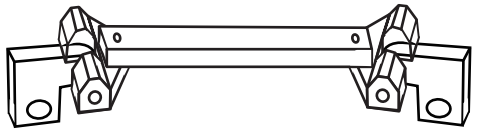
POLITECNICO
DI TORINO
Department
of Architecture and Design



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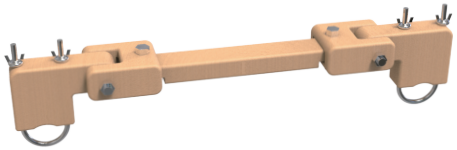

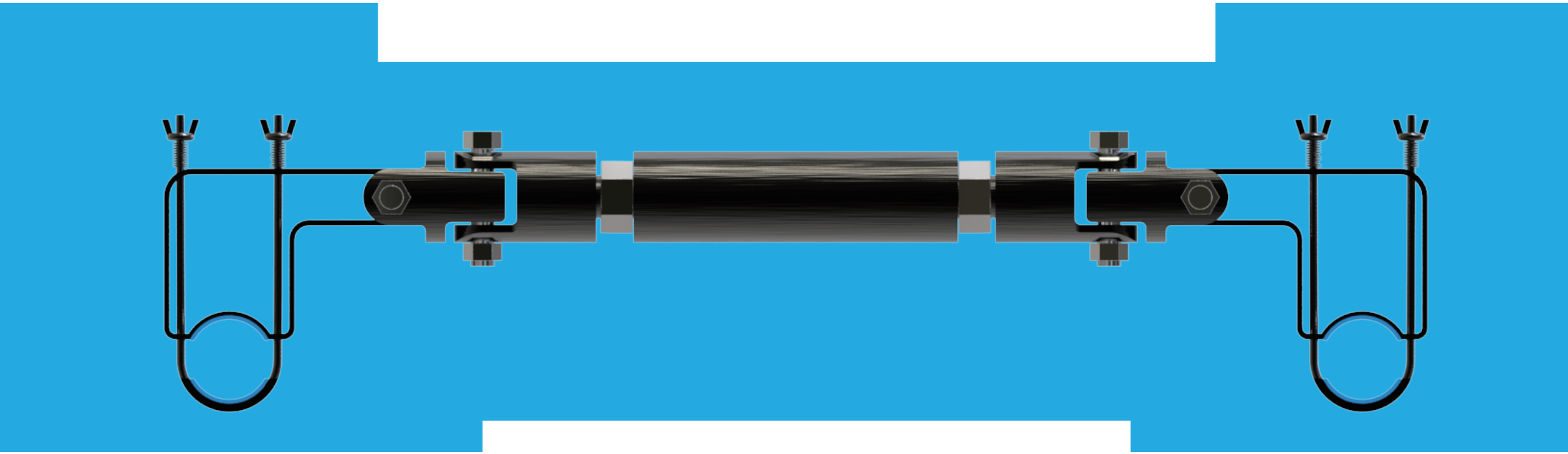

POLITECNICO DI TORINO

Advisor :
Prof. Cristian Campagnaro

Candidate :
LIU DAWEI

POLITECNICO
DI TORINO

Master's degree in Systemic Desgin
Department of Architecture and Design
Graduated in 2019
Master Thesis

TRANSFOREM 0

Advisor :
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Part IV

The evolution of the product

Part V

FINAL PRODUCT

01.
THE SOURCE OF THE DESIGN

1.1 Tutor’s program in AISM

1.2 Introduction of the AISM Center and Multiple Sclerosis

1.1 Tutor's program in AISM

Politecnico di torino & AISM center workshop

The workshops of polito provide an opportunity to address practical and extemporary design experienes.The main features of a workshop are the limited duration (one week) and the presence, as tutors,of professionals from atypical sectors that are close to the design area.

Active participation, sharing of ideas and the collective experimentation of new solutions in a short amount of time make Athe workshop an essential educational experience for young designers.

The collaboration with internationally renowned companies is also a professional opportunity for students to confront themselves with the world of work.

Fig. 1.1.1-Politecnico University design workshop logo

Master's workshops face the issues of social design, starting from users' needs, behaviours and cultural approaches, and the context they live in. Within the workshop, students will look for solutions to improve the quality of life of the people involved. They will experiment new ways and tools to provide answers to the analysed social challenges

Fig. 1.1.2-the project of "No cash，new life"

Design for each one in AISM

Fig. 1.1.3-" Design For Each One" from Polio

A creative and experiential "journey" through the world of motor disability. From the construction of the report to the conception (and co-construction) of assistive products, the path provides workshop experiences in a group with the aim of satisfying concrete needs and facilitating daily gestures.

1.2 Introduction of the Multiple Sclerosis and AISM Center

What is multiple sclerosis?

Multiple sclerosis (MS) is a demyelinating disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged. This damage disrupts the ability of parts of the nervous system to communicate, resulting in a range of signs and symptoms, including physical, mental, and sometimes psychiatric problems.

Specific symptoms can include double vision, blindness in one eye, muscle weakness, trouble with sensation, or trouble with coordination.

MS takes several forms, with new symptoms either occurring in isolated attacks (relapsing forms) or building up over time (progressive forms). Between attacks, symptoms may disappear completely;however, permanent neurological problems often remain,especially as the disease advances.

While the cause is not clear, the underlying mechanism is thoughtto be either destruction by the immune system or failure of the myelin-producing cells.Proposed causes for this include geneticsand environmental factors .MS is usually diagnosed based on the presenting signs and symptoms and the results of supporting medical tests. There is no known cure for multiple sclerosis. Treatments attempt to improve function after an attack and prevent new attacks.

Fig. 1.2.1-Patients with multiple sclerosis

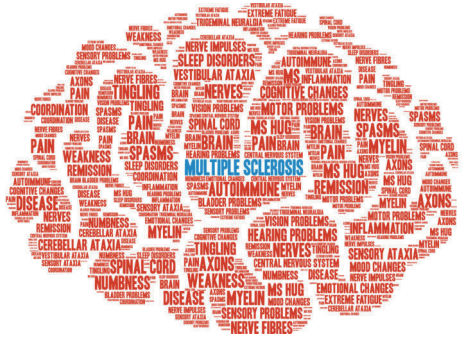


Fig. 1.2.2-Features of multiple sclerosis

Medications used to treat MS, while modestly effective, can have side effectsand be poorly tolerated. Physical therapy can help with people's ability to function.

The long-term outcome is difficult to predict, with good outcomes more often seen in women, those who develop the disease early in life, those with a relapsing course, and those who initially experienced few attacks. Life expectancy is on average 5 to 10 years lower than that of an unaffected population.

Multiple sclerosis is the most common immune-mediated disorder affecting the central nervous system.
In 2015, about 2.3 million people were affected globally with rates varying widely in different regions and among different populations. That year about 18,900 people died from MS, up from 12,000 in 1990. The disease usually begins between the ages of 20 and 50 and is twice as common in women as in men. MS was first described in 1868 by Jean-Martin Charcot.
The name multiple sclerosis refers to the numerous scars (sclae—better known as plaques or lesions) that develop on the white matter of the brain and spinal cord.
A number of new treatments and diagnostic methods are under development.

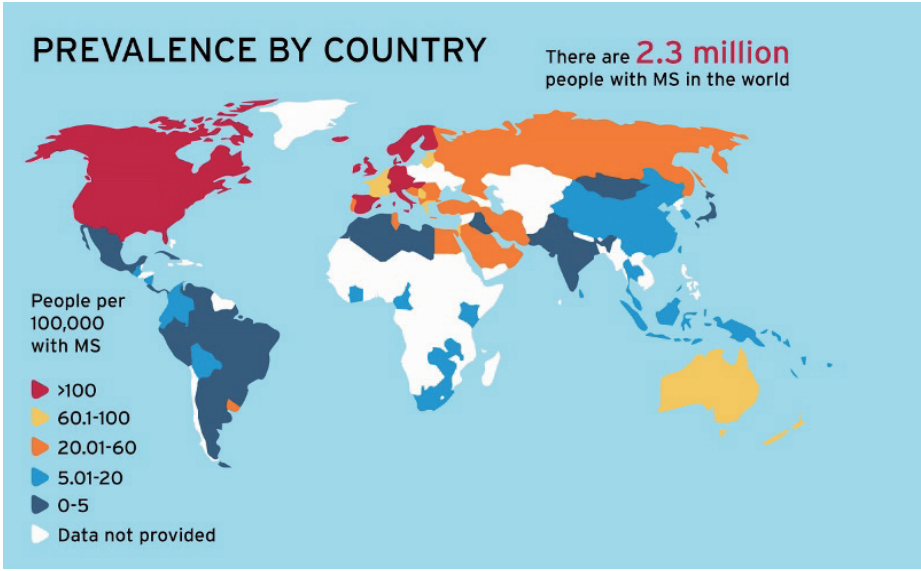


Fig. 1.2.3-Politecnico University design workshop logo

Types of MS

There are four types of MS:

- Clinically isolated syndrome (CIS): This is a single, first episode, with symptoms lasting at least 24 hours.
- Relapse-remitting MS (RRMS): This is the most common form, affecting around 85 percent of people with MS and involving attacks of new or increasing symptoms.
- Primary progressive MS (PPMS): Symptoms worsen progressively, without early relapses or remissions. Around 15 percent of cases are PPMS.
- Secondary progressive MS (SPMS): After initial episodes or relapse and remission, the disease progresses steadily.

Symptoms of MS

MS affects the central nervous system（CNS）, which controls all the actions in the body. When nerve fibers that carry messages to and from the brain are damaged, symptoms may occur in any part of the body.
For some patients, symptoms are so mild that they do not notice anything until later in the course of the disease. Others may be aware of their symptoms in the early stages.

The overall symptoms of MS are:

muscle weakness
visual disturbances
difficulties with co-ordination and balance
numbness and tingling, as in "pins-and-needles"
problems with thinking and memory

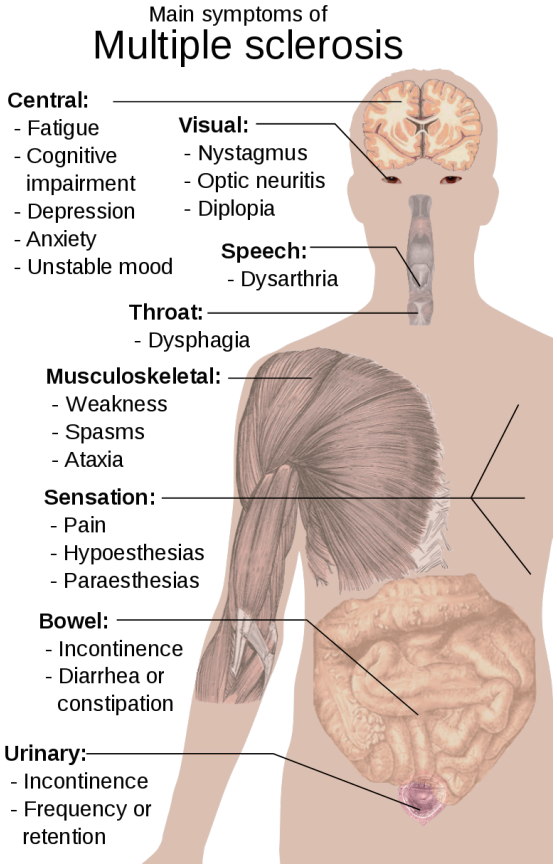


Fig. 1.2.4-Main symptoms of MS

Effects of MS

These can lead to:
Bladder problems: There may be difficulty emptying the bladder completely, frequent urination, and urge incontinence.
Bowel problems: Constipation can lead to fecal impaction, and this can lead to bowel incontinence.
Fatigue: This affects up to 90 percent of patients, and it can undermine their ability to function at work or at home.
Dizziness and vertigo: These are common problems, along with difficulties with balance.
Sexual dysfunction: A loss of interest in sex is common in both males and females.
Spasticity and muscle spasms: Damaged nerve fibers in the spinal cord and brain can cause painful muscle spasms. Muscles might get stiff and be resistant to movement, known as spasticity.
Tremor: There may be involuntary quivering movements.
Vision problems: There may be double vision or blurring vision, a partial or total loss of vision, or red-green color distortion. This usually affects one eye at a time. Inflammation of the optic nerve can result in pain when the eye moves.
Gait and mobility changes: MS can change the way people walk, because of muscle weakness and problems with balance, dizziness, and fatigue.
Emotional changes and depression: Demyelination and nerve-fiber damage in the brain can trigger emotional changes, apart from the challenges of adjusting to the diagnosis of MS, an unpredictable, disabling disorder. Research has linked MS with a 50 percent chance of depression.

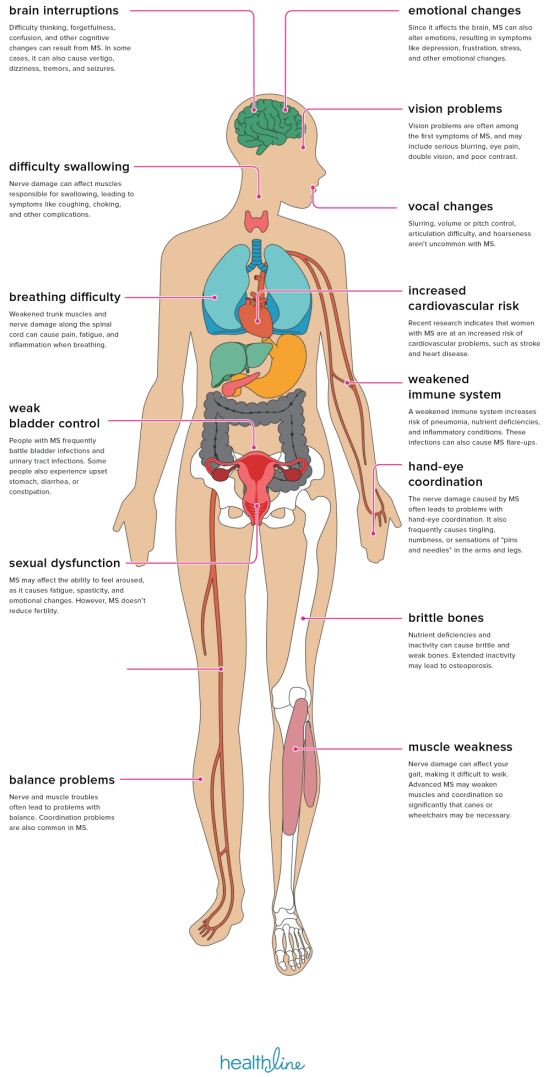


Fig. 1.2.5-Effects of MS

Causes and risk factors

The exact cause of MS is unknown, but it is thought to be an autoimmune disorder. This means that the immune system attacks the myelin as if it were an undesirable foreign body, just as it might attack a virus or bacteria.

Risk factors include:

Age: A diagnosis is more likely between the ages of 20 and 50 years
Sex: More women develop MS than men
Ethnicity: It is more common among people of European descent
Genetic factors: Susceptibility can be passed down in the genes

Fig. 1.2.6-Image thinking of Cause of MS

Treatment

There is no cure for MS, so treatment focuses on suppressing the autoimmune response and managing symptoms.

Medications

Rehabilitation

Rehabilitation aims to help patients improve or maintain their ability to perform effectively at home and at work.

Programs generally include:

Physical therapy: This aims to provide people with the skills to maintain and restore maximum movement and functional ability.
Occupational therapy: The therapeutic use of work, self-care, and play activities to increase development and prevent disability.
Speech and swallowing therapy: A speech and language therapist will carry out special training.
Cognitive rehabilitation: This helps people manage specific problems in thinking and perception.
Vocational rehabilitation: This helps people with disabilities make career plans, learn job skills, get and keep a job.

Fig. 1.2.7-Mediation threapy

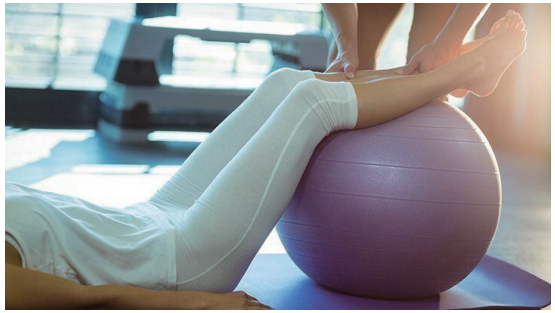


Fig. 1.2.8-Physical threapy

The Italian Multiple Sclerosis Society

The Italian Multiple Sclerosis Society (AISM) is the only organization in Italy that addresses every aspect of multiple sclerosis (MS), through advocating for the rights of people with MS and providing services and through orienting, promoting, and financing scientific research.

MS is among the most common major diseases of the central nervous system. It is chronic, unpredictable, progressive and can lead to serious disability. MS is diagnosed in young adulthood, typically between 20 and 40 years of age and women are diagnosed nearly three times as often as men. The type and severity of symptoms as well as the disease course varies from one person to another. In Italy there is a person diagnosed with MS every 3 hours.
AISM was founded in 1968 with the objective of advocating for the rights of people with MS, and over time has become the principle resource not only for people with MS, but for families, healthcare professionals and anyone involved in the fight against this disease.

Today we celebrate an important milestone of 50 years of commitment to people with MS. The path to which AISM has been committed over the last 5 decades has required planning, participation, passion and diligence, with a shared vision consistently focused on bringing tangent results to the MS community.

Fig.1.2.9-The celebrations of the 50th anniversary of the activities of AISM

SCLEROSI MULTIPLA ONLUS
associazione italiana
un mondo libero dalla SM

Fig. 1.2.10 -AISM Logo

AISM center in TORINO(AISM)

Fig. 1.2.11 -Turin

The Turin Day Center is a social rehabilitation facility designed to accommodate adult citizens with Multiple Sclerosis or similar neurological disorders, in situations of severe, medium and mild disability. He is part of the Network of Social Health Day Services of the Municipality of Turin.

The day service provides hospitality, assistance and services for daily activities; offers opportunities for community life, stimuli and possibilities for occupational and recreational / cultural activities, maintenance and social / rehabilitation activities.

02.
THE BEGINNING OF THE PROJECT

2.1 A story
2.2 Introduction of the Foosball
2.3 5W2H Analysis
2.4 The sprout of my project
2.5 Generation of design concept

2.1 A story

Fig. 2.1.1-Rudy with Foosball

There is one person in AISM in Torino,his name is Rudy. Unfortunately, he got MS.He just move with wheelchair,he can't easily to control his body,even his arms and hands.But he is optimistic and tough,he still love his life.In AISM,there is a most popular activity that is foosball.Rudy also love playing this game,he want to play well and enjoy in the game.But he can't play like normal people,he meet some problems,the next I will help him to play better than now.

2.2 Introducion of the Foosball

The origins of foosball

The origins of foosball are a bit murky.
Some sources believe that it started as a parlor game in the 1880s or 1890s, possibly in different parts of Europe simultaneously. Nobody is sure who invented it. Frenchman Lucien Rosengart, an automobile engineer for Citroen, claimed to have come up with the game to keep his grandchildren entertained in the winter. But Alexandre de Fiesterra also said he had the idea while in the hospital recovering from injuries sustained in the Spanish Civil War. The only thing we can say for sure is that Englishman Harold Searles Thornton has the earliest-known patent from 1923, which looks and operates just like the game we know today.

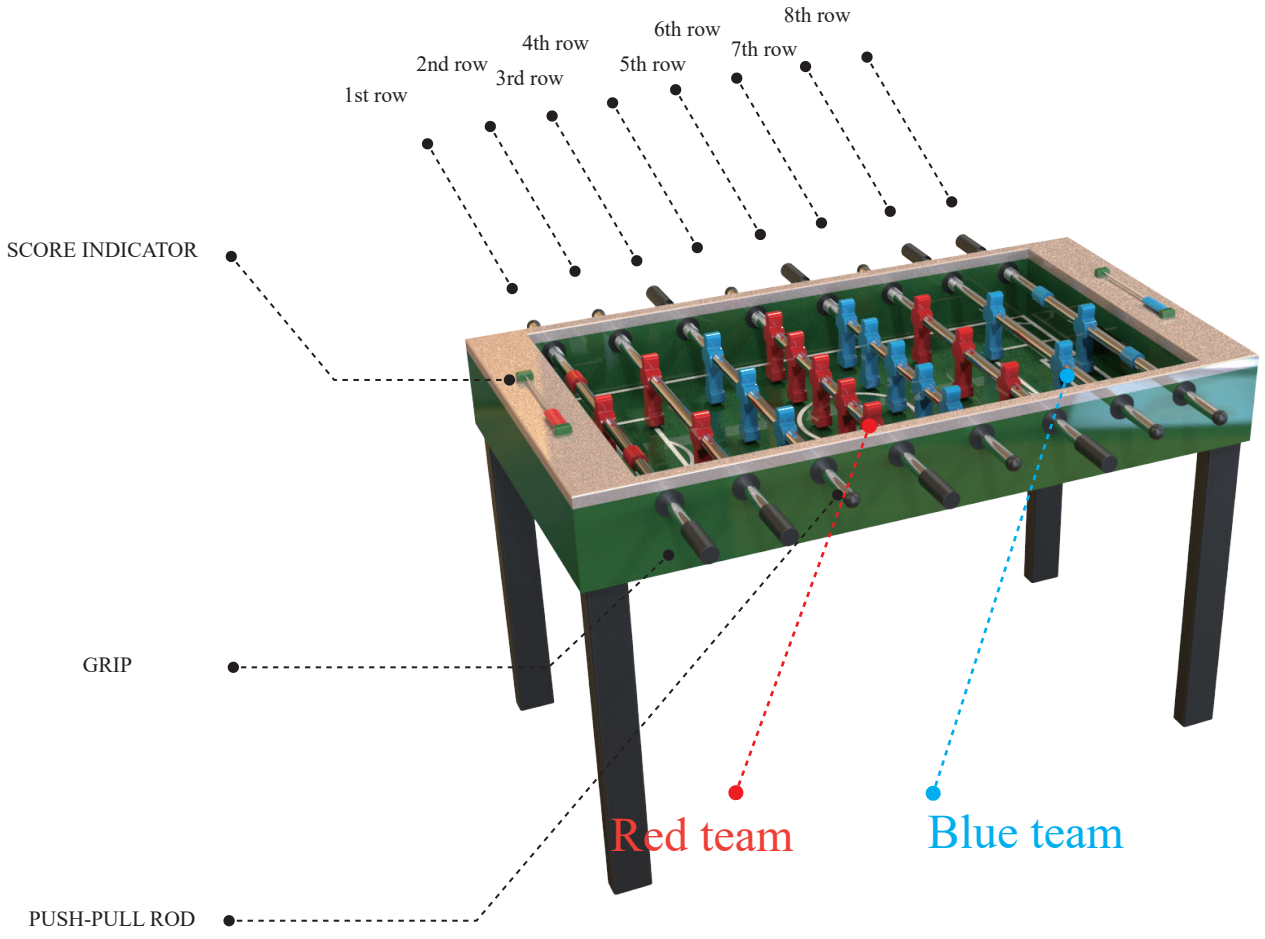
What Is It?

If you're fairly new to being a fooser, there is a good chance that you've either seen one of the tables or watched some people at play. The object of the games is to score the most goals against your opponent, which you do by maneuvering a small ball across the table's surface with the help of little men that are attached to the playing rods. There are eight rods in total in the table, with each team having control of four of the rods. It's easy to know which ones are yours to control as they have handles or grips on them. All you do is flick your wrists to control and rods and do your best to move the ball into a position to score against the opposing team. While that is a simplified version of the game, it gives you a brief overview of the basics.

Fig. 2.2.1-Foosball in early

Fig. 2.2.2-Foosball in some place

Football table guide

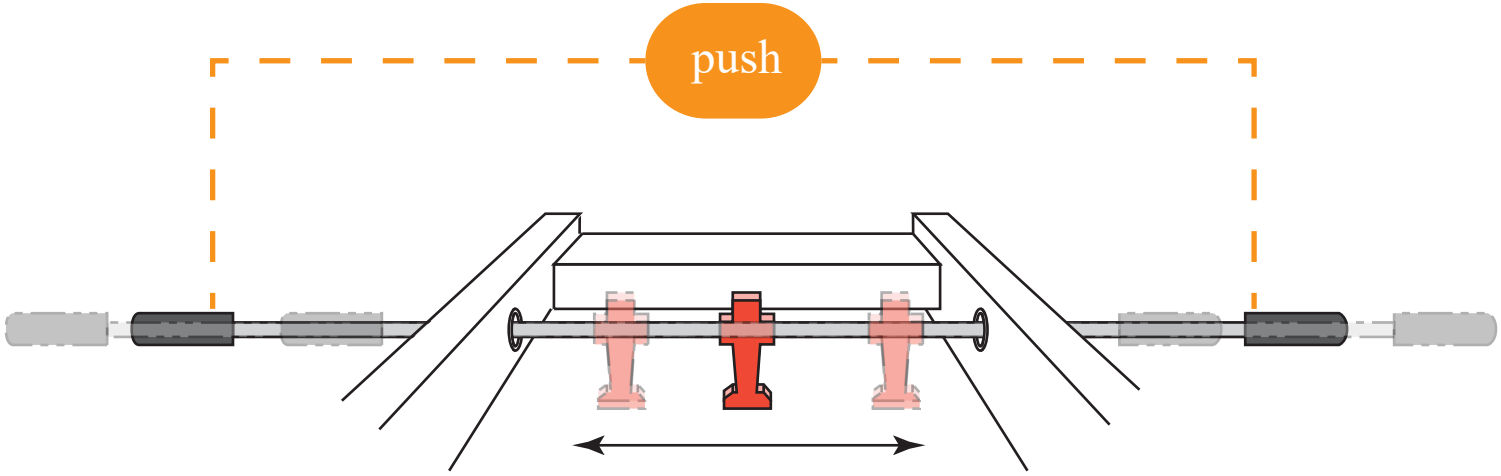


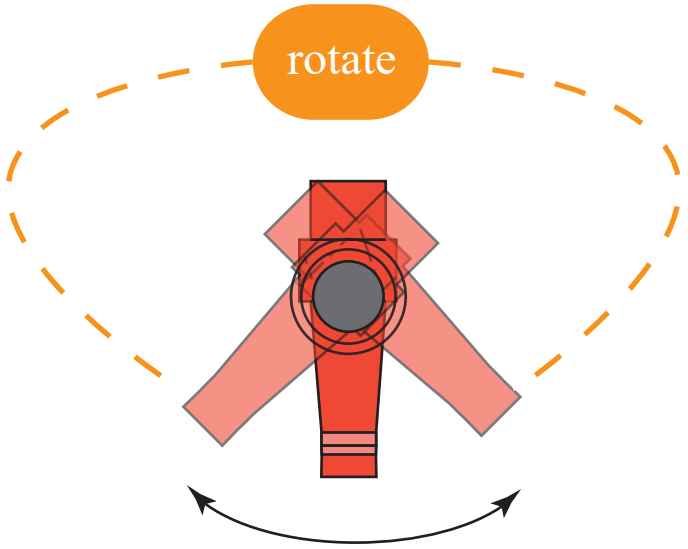
Row 1	**Goalkeeper**	1 foosman (sometimes 2 or 3)
Row 2	**Defence**	2 foosmen (*sometimes 3*)
Row 3	Opponent's attack	3 foosmen (*sometimes 2*)
Row 4	**Midfield**	5 foosmen (*sometimes 4 or 6*)
Row 5	Opponent's midfield	5 foosmen (*sometimes 4 or 6*)
Row 6	**Attack**	3 foosmen (*sometimes 2*)
Row 7	Opponent's defence	2 foosmen (*sometimes 3*)
Row 8	Opponent's goalkeeper	1 foosman (sometimes 2 or 3)

Fig. 2.2.3-Introduction of the row

Table football can be played by two individuals (singles) – and also with four people (doubles), in which there are teams of two people on either side. In this scenario, one player usually controls the two defensive rows and the other team member uses the midfield and attack rows. In informal matches, three or four players per side are also common.

How to play the football table





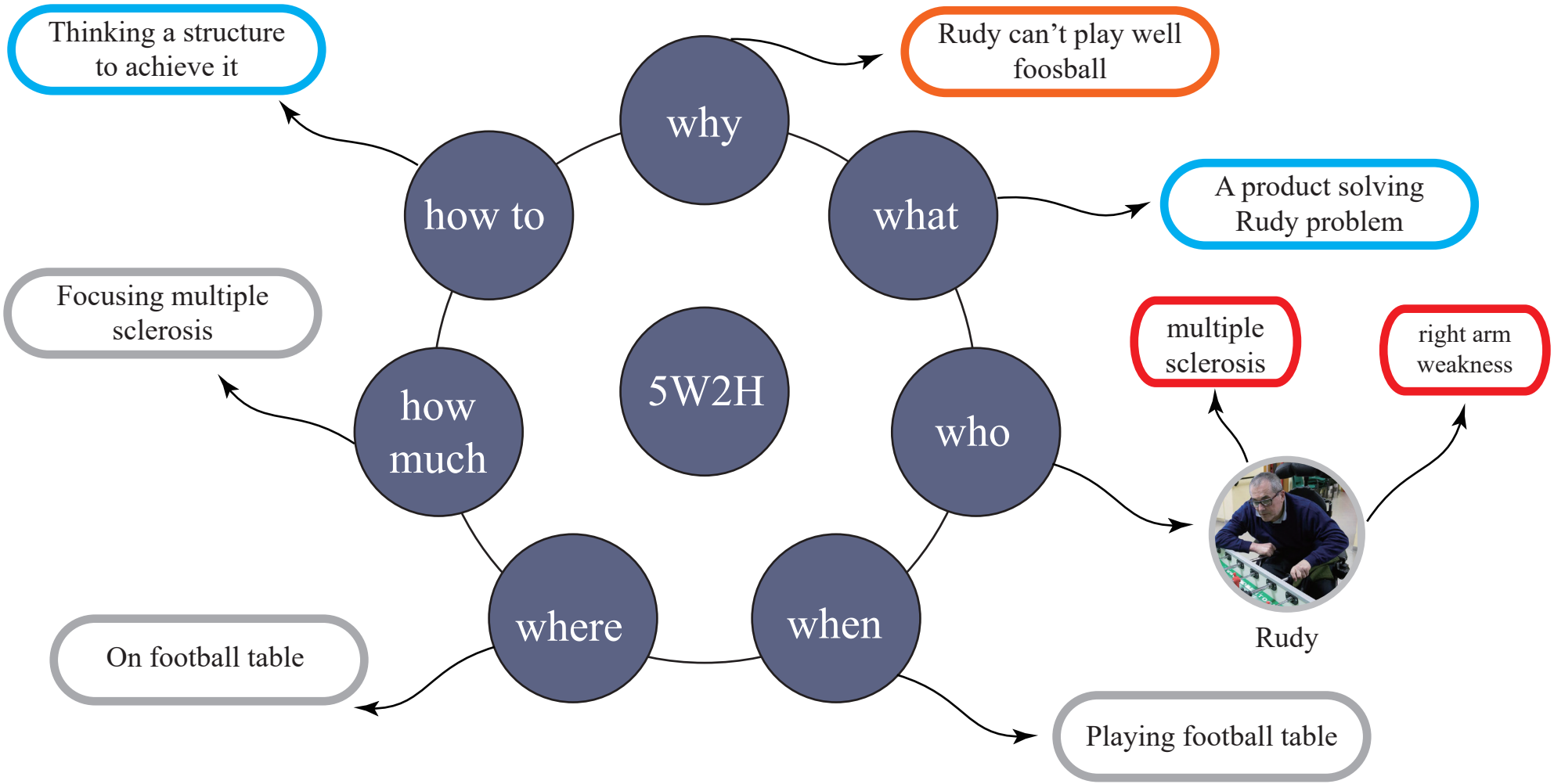
Use Tips for normal

if you want to play the-football table, obvious-ly,you just need to push and rotate the handle,then you can enjoy the game

Rudy’ s problem

There is a one problem for Rudy, he can’t use the right arm to control the handle, so I need to think a way to solve it.

2.3 5W2H Analysis



2.4 The sprout of my project

Rudy's problem

When he plays the foosball table, you can see that he needs the right arm to lean on the table, and then the left arm to control one of the grips. If a ball comes to the lever that right arm control at this time, he can't use his right hand to control the grip.His right hand can't rotate the lever.

Right arm

- Hard push and pull
- Can't rotate

The sprout of my project

1.Mechanical arm

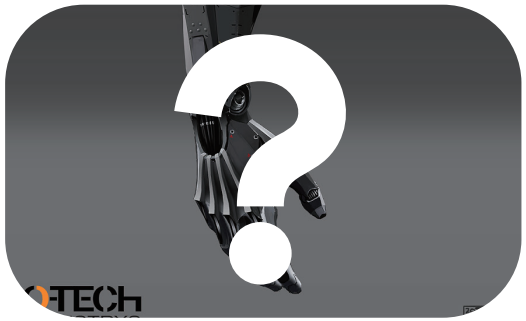
2.A product that help Rudy to rotate with right arm

3.A product that make Rudy use one arm to control two rows

2.5 Generation of the design concept

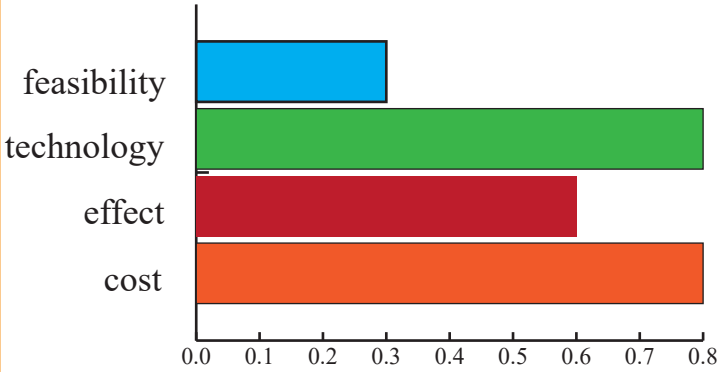
Compared with design concept

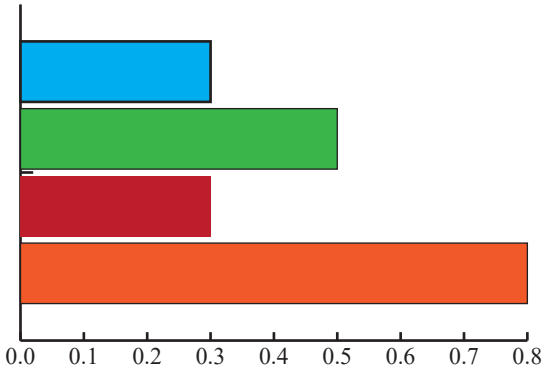
1.Mechanical arm

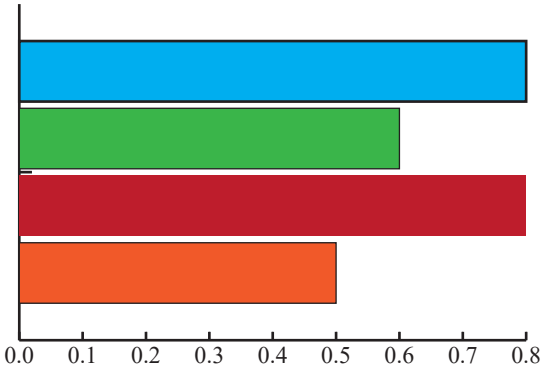


2.A product that help Rudy to rotate with right arm

3.A product that make Rudy use one arm to control two rows

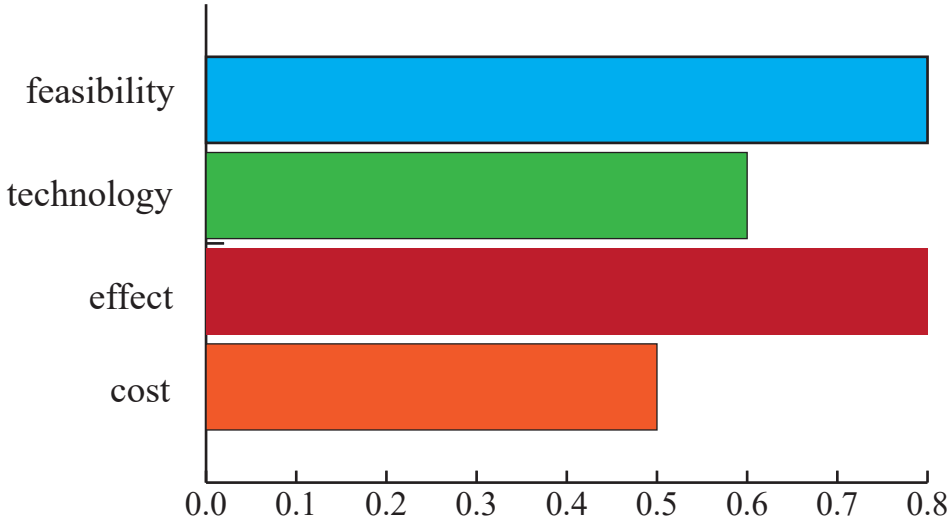






The choice of design concept

A better way to design



3.A product that make Rudy use one arm to control two rows

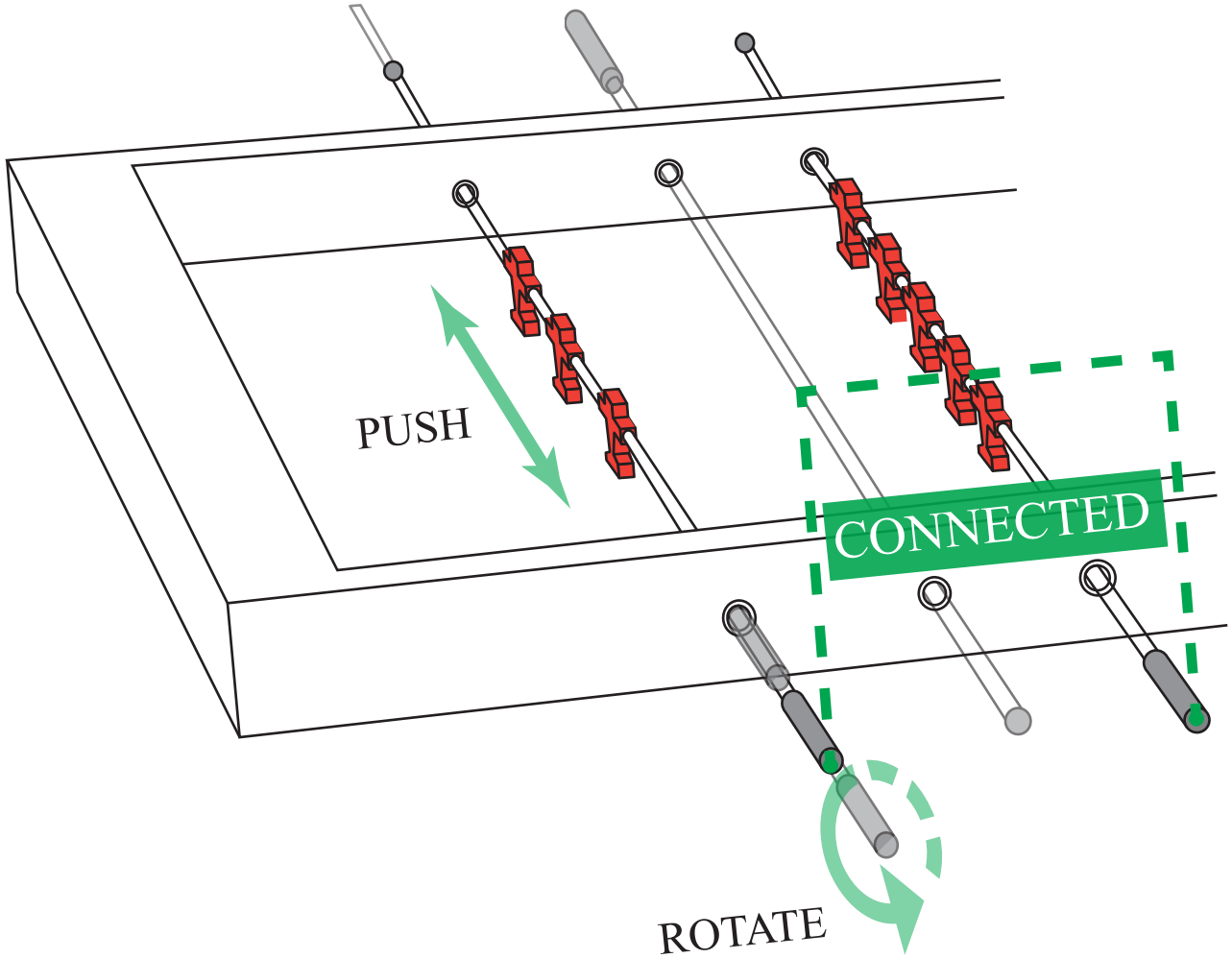
By comparing, it is esay to find the 3rd way is better than the other way. There are higher fesibility ,technology,efeeect and lower cost. So it is a best choice to start analyzing

03.
THE RUDIMENT OF THE PRODUCT

3.1 A new structure
3.2 The first generation model
3.3 The second generation model
3.4 Problem summarizing and solve way

3.1 A new structure

How to control two handles with one hand



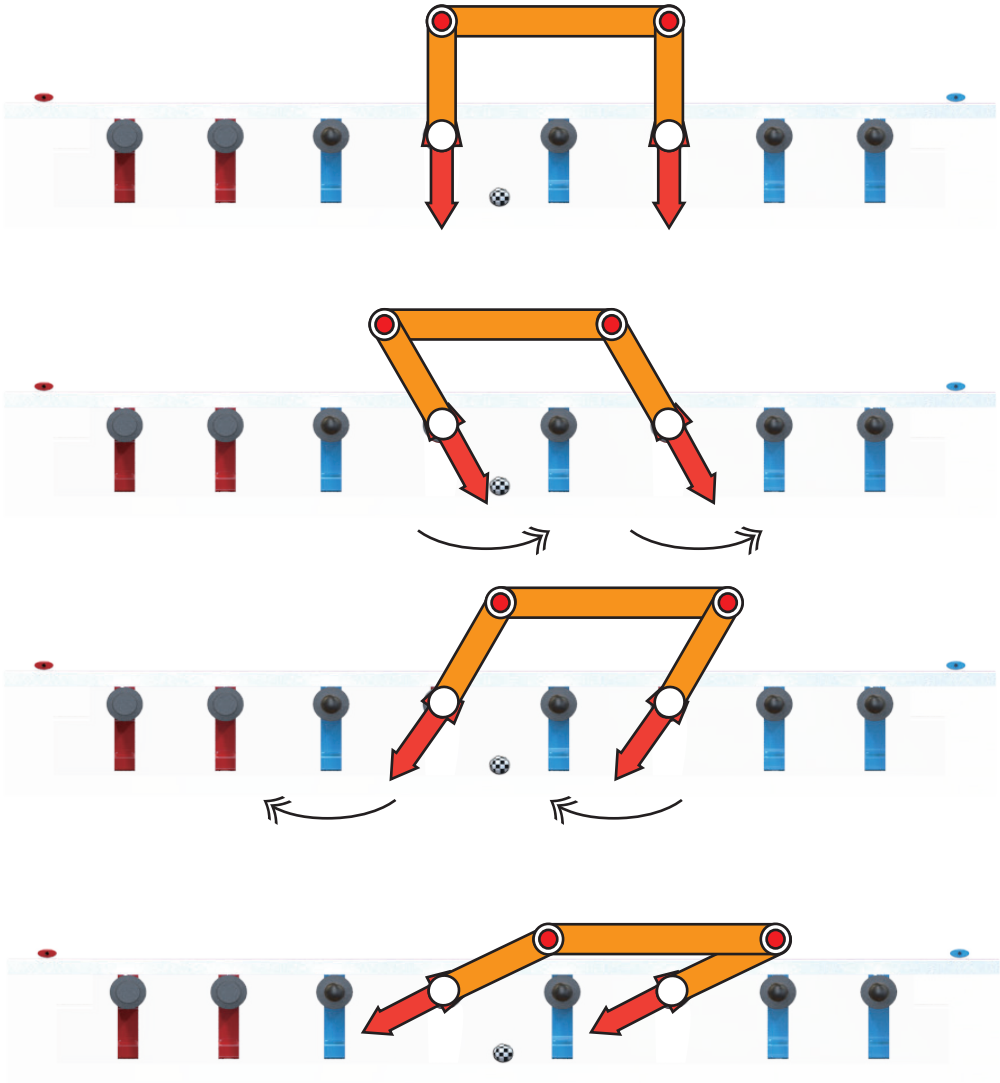
Analysis

According to the schematic diagram,we need a stucture to conncect two handles, to lock the handles, and push the rod

Struction function

- conncect two handles
- lock the handles
- push the rod

A original structure connecting two handles

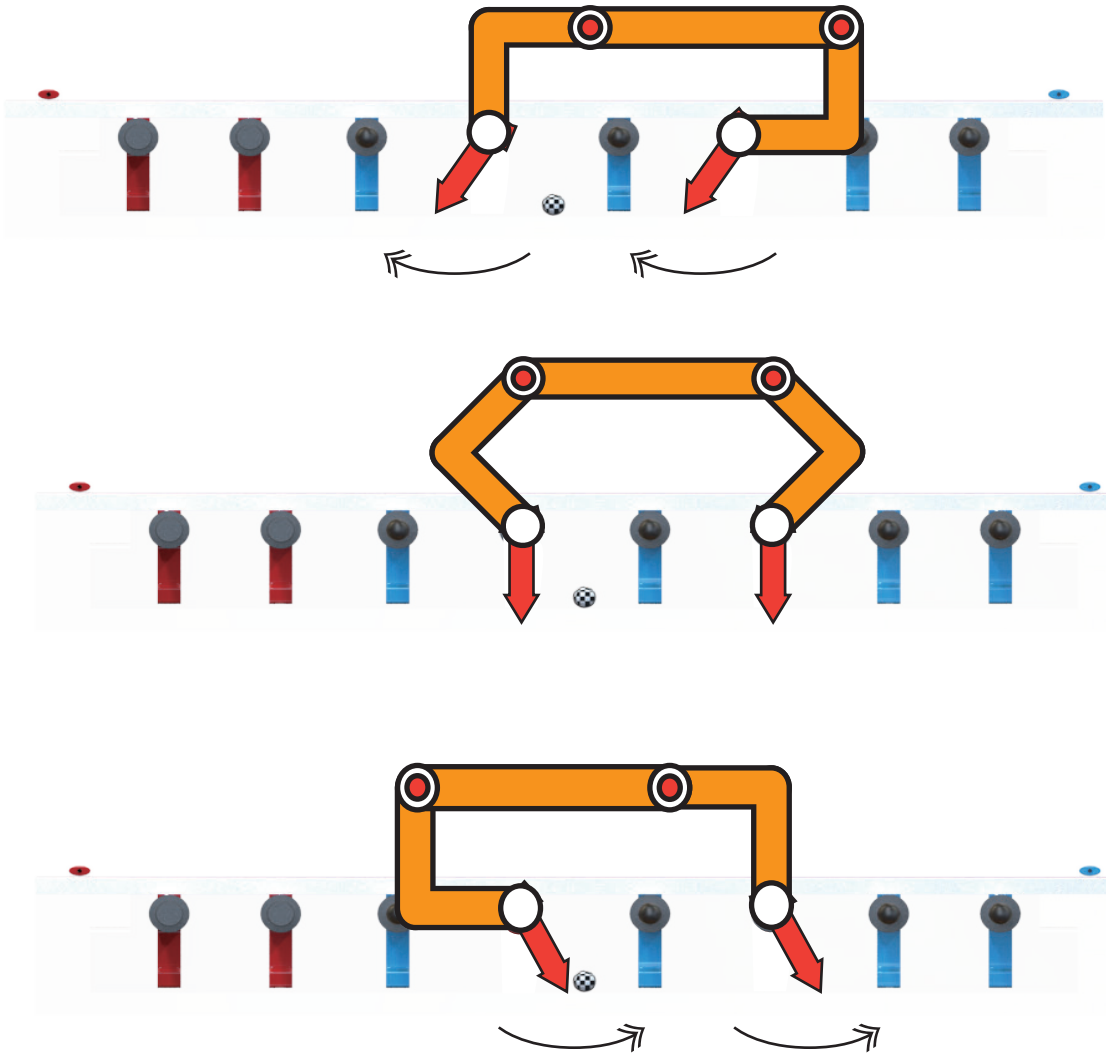


Structure Components

SWOT Analysis

Strengths	easy rotate easy structure easy operate
Weaknesses	unduly rotate
Opportunities	flexibly rotate
Threats	too much rotation angle uncontrollable rotate

A new structure connecting two handles



Structure Components

SWOT Analysis

Strengths	easy rotate easy structure easy operate
Weaknesses	more material
Opportunities	controllable rotate
Threats	more limit

3.2 The first generation model

Handmade model display

Instruments

pencil

adhesive tape

scissor

ruler

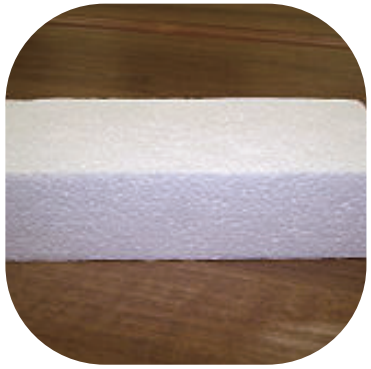
compasses

screw

The ring of iron

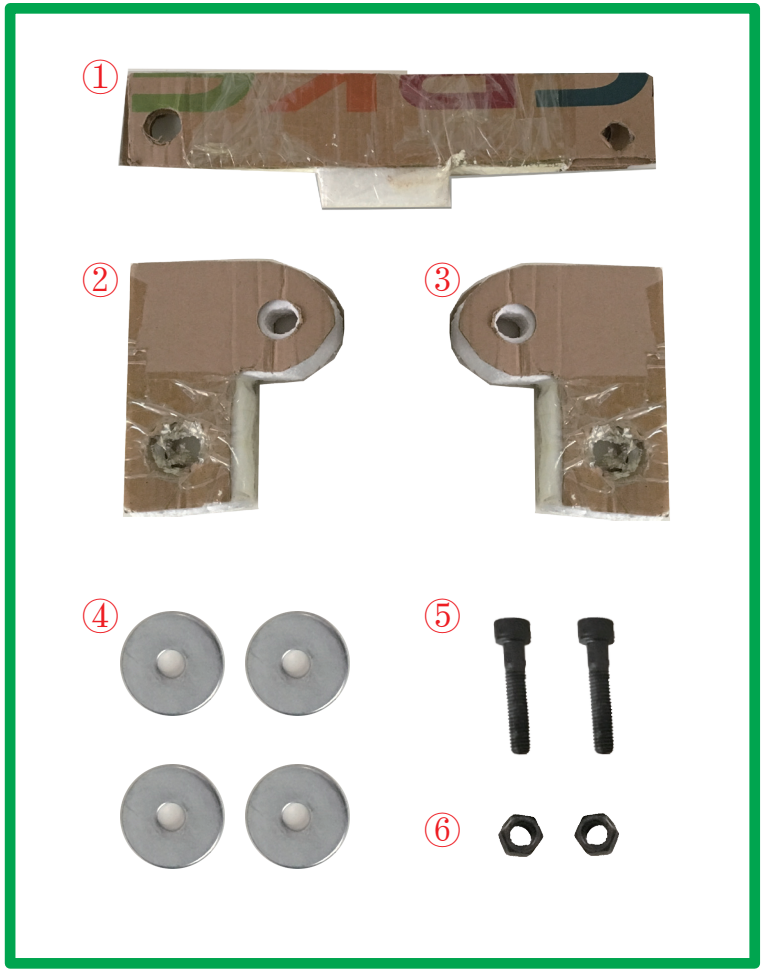
Material

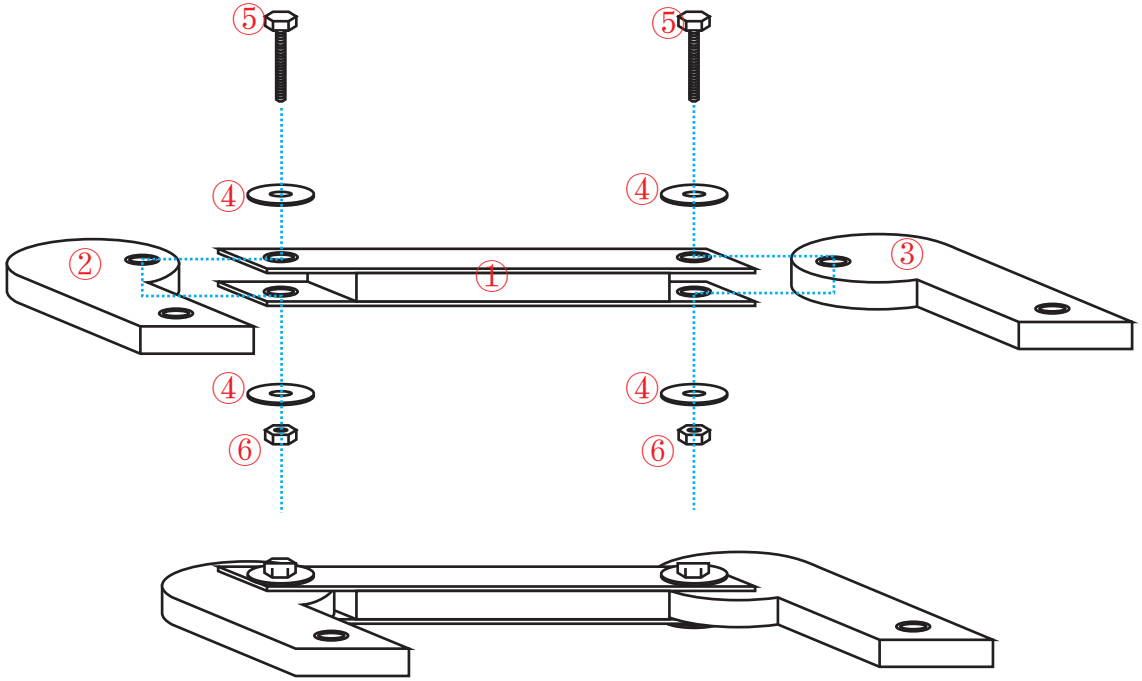
paperboard



plastic foam

Structure Components explanatory drawing

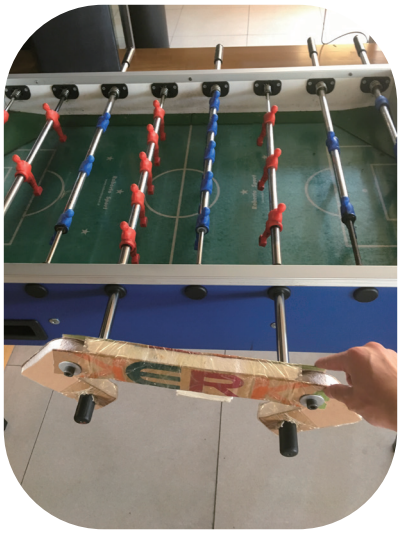




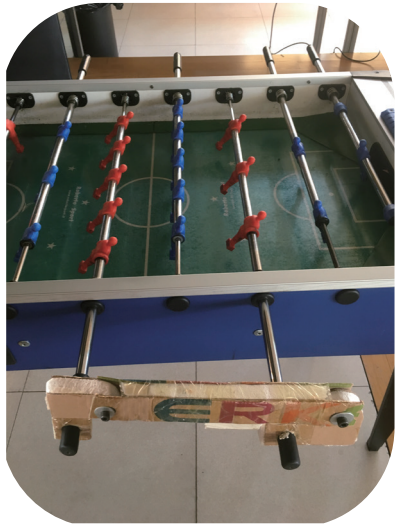
The picture on the left show the various components of the model.According to the tips on the right picture, you can assemble into a complete model.

Model Test and Analysis

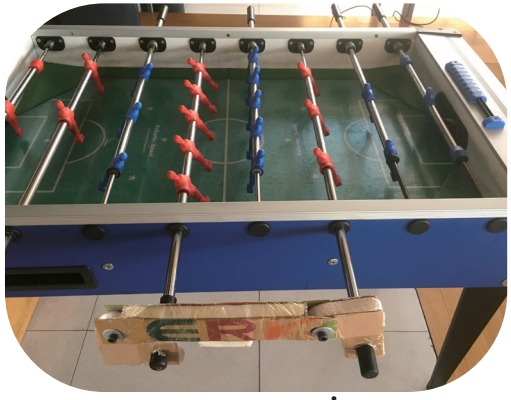
Model test



start position



push postion



rotate postion

rotate postion

Advantage	Weakness
can rotate and push with one hand	hard lock(when I use the model, the row position change)
easy use way (moving front to back and right to left)	weak material (it can't easy to operate the table ,the material is easy to shape change)
	push problem (it can't make the three man row to reach the border)

3.3 The second generation model

Handmade model display

Instruments

pencil

adhesive tape

scissor

ruler

compasses

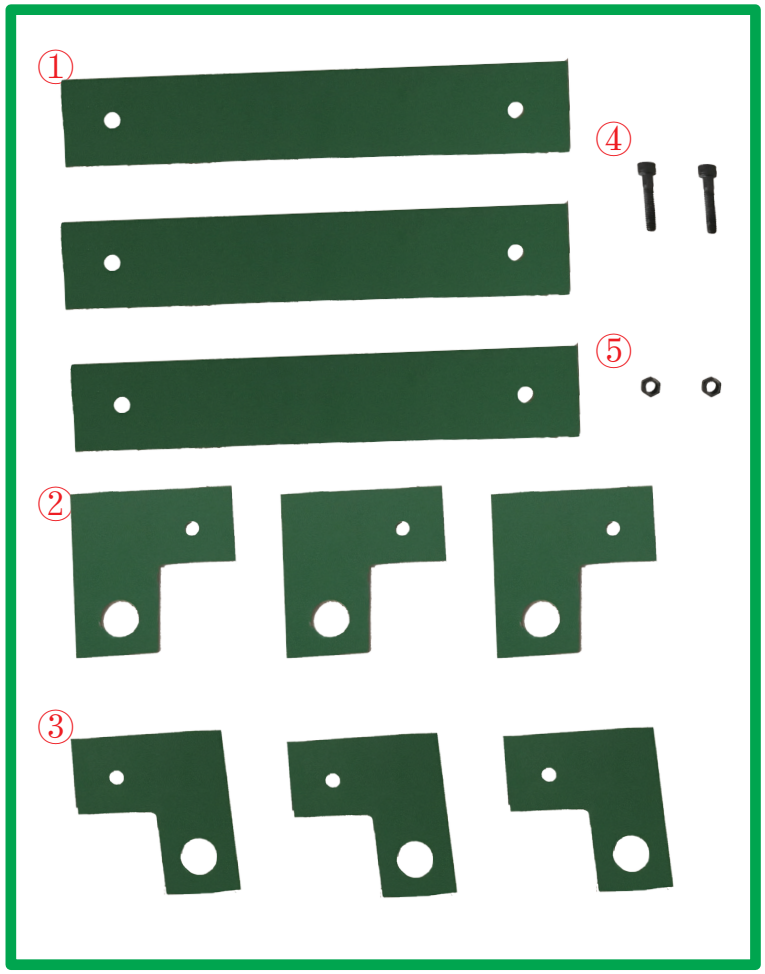
screw

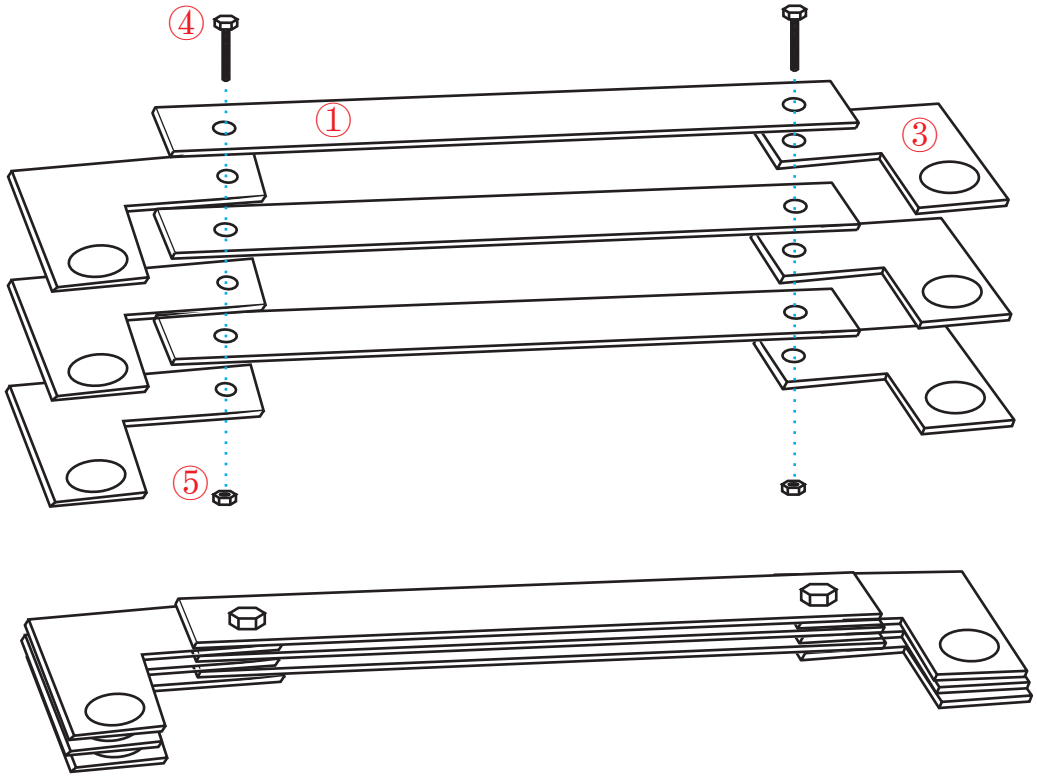
The ring of iron

Material

paperboard

Structure Components explanatory drawing





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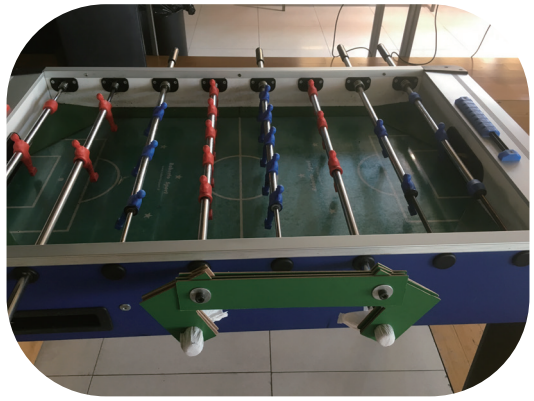
Model Test and Analysis

Model test



start position

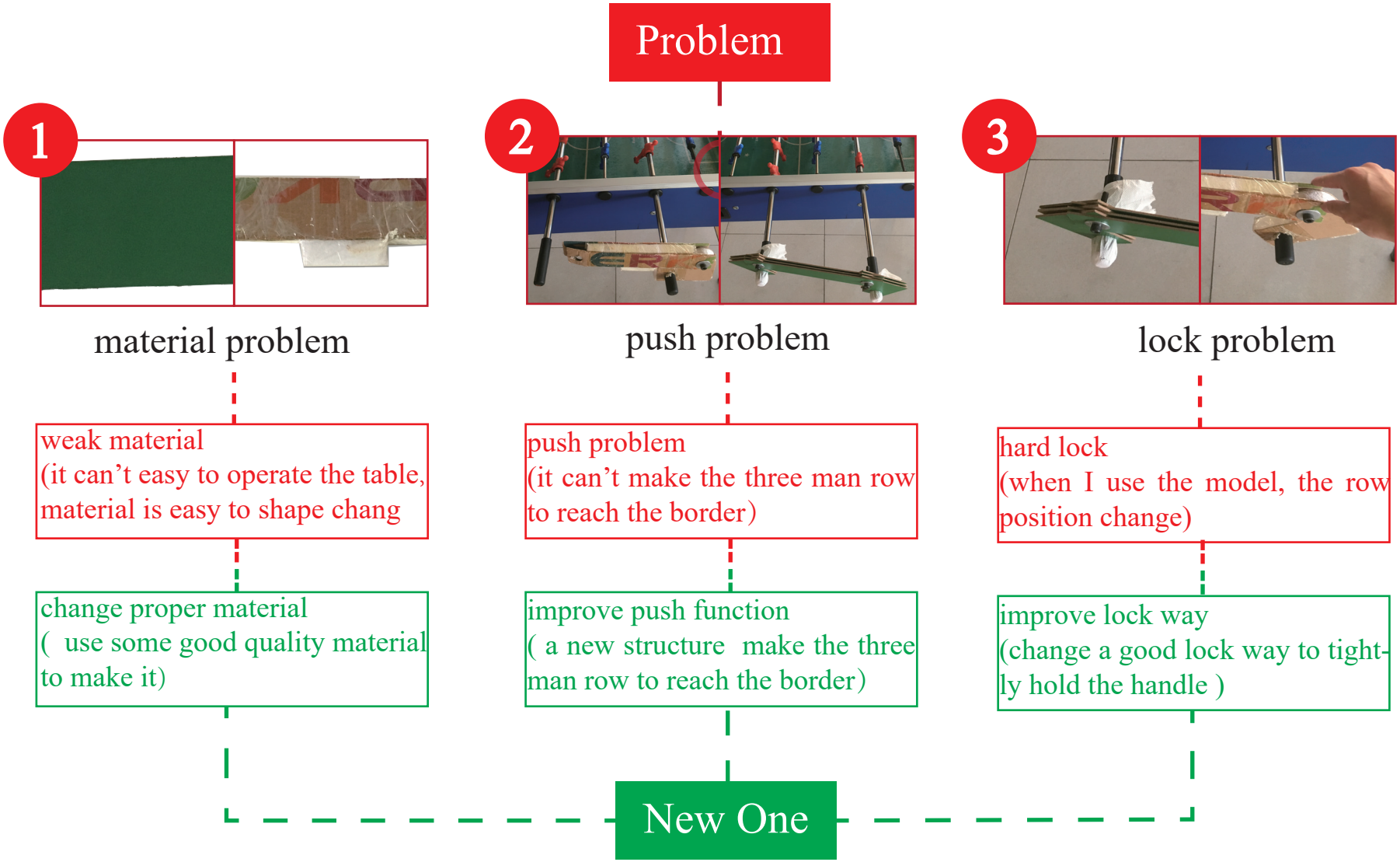
push postion

rotate postion

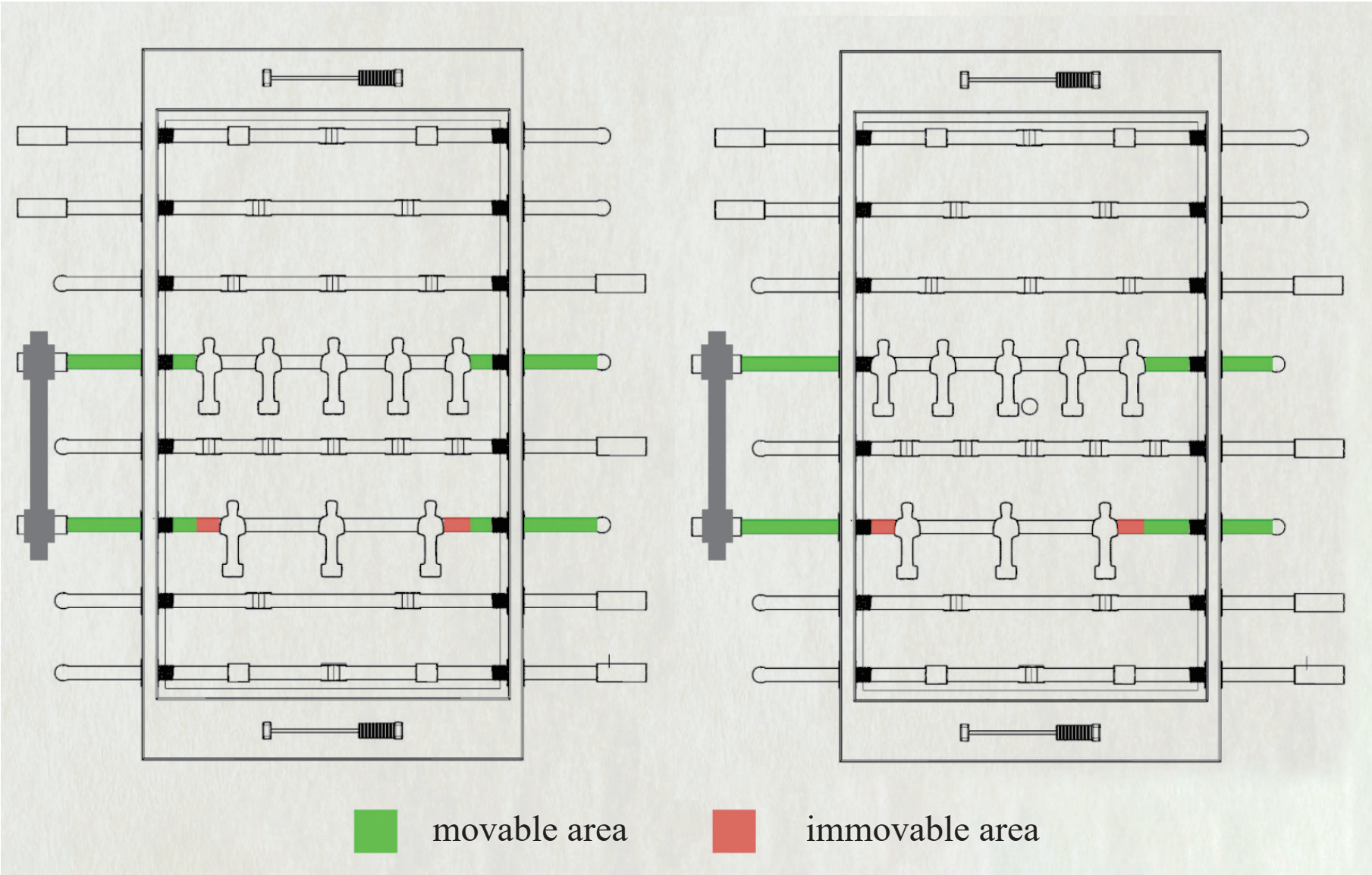
rotate postion

Advantage	Weakness
can rotate and push with one hand	hard lock (when I use the model, the row position change)
easy use way (moving front to back and right to left)	push problem (it can't make the three man row to reach the border)
better material (it didn't hap-paned shape changed than before when you use it)	

3.4 Problem summarizing and solve way



Push problem explanatory drawing

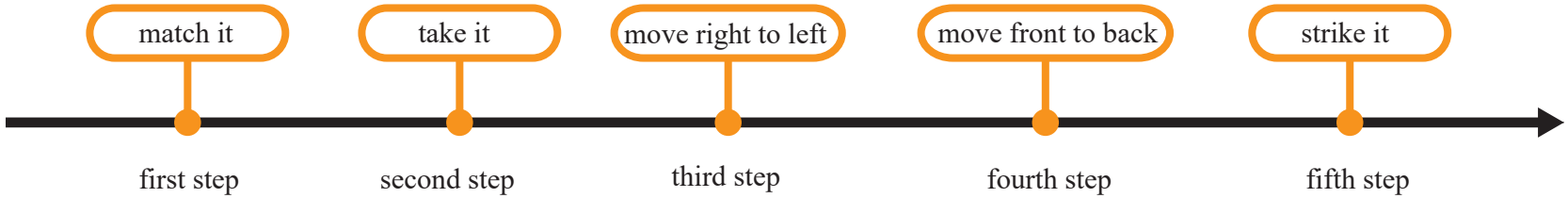


04.
THE EVOLUTION OF THE PRODUCT

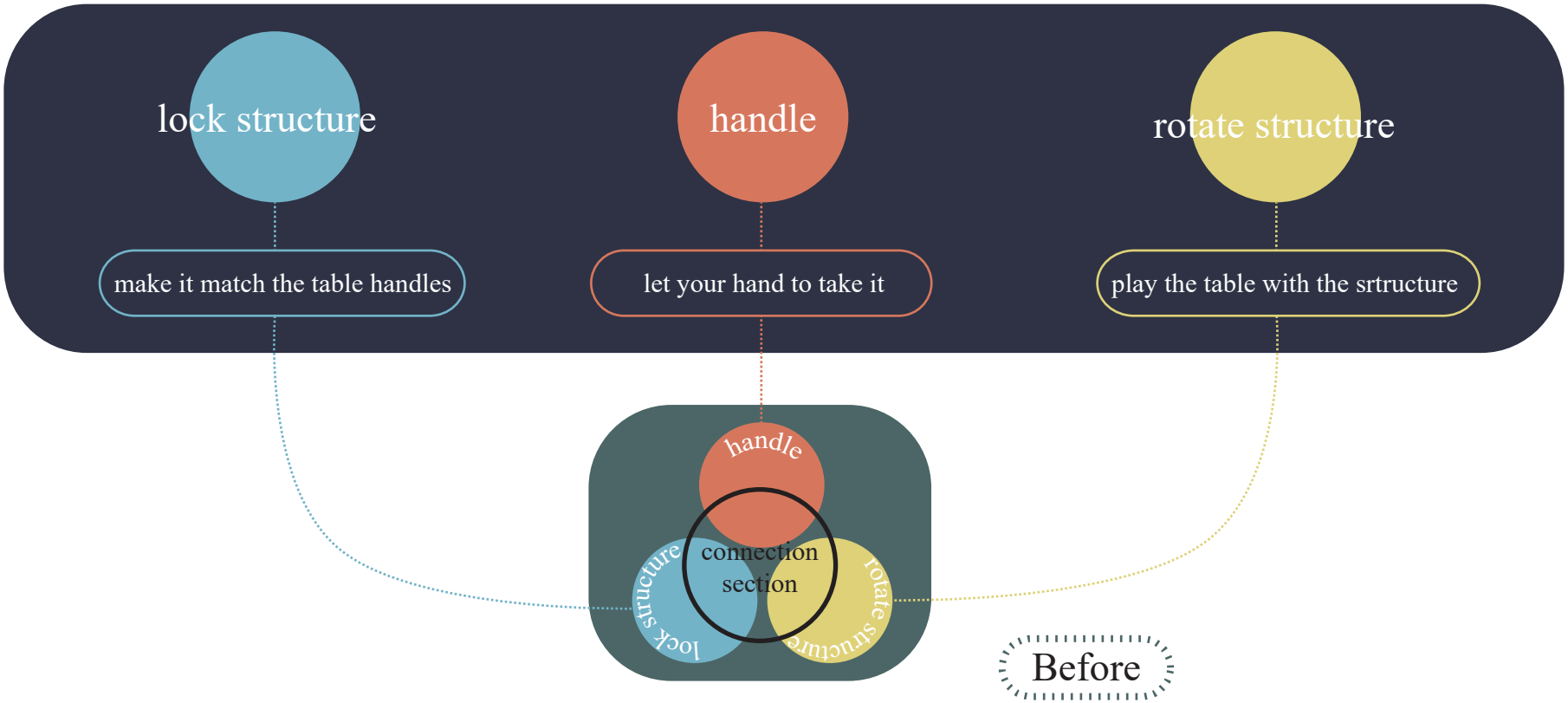
4.1 A new analysis way
4.2 The third genration model
4.3 The fourth generation model
4.4 How does the New Transform work
4.5 The fifth geberation model

4.1 A new analysis way

How does TRANSFORM work

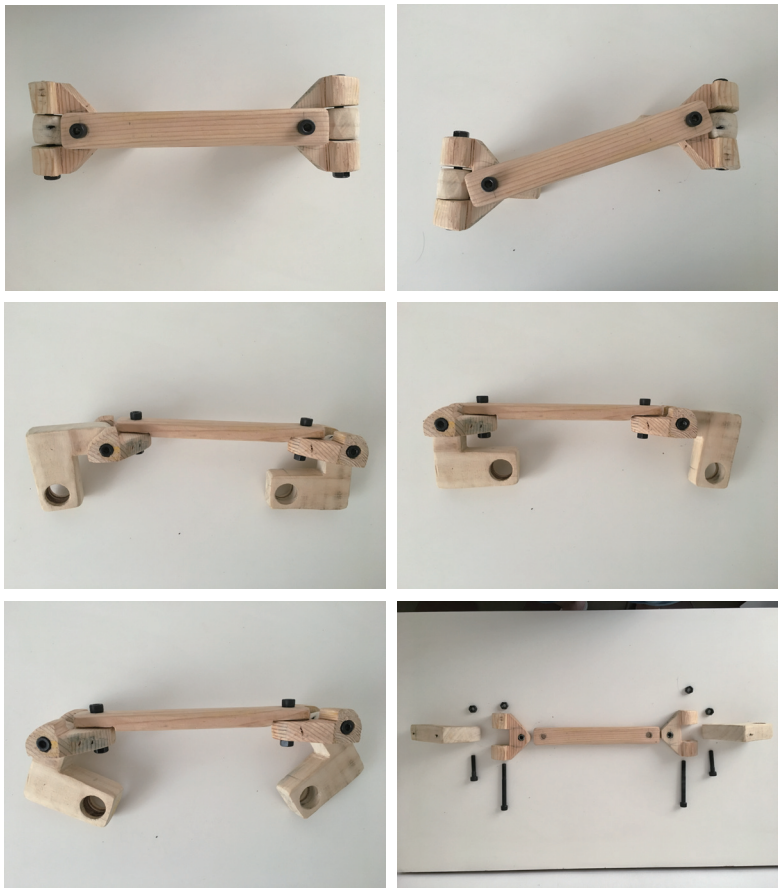


Components and functions



4.2 The third generation model

Handmade model display

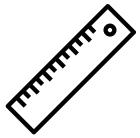


Instruments

pencil

adhesive tape

scissor



ruler

compasses

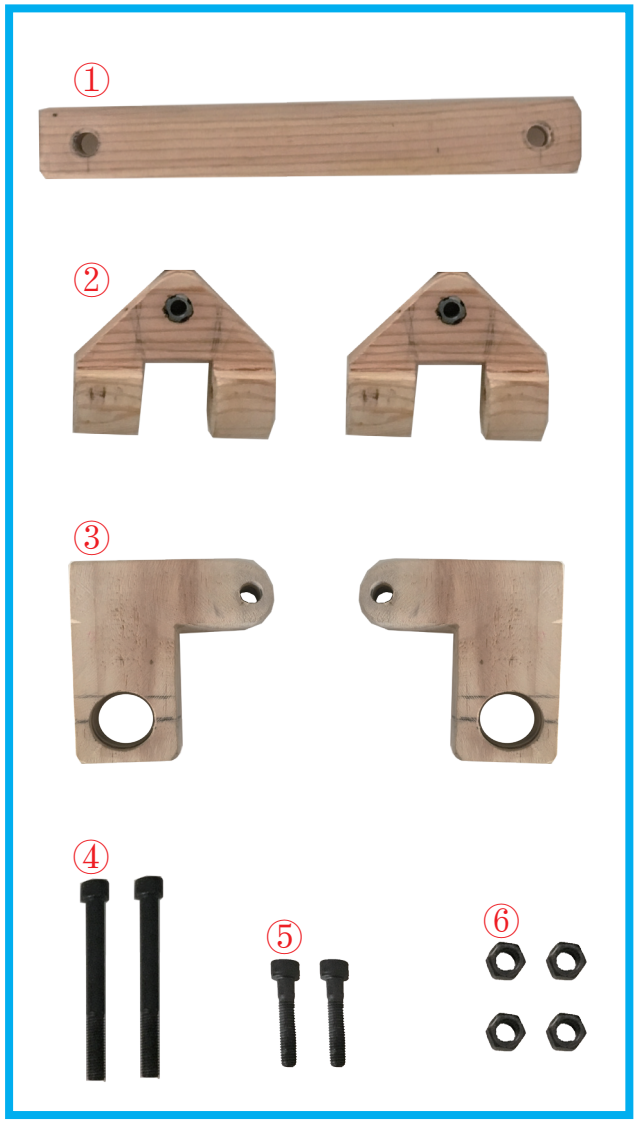
screw

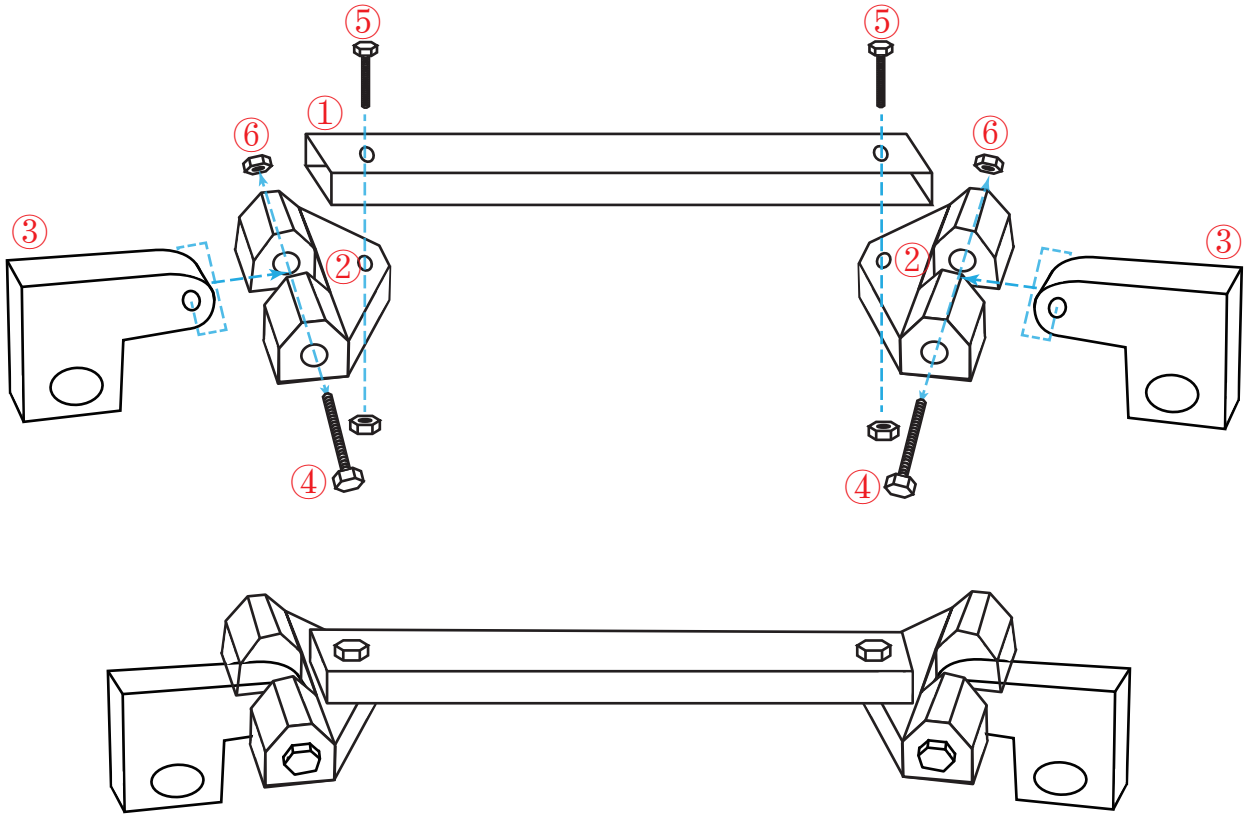
The ring of iron

Material

wood

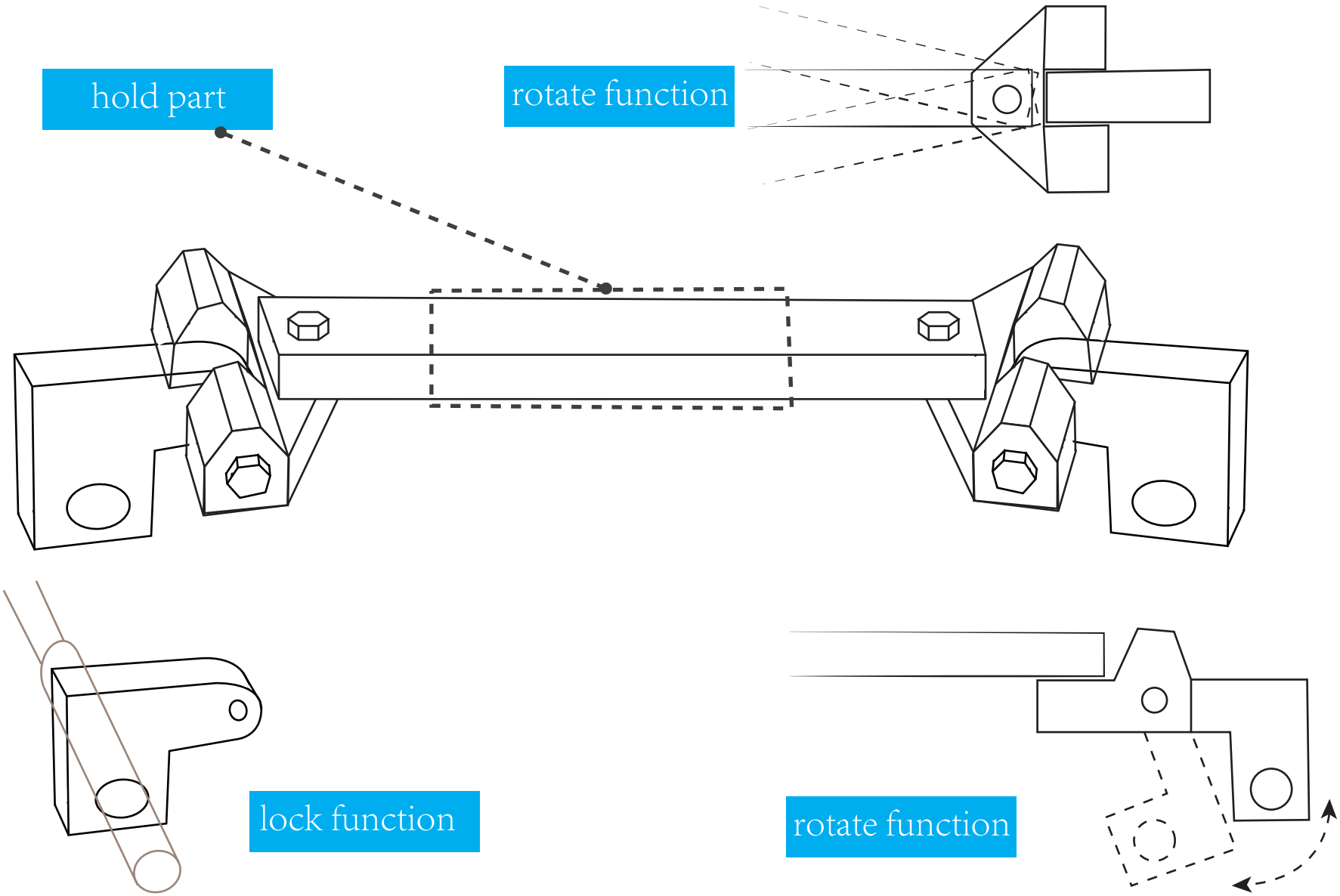
Structure Components explanatory drawing





The picture on the left show the various components of the model.According to the tips on the right picture, you can assemble into a complete model.

Function explanatory drawing



Model Test and Analysis

Model test

start position

push postion

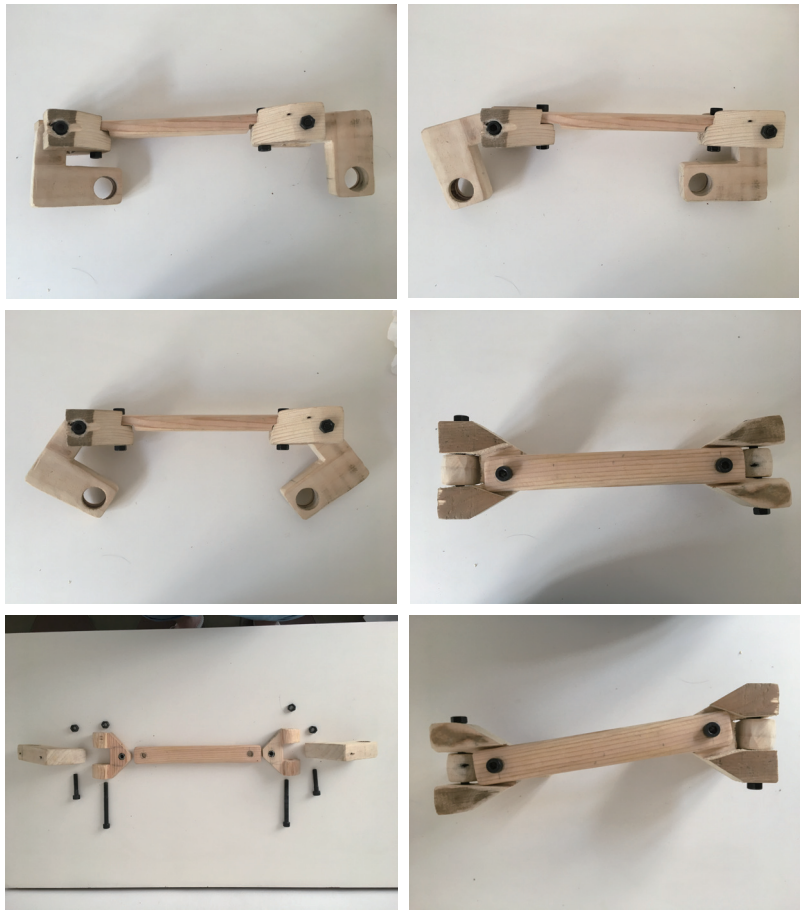
rotate postion

rotate postion

Advantage	Weakness
can rotate and push with one hand	hard lock(when I use the model, the row position change)
easy use way (moving front to back and right to left)	push problem (it push to much to make the model block)
can push two row to reach the border	

4.3 The fourth generation model

Handmade model display



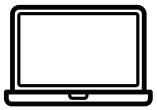
Instruments

pencil

adhesive tape

scissor

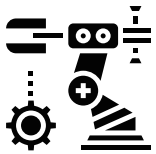
ruler



laptop

screw

The ring of iron

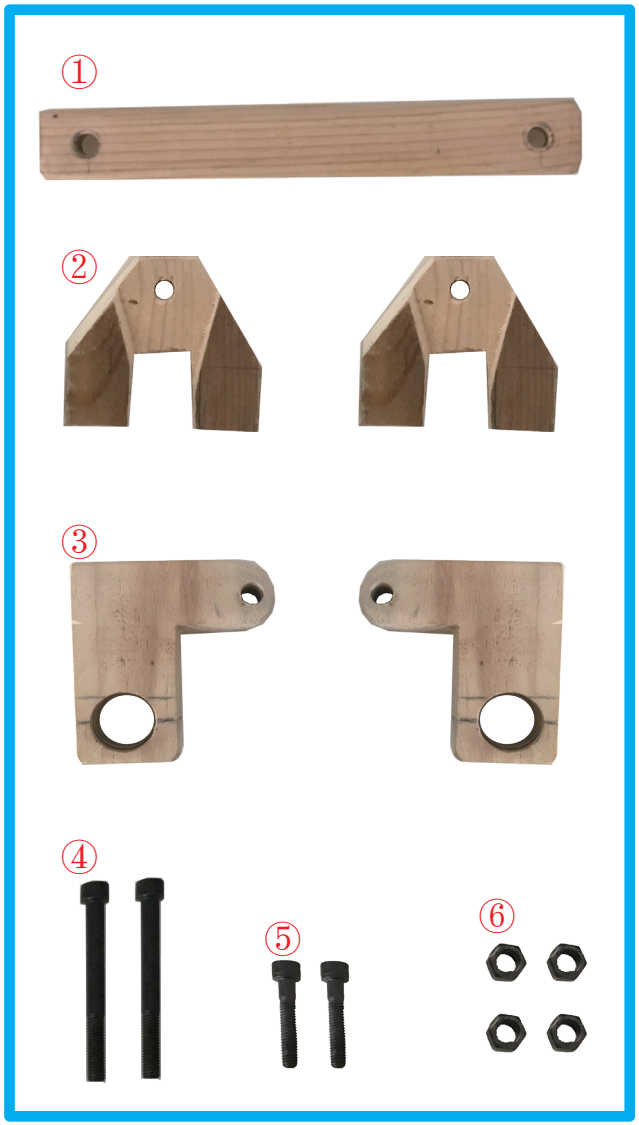


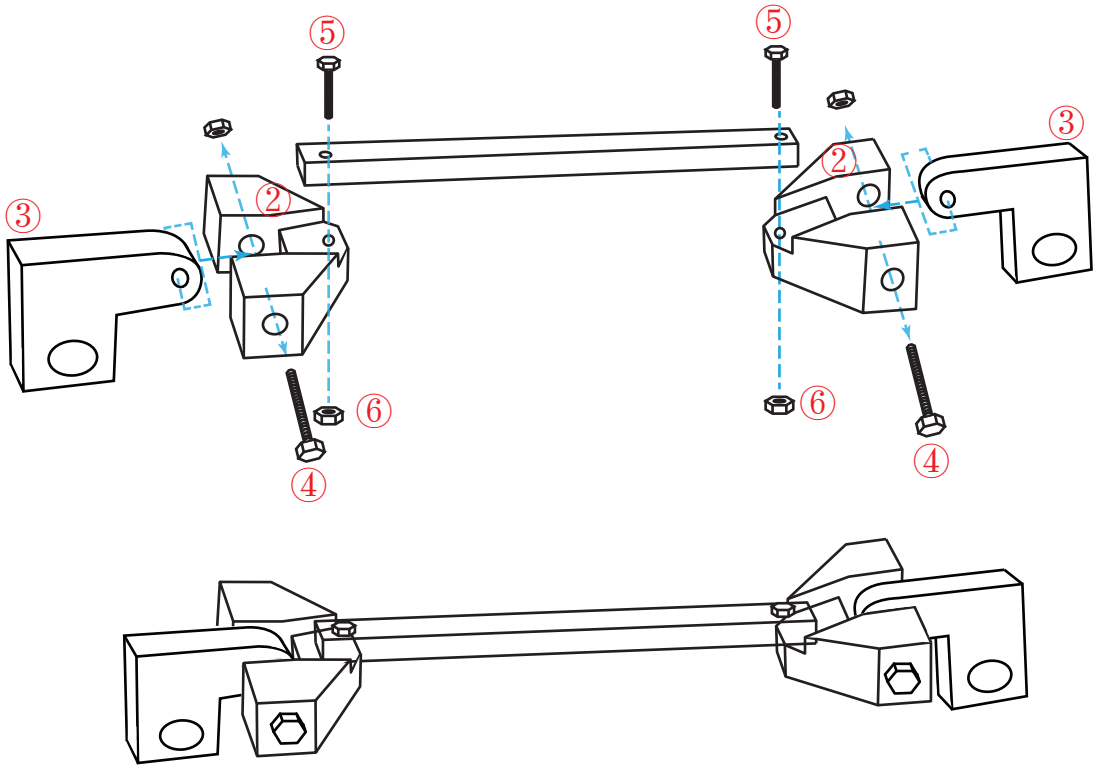
machine

Material

wood

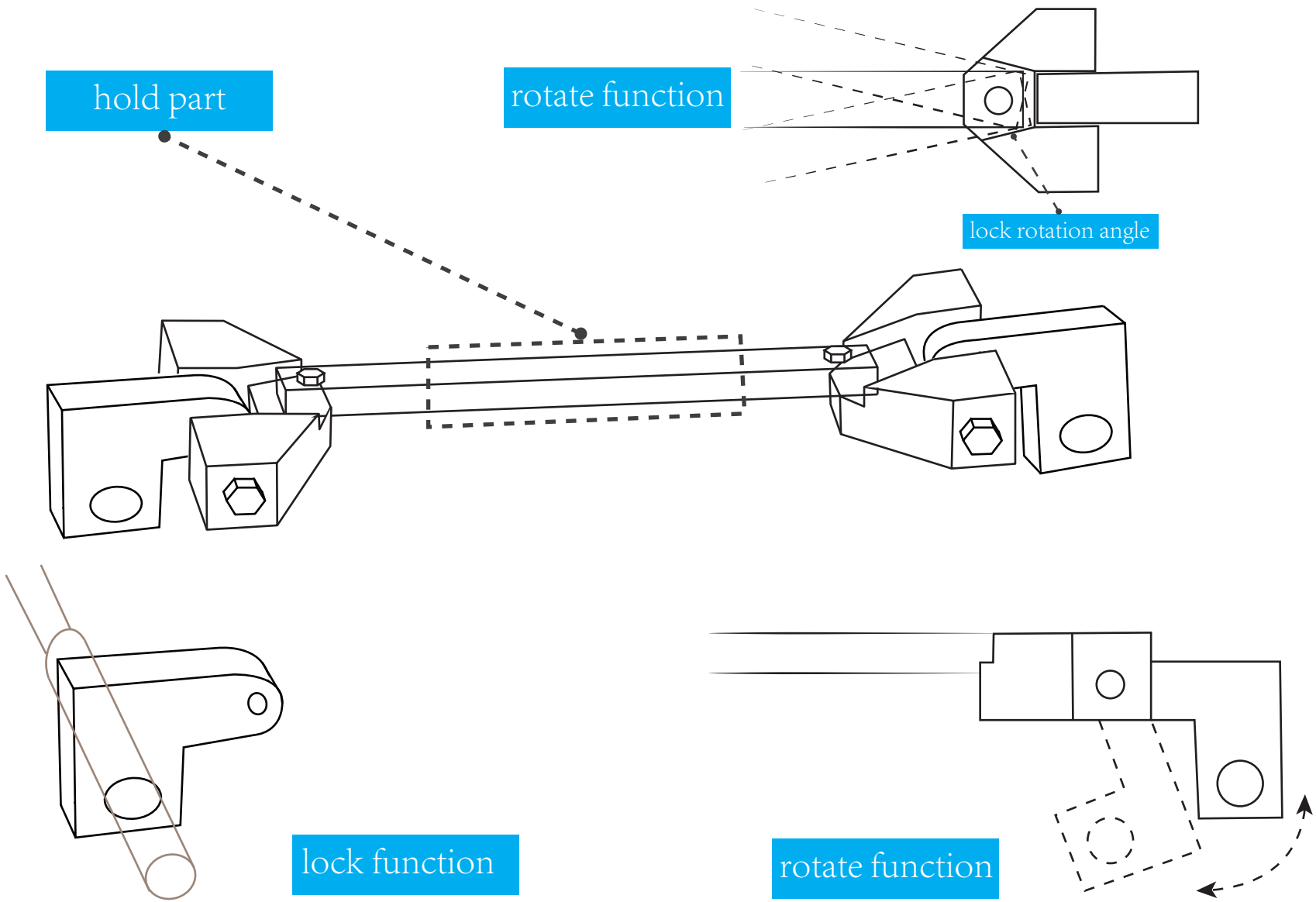
Structure Components explanatory drawing





The picture on the left show the various components of the model.According to the tips on the right picture, you can assemble into a complete model.

Function explanatory drawing

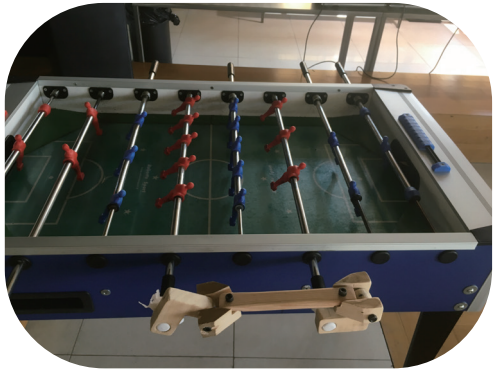


Model Test and Analysis

Model test

start position

push postion

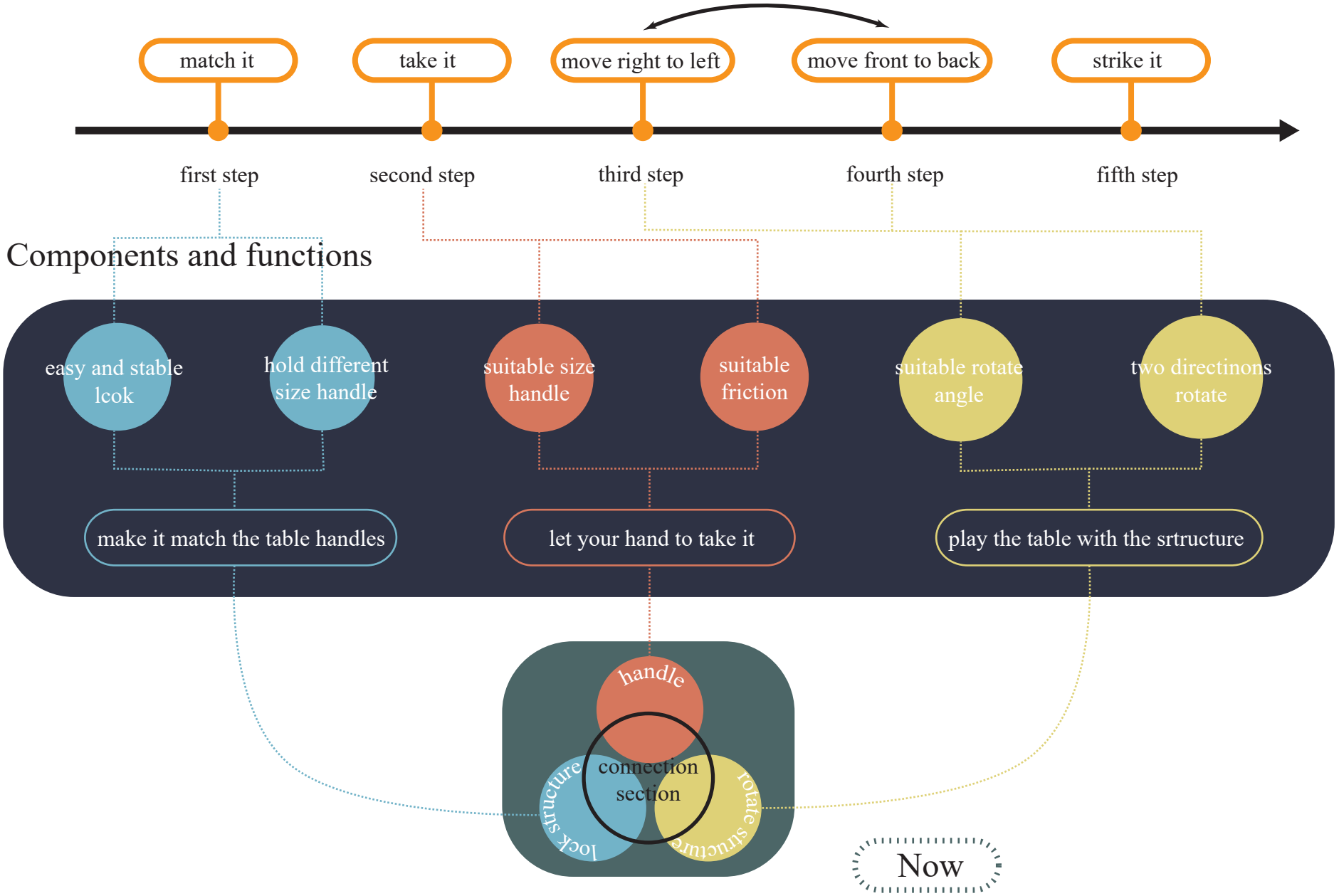


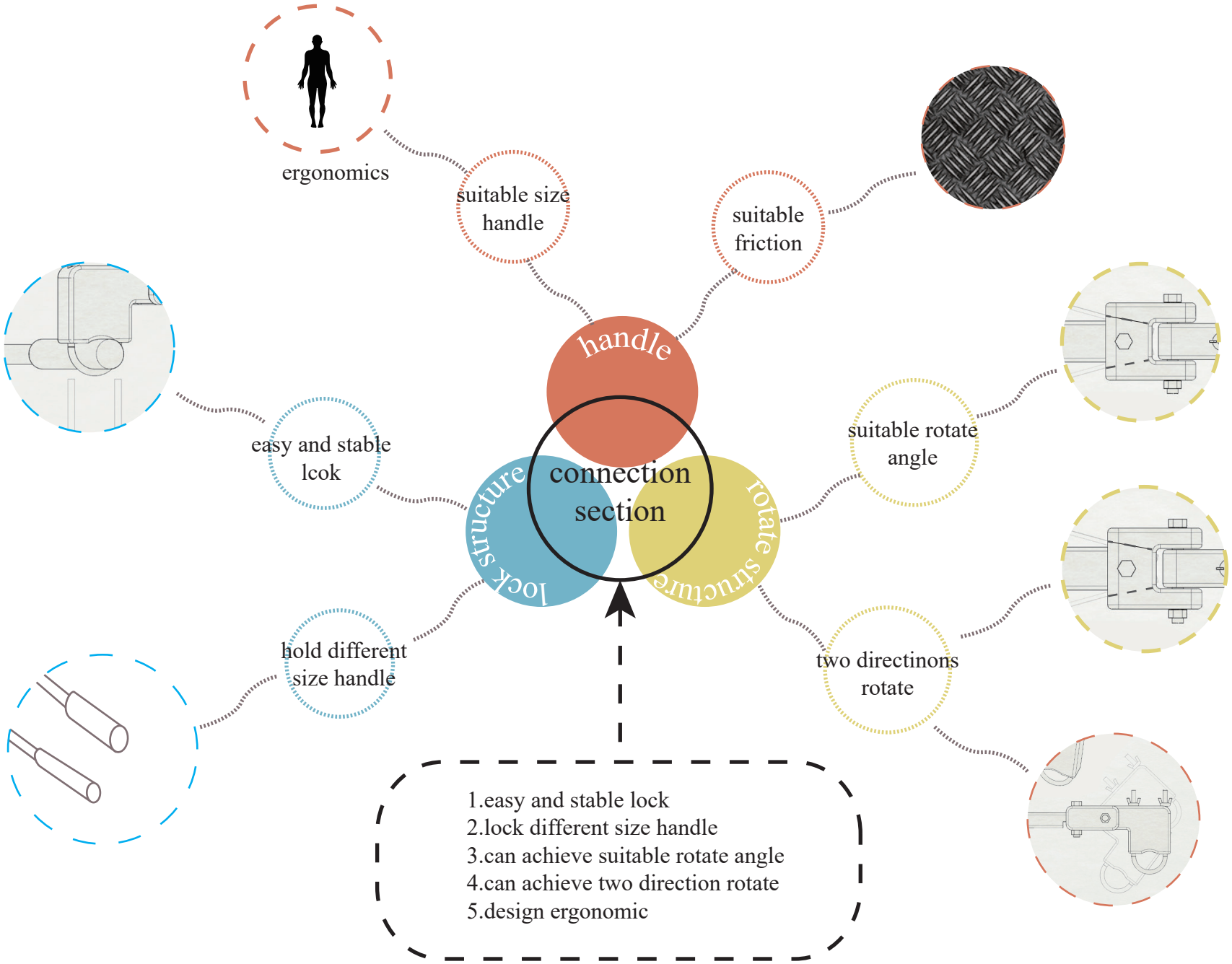
rotate postion

rotate postion

Advantage	Weakness
can rotate and push with one hand easy use way (moving front to back and right to left) can push two row to reach the border controllable push	hard lock(when I use the model, the row position change)

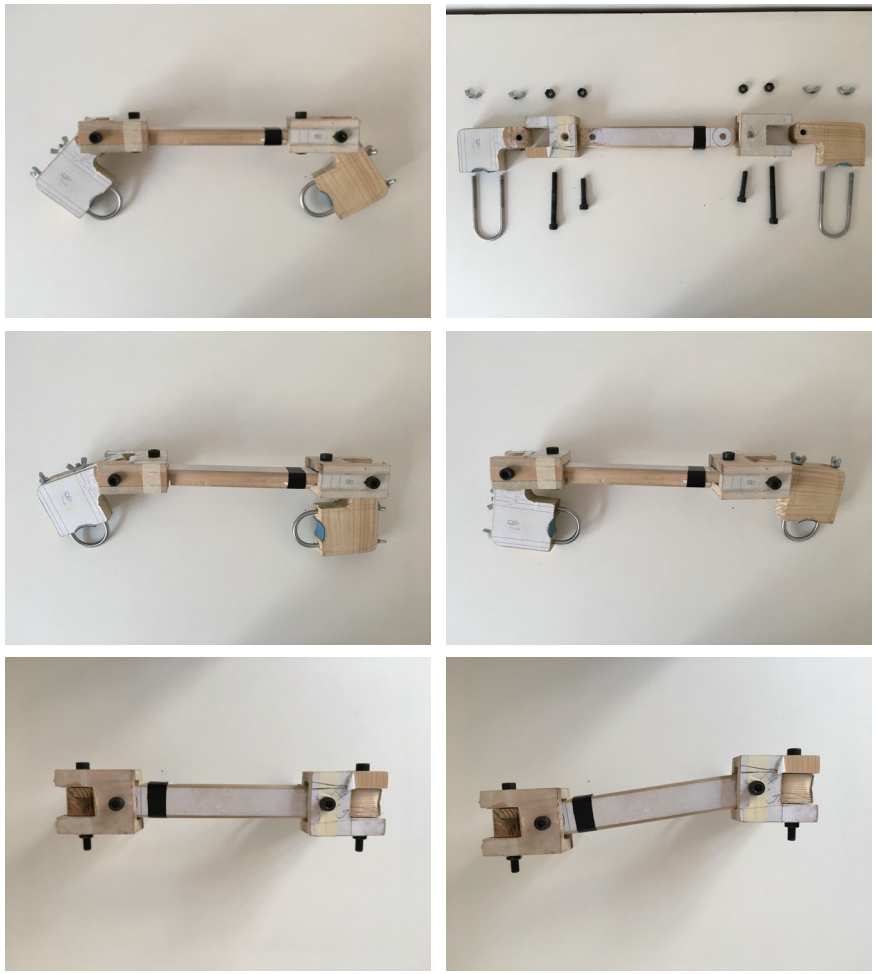
4.4 How does the NEW TRANSFORM work




ergonomics
suitable size handle
suitable friction
handle
easy and stable lcok
lock structure
connection section
rotate structure
suitable rotate angle
hold different size handle
two directinons rotate
1.easy and stable lock
2.lock different size handle
3.can achieve suitable rotate angle
4.can achieve two direction rotate
5.design ergonomic

4.5 The fifth generation model

Machine production model



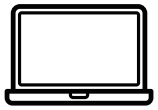
Instruments

pencil

adhesive tape

scissor

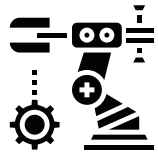
ruler



laptop

screw

The ring of iron

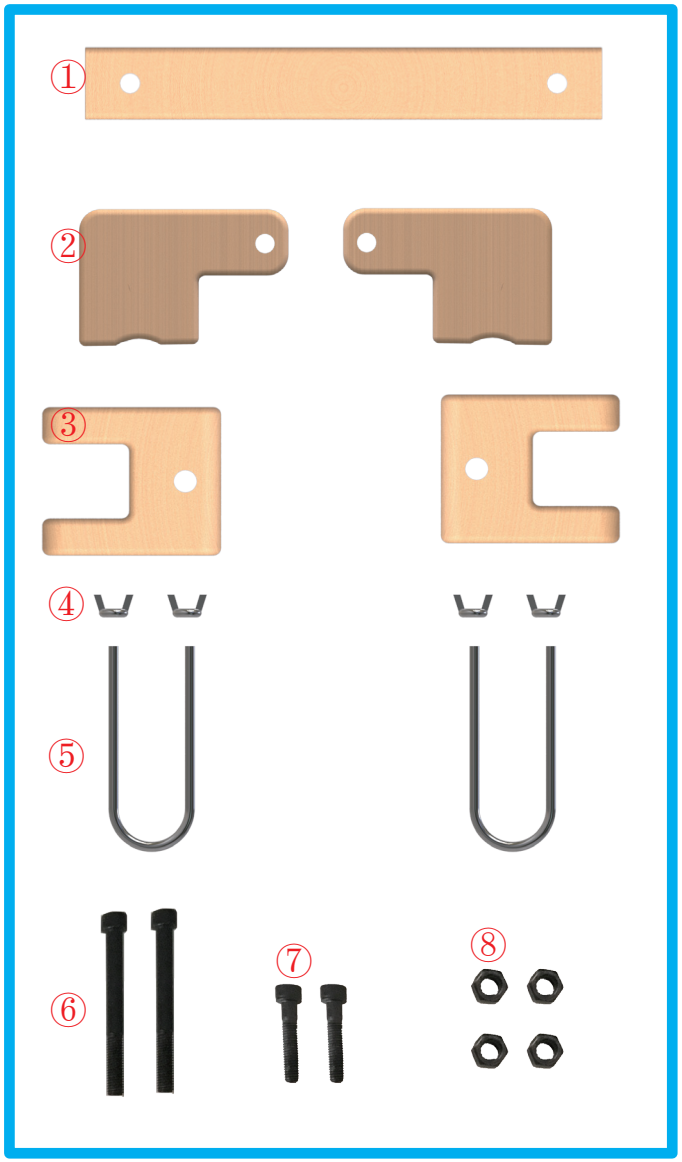


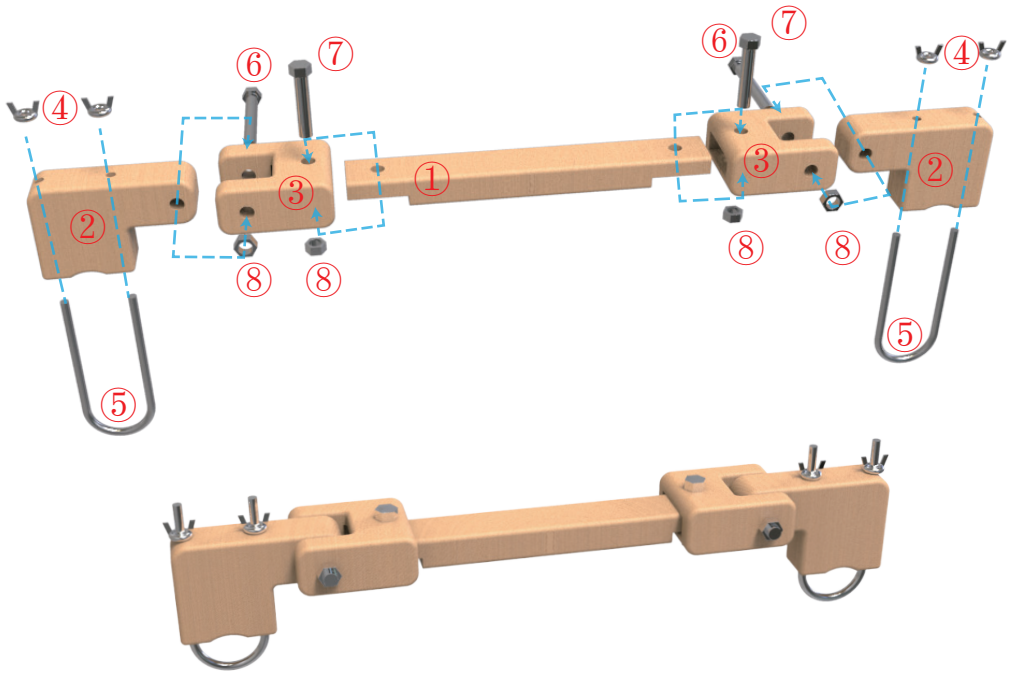
machine

Material

wood

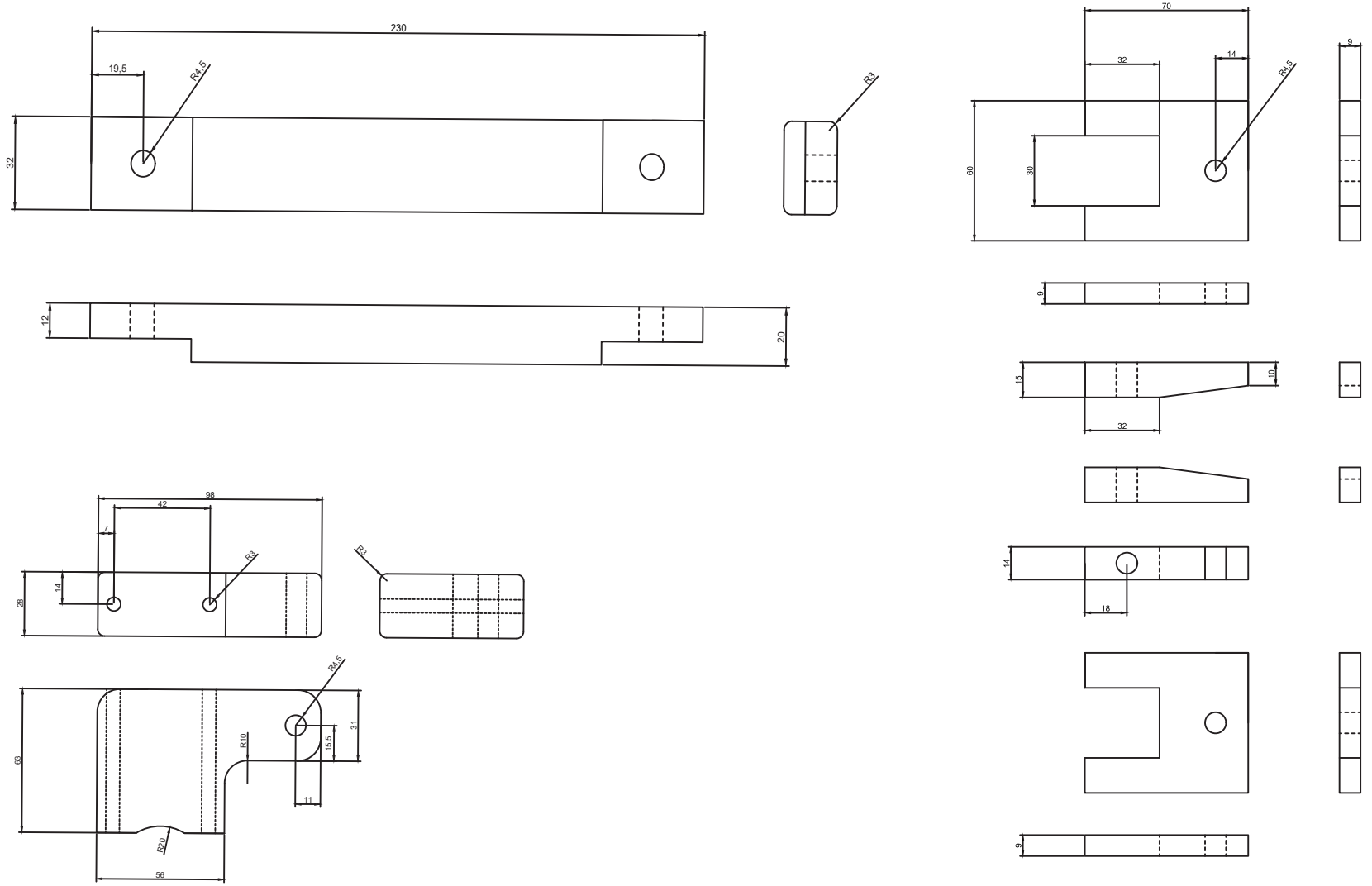
Structure Components explanatory drawing



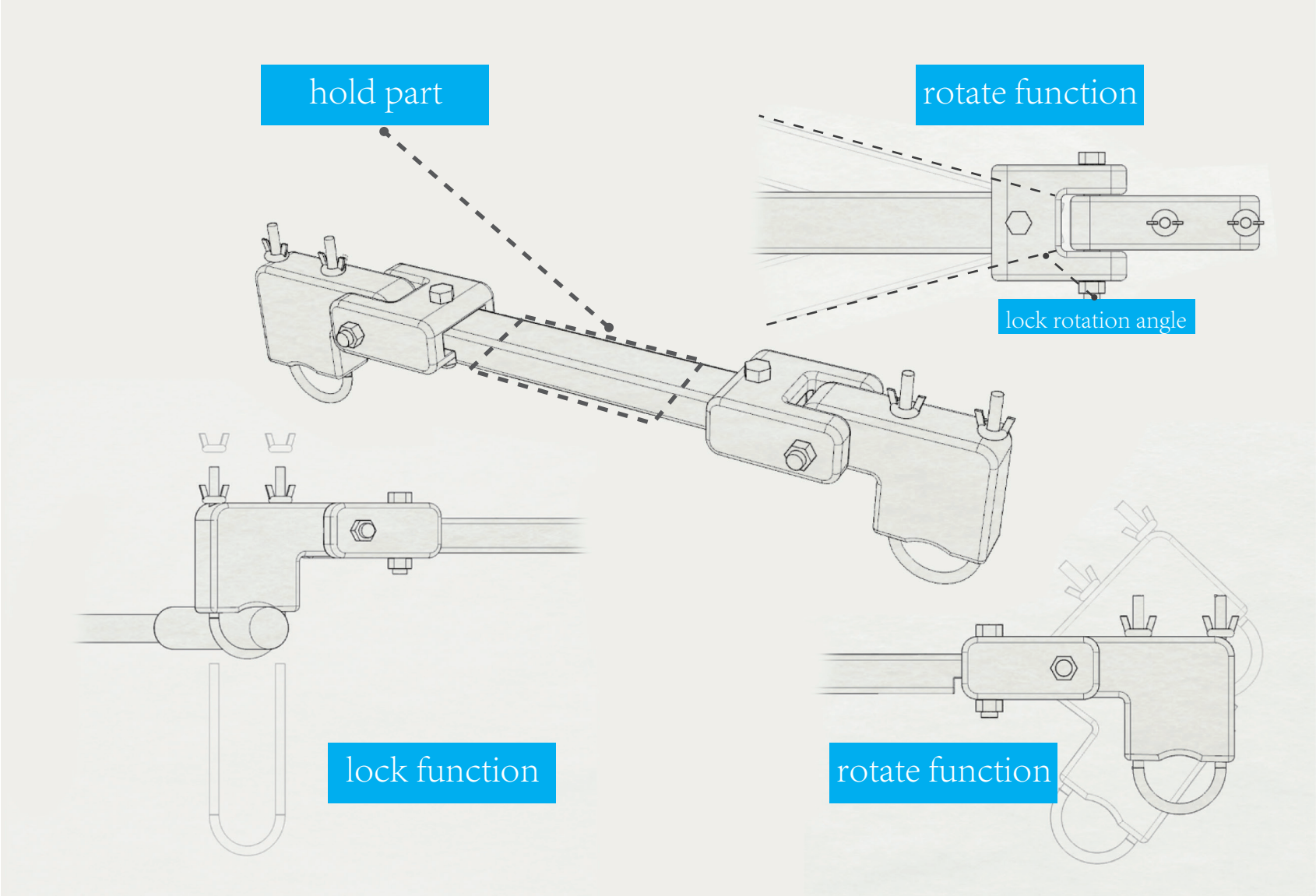


The picture on the left show the various components of the model.According to the tips on the right picture, you can assemble into a complete model.

Engineering drawing

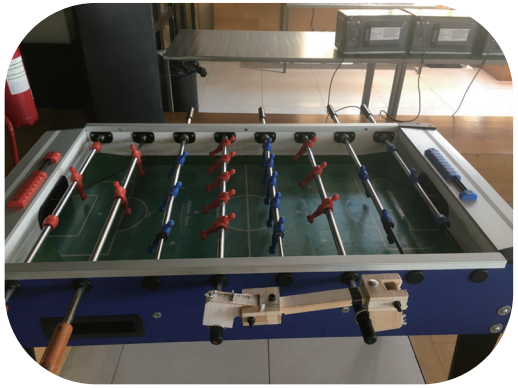


Function explanatory drawing

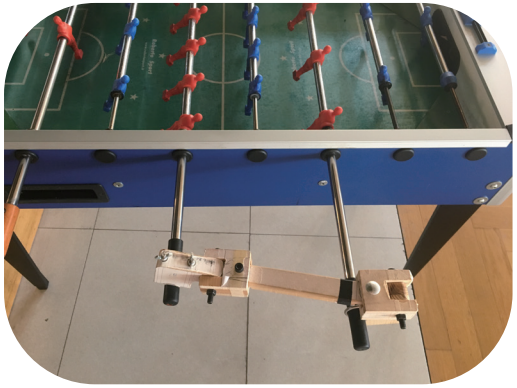


Model Test and Analysis

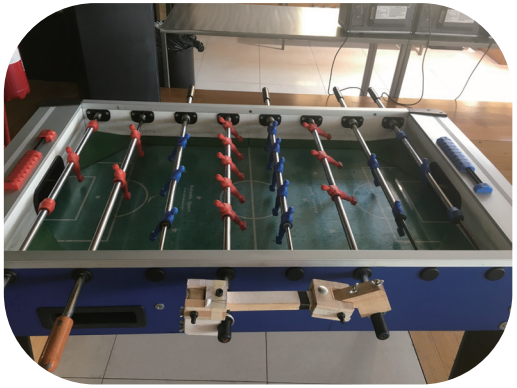
Model test



start position



push postion



rotate postion

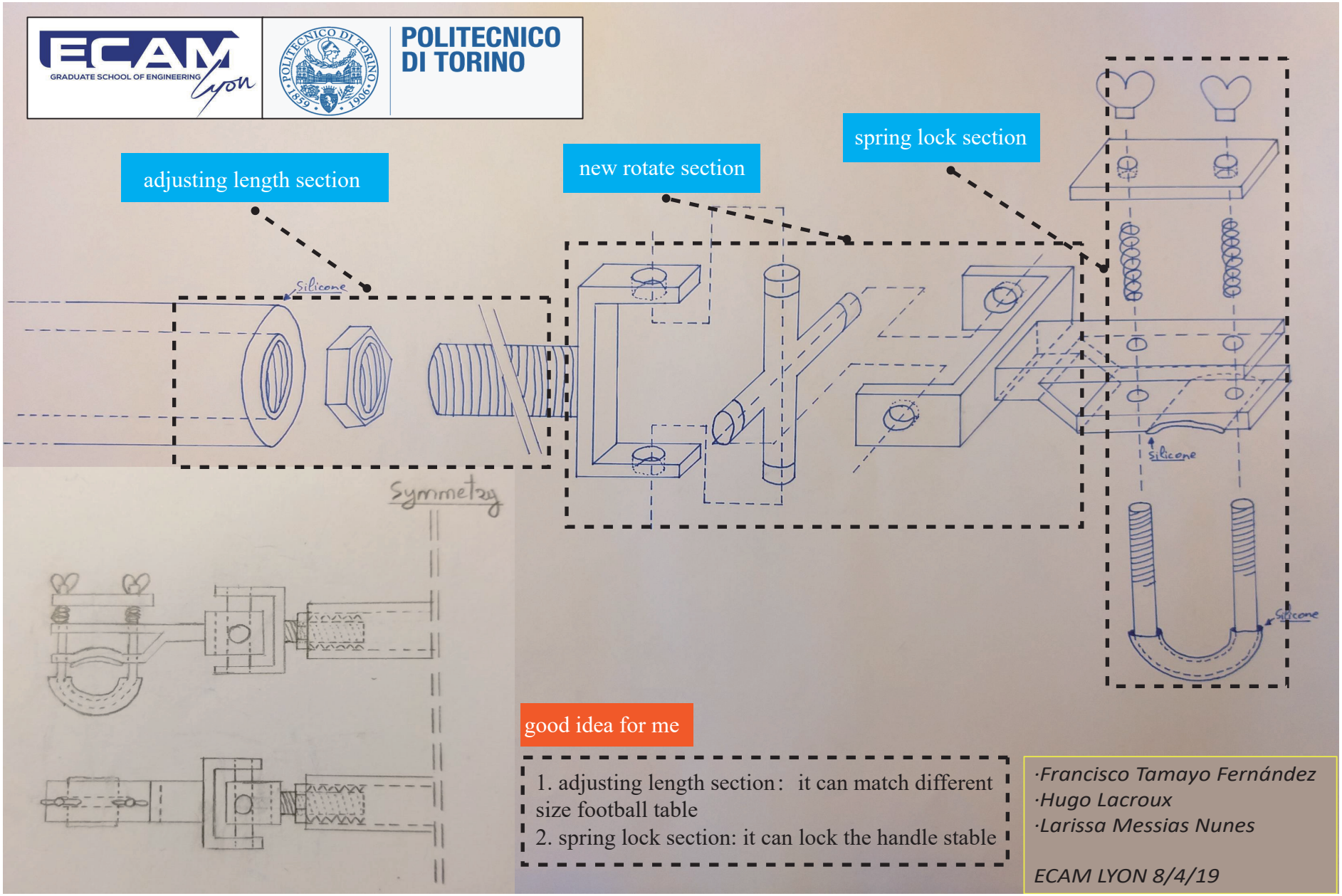
rotate postion

Advantage	Weakness
can rotate and push with one hand	weak lock(when I use the model, the row position change)
easy use way	weak material (model life is short)
can push two row to reach the border	can't adjust all kinds of table (different distance about two row)
controllable push	
can lock the handle	
better material	

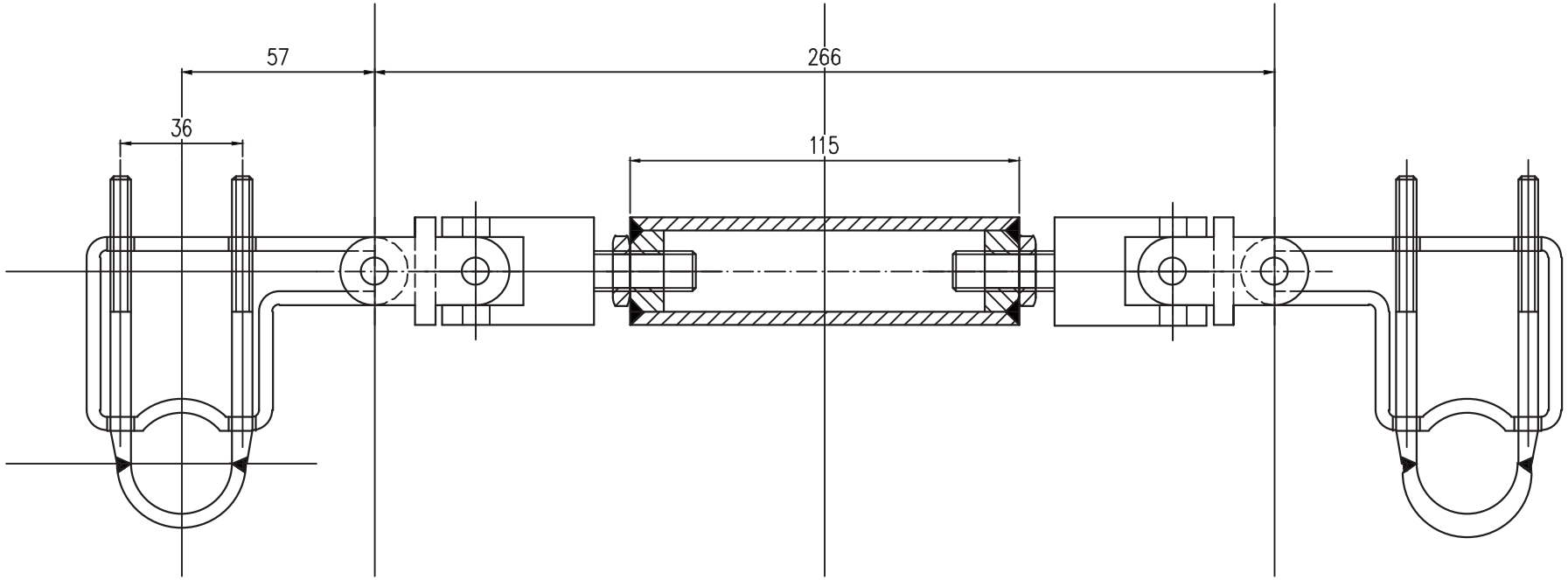
05.
THE FINAL GENERATION MODEL

5.1 Tutor’s group an analysis
5.2 The final generation model
5.3 Function explanatory drawing
5.4 How to use ‘Transform 0’
5.5 All models analysis

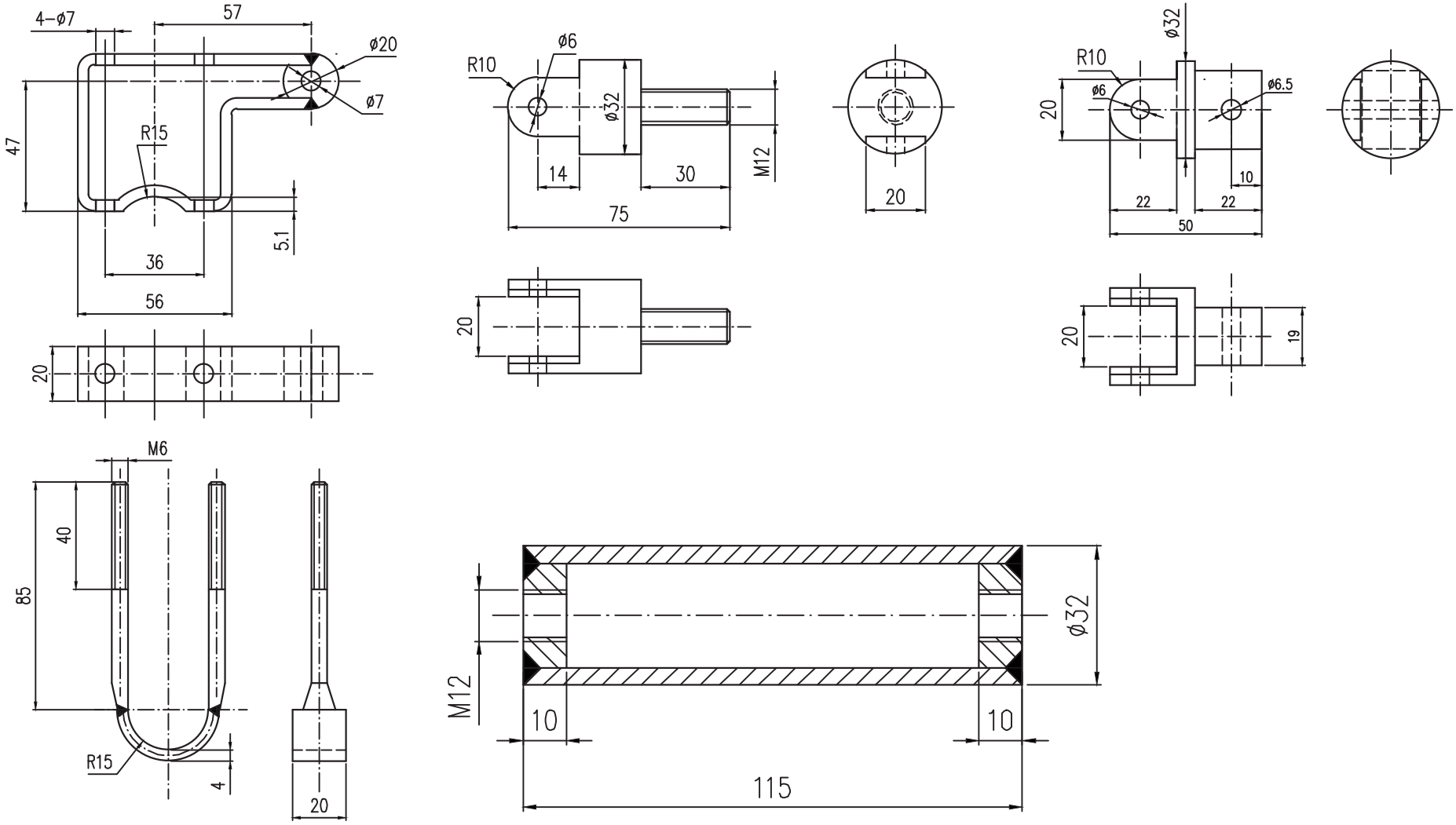
5.1 Tutor's group idea and analysis



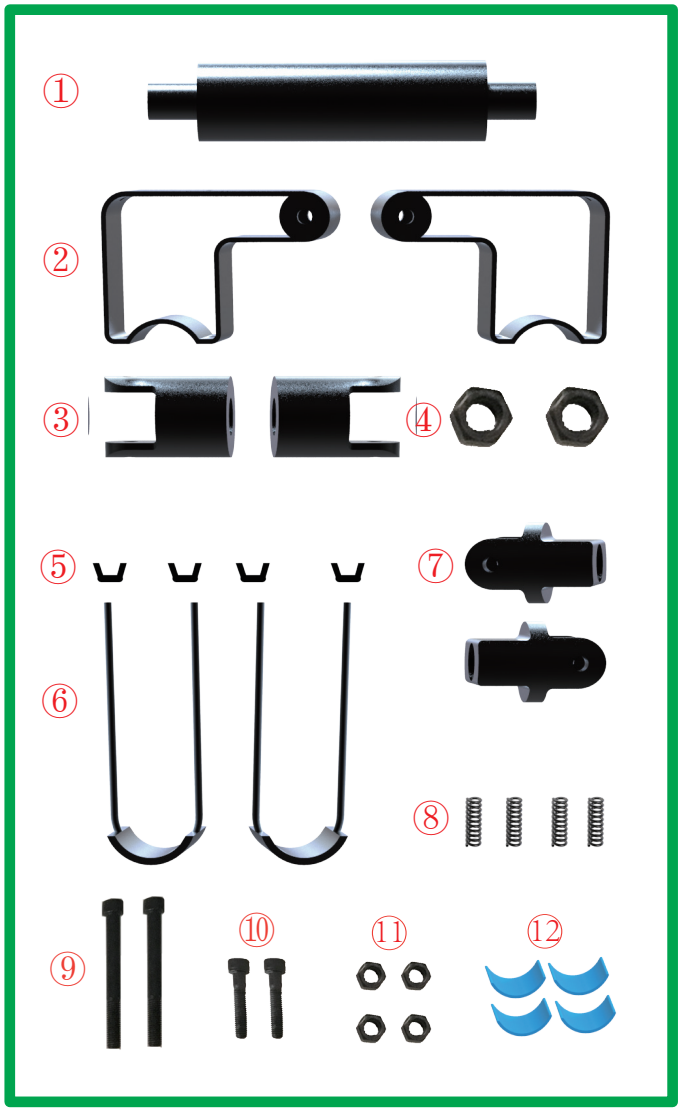
5.2 The final generation model

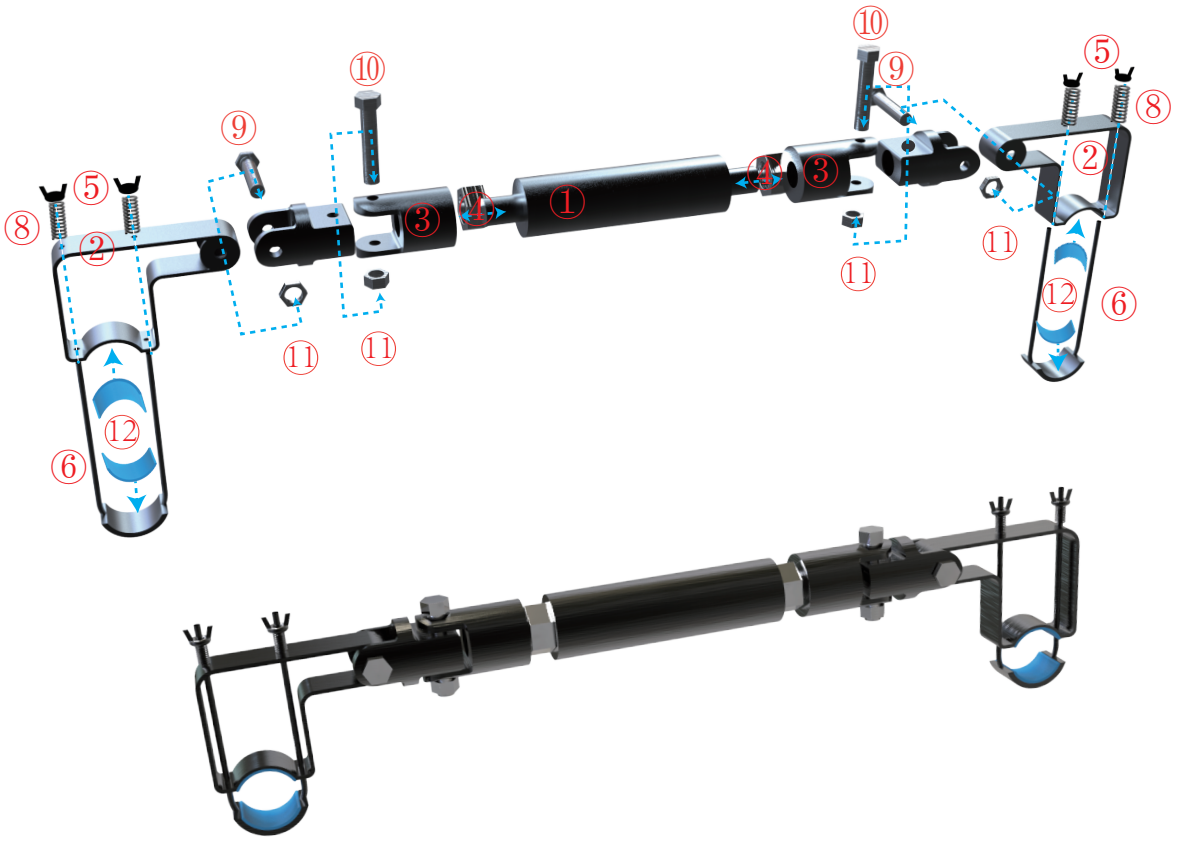


Engeering dwawing



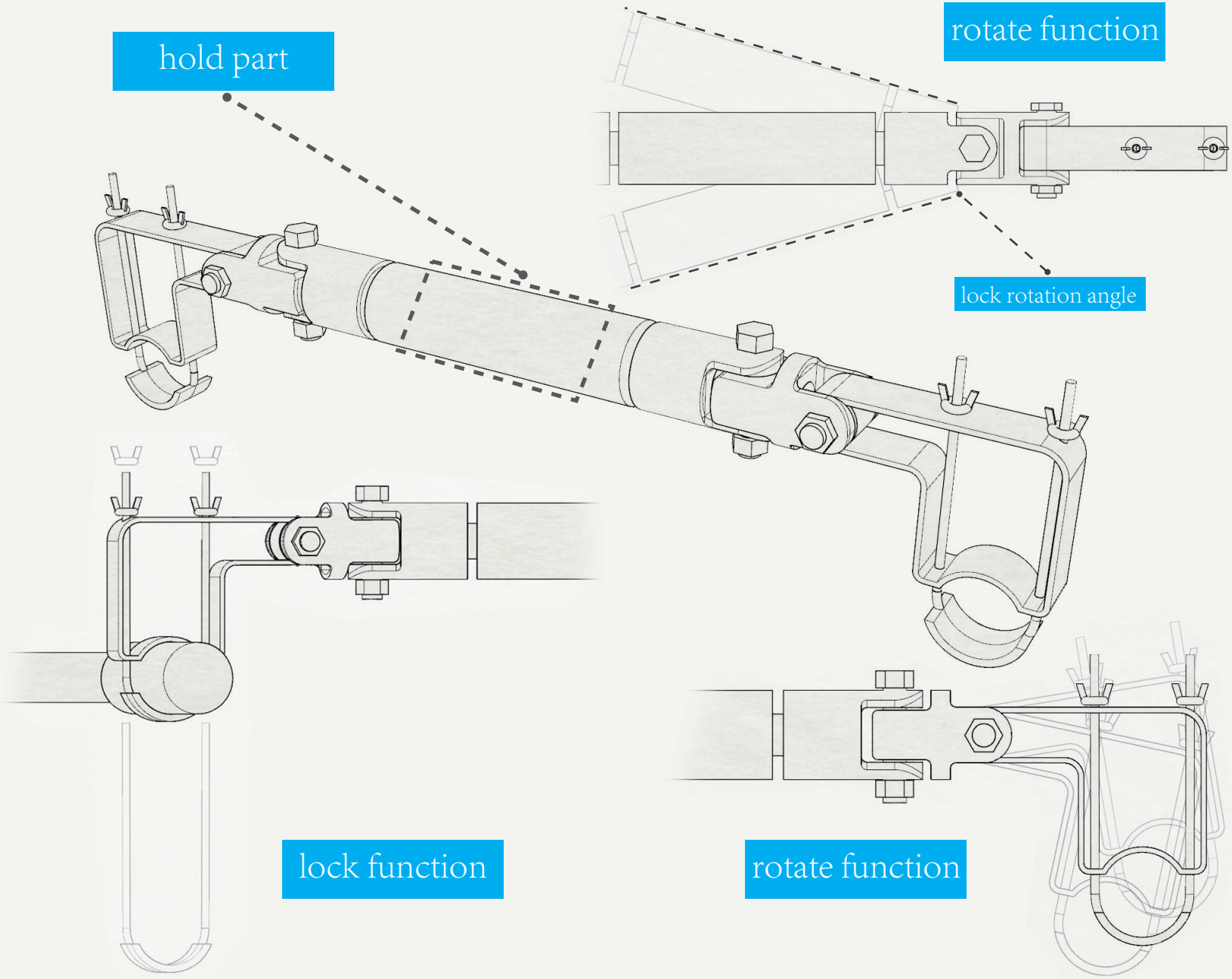
Structure Components explanatory drawing





The picture on the left show the various components of the model.According to the tips on the right picture, you can assemble into a complete model.

5.3 Function explanatory drawing



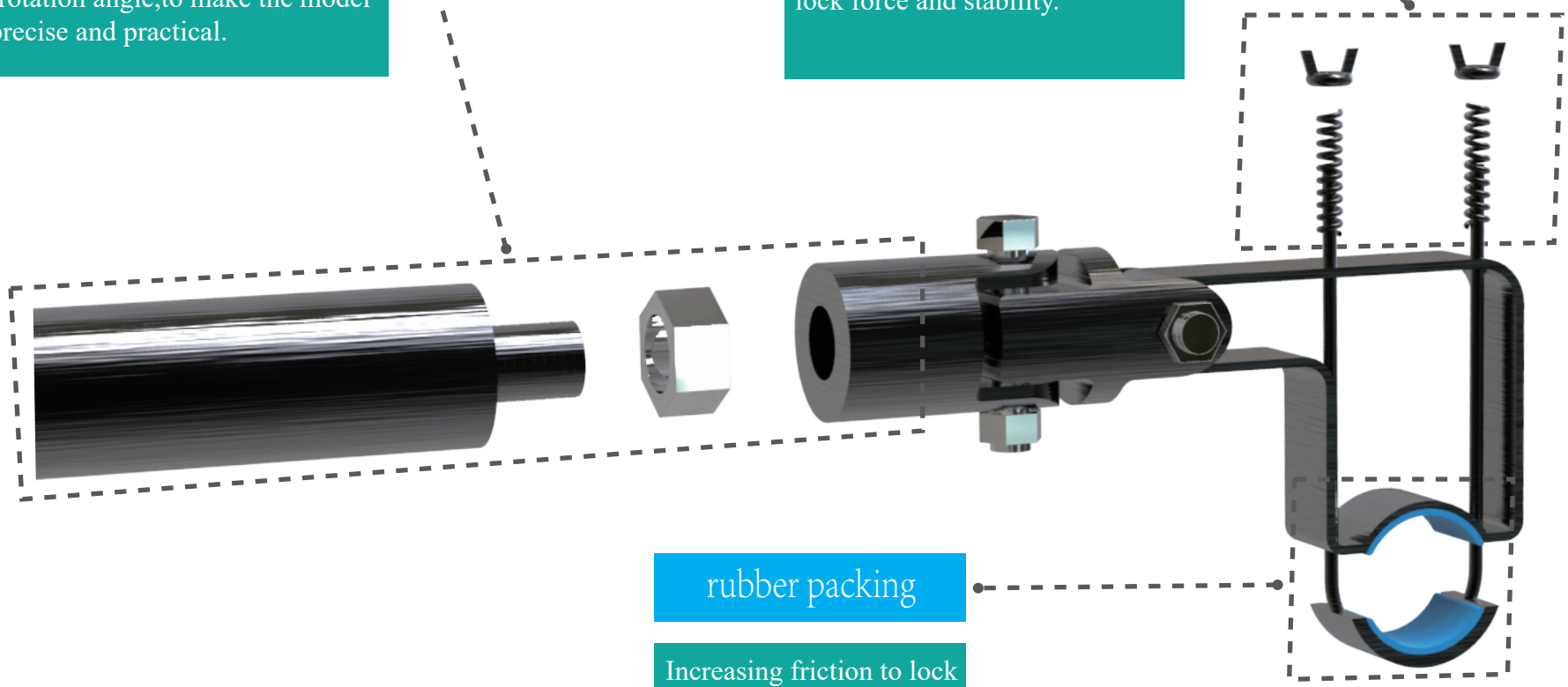
New Function explanatory drawing

length adjustment function

By adjusting handle length,it can match different siez football table. It also can adjust rotation angle,to make the model more precise and practical.

spring lock function

The new model add new function that is spring lock,it enhace the lock force and stability.



rubber packing

Increasing friction to lock stable

5.4 How to use ‘ Transform

match it

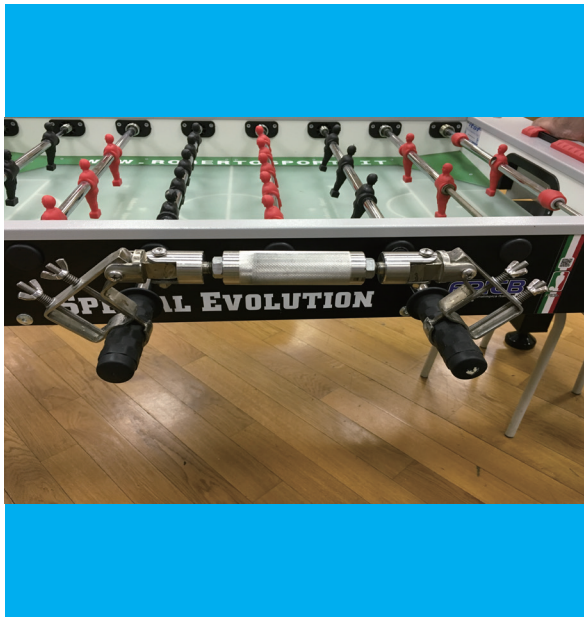
take it

move right

first step

second step

third



to left

move front to back

strike it

step

fourth step

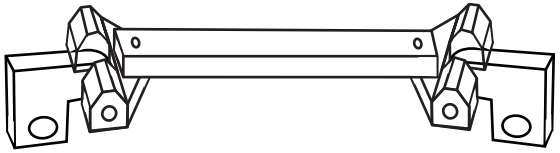
fifth step

5.5 All models analysis

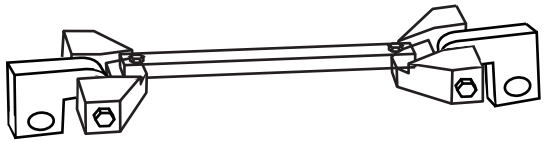
1

2

3



4



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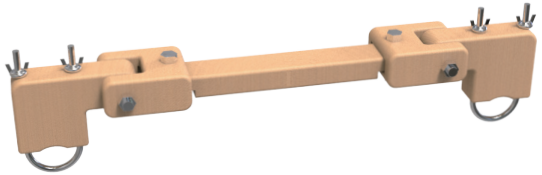


6

Advantage

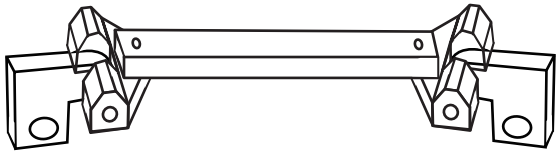
1	can rotate and push with one hand	2	Easy use way (moving front to back and right to left)
1 + 2		3	Better Material (it didn't happaned shape changed than before when you use it)
1 + 2 + 3		4	can push two row to reach the border
1 + 2 + 3 + 4		5	controllable push and rotate
1 + 2 + 3 + 4 + 5		6	
1 + 2 + 3 4 + 5 + 6		7	Tough Material
		8	

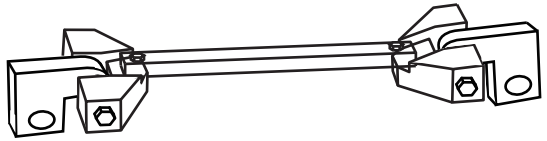
	Weakness			
	1 Hard Lock (when I use the model, the row position change)	2 Push Problem (it can't make the three man row to reach the border)	3 Weak Material (it can't easy to operate the table,the material is easy to shape change)	
	3	1 + 2		
	2	1	4 Push Problem (it push to much to make the model block)	
	4	1		
Can lock the handle	1	5 weak lock(when I use the model, the row position change)	6 weak material (model life is short)	7 can't adjust all kinds of table (different distance about two row)
can adjust all kinds of table	5	6	7	8 a little heavy (not flexible)

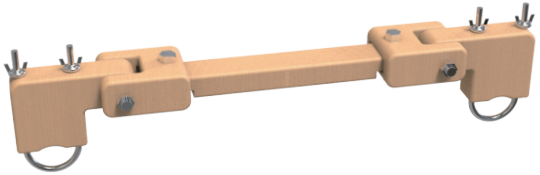
Conclusion

1 

2 

3 

4 

5 

6 

The first contact with this topic was introduced to me by my tutor, letting me understand the world of patients with arthroccal disease. As a student of learning design, I naturally want to use my own design to improve their lives. So I started my topic.

The person I want to help is Rudy. He is a joint sclerosis patient. His usual leisure activity is playing football tables, but unfortunately Rudy has a hand that can't operate the handle very well, so I started to help him to solved this problem.

Conclusion

The beginning of the project was difficult. I thought a lot of ways to solve this problem, but I failed without accident. So I began to clarify my purpose, to find the right structure to connect the two rows, so that it can operate the two rows with one hand. When I came up with this structure, I made a simple model to test if it could be successful.

The result was satisfactory and it was successful. Then caming the new problems, such as weak materials, single structural functions, and inability to install stably. Under the guidance of my tutor, I began to learn to think in a more systematic way to solve problems step by step, and then to improve the model. In fact, there are still many places where the model can be improved . I hope to share my plan.Letting everyone participate in the design and improvement.

I really like this topic, and I also enjoy helping others. Design is the solution that solving the problem. This is a very interesting and meaningful process.

Reference

Books

"NINDS Multiple Sclerosis Information Page". National Institute of Neurological Disorders and Stroke. 19 November 2015.Archived from the original on 13 February 2016. Retrieved 6 March 2016.

Milo R, Kahana E (March 2010). "Multiple sclerosis: geoepidemiology, genetics and the environment". Autoimmunity Reviews.9 (5): A387–94.

Tsang BK, Macdonell R (December 2011). "Multiple sclerosis- diagnosis, management and prognosis". Australian Family Physician. 40 (12): 948–55.

Compston A, Coles A (October 2008). "Multiple sclerosis". Lancet. 372 (9648): 1502–17.

GBD 2015 Mortality and Causes of Death Collaborators (October 2016). "Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015".

Compston A, Coles A (April 2002). "Multiple sclerosis". Lancet. 359 (9313): 1221–31.

Murray ED, Buttner EA, Price BH (2012). "Depression and Psychosis in Neurological Practice". In Daroff R, Fenichel G, JankovicJ, Mazziotta J. Bradley's neurology in clinical practice (6th ed.). Philadelphia, PA: Elsevier/Saunders.

Lublin FD, Reingold SC (April 1996). "Defining the clinical course of multiple sclerosis: results of an international survey. National Multiple Sclerosis Society (USA) Advisory Committee on Clinical Trials of New Agents in Multiple Sclerosis". Neurology.46 (4): 907–11.

The Design of Everyday Things. 1990 and 2002 (paperbacks of The Psychology of Everyday Things with new prefaces). Revised and Expanded Edition, 2013. [Donald A. Norman, VG]

Design for the Real World: Human Ecology and Social Change: Victor Papanek

Webs

https://areeweb.polito.it/didattica/designworkshop/

https://www.medicalnewstoday.com/articles/37556.php

https://en.wikipedia.org/wiki/Multiple_sclerosis

https://www.aism.it/italian_multiple_sclerosis_society_aism

https://cnx.org/contents/whYRSmRY@1/Introduction-to-Nervous-System-Chapter-9

https://www.foosballrevolution.com/buying-guide/

https://www.flaticon.com/

https://didattica.polito.it/pls/portal30/sviluppo.guide.visualizza?p_cod_ins=01PCQPO&p_a_acc=2013&p_lang=EN