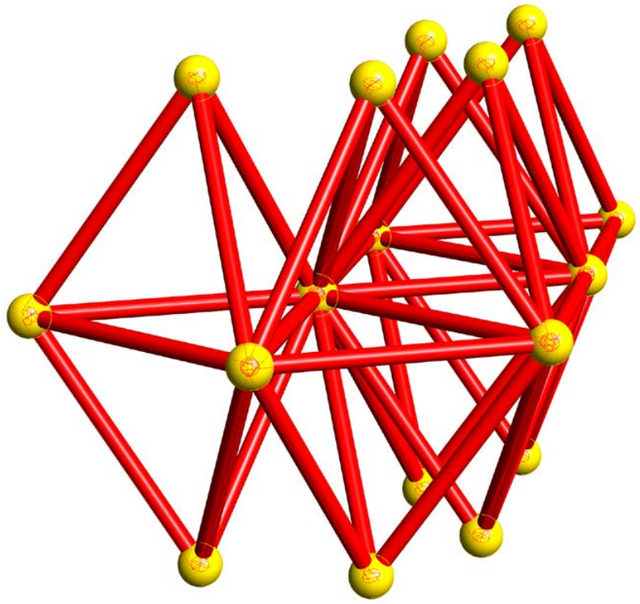


Figure 82. Truss example 2

Forming truss system

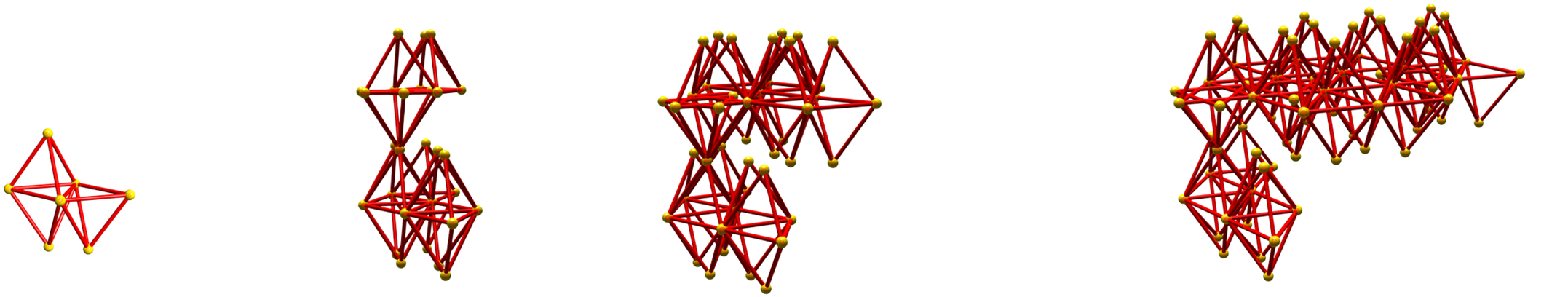


Figure 83. The grasshopper digital script Forming truss system

Making the system pass through certain points

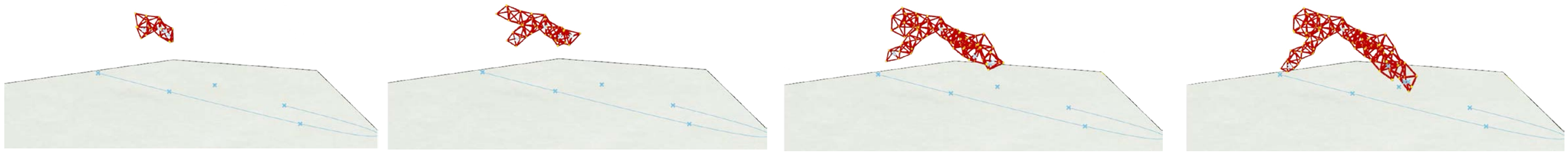


Figure 84. The grasshopper digital script Making the truss system pass through certain points

Design Catalogue

1

2

3

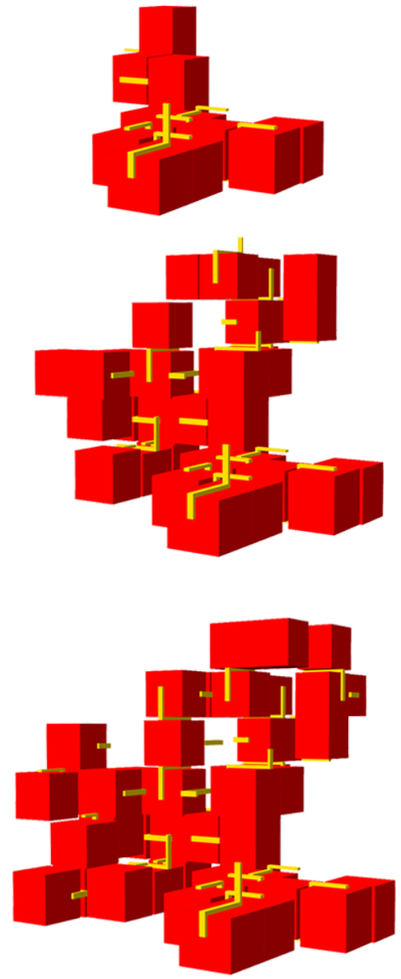


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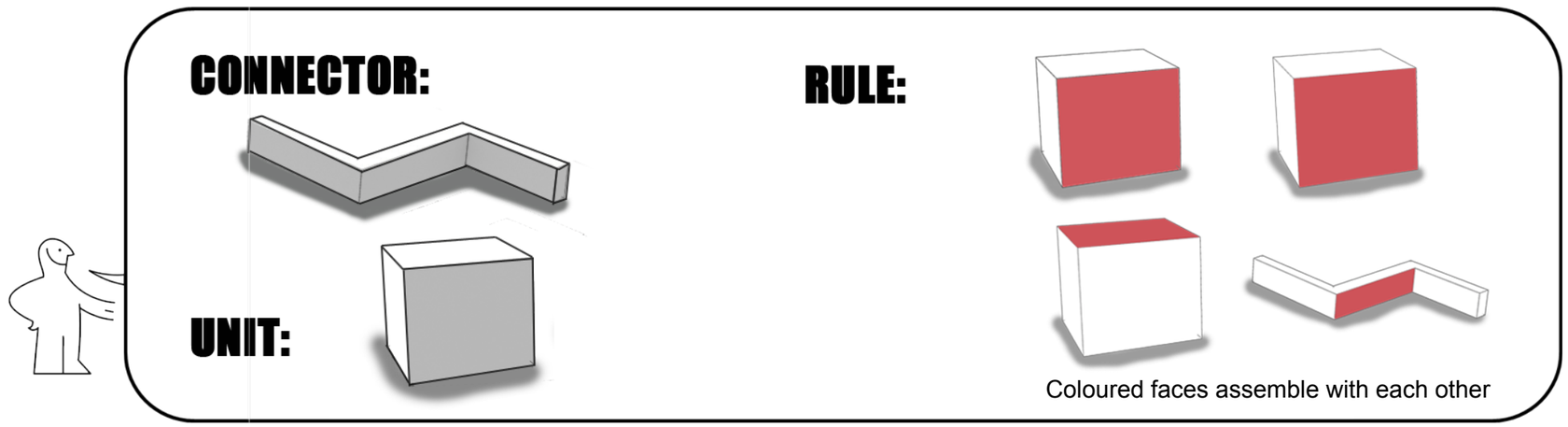
Figure 85. Assembly stages

Figure 86. The design



Design Catalogue

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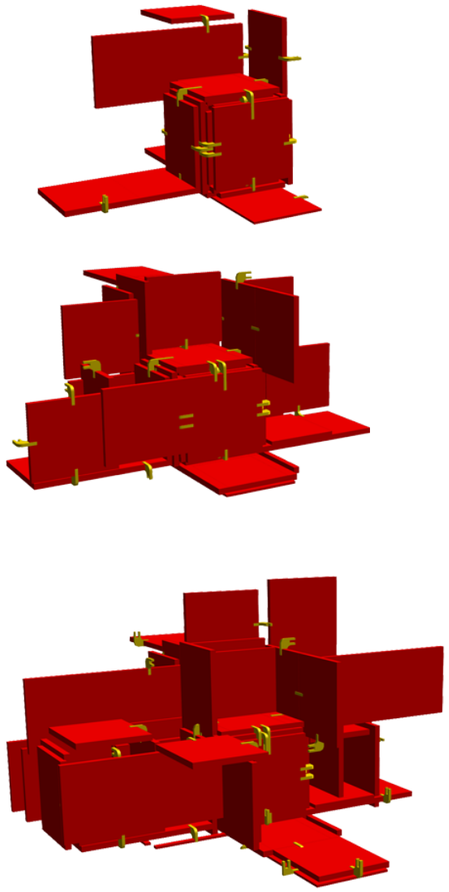


Figure 87. Assembly stages

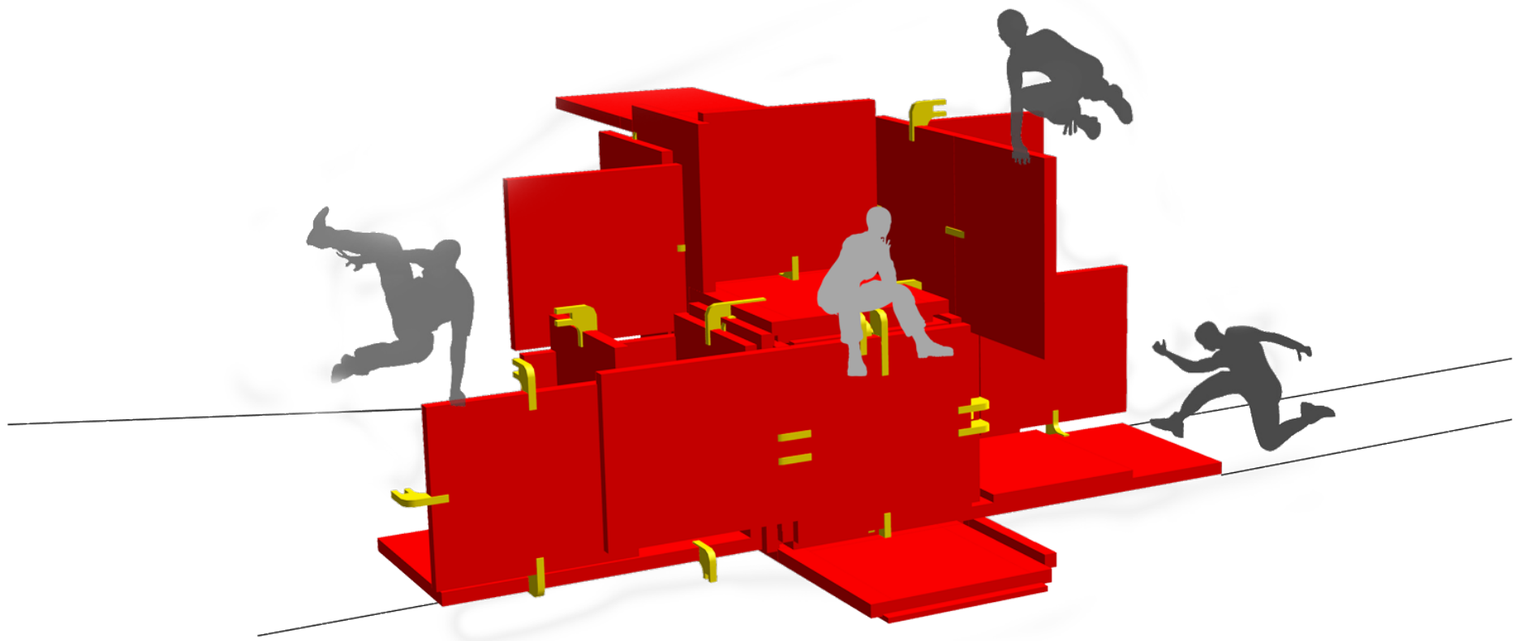
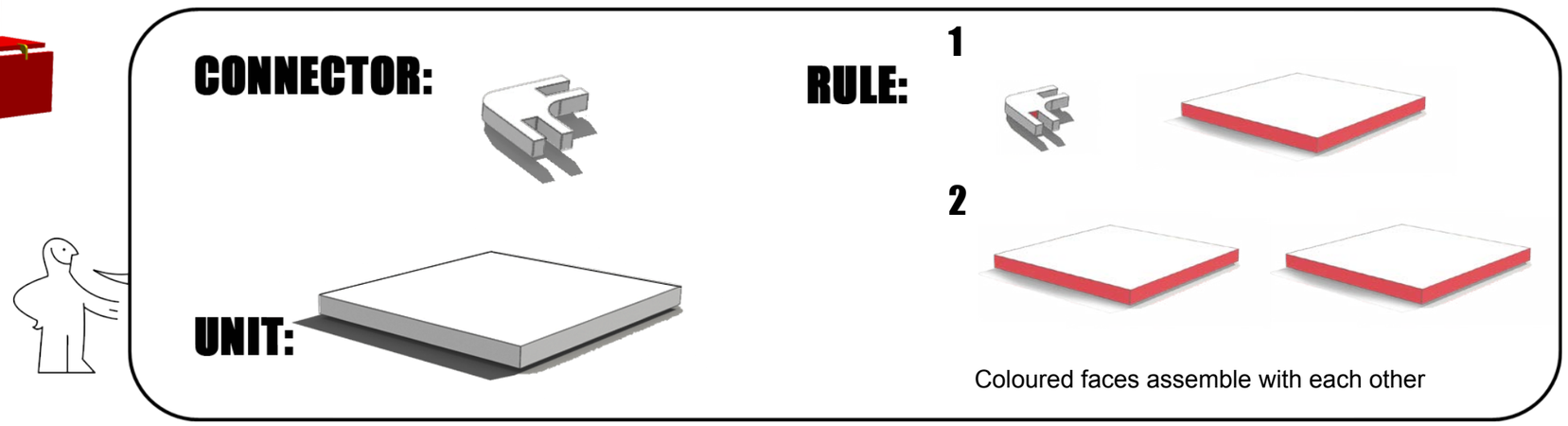
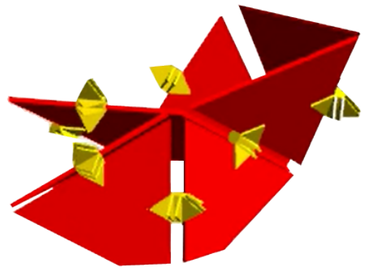


Figure 88. The design



Design Catalogue

1



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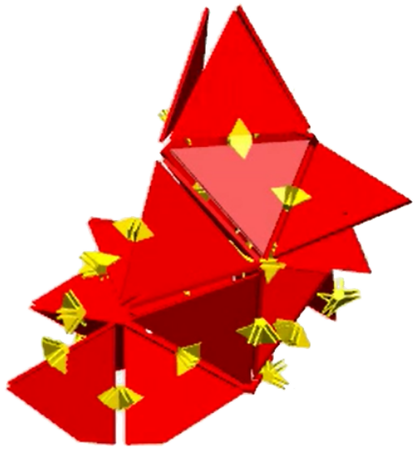


Figure 89. Assembly stages

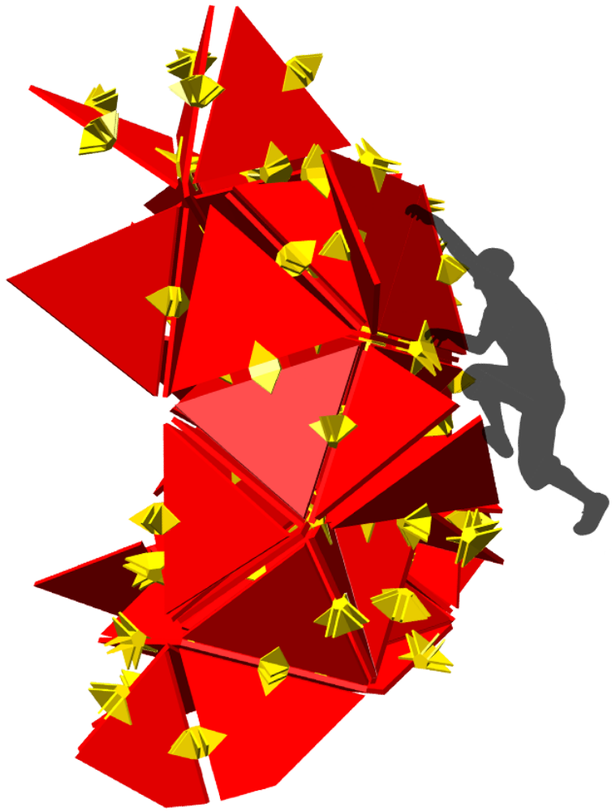
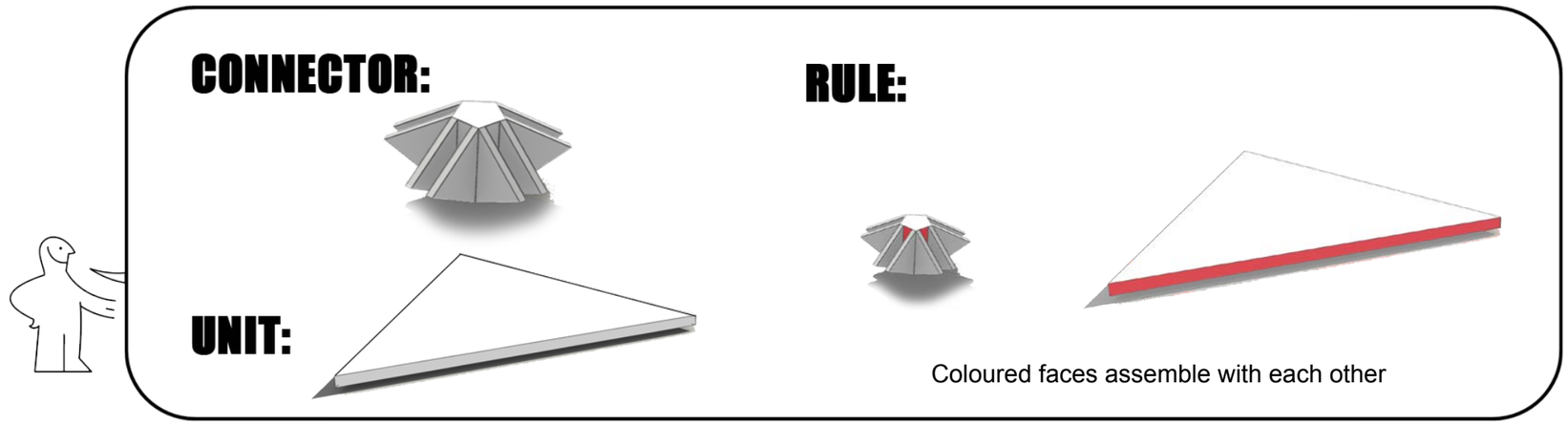


Figure 90. The design



Design Catalogue

1

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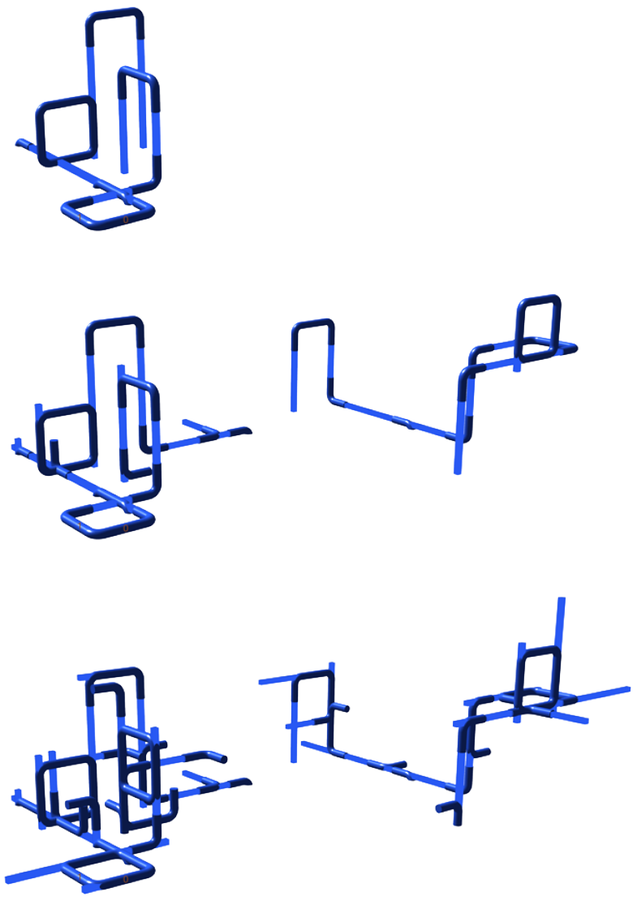


Figure 91. Assembly stages

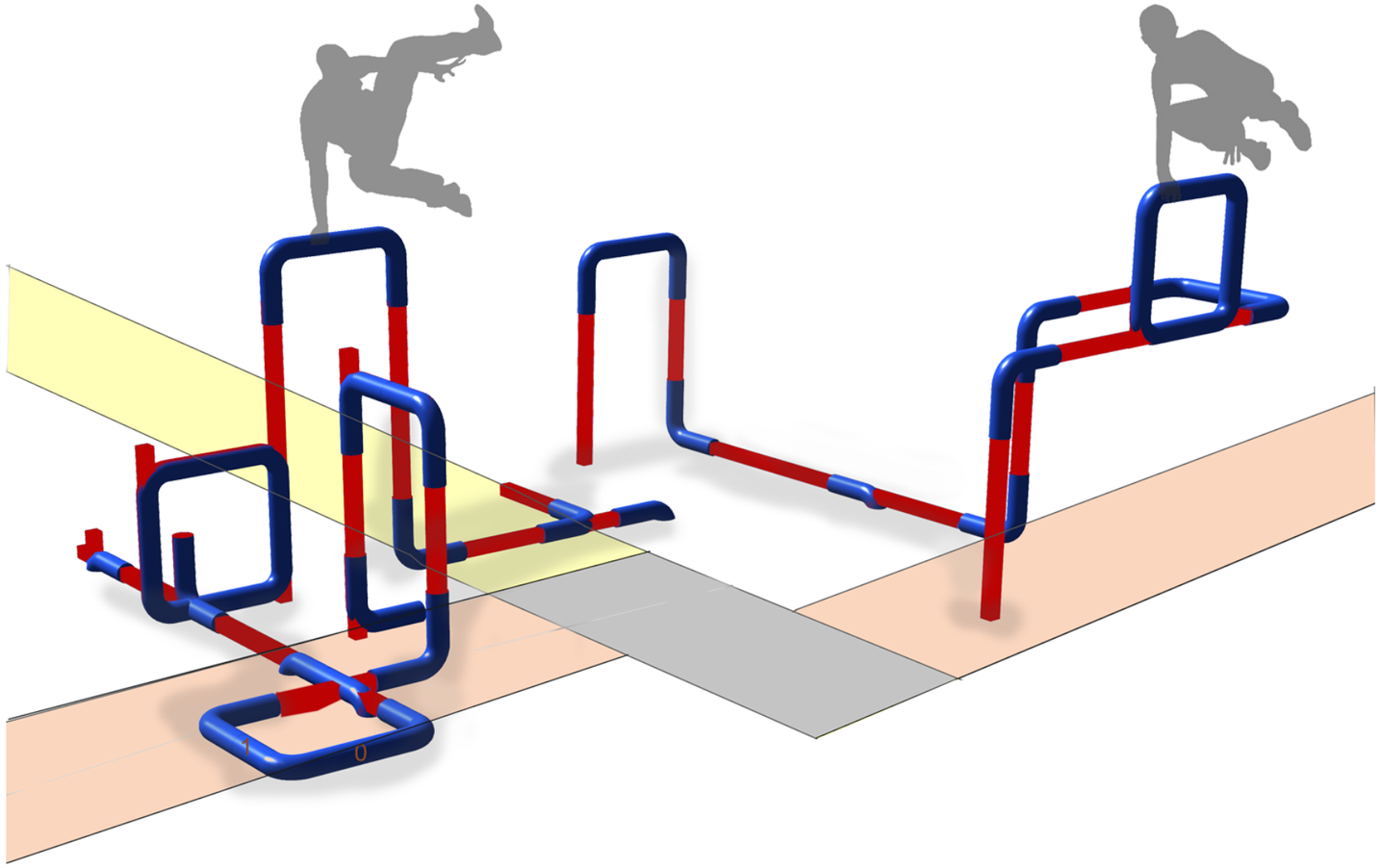


Figure 92. The design

CONNECTOR:

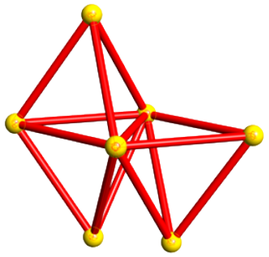
UNIT:

RULE:

Coloured faces assemble with each other

Design Catalogue

1



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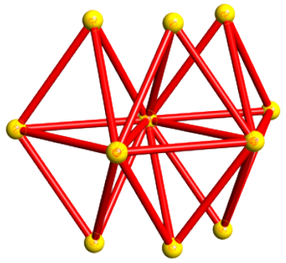

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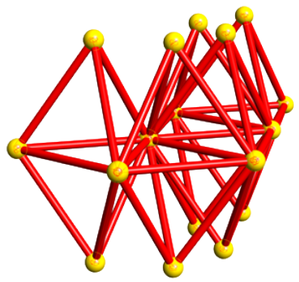

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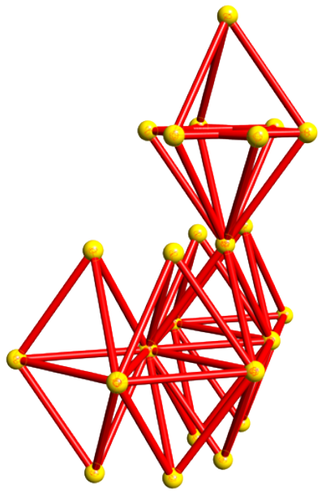


Figure 93. Assembly stages

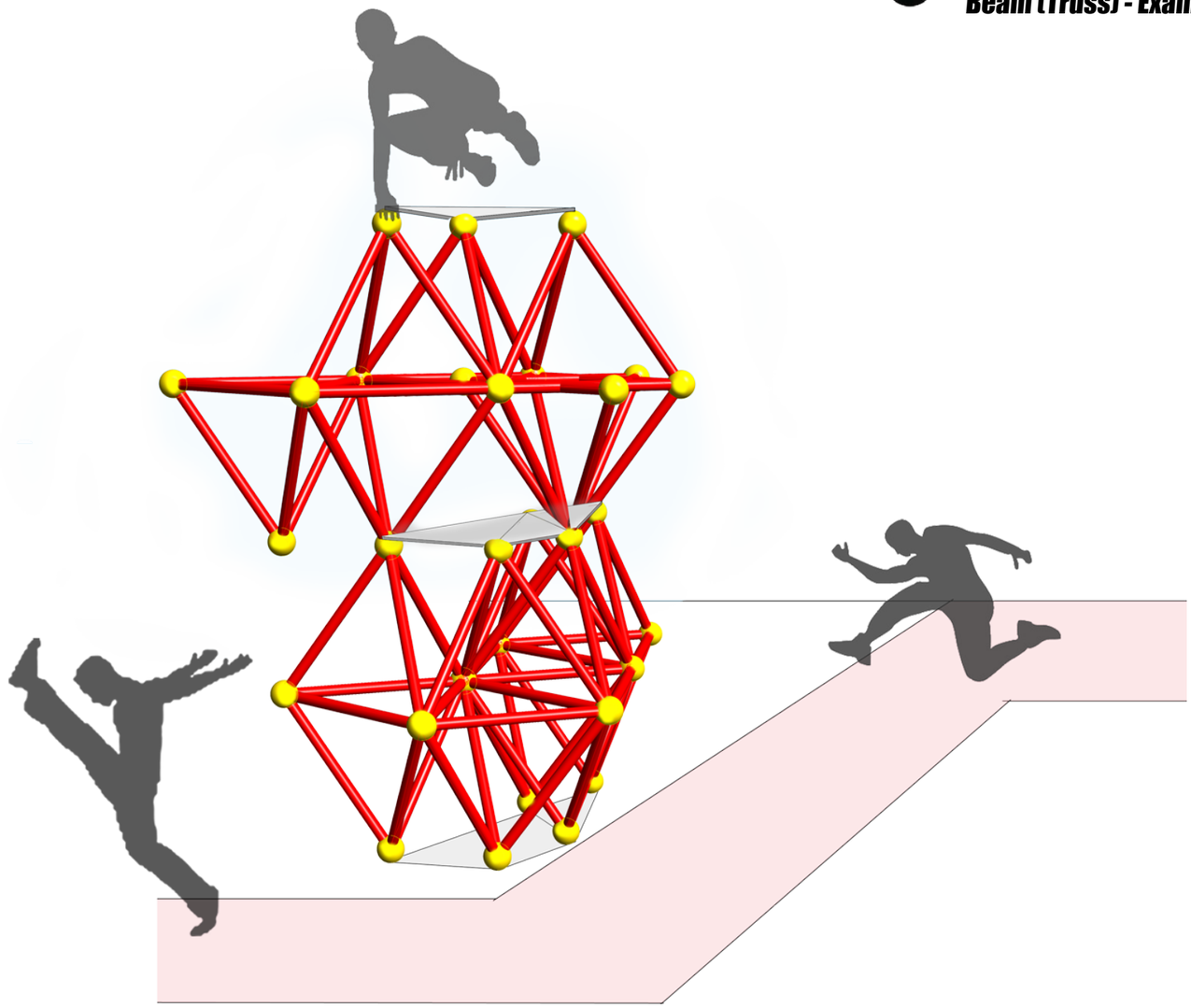
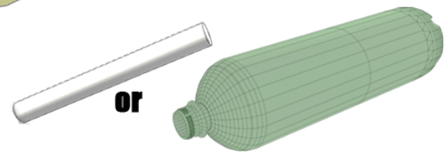


Figure 94. The design

CONNECTOR:

N.B: For script simplicity, it is symbolised as a sphere in the diagrams above.

UNIT:



RULE:

Coloured faces assemble with each other

N.B : this design is picked for the fabrication part

Design Catalogue

Using the assembly logic to do some artistic options give the opportunity for youth to express their freedom of play.

1

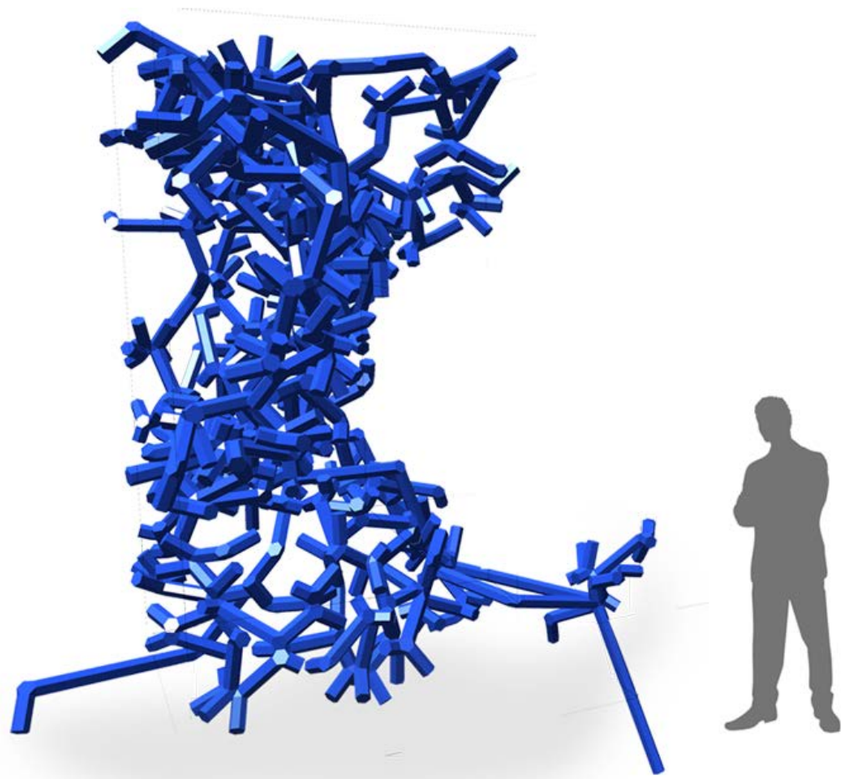
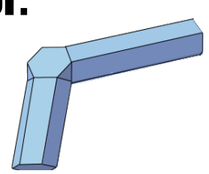
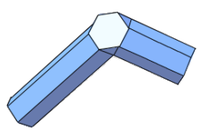


Figure 95. The design (artistic applications)

Connector:  **Unit:** 

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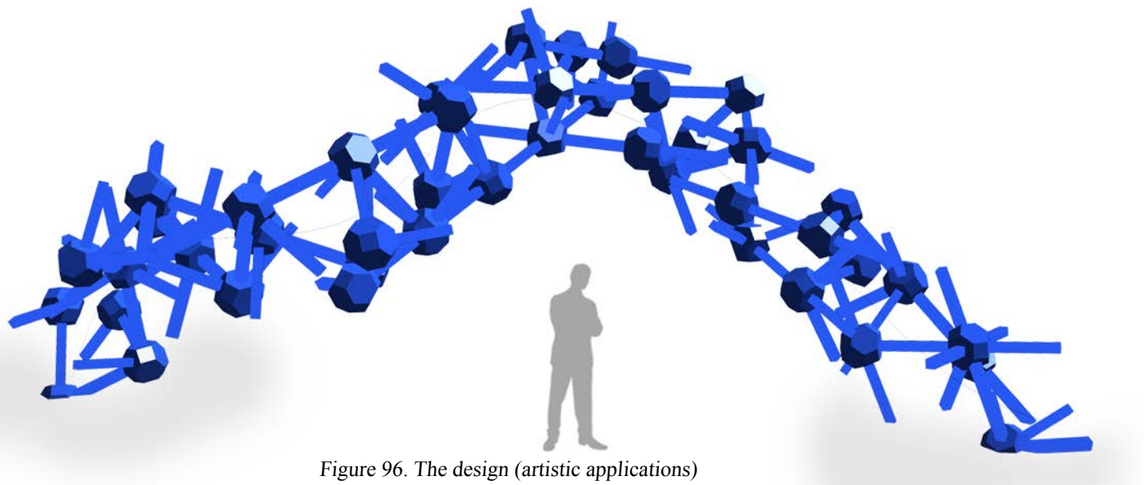


Figure 96. The design (artistic applications)

Connector: **Unit:**

3

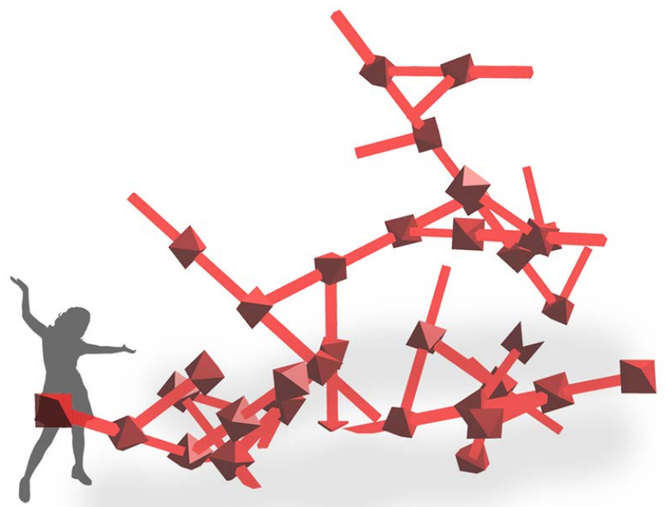
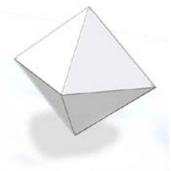


Figure 97. The design (artistic applications)

Connector:  **Unit:**

Design Catalogue

1

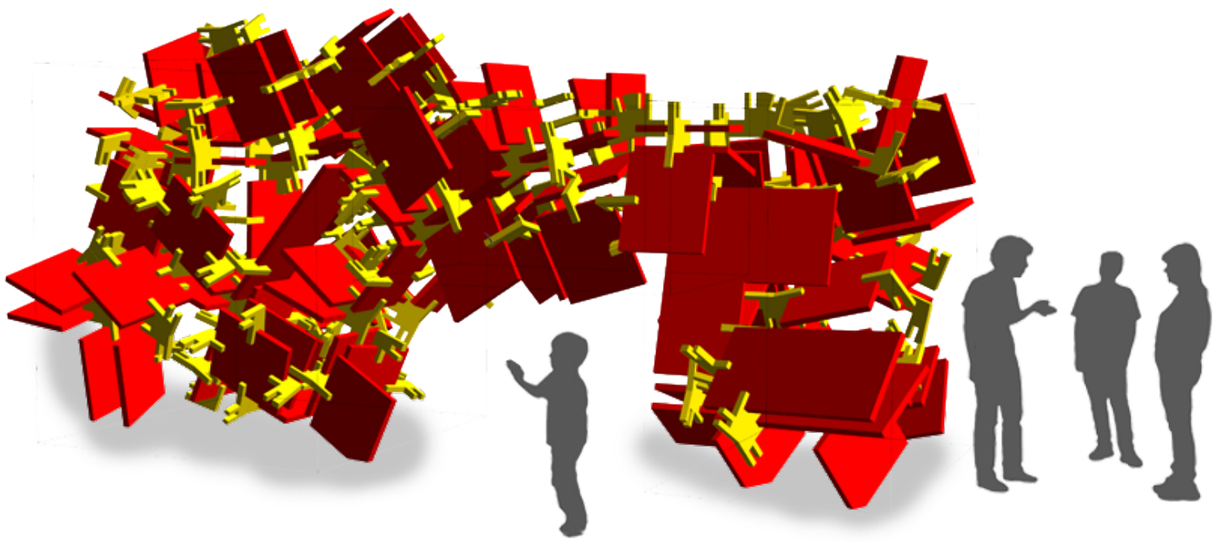


Figure 98. The design (artistic applications)

2

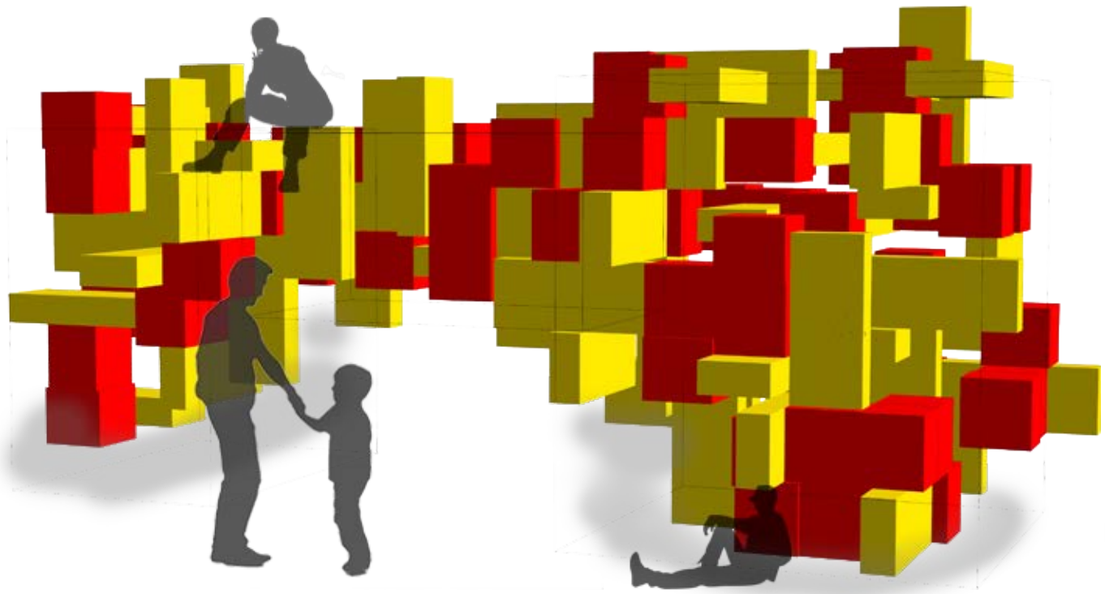
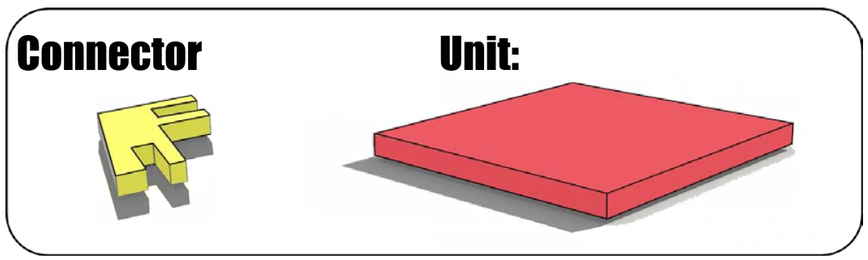
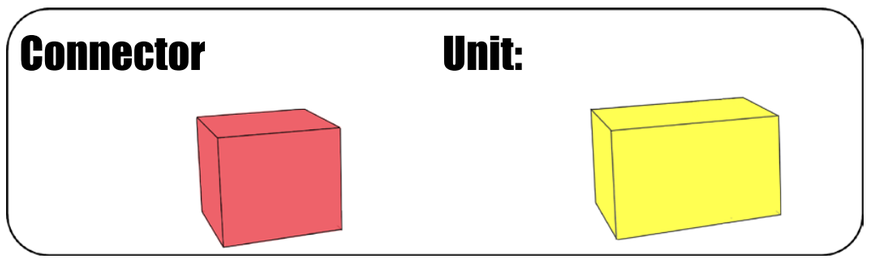


Figure 99. The design (artistic applications)





Fabrication Example (DO)

Taking bottle example (one of the catalogue) then fabricating it on a real model

IMAGINE

Idea from VR

DO

Children do their design

TEST

Test & play

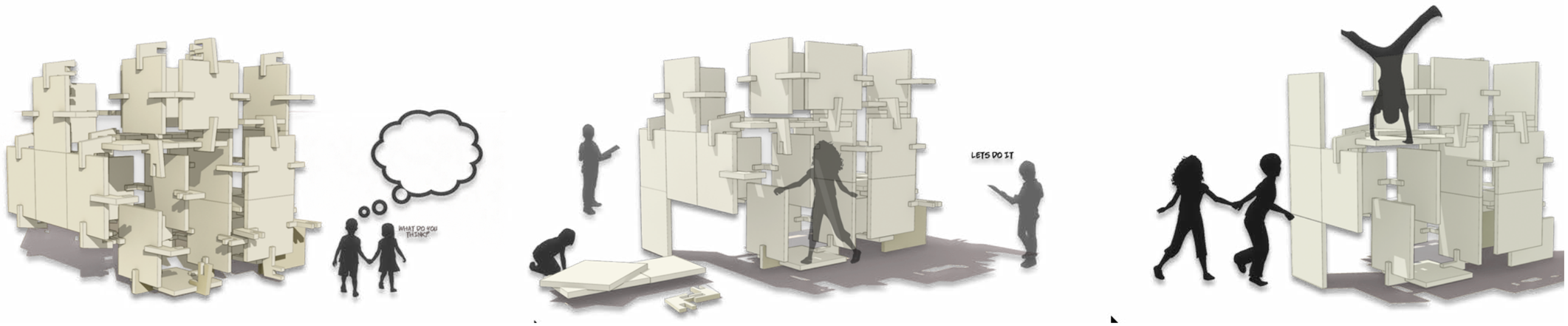


Figure 100. Fabrication process stages (Do)

Fabrication reference

Truss fab [10]

Truss fab system inspired me to make structure formed bottles and stable enough to support weight.

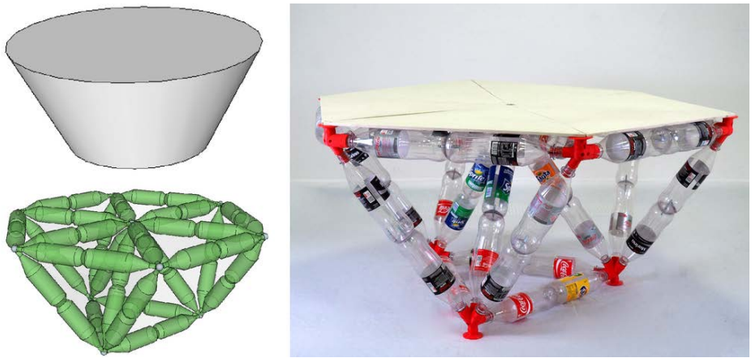


Figure 101. Using truss fab system for designing tables (source: Trussfab)

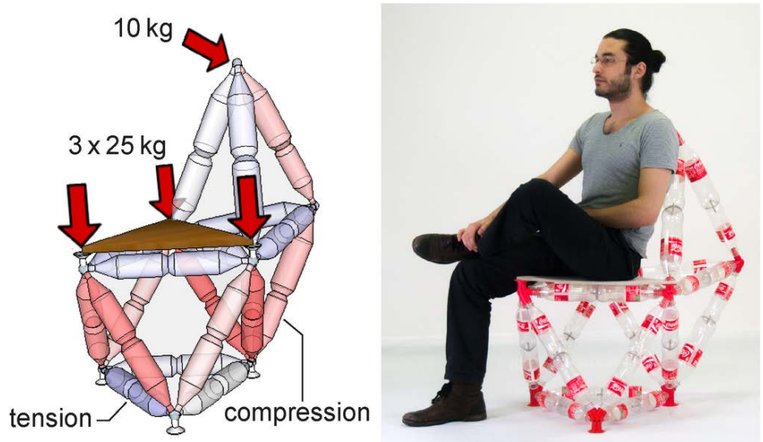


Figure 102. Using truss fab system for designing chairs (source: Trussfab)

Figure 103. The system can hold weight (source: Trussfab)

Figure 104. Connectors (source: Trussfab)

Fabrication Example

Idea

Building a prototype unit to form a truss system, to hold some weight, using plastic bottles as trash material. This idea can be also applied to PVC pipes.

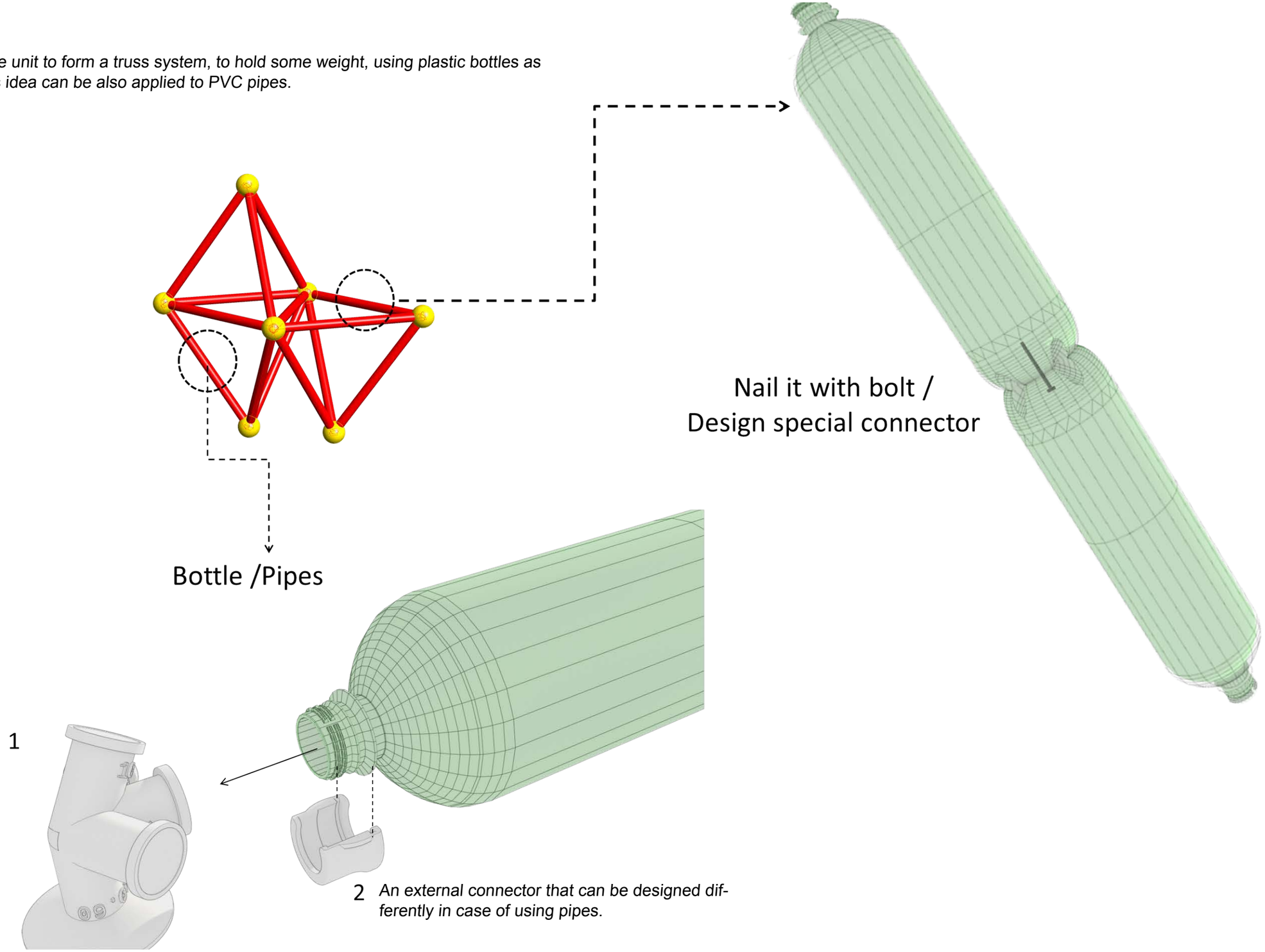


Figure 105. Fabrication Example

Difficulties in the original design

Using this system is a bit tricky as it is still quite new. With replication of the same system it doesn't fit with the bottle types in Sweden especially in the connector part, so I redesigned it simplifying the model form while changing their size.

Original design

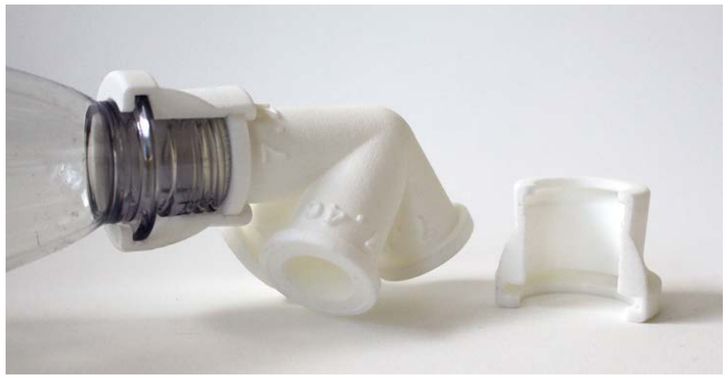


Figure 106. Connector Original design (source: Trussfab)

My replication

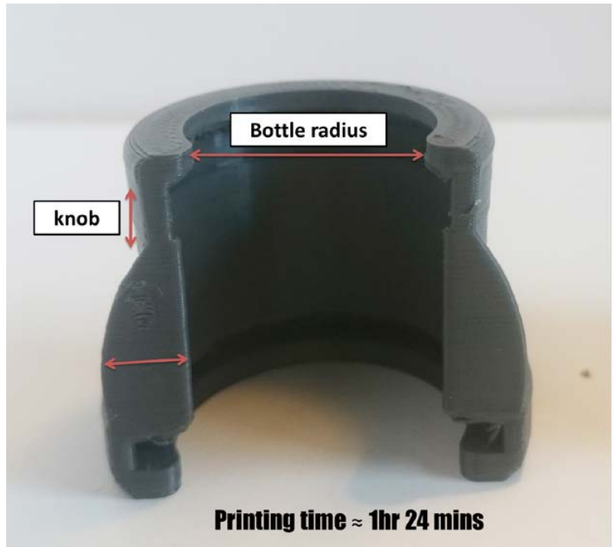


Figure 107. My replication of Original design (front view)

Figure 108. My replication of Original design (back view)

My modified design

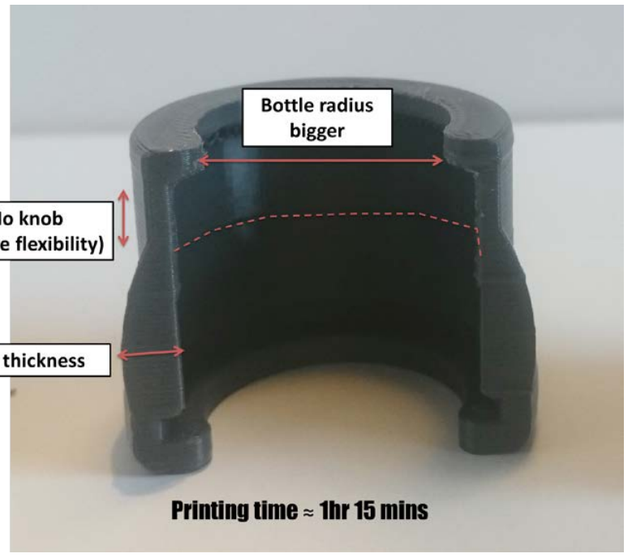


Figure 109. My modified design (front view)

Figure 110. My modified design (back view)

Fabrication steps

Truss parts

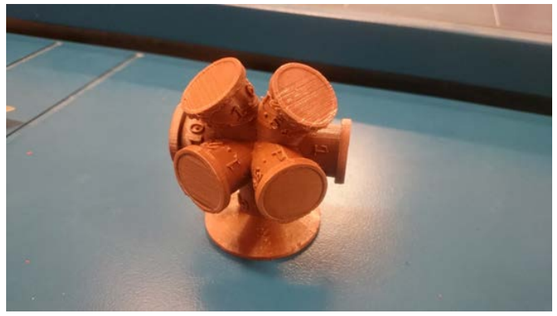


Figure 111. 3D printed connector

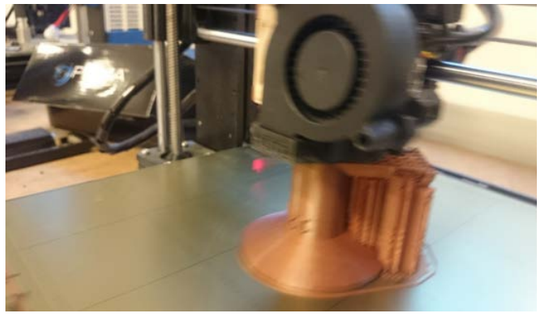


Figure 112. 3D printing of the connector

The best fit connector was designed after a series of failure, but once the right design was reached it was an easy task to finish.

There are 2 types one for ordinary bottles while the other is shorter by (3mm) for shorter neck bottles.

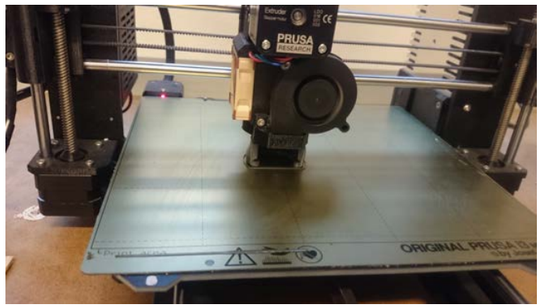


Figure 113. 3D printing of the connector parts

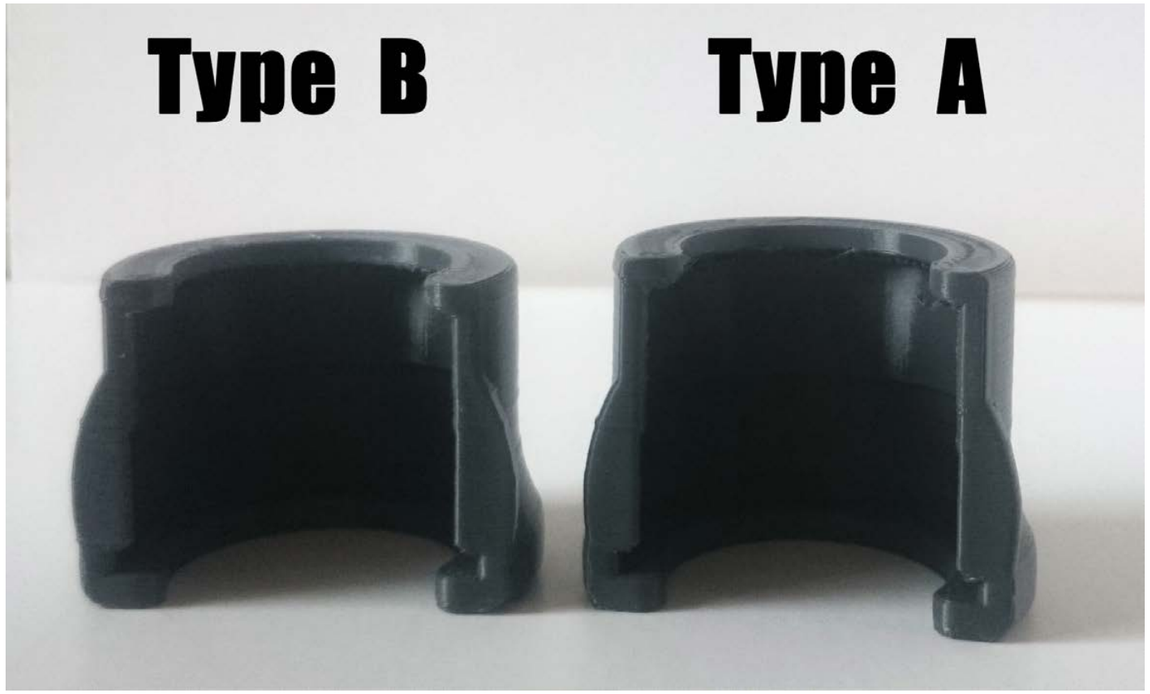


Figure 114. Different connector types to fit different bottle sizes

Figure 115. All parts are ready for assembly

Figure 116. Different bottle sizes

Fabrication steps

01 Preparing the bottle

Figure 117. Putting the screw inside the bottle

02 Fitting 2 bottles together

Figure 118. Fitting two bottle together

03 Fixing it to the 3D printed connectors

Figure 119. Fixing bottle to the 3D printed connectors

04 Building the truss beams

Figure 120. Building the truss beams

05 Making of angles

Figure 121. Making of angles

06 Finishing the triangle

Figure 122. Finishing the triangle

Final model

Figure 123. Final model

01 Add surface

Adding a wooden surface will make it stronger and better to take loads by distributing loads on larger surface area

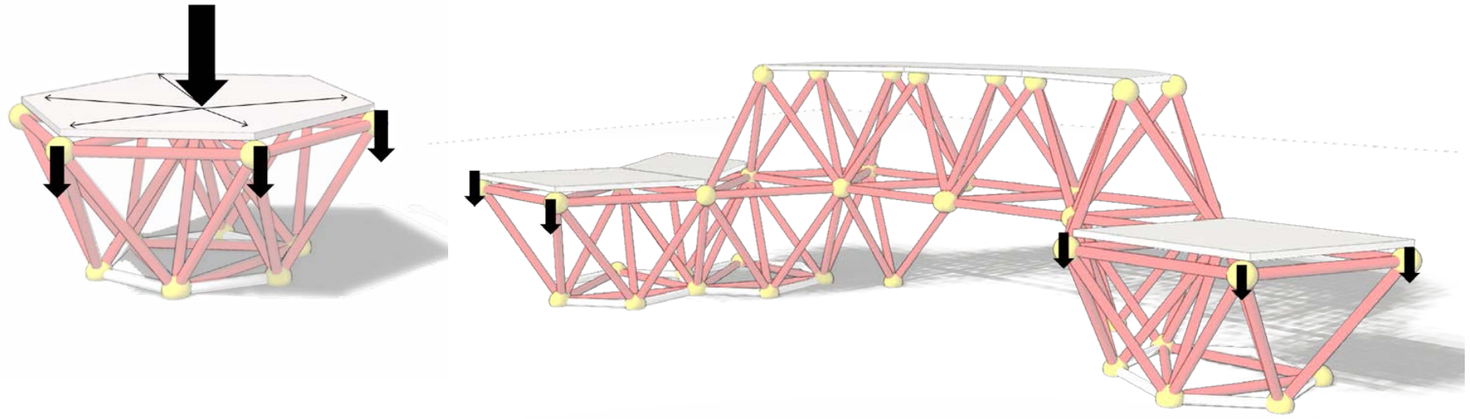


Figure 124. Adding wooden surface to the system

02 Add side members

Adding these members will make it stronger

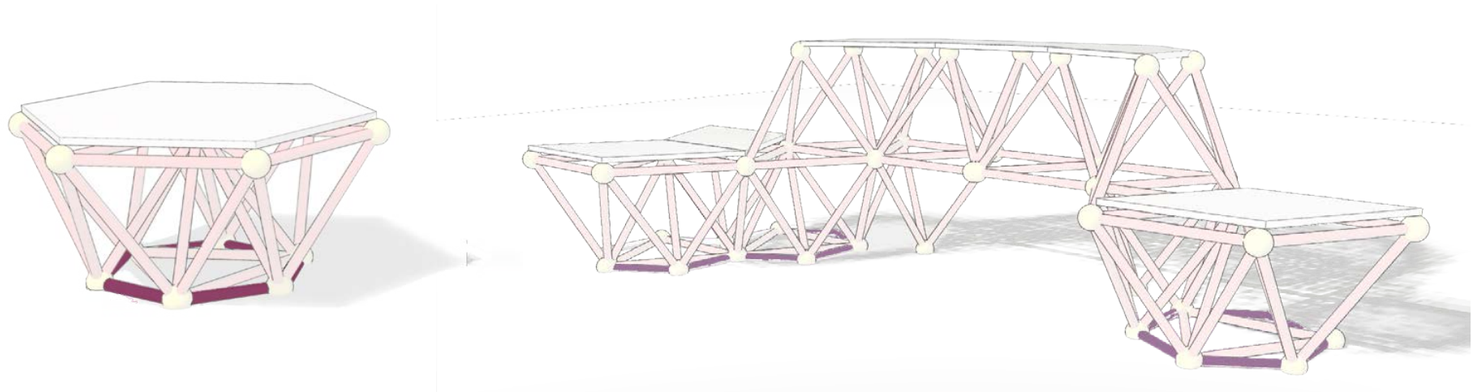
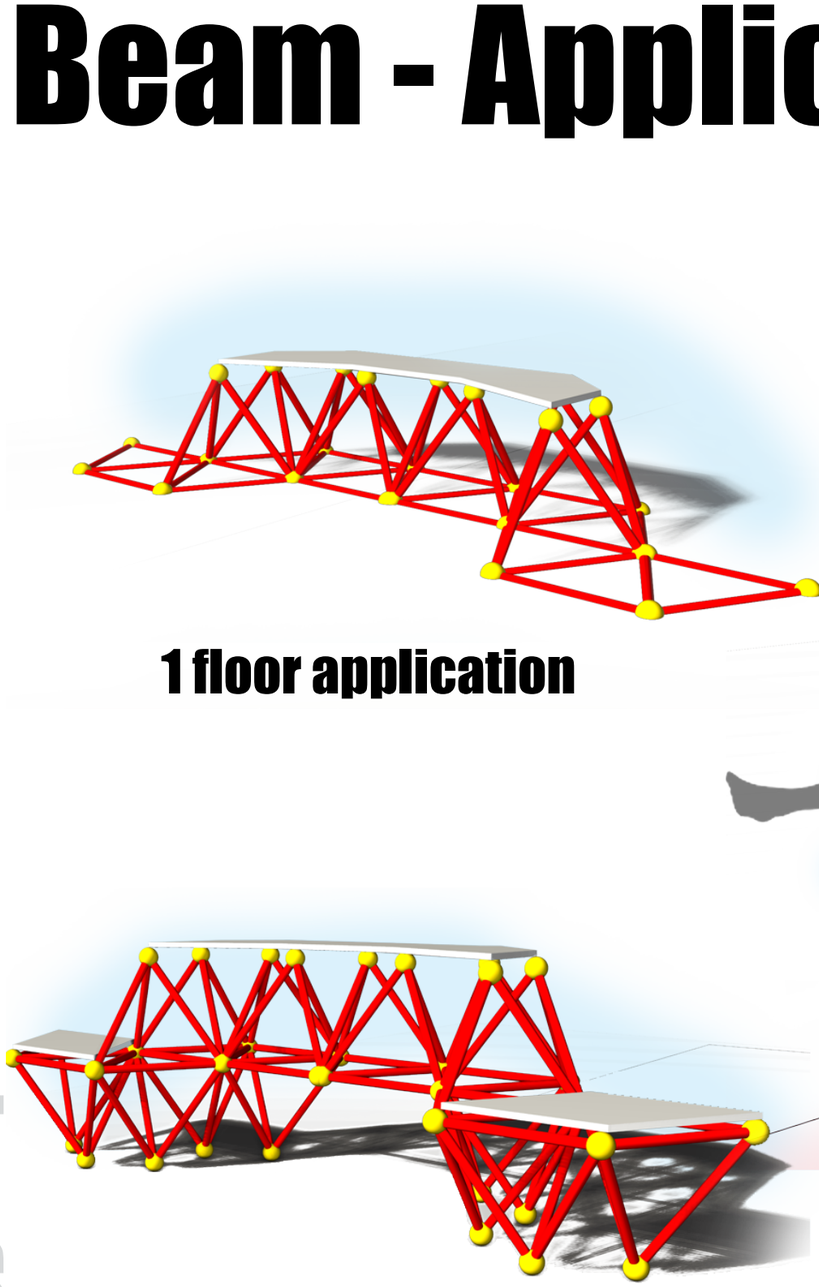


Figure 125. Adding side members

Beam - Application

1 floor application



2 floor application

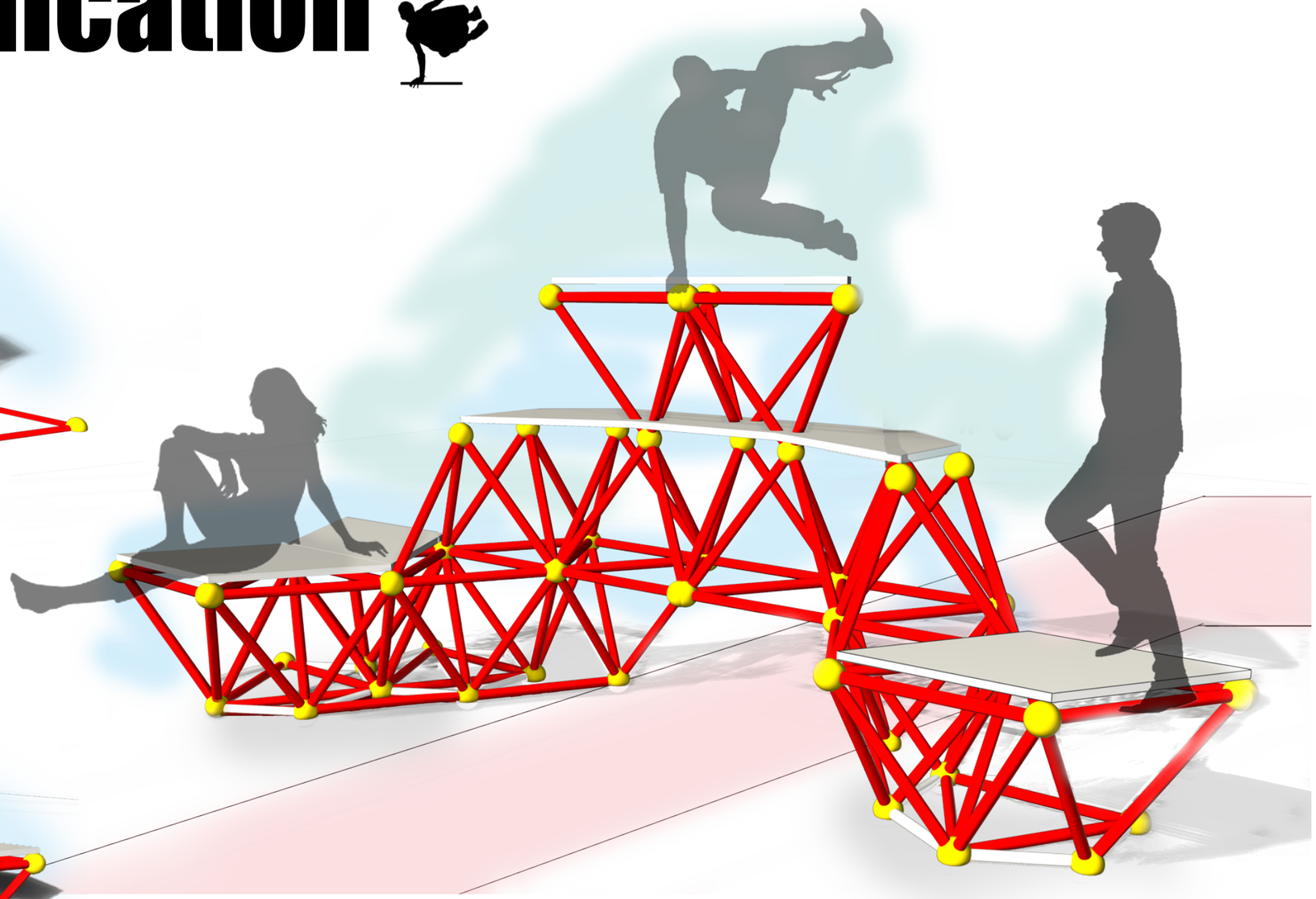
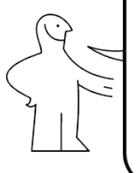


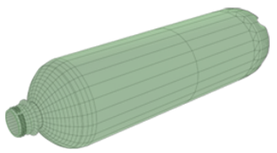
Figure 126. Final design



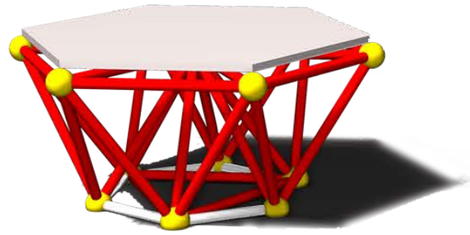
CONNECTOR:

UNIT:

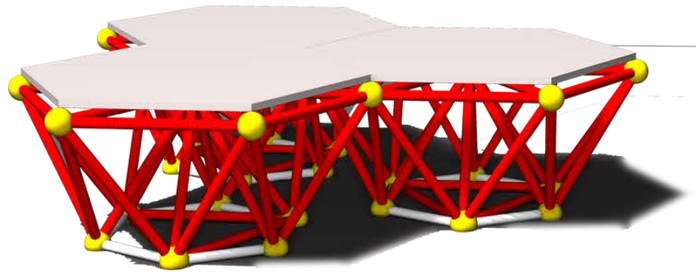
or



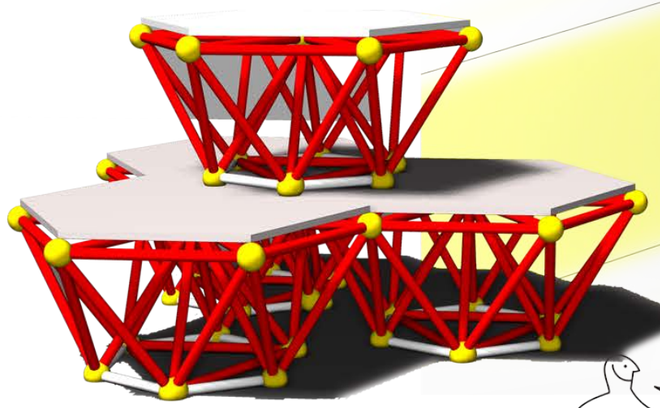
Beam - Application



1 Unit application



1 floor application



2 floor application

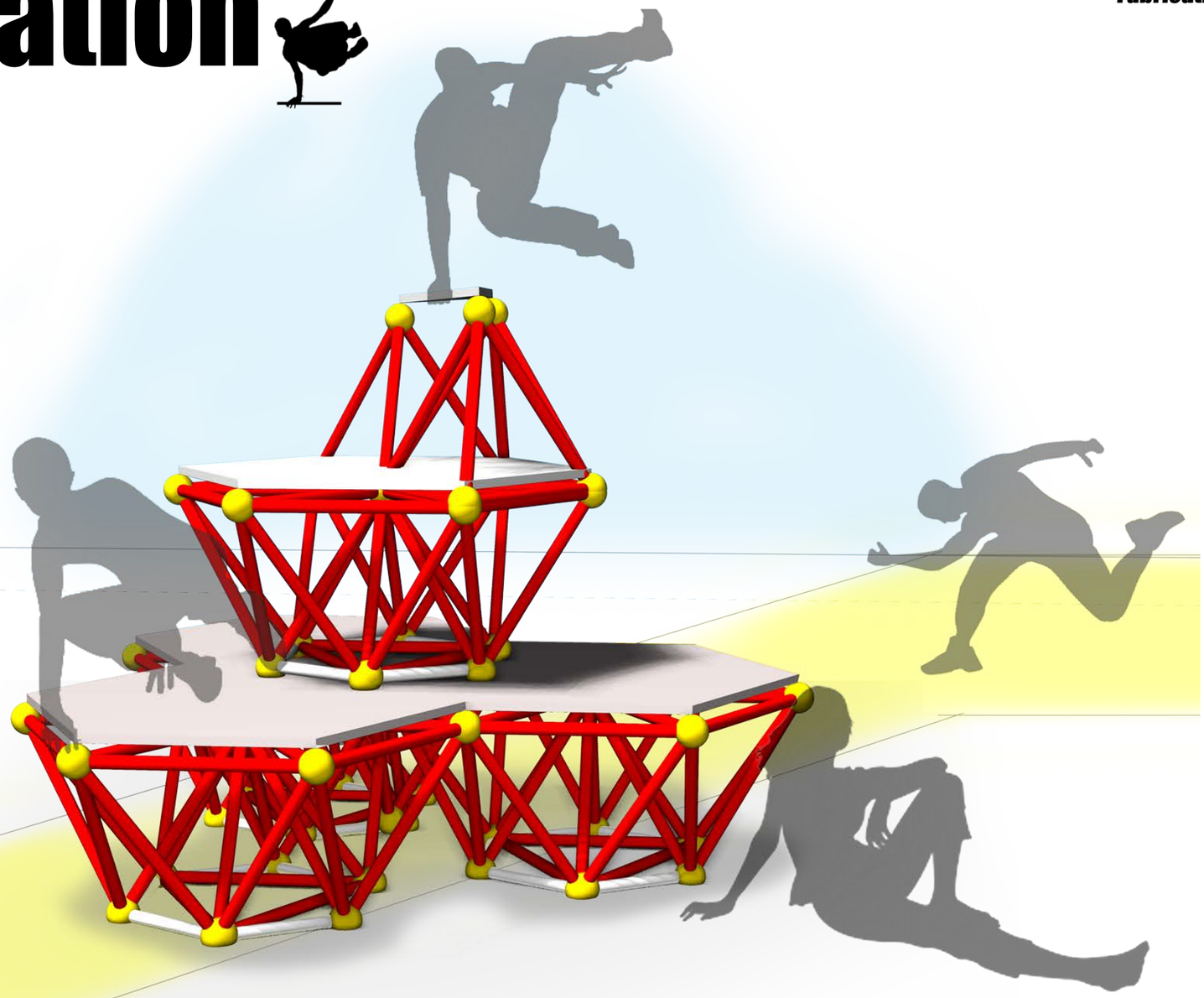
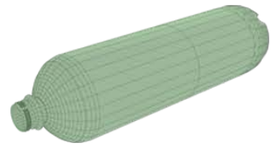


Figure 127. Final design

CONNECTOR:

UNIT:

or



Strength/ Limitation

Strength

The process tested in this research has the following points of Strength:

1. Adaptability: it is not site specific (can be indoor &outdoor).

2. Not shape or form specific (variety).

3. Allow social interaction between participants,as it encourages team-work .

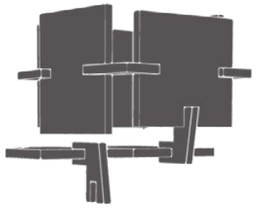


Figure 128. Not shape or form specific

Limitation

1. Three-D printing is a good tool for making creative forms. However, it has an important limitation of being time-consuming. Therefore, 3D printing could be very beneficial in making the first, originally created prototype, but when it comes to fast or mass production another fabrication method might be required.

2. It needs instructor for digital scripting.

3. The material dimensions need to be standardized to make the script work properly and to ensure successful results .Therefore workshops (for wood and other materials) will be required.

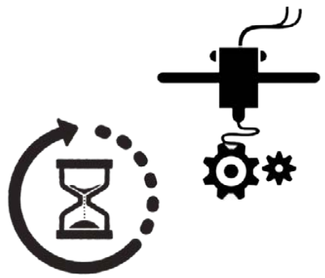


Figure 129. Time consuming

Conclusion on the fabrication process

01 Regarding art activities

It has a great potential to do a lot of shapes.

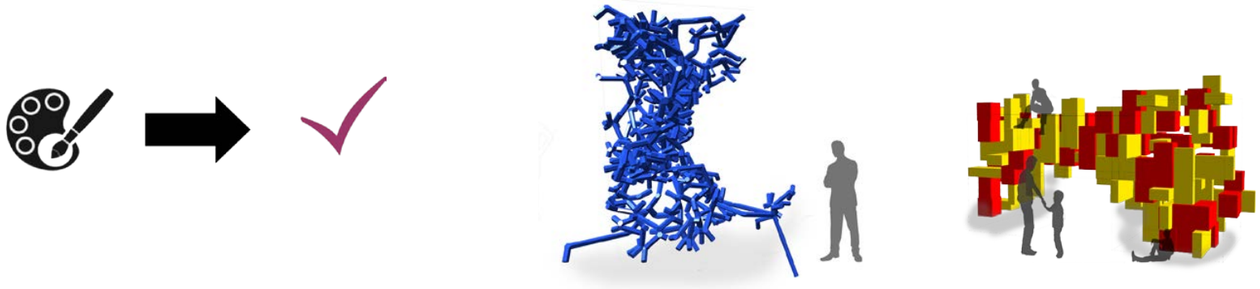


Figure 130. Examples of art application resulting from the process

02 Regarding Parkour

The process produced some structures that can hold weight to some extent.

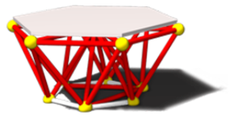
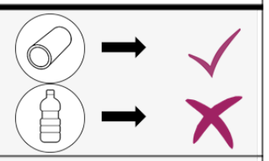
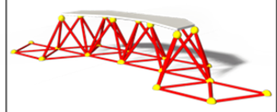
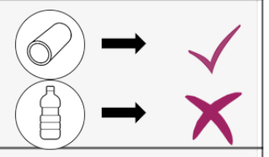
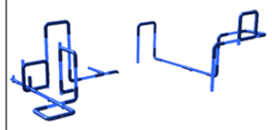
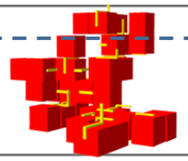
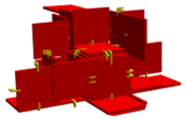
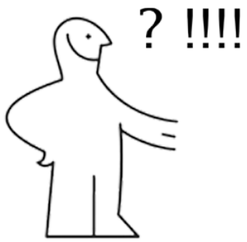
	Precision	using wall	Vaulting	jumping	hanging
	✓	✗	✓	✓	
	✓	✗	✓	✓	
	✓	✗	✓	✓	✓
	✓	✓	✓	✓	✓
	✗	✗	✗	✓	By design (Not tested) ✓
	✓	✓	✓	By design (Not tested) ✓	By design (Not tested) ✓

Figure 131. Showing my Conclusion on the fabrication process regrading Parkour

03 Other activities

The process can offer many more design opportunities that can be shaped according to the user's imagination



Case study

The idea of **[Play]station** can be applied in many areas allover Sweden, I chose an old storage building in Nyhamn area, Malmö to be the site of the case study of my project.

SITE SELECTION

Refugee distribution in Sweden [11]

Most refugees were channelled into rural Sweden.

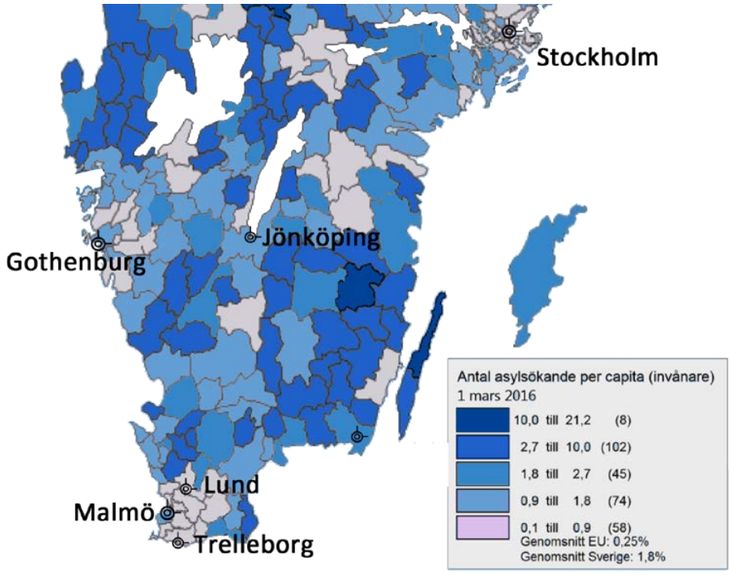


Figure 132. Refugee distribution in Sweden

Train lines in Sweden

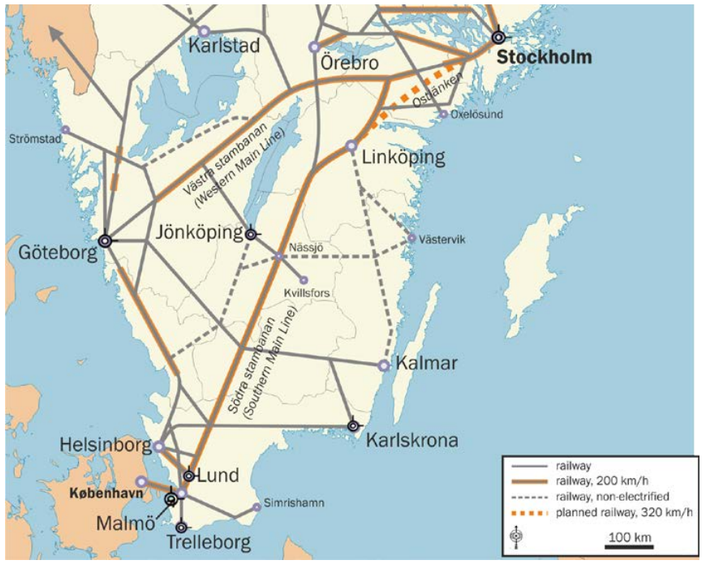


Figure 133. Train lines map in Sweden (source : Boris Chomenko's drawing)

Regarding Skåne

Most refugees are living in rural areas outside big cities. Malmö city is chosen to be the site for my case study as it is a crossway of many train lines. Therefore, it will be easy to get there from allover Skåne and, in particular, from the eastern side around Simirshamn city. It is also very close to Copenhagen, Denmark. Moreover, the chosen building is an old storage building nearby the railway station.

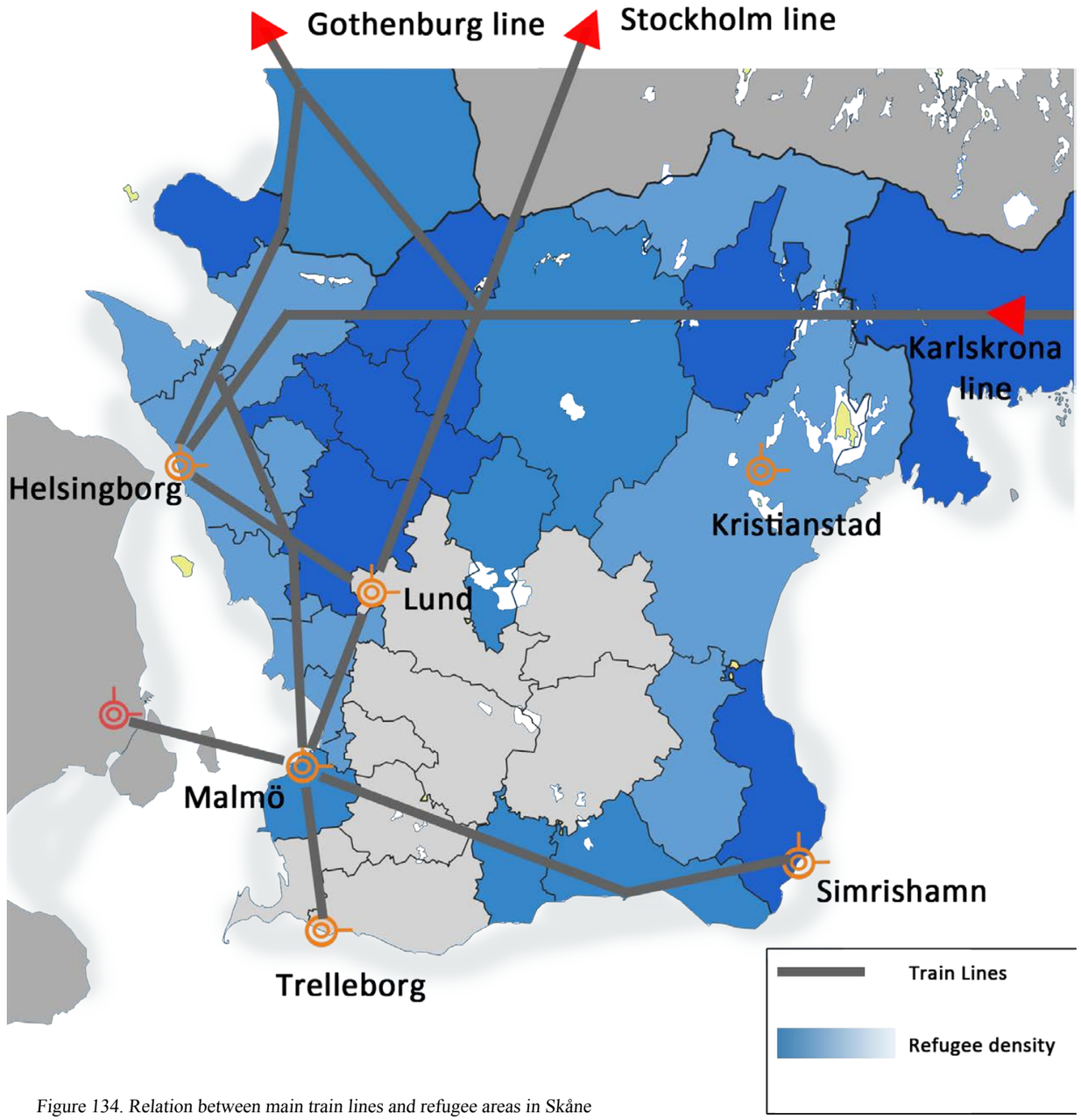


Figure 134. Relation between main train lines and refugee areas in Skåne

Nyhamn area, Malmö

Why this site ?

***1. Central location**: with a nearby train station, hence, attracting youth from allover the southern part of Sweden. The area is particularly lacking this kind of recreation.*

***2. Neutral area:** This site is not within the catchment area of any of the organizations or youth communities therefore it will be easy to implement the project in.*

***3. Temporary site**: Suitable for experimenting new projects and ideas.*

***4. Old storage building**: with a wide open space, as it was an old garage for trains. It provides an excellent opportunity of wide indoor playground. Exterior playgrounds are often inconvenient due to weather conditions in Sweden*

Figure 135. Site place from goggle maps

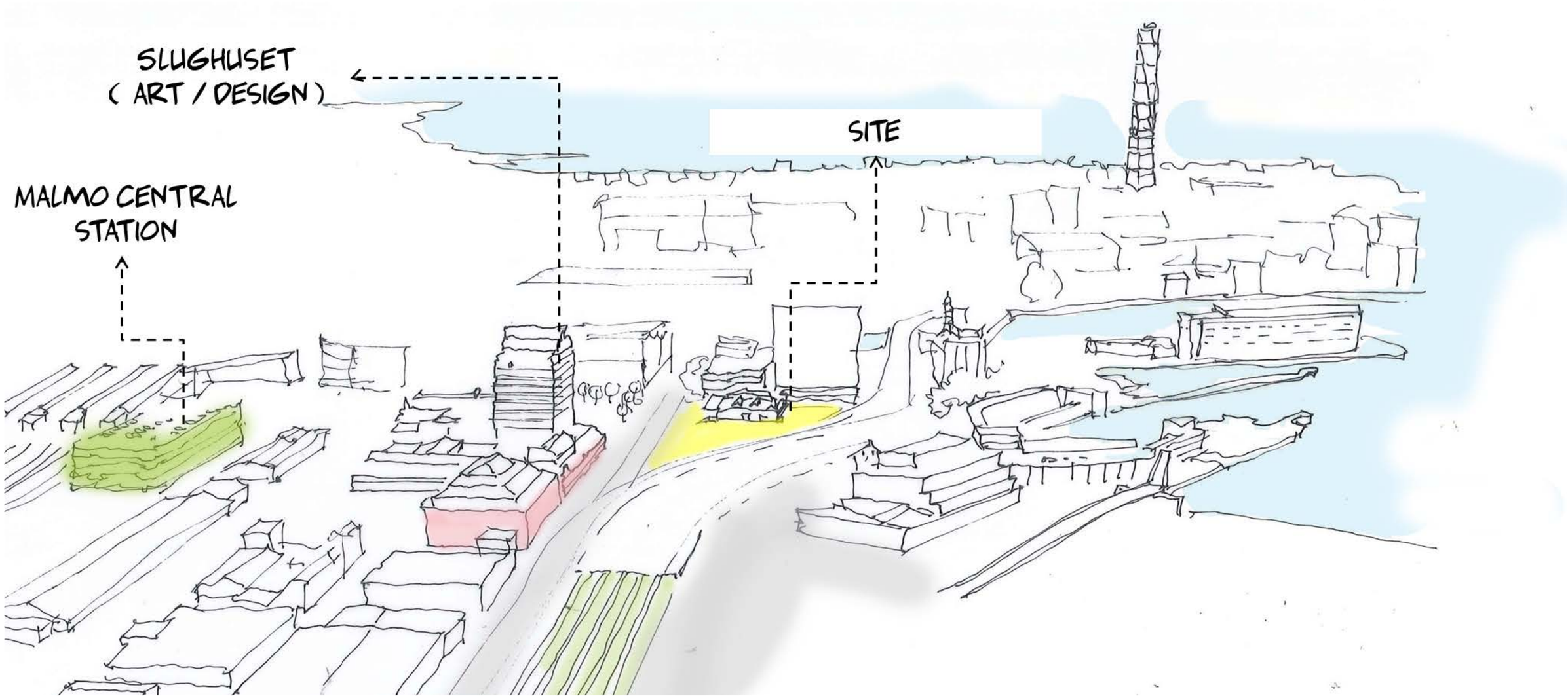


Figure 136. Sketch showing the main important attractions in the site

Design example (storage building)

The building offers a lot of doors and openings that can be suitable for different playing possibilities both indoors and outdoors. Moreover there is an exterior garage space that can be partially included in the play area

Figure 138. Image of the storage building

Current plan

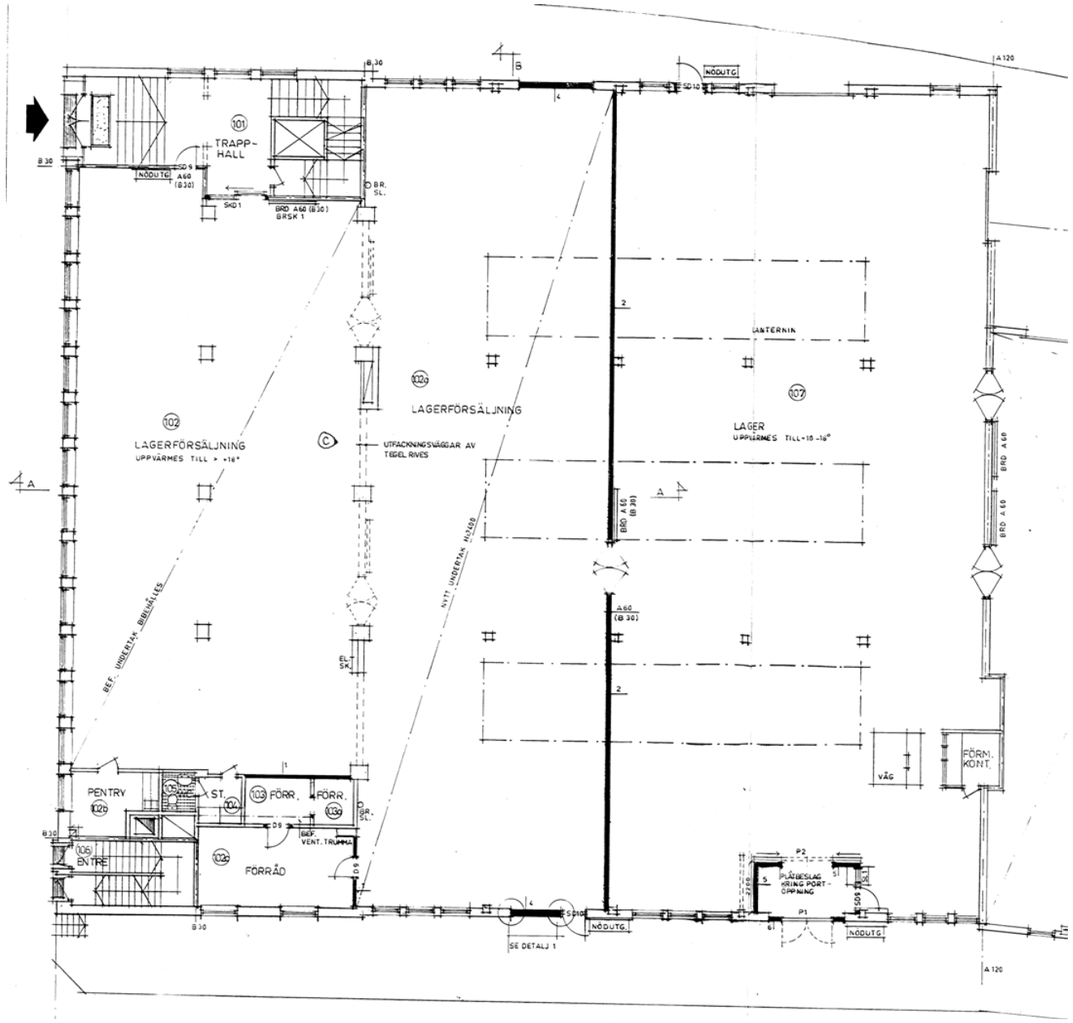


Figure 139. Current plan of the storage building (source: Malmö municipality)

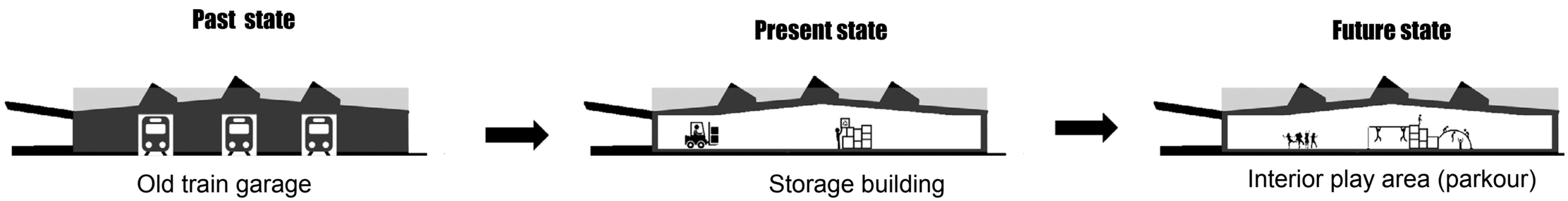


Figure 140. Showing transformation of the building to accommodate play activities

What is added to building

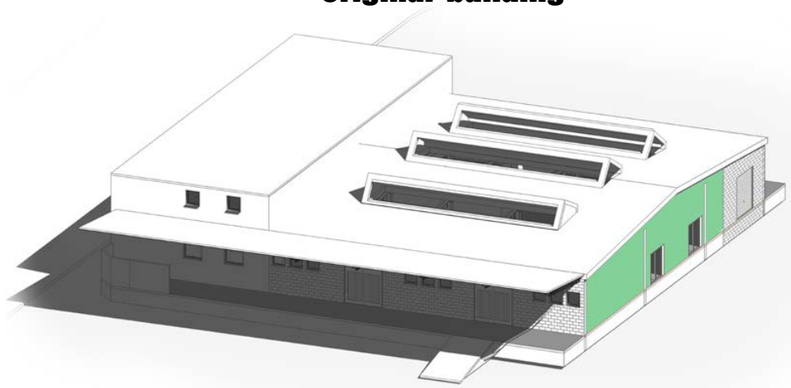
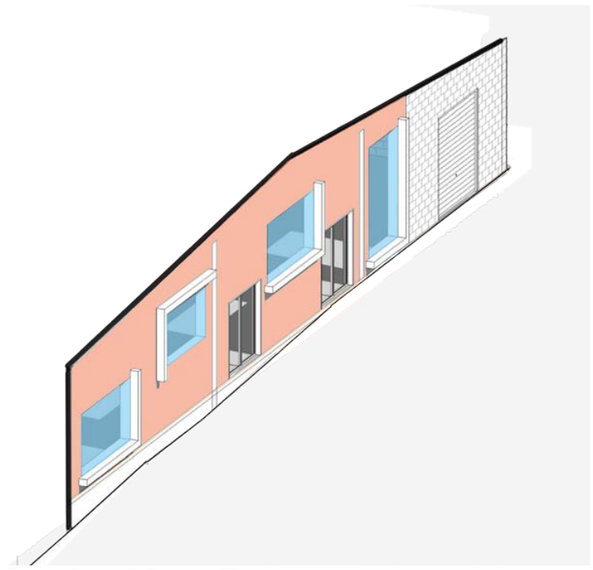
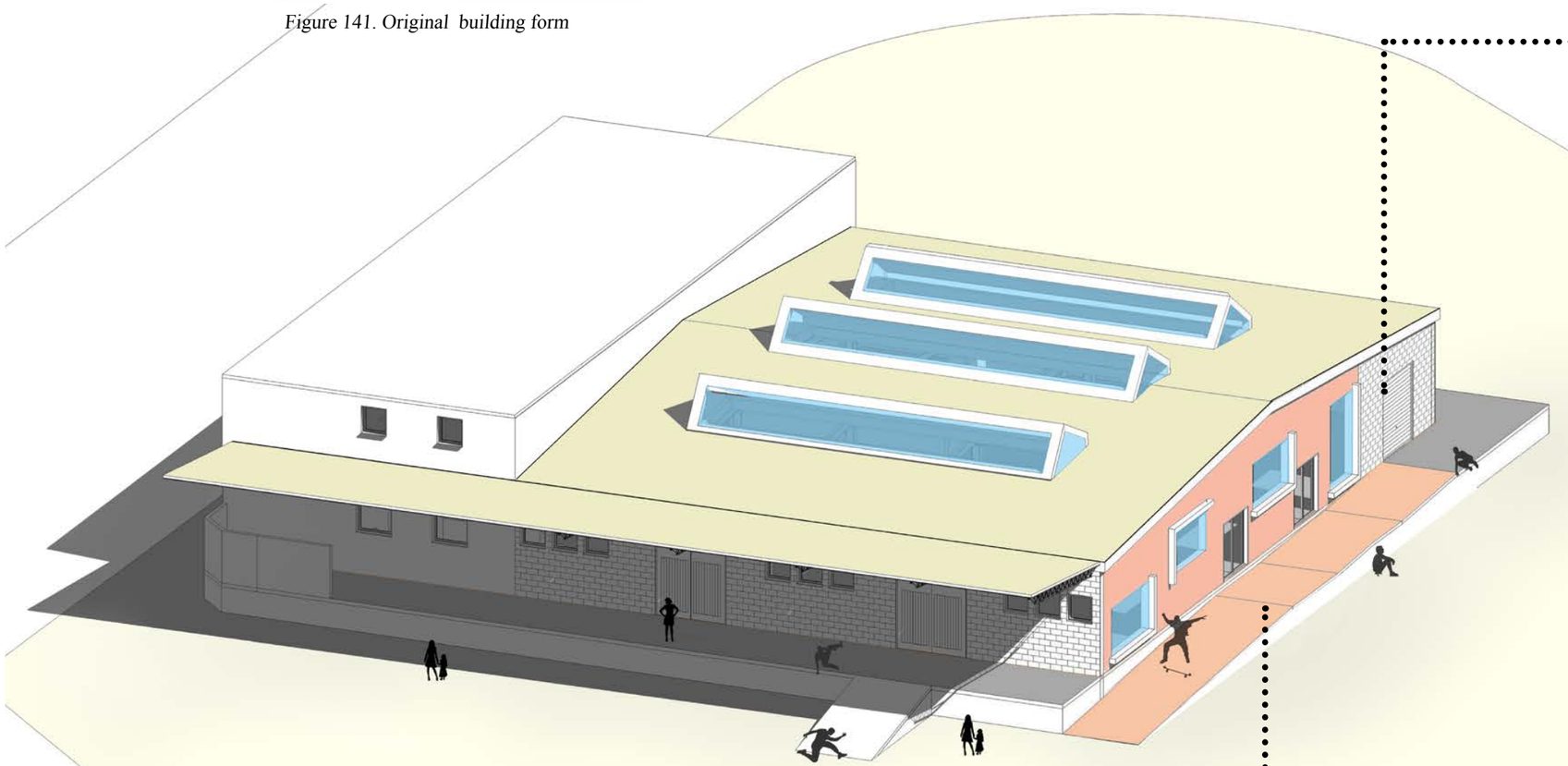
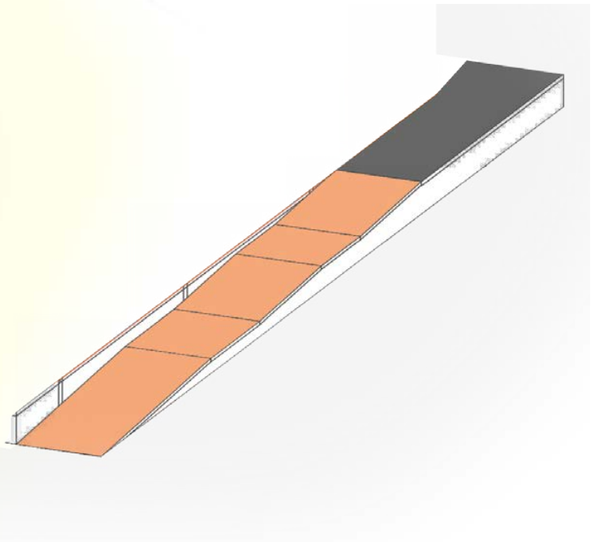


Figure 141. Original building form



Modifying the side wall (more light indoors)





Adding external ramp (more sitting area , more outdoor playing opportunity)

Figure 142. Building after modification

Zoning

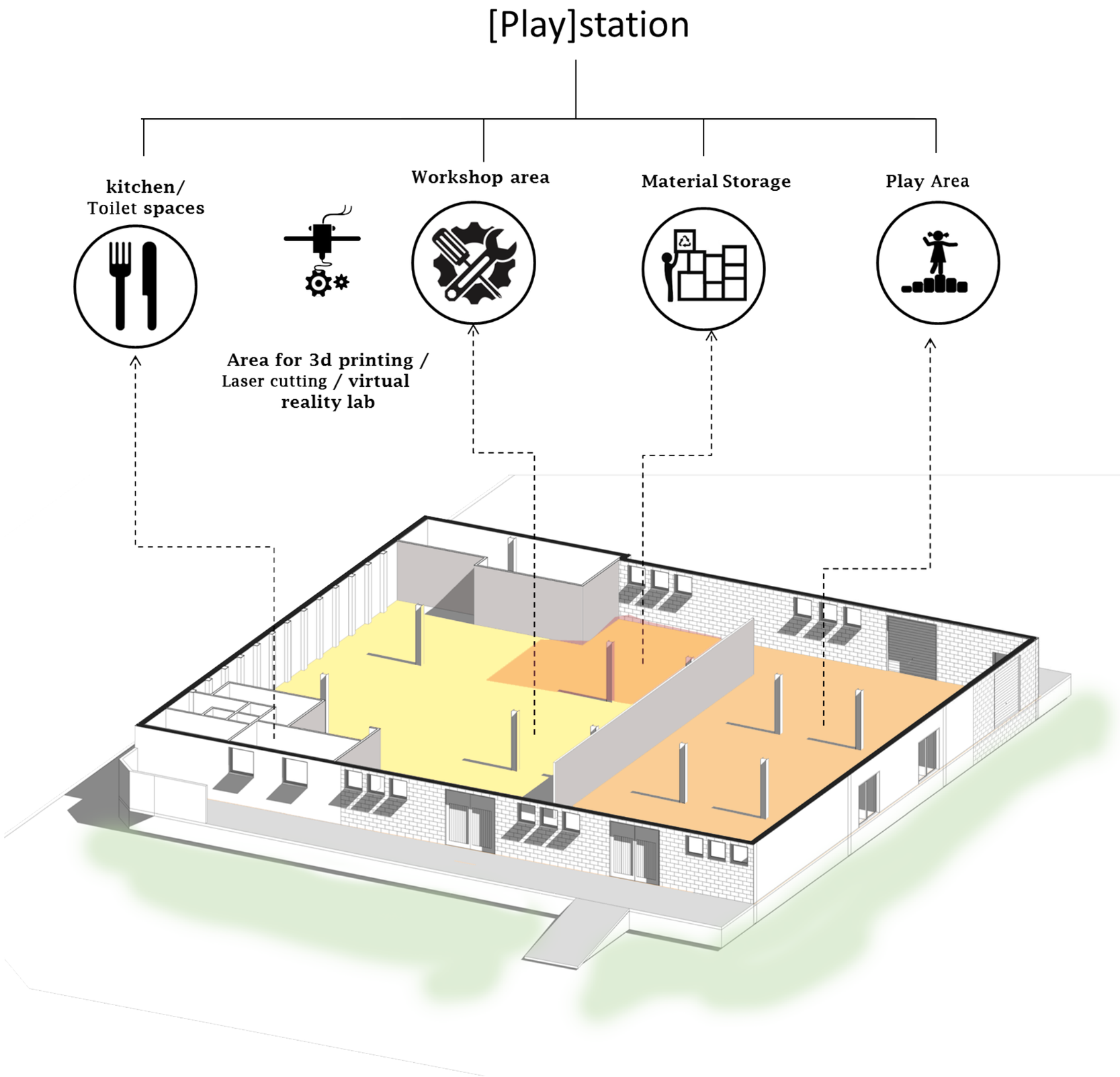


Figure 143. Applying [Play]station zoning to the storage building

Activities in the plan

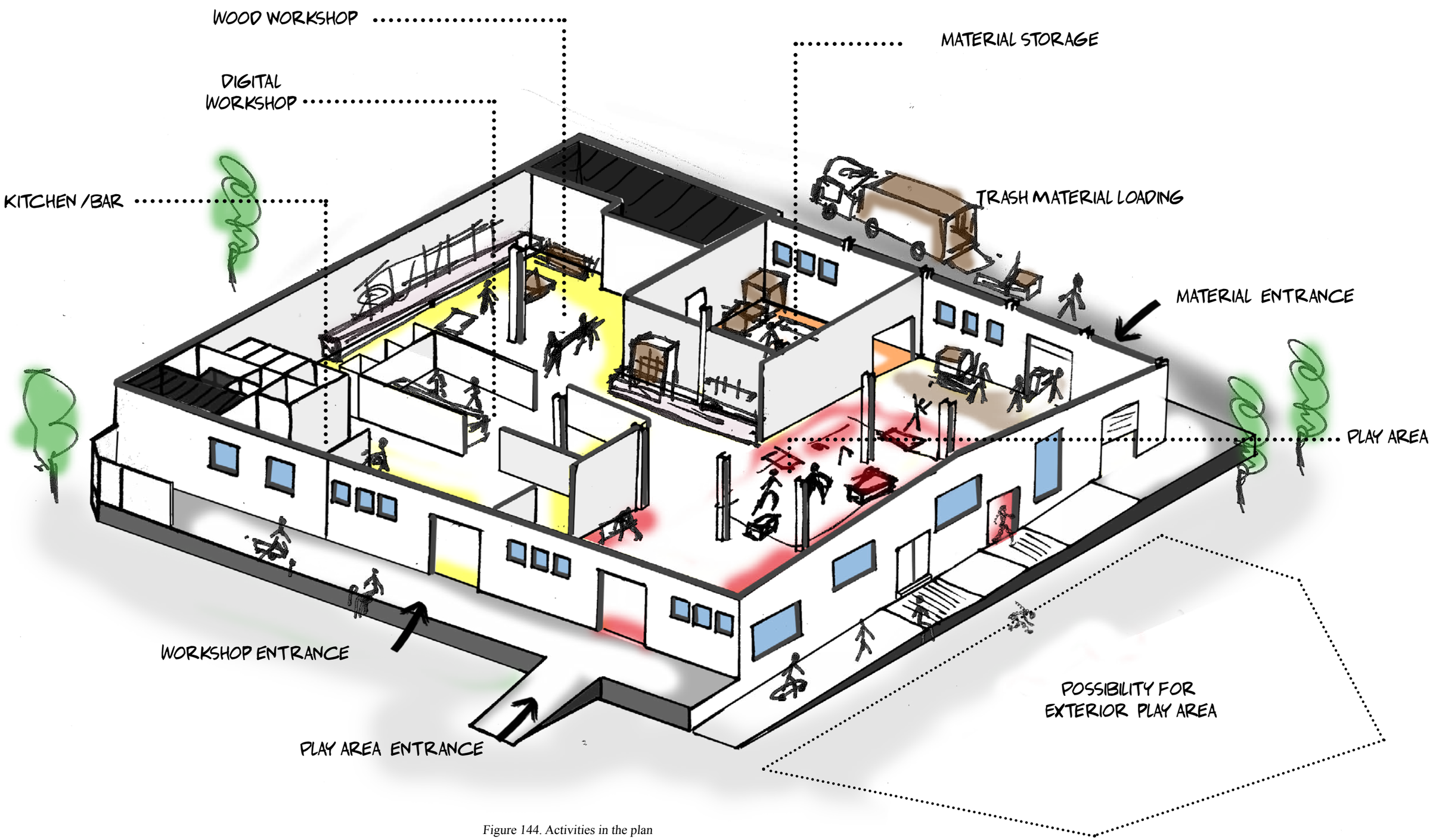


Figure 144. Activities in the plan

Plan (scale 1:200)

Keeping the original state and reuse the building by adding fabrication workshops, storage of trash. Also, there are service facilities including lockers, small kitchen and a number of toilets.

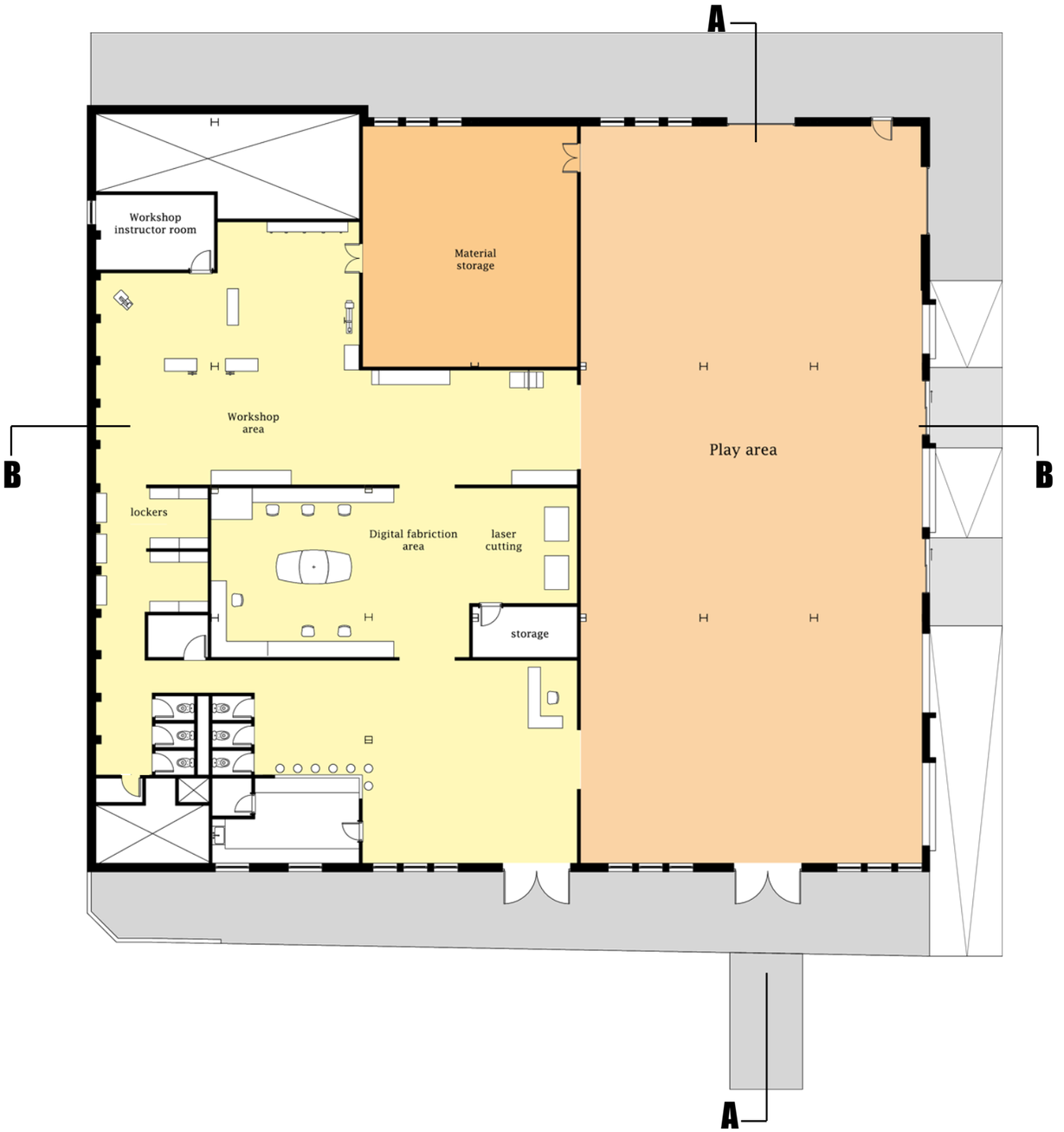
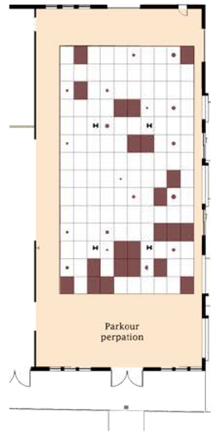
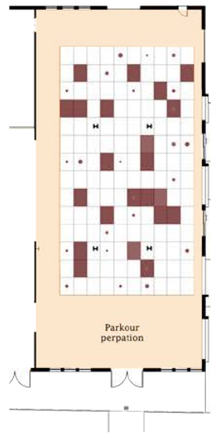


Figure 145. Plan (scale 1:200)

Play area possibilities



The play area is an adaptable space that has many possibilities to act as interior parkour track, artistic gallery , ...



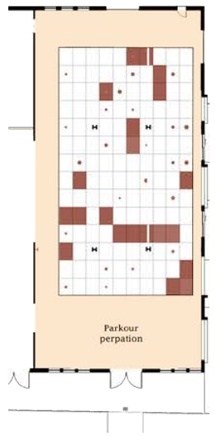


Figure 146. Different parkour design possibilities

Sections

Figure 147. Section A-A

Figure 148. Section B-B

Interior showing the workshops

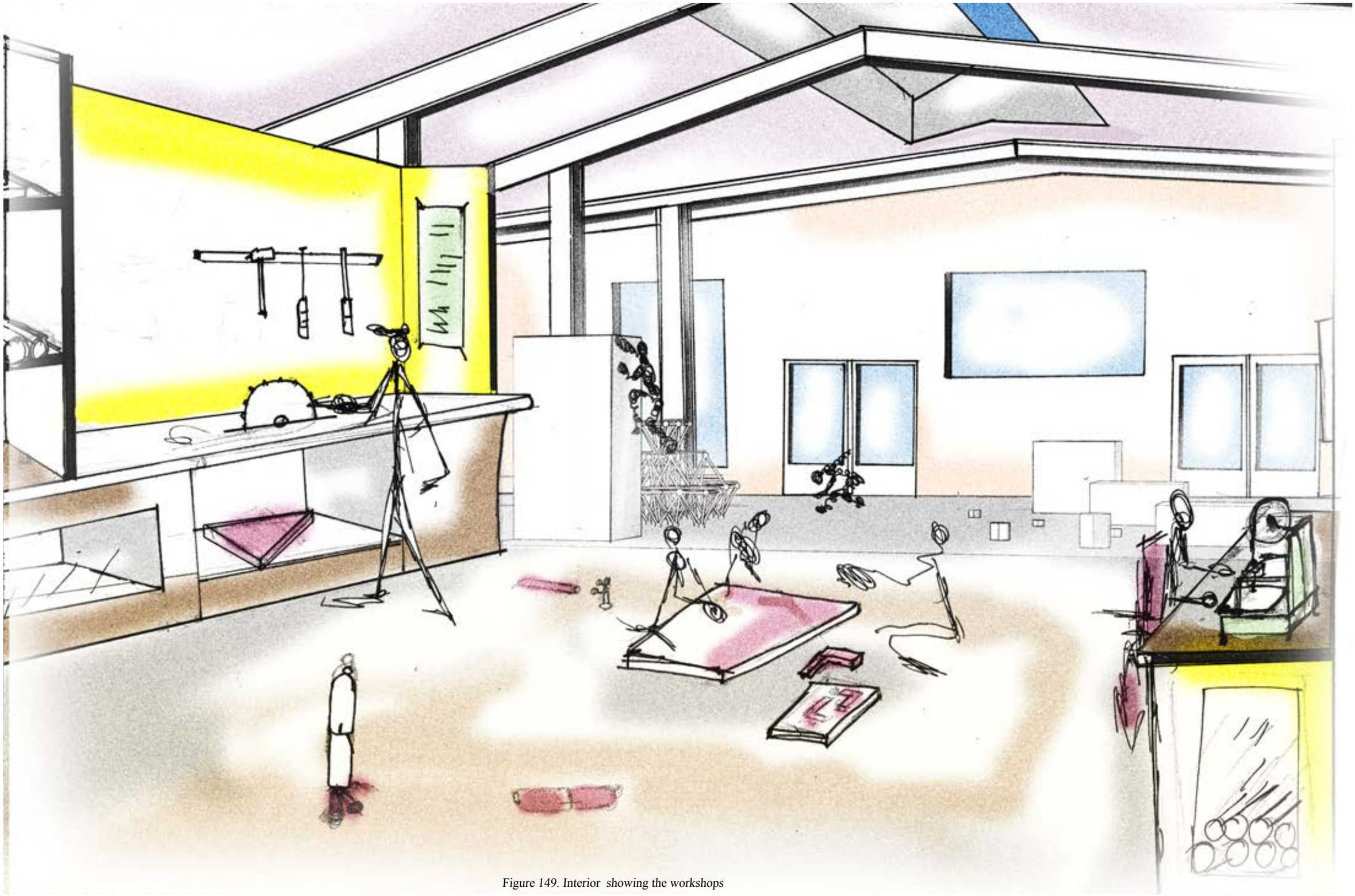


Figure 149. Interior showing the workshops

Interior in the play area (playing Parkour)

Figure 150. Interior in the play area

Conclusion

[Play]station *is a youth building with an indoor playground to accommodating activities with the purpose of empowering teenagers. It deals with the physical, mental, and artistic aspects of human development and needs.*

01 Freedom of design (in shapes and things)

Children are involved in designing the playgrounds with the help of the workers and using the design catalogue as a guideline for their future designs .

02 Use of technology

By teaching teenagers the software skills and digital scripting in a simple way that enable them to design a variety of shapes

03 Taking limited risk

There are trained instructors to ensure the safety in using the materials and tools

04 Integration tool

Through the mix between refugee and indigenous in performing a common activity. Site selection

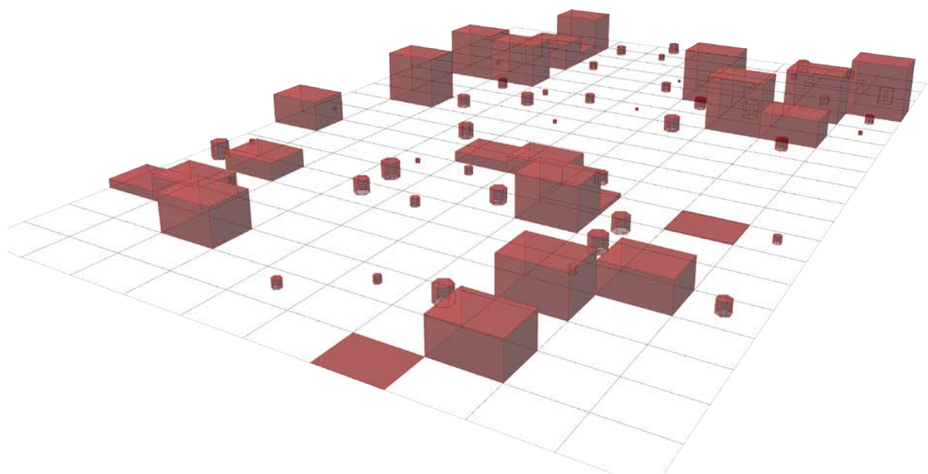
05 Has an agreed upon (theme) activity

Participants are encouraged to do team work and group play to achieve their agreed upon design (parkour tracks and artistic shapes as an example in the play area)

06 Use of environment

The use of recycled materials and turning them into play.

[Play]station offers a new way to empower young teenagers, especially unaccompanied minors(UAM), by giving them the opportunity to build their play area. This is done by learning teenagers manual and high mental skills.
My role is to organize that learning process. The included design catalogue demonstrates just a few examples out of a wide range of possible designs that could be created through the cooperation between participants in making their play area. This cooperation provides a better chance of interaction and exchange of information beside manual and high mental skills between participants. Raising their capabilities is expected to provide them a better chance for future employment.



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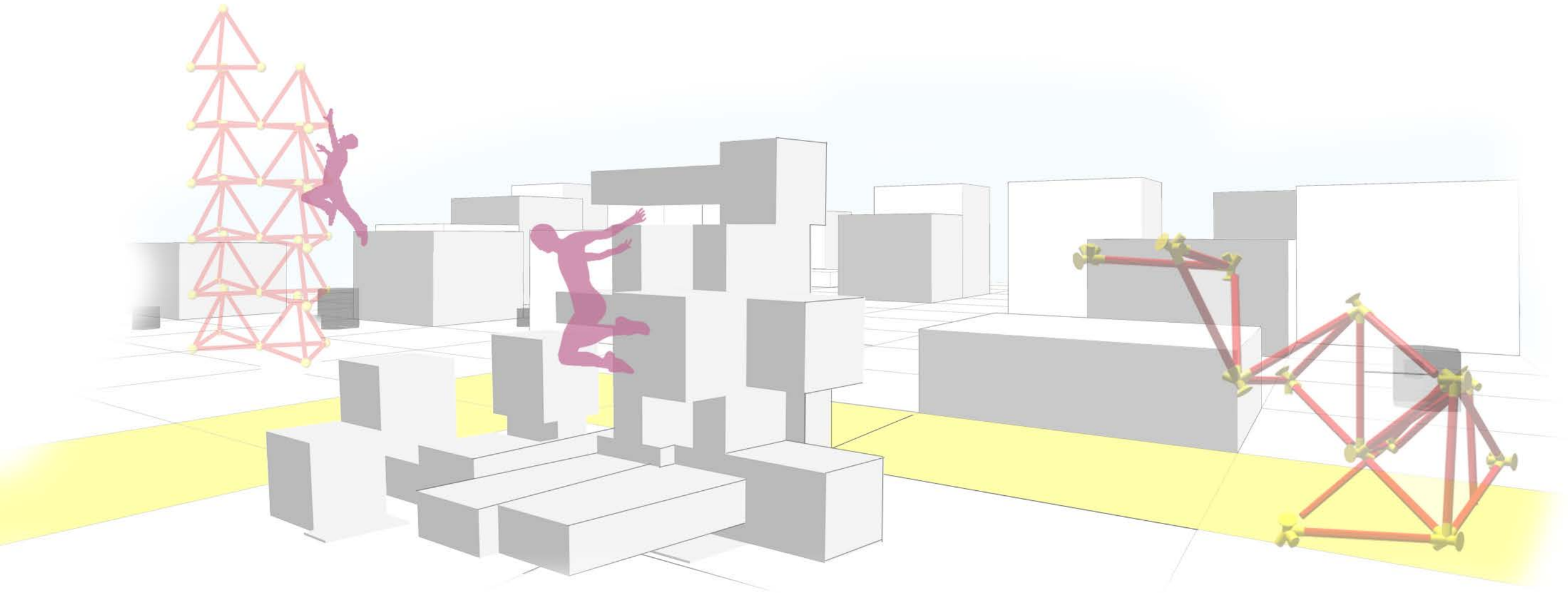
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