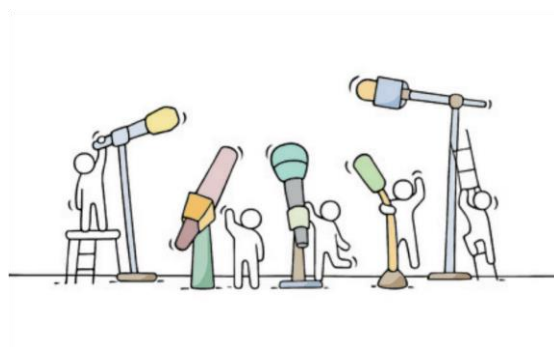


# What's special about my major?

## Final Speech Program

Neither can anyone be eloquent upon a subject that is unknown to him,  
nor, if he knows it perfectly and yet does not know how to shape and polish his style,  
can he speak fluently even upon that which he does know.

Cicero: *On the Orator*



UPS Talks

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## Day 1 [December 13, 2023]

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**Morning Session**    **09:50-11:25 (Room: 清华学堂 202)**

**Session Chairs:** 黄春阳 胡舒涵

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### ✧ **Speech 1: Automation: Controlling Systems and Controlling Your Life**

Speaker: 张淑杰 # Automation

Question Masters: 胡舒涵、王骞成

Speech text:

How does the major “automation” appear to you? Does it imply the famous final coding program known as “the Thunder Class”? Or does it refer to the department which always wins the John Ma

Cup? Yes, it is automation. But are you able to distinguish the differences between automation and electric engineering or computer science, as there seems to be some overlap between them? In fact, the main difference is their different focuses.

In China, the major called automation was established in the 1950s. It's the product of borrowing the pattern of higher education from the Soviet Union. Ever since it was established, the whole subject has been based on and it will still be based on the control theory. We do learn some courses similar to those of EE and CS, but the hardware and software are just tools for our main focus - the control theory, a theory about collecting and processing the feedback from a system to better control its behavior later on. To achieve this, automation scientists welcome all kinds of mechanics, networks and algorithms.

It's amazing that merely a theory can support such a large subject, isn't it? Let me explain how this theory can make it.

Before the first Industrial Revolution, controlling a system, like a millwork or a steam engine, and directing it to perform as demanded, were very common and useful in life and production. So based on the experience accumulated in controlling, scientists developed a theoretic system with math and named it the control theory, or cybernetics if using terminology. The application of this theory is equally common and useful nowadays. For example, the regulation of the gene expression needs biological feedback, the training of neuronal network needs feedback from the loss function and for sociology, feedback is the key to testing whether the modelling of a society is reasonable.

And the control theory brings us students of automation a lot of inspiration. By receiving instant feedback from the teacher and adjust the coding day and night for several weeks, we completed the task of thunder class which seemed impossible. By summarizing successes and failures every week and use the feedback to adjust our physical training, we try our best to "control" the ownership of John Ma Cup every year. And, as a transfer student from clinical medicine, here's one more thing I have learned from heeding the feedback from my heart and re-choosing my major: You use your heart's feedback to control your life. You design the algorithm of pursuing your love.

In conclusion, automation is not just about mastering the control theory. It's about applying this theory across various fields and even life itself. This is what makes my major special. Thank you.

## ✧ **Speech 2: Animal Welfare: Being Friendly to Our Friends**

Speaker: 杨天明 # School of Life Sciences

Question Masters: 曹世腾、邢周豪、周怡巧

Speech text:

Hello, everybody. I am Yang Tianming from the School of Life Sciences. Today, I would like to address a topic that is crucial to my work – animal welfare .

When you entered the lab, what is the first thing the mentor taught you? Wearing gloves and a mask, putting on a lab coat, staying away from dangerous reagents, and avoiding eating or drinking anything in the lab. All these things are for your safety. But the first thing I learned is not for my safety but to ensure the safety of the mouse—the experimental animal.

As a neural biology researcher, I deal with mouse every day. I use a technology called optogenetics to investigate how the brain is involved in real-time adjustment of movement. After genetic editing, the neuron of the brain will get a protein that can sense the light, as we light up these neuron through special fiber, the protein can change the activity of the neuron. Through optogenetics, I can control neurons. I can change the behavior of animals. And most importantly, I can study the function of the brain.

Only when we understand the function of the brain can we comprehend the root causes of serious brain disease, such as Parkinson's disease. And then we will have the opportunity to cure patients. So, I have to conduct animal experiments, even though these experiments are very cruel to the animals.

But I am definitely not a cruel man. When I have to perform surgery on a mouse, I additionally use three types of drugs – one to relieve pain, one to fight inflammation, and another to provide nutrition. When I return the mouse to the animal center, I use heating pads to keep it warm. And when I put the mouse to its cage, I make sure that it has a roommate so it won't feel lonely.

Despite these, it is inevitable that I cause harm to the mouse. Fortunately, in the year 2000, some scientists began to construct organs from cells, and now some are trying to build mathematical models of mice using AI. They are still far from success, but at least it gives me a hope. Hope that one day, I can complete my experiment just by sitting in front of my computer. Thank you.

✧ **Speech 3: Biomedical Engineering: Being a coordinator of medical service.**

Speaker: 石啸睿 # Biomedical Engineering

Question Masters: 罗艺轩、徐启轩

Speech text: If you go to see a doctor, they may ask you to take a magnetic resonance examination to see which part of your body is in a poor condition. You might be familiar with this imaging method, but how many of you have ever thought about this medical detection is actually an application of quantum physics? This is where the biomedical engineers make endeavors, to coordinate different subjects in science and engineering for medical service, and it is the significance of coordination that drives the formation of my major---biomedical engineering.

Talking about biomedical engineering is no picnic for me, since it is not widely accepted as an independent major up to now. I still remember once I had a conversation with my tutor, who is a biologist. He told me what I study is simply useless. Of course I am not that happy about this comment, but I did think biomedical engineering might be just a redundant major when I thought about my future career in high school. Nonetheless, I gradually catch the soul of this major---coordination.

According to the definition, biomedical engineering is a combination of principles from nearly every science and engineering subject, including physics, chemistry, biology, computer science, medicine and so on. It aims to come up with new medical concepts in disease prevention, detection and therapy. Let's take the magnetic resonance as an example. It is difficult to see the inner tissue of a person because our skin and muscle are not transparent. However, we have already known in physics that different substances would act differently when exposed to an identical radiation. Then biomedical engineers apply this knowledge to medical detection, since the diseased cells are more greedy than normal ones. They will absorb more radiation, which we can easily tell from the image.

In history, we can see brilliant people who were masters in many aspects, like the well-known artist, scientist, and inventor, Leonardo da Vinci. But as humankind get closer and closer to the law of nature, and the technology tend to be more and more sophisticated, one can no longer be professional in all subjects, but it is possible to retain a comprehensive understanding of the whole scientific world, and bring up more effective ideas in medical service. Now in the 21st century, people have higher expectations for health and life, so we are calling for more researchers to coordinate different subjects, which remains as the soul of biomedical engineering. Thank you!

#### ✧ **Speech 4: Civil Engineering: The Keeper in the Concrete Forest**

Speaker: 宋浩喆 # weiyang-civil engineering

Question Masters: 石啸睿、王赛成

Speech text:

When it comes to civil engineering, what will come to your mind? Noise and dust from the building site, or a figure with red helmet mixing concrete, which in Chinese we say, “dahui”.

There are many stereotypes about my major. Actually some engineers do go outside and into the worksite themselves. But they are just a part of civil engineers. Civil engineering, which better describe the major than Chinese “tumu”, covers almost all constructions in life. And I would rather see civil engineers as silent keepers of the modern society, which is based on urbanization. We work hard to keep it steady and safe.

People mainly leave their impression of civil engineers at times of development and construction, when the new part of the city was yet a bunch of worksites. That explains why my major was a hit ten years ago. But just as I have said, we cover all constructions.

From a time perspective, we take charge of a construction through its lifetime. The first thing we do is to design the structure. we take every issues into consideration, like how much weight the structure will take or what will wind and other things influence it. And do not forget to leave enough room for the existing uncertainty, like earthquakes and extreme weathers. The structure designers working in offices accounts for the majority of civil engineers. oh, one more thing to go, we are not the same as architects. They can come up with fancy ,unbelievable designs, but then we are the ones to make the impossible possible. like verify the steadiness of the structure and modify it. Well , some fancy designs just drive our engineers mad.

When the construction is done, our work go on and the emphasis become keep watching. Though it seems that buildings and structures never move, they sink or float in the mud, crack and become fragile as time goes by. Applying new technologies to monitor the change happening inside the structure becomes an important topic, so that we can learn about the situation of the building more effectively. That is what is going on around us now. Civil engineers are not seen as much as before, but they are the ones who know this concrete forest around us best, and they are still there to keep the safety of people and the operation of modern society.

Last but not least I'd be glad to say, to keep pace with the world, our major are broadening her meaning to keep, covering all the constructions. to the underground world, to the marine, to other developing countries; to the moon and mars.

Wherever human beings reach, we will pave the way and work as silent keepers.

### ✧ **Speech 5: Layering: a Key to Advancement of Computer Engineering**

Speaker: 阎禹辰 # Computer Science and Technology

Question Masters: 勾天润、张淑杰

Speech text:

As a young discipline, computer engineering has developed rapidly over the past seventy years, with an increasing impact. Have you ever wondered how it advances and innovates so fast? Today, I'd like to share a concept that I believe is crucial: layering. It is an approach of dividing a system into multiple layers, where each one has its specific function and interacts with adjacent layers through well-defined interfaces.

Suppose that a friend from a distant place sends you a letter. Along the way, it goes through several post offices, to your apartment building, and finally to your doorstep. Each step is handled by a single person and there are many transportation choices. The architecture of computer network is similar to that, where different layers sequentially modify the packets you send with respective function. If one layer wants to add encryption or adjust the algorithm, others are not affected.

Another example is programming. Machines can only understand binary strings with zeros and ones, which are not human-friendly at all. Thus, a system gradually formed: There are high-level languages convenient for humans programming; next layer is lower-level instructions which specify the function of binary strings; and the lowest is microinstructions representing the changes in circuits.

When I started learning high-level languages two years ago, the bottom level was still too hard for me to comprehend. When I studied instructions a year ago, I only cared about abstract hardware operation. And when I design microinstructions this semester, it suddenly hit me that what I've learnt connected together as a system. I realized the beauty of layering: Cutting a complex system into layers significantly reduces the cost of learning, and improves the efficiency of development and maintenance.

Looking back at the advancement of computer engineering over the past few decades, different layers have been alternately achieving innovation and breakthroughs, and the means of implementation within a single layer have become increasingly diverse. Multiple combinations of layers matched various application scenarios, allowing computer engineering to flourish.

In fact, the concept of layering is widely applied today. Computer engineering itself, as a discipline, has electronics in the lower layer and automation devices in the upper layer. Moreover, embracing a layering mindset helps broaden our perspectives: If we encounter a requirement or rule which is difficult to understand, perhaps we can find out its origin in another layer beyond our current perspective. Thank you!

#### ✧ **Speech 6: The philosophy of Programming is inspired by life and inspiring my life**

Speaker: 杨峻麟 # Computer Science and Technology

Question Masters: 邢周豪

Speech text:

In our major, there is a course called object-oriented programming. In this class, a programming method called adapter is introduced.

Before I explain this method, I believe you have seen this device before. Yes, it is an adapter.

When we want to charge, but the plug and the outlet have different interfaces, and they don't match, then, we will use adapter. People learnt lesson from this little device, and develop a programming method called adapter. How does it work?

When we solve certain tasks, it might be time-consuming to write a new piece of code from scratch. However, sometimes, there is an existing piece of code which we call it "plug code". It is quite similar to the one we want, but it has the wrong interface so it cannot complete the task. But, if we combine our plug code with just a few lines of code, which we call "adapter code", the interfaces will match, and our task can be completed in a much more efficient way. In a nutshell, what this programming method wants to tell us is that: adapting existing tool to a new one, is much easier than building a new one from scratch.

As you can see, this programming method is taken from our daily life. What's more, the philosophy in this programming method turns out to be useful in my life.

This semester, I took part in hosting several big forums.

And, just A few weeks ago, my friends and I were appointed to host a lecture about scientific research. There are few materials we could refer to. At that time, it seemed like we had to start

from scratch.

However, at Wednesday night the memory of hosting forums came back to me, and I suddenly realized that, the method of holding forums was like the plug code, and to host this lecture, we may just need to add the adapter code to the plug code, which means using the method of hosting forums, and adding a little change to it in regard to our lecture.

After that, we use the adapter programming method in our work, and everything turned out fine.

Of course, the philosophy has its origin in life, rather than programming, but somehow, through learning programming, I began to have a deeper understanding of them.

Therefore, Programming is not far from our life at all, it is inspired from our life, and it will inspire us in our life as well.

### ✧ **Speech 7: How can hydraulic engineering play a role in actual floods**

Speaker: 任庆毅 # Hydraulic Engineering

Question Masters: 周怡巧、勾天润

Speech text:

Hello everyone, I am RenQingyi from Department of Hydraulic Engineering. My topic is “How can hydraulic engineering play a role in actual floods”

Four months ago, I went to Liucun Town, Changping District, Beijing, together with my classmates from the geology internship course, and took the photos you see on the screen. The lamppost in the middle formed a sharp contrast with the dilapidated scene around it. According to the description of the local villagers, this was originally a well-constructed square, and people danced square dances here every night. From the several big lights on the top of the lamppost, you can imagine how lively it must have been here at night.

In fact, this is one of the places affected by the 23·7 catastrophic flood in the Haihe River Basin this year.

My hometown, Hebei, was also covered by this devastating flood, so at that time I received messages of concern from some friends. Some of them know that my major is Hydraulic Engineering, so they asked me by the way: "What did you Tsinghua Hydraulic Engineering people do in this flood fight?" And I would say: “ We did play an important role in forecasting and early warning”.



Since February this year, the Department of Hydraulic Engineering of Tsinghua University has taken the lead in carrying out a national research and development project aimed at preventing and controlling flash floods, and it came in handy during the flood at the end of July. What I am proud of is that I also undertook part of the data compilation work and contributed my own strength during this flash flood forecasting process. This also made me realize that the knowledge I learned can really help bring benefits and help to people's lives.

Specifically, we establish a hydrological model based on terrain data collected by satellite radar, as well as rainfall and water flow data collected by rainfall and flow stations in previous years. When new rainfall occurs, it can calculate water flow and other data based on rainfall. Based on this data, we can establish a visual hydrodynamic model, and then you can see whether the water level will flood to the knee or head. We refer to these two models as digital twin technologies for mountain flood basins.

Thanks to our forecast data, government departments took timely response measures.

In order to verify and correct the accuracy of our model, we conducted on-site research at the disaster site after the flood, and determined the intensity and volume of the flood through flood marks. That is what we were doing in these pictures.

That's all, thank you.

## ✧ **Speech 8: Clean Energy in Light Bulbs**

Speaker: 吴晨聪 # Electrical engineering

Question Masters: 徐启轩、杨峻麟

Speech text:

Good morning everyone, I am 吴晨聪 from the Department of Electrical Engineering. Also, I'm the only student from electrical engineering in this class.

Alright! Electrical engineering, electrical means we are doing something close to electricity. And I strongly believe that some of you'll feel like yes! I know, you are the people who climb up to the light bulb and fix it when it's broken. Well... Indeed, you're right. In your eyes, we are just fixing the device. However, in our eyes, electrical engineers, we focus on what we can use to light up the

light bulbs, and how we can enhance the efficiency of the light bulbs. In other words, we tackle energy problems.

6 years ago, a terrifying typhoon distorted my hometown Macau. I witnessed the worst disaster in the past fifty years in Macau history which caused uncountable economic losses and even loss of life.

Indeed, the reason more and more climate problems appear these years is that human beings are using non-renewable fossil fuels on a large scale. Without clean energy transformation, our descendants will face a society with horrible environmental disasters. Sustainable and clean energy is the lifeblood of our modern society. Electrical engineering is one of the key solutions that the world needs.

Therefore, as a high school student, I started to do research and projects on clean energy with the professors at the University of Macau. I replaced the electrode of the traditional metal battery with an organic material that I synthesized on my own. Which can significantly enhance the performance of the battery and reduce the pollution to the environment. An innovation in clean energy batteries, it lights up my first light bulb in the clean energy revolution.

In Tsinghua, I met people who shared the same goals in the clean energy revolution as me. With my innovation in clean energy batteries, I formed a team and we are going to set up an organization about clean energy in Tsinghua, we are putting effort into calling out more people to focus on the energy issues nowadays. We are lighting up the light bulbs of energy revolution in their hearts.

In conclusion, electrical engineering is not only a field related to electricity but also revolves around energy, especially clean energy. As a student in electrical engineering, I stand at the forefront of the clean energy revolution and strive for a cleaner and greener future. That's our work or I would say that's our duty. Next time, when you are changing the light bulb, remember you are not only fixing the light bulbs but also lighting up the big light bulbs in the energy problems in the world.

#### ✧ **Speech 9: Be a rational narrator of the world**

Speaker: 周怡巧 # Physics

Question Masters: 石啸睿、吴晨聪

Speech text:

Hello, every one. I'm YiQiao from Zhili College. When mentioning my major, I dare to say that most of you have a good command of it , or at least are rather familiar with it, (the apple is falling and the sun is rising) I believe that you've already got the answer. Yes, it is physics.

But what is physics? We usually think that physics is about explaining the world. But this semester my physics teacher told us that with this notion in mind, we may easily go mad or become philosophers or theologians rather than physicists, like Newton did in his later years. The truth is, explaining the world is actually the mission of philosophers. Physics is all about describing the world. Only describing, nothing more. The apple falls, the banana falls, the fruit falls, the particles attract each other, these are all good physics. We have all kinds of principles, just take the example of the apples and Newton, Newton's Law of Universal Gravitation makes the apple's falling down more reasonable, but it doesn't tell who or what causes it, be it the god or the fairies, physicists don't care about it. Therefore, physicists are romantically called: the narrators of the world.

But if describing is all the pursuit of physicists, why don't we just list all the facts one after another? This actually comes out of our nature, and is what makes us different from animals or computers. We want to learn more about the world, but our brain is limited, so we cannot just insert one fact after another into our brain like the computer, our brain definitely cannot afford this. So our well-developed mental faculties summarize the facts, categorize them, generalize them. It's our gifted talent to draw the profound blueprints describing the world in such a rational and concise way that we are really proud of. (I remember that in the former class one classmate mentioned the beauty of formula lies in its simplicity, maybe this can help explain why.)

Just as Feynman once mentioned, science not only has the value of practical knowledge, but also has the value in intellectual enjoyment. Be the narrator and keep rational, always exploring and never surrender, that's what I think is so special about my major.

Thank you.

## ✧ **Speech 10: Interdisciplinary Horizons: Embracing the Marvels of Mechanics and Beyond**

Speaker: 曹世腾 # mechanics

Question Masters: 邢周豪

Speech text:

Hello, everyone. I am Shiteng Cao. Honestly, I must say the name of my major is quite long: Theoretical and Applied Mechanics plus a double degree in Civil, Hydraulic, and Ocean Engineering. Long name is the feature of QIANGJI Program.

So Firstly, from the long name, you can see the most special point of my major ——so many subjects we have to learn. In our daily learning, we not only focus on mechanics to lay a solid foundation but also dive into civil engineering, learning how to build houses, and explore hydraulic and ocean engineering, studying the movement of water and phenomena like waves and tides in the ocean.

As Shakespeare said, jack of all trades, master of none. Admittedly, the idea of learning a bit of everything may seem challenging, but I don't view it negatively. Learning a bit of everything allows me to step out of my comfort zone consistently. As QIANGJI Program demands, we started with challenging mathematics courses. Later, we dived into engineering, learning how to draw industrial diagrams. Additionally, we explored economics and management courses as engineering jobs require that. Learning a bit of everything not only improves my rapid learning skills but also makes me feel that the money paid to Tsinghua University is truly worthy. In fact, after completing my undergraduate studies, I plan to pursue a master's degree in big data and artificial intelligence, despite its limited relevance to my undergraduate major. This interdisciplinary approach is mainly the result from my long-name major, because of the "learn a bit of everything" mode during my undergraduate years. So, Overall, I don't consider my major a bad choice.

Speaking of my major, the field of mechanics is truly fascinating. When we talk about mechanics, we are essentially discussing how the objects A functions with object B. The word 'function' may sound weird. To put it in another way, just focus on the feeling of standing on the ground, can you feel the force that keeps you steady, but not floating on the cell. That is mechanics. The earth functions with you. It sounds simple, right? But it is the core meaning of mechanics.

So, here comes the question: what is the point that I spend 4 years in Tsinghua for this mechanics diploma ?

On the one hand, models become more complex. In the previous example, you essentially treated the person as a point or the rigid body whose shape does not change. However, in many cases, a person's shape can change, such as when dancing, and we want to understand how much force does the person's muscle generate during the complex movements. On the other hand, the environments in which problems occur can change. In the previous example, you were simply standing on the ground, ignoring air resistance. But when swimming in water, we must consider resistance force of the water.

The third point is that the charm of mechanics is not limited to mechanics. Mechanics has changed my way of thinking. We can use mechanics to explain many problems, such as simulating traffic flow. When I am preparing the speech, I even think that mechanics could be used to explain love. The stability of love could be a statics problem, and the dishonesty of love could be a dynamic problem?

In conclusion, my major is both broad and deep. As a student who will graduate in six months, if everything goes well, I hope it does, I want to share my personal experience. During my four years in university, I often didn't feel the impact of my major on me. However, this speech gave me an opportunity to reflect on my major, and I discovered that its influence on me is much greater than I imagined. It's like the growth of grass in spring. We don't notice it every day, but suddenly, on someday's morning you open the window and you see a lush green scene. It's truly a delightful surprise.

Thank you.

### ✧ **Speech 11: Become a painter who depicts the world**

Speaker: 钱善民 #physics

Question Masters: 胡舒涵

Speech text:

Hello everyone, I am QSM from department of physics, today It's my honor to introduce some of my views about physics, some strange views.

First, I want to ask a question, when you think of the physics, what comes to your mind at once.

Different people maybe have different ideas. And if you type “what is physics” in the Baidu search bar, it may give you two sentences, one is that physics precisely define the most fundamental measurable quantities in the universe. And another one is that physics find relationships between those fundamental measured quantities. It seems that the physics is a rigorous and even a little cold science, one of the most important sciences. But it also has an artistic side.

A basic fact is that people never find anything of nature in some way, they just depict them. We create many words, equations, graphs, charts, diagrams and models to describe our world as we think of it. We believe that the world is beautiful, or in other word, it's symmetrical, unchanging, unified. They are like the three primary colors of art. and the physicist use them as paint and use the mathematics as a brush, finally they create a beautiful picture of nature. Maxwell thinks Electromagnetism should be depicted with a color called unity, then he creates the Maxwell's equations. And another painter who is called Einstein, he like the symmetrical color, or in other word, relativity principle. And this great artist use it create many beautiful pictures, such  $E=mc^2$ .

At all, physical is not only a science that aims to explore the universe, but also an art which plan to depict the whole world. When our ancestors firstly stand up and look at the stars, a white paper called physics has unfolded in front of them. And then the pictures of nature are painted one after one by the people generation after generation. And today, it comes to us.

Become a painter who depicts the world, this is just what I think about the physics. Thanks!

### ✧ **Speech 12: A major that works with all**

Speaker: 徐启轩 # The major of environment

Question Masters: 吴晨聪、宋佳蔚

Speech text:

Hello everyone! I'm Qixuan, long time no see! I actually didn't skip class, I was at COP28, a United Nations-held climate change conference. During the past 2 weeks, I met people from different fields: politics, finance, energy, geology, computer science... It's hard to believe that I encountered so many people from other majors in this world's biggest environment conference, and that's just what's special about my major: what we do in the major of environment expects the participation of people from all walks of life.

You are now probably wondering: I'm studying computer science, he's at the department of electrical engineering, while she is a business school student... What's our business to do with environment? Actually, when walking in a 4-square-kilometer venue, I talked with MIT students who developed a machine learning model that optimized their city's carbon emission; also ran into Wang Shi, the founder and former CEO of Wanke corporation, who shared to me his latest electricity-saving system that reduces total power consumption by 10%; there was also the very popular business concept ESG, Environment, society and governance, being heatedly discussed among all companies. Environment experts provide sustainable solutions, but it is people from various industries that implement and then apply our ideas, that's exactly why we expect everyone's participation.

At this point, another question may pop in your mind: since the environment major is one of the four sinkholes that don't provide me with money, why should I jump into it? I hereby clarify this stereotype: sustainable solutions provided by environment major isn't giving up your usual development and profits, instead, we encourage you to explore the combination between environment and business as usual. Take the energy-saving system I mentioned before as an example: once the system is put into practice, a community can save millions of energy cost. What's more, using less energy also contribute to the decarbonization process, which will eventually make our planet cooler: if we gradually deploy similar technologies in all industries, we can experience a dream-like summer with no 40-degree days. With all these advantages, I believe your participation in our major's work is more than just worthy.

Remember what Armstrong said on the moon? That's one small step for a man, one giant leap for mankind. If we each take a small step towards the major of environment, mankind will take one giant leap towards our shared, sustainable future. Thank you!

### ✧ **Speech 13: How is Civil Engineering related to our daily life**

Speaker: 郭雨莲 # Civil Engineering

Question Masters: 胡舒涵

Speech text:

Since the former speaker has already given a brief introduction to civil engineering, I would like to present this field in a more down-to-earth way: how is it related to our daily life. When speaking of Civil Engineering, many of you may come up with dahui or banzhuan or other things related to

concrete and steel. Well, Civil Engineering is more than that. It's actually super connected to many aspects of our daily lives. Let's start with where we live. Think about those tall skyscrapers and the cozy houses we call home.

Civil engineers are the brains and muscle behind them. These buildings aren't just about keeping us dry and warm; they're a huge part of our lives, holding all our memories and feelings. They are marvels of engineering, combining aesthetics, functionality and safety, and stand as testaments to human intelligence and toughness. Then, let's talk about how we get around – the roads, bridges, and tunnels we use to zip to work, school, or wherever. Civil Engineering is the magic behind these lifelines. They don't just make our travel easier; they serve as vital links for economic development and social interaction.

And here's something cool – civil engineers are like our guardians against disasters. My thesis, for example, is about tsunami simulations. It's like a race against time to figure out where a tsunami might hit after an undersea earthquake. This can help warn and evacuate coastal areas super quickly, reducing the damage and saving lives. At the same time, civil engineers are figuring out ways to use renewable materials and cut down on building emissions, aiming for a greener and more sustainable future. Ancient Chinese used four words to describe the essentials of daily life: "clothing, food, housing, and transportation." Civil engineering governs half of these: "housing" and "transportation". In a word, Civil Engineering is not just about concrete and steel; it's about creating a safer, more efficient, and sustainable world. It's a field that touches every aspect of our lives, making it not only special but also irreplaceable. Thanks for listening!

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## Day 2 [December 20, 2023]

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**Morning Session    09:50-11:25 (Room: 清华学堂 202)**

**Session Chairs:** 杨峻麟 张淑杰

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### ✧ **Speech 14: Human+AI: a Powerful Duo in the Smarter Era**

Speaker: 宋佳蔚 # Artificial Intelligence



Question Masters: 石啸睿 刘昊天

Speech text:

Hi, everyone! I am Jiawei from IIS, and my major is Artificial Intelligence. Today I'm here to share a little journey that started back in high school. I remember reading about AI taking over the world, but instead of fearing it, I got curious, as a bystander.

How intelligent is AI? That's the most basic question. In 2016, AlphaGo beat Lee Sedol in a five-game Go match. In 2018, Siri was expanded to support over all products of Apple. In 2020, GPT-3 came to our world with its impressive text generative ability. AI is so special because it has become such a part of our lives that we cannot ignore its existence. We are all users today. Sometimes we may wonder, is AI going to take human's place and become master of the world?

My answer to this question is no. Definitely no. What I'm saying is that we need to appreciate the huge opportunity that humans and AI come together to achieve outcomes that neither one could do alone on their own. I believe many of you have heard of or even used chatGPT as a productivity tool. Remember when you are using it? Polishing your email you're going to send to your tutor, searching for materials you need for your class paper, or asking for advice about what present you could prepare for your girlfriend's or boyfriend's birthday? AI could serve as your external brain. But most importantly, we are learning together with AI. Not replaced, not taken over, but learning together. When you are reaching out to AI for help, you get decent sentences in your email you may not know how to express before, you get organized ideas for your topic you have never known, you get personalized suggestion on the birthday present because AI will ask you about more details and then give its answer by your user portrait. Why does AI have the ability to answer these questions? Because humans are offering data. AI works as the concentration of human wisdom, which in turn helps people learn the wisdom of the entire human race.

Still we may have doubts about AI gaining consciousness of its own and destroying humans for their own benefit. As developers, when promoting the tech of AI, we need to be so careful about safety to let AI align with the underlying unconditional love for humans.

We are hungering for a duo with AI in this smarter era. Thank you.

## ✧ **Speech 15: Rational? Maybe irrational**

Speaker: 扈心航 # Economics

Question Masters: 魏衍芑 曹世腾

Speech text:

You're strolling along the streets on a sunny afternoon in mid-January, you have finished all your finals and now it's time for you to plan your winter holiday. Within seconds, you receive a phone call, a new short message, a WeChat message and an e-mail, your friends are calling you for a trip to the seaside, your cousins want to invite you over for the Spring festival, your supervisor wants you to remain at school to finish your graduate thesis and you, the decision maker, feels nothing but lost in all these proposals.

Well, you can't accept or agree to all of these invitations or requirements because you only have a limited of time, taking one means that you will be definitely turning down other ones. So how are you going to make a decision you will never regret?

In economics, there is a specified concept that seems to be born for this scenario in life, utility. Every single activity we experience in life has their utility level and decisions should be made to maximize our utility. Playing video games with your buddies may generate a 100-utility level while going ice skating may only generate 80, thus you choose to play video games. There seems to be many synonyms for the concept of utility, happiness, fulfillment, improvement etc.... The truth is, utility is the sum of all these terms, it ideally captures the added value for a person when he or she makes a decision.

In economics, the most fundamental assumption is that everyone is a rational person, being rational in terms of economics is that we will always make the choice that adds the most to our utility. According to economics, if we act to this principle, we will be able to make the best decisions and lead a successful life that satisfies our own expectations.

However, is this really that useful in real life?

After I learned economics principles in my first year, I have been striving to be a rational person in life myself, and if there is anything I learned during these three years, it is that it's impossible to become a completely rational person. The reason why this was, still is and will continue to be a fundamental assumption, instead of a fundamental truth, is that the definition of being rational in

economics, is an idealistic concept segregated from our real life. While the utility of playing basketball and video games does seem easy to determine, there are so many scenarios in life in which we can't quantify certain decisions. How would you define the utility of spending time with your family and working for your career? How would you decide between enrolling a graduate program in China and studying abroad? Some people may say that there is always something to help quantify the issues, including money, including demanded time and effort, but are these enough to help you form a numerical utility level for a complicated decision that has two sides? Even if someone in the future comes up with a perfect model that is able to label decisions in a short-term precisely, don't we have to consider long-term effects as well? The butterfly effect tells everyone that one single decision in life may lead to irreparable changes in life, how will we evaluate the utility change of a decision in our entire lifetime?

The truth is, it's hard, future outcomes of a single decision may be affected by social environment, political changes, natural disasters, all of which are beyond individual control, these external risks lead to uncertainties in life and leads to uncertainties to our decision utilities.

Now you may be puzzled about my speech, I'm telling you how useful and meaningful being a rational person and maximizing your utility in life is, and then I'm telling you how impossible it is to achieve that goal, I seem to be going against myself.

But no, what I'm trying to say, is that it's ok not to be rational in life sometimes, well, most of the times, maybe. Not being able to maintain rationality isn't your fault, we human beings are not rational creatures not only because we can't control the uncertainties in future development, but also because we have feelings and emotions that we cannot simply quantify and these uncertainties, feelings, and emotions are what makes our life sparkle and appealing.

So, forget being a rational person, try using utility as a tool or model that is and only is in your service when needed and try being a real person who is sometimes rational, sometimes emotional, sometimes even unreasonable.

## ✧ **Speech 16: Bottled Sun: a Way to Developing New Energy Sources**

Speaker: 罗艺轩 # Engineering Physics

Question Masters: 郭雨莲 黄春阳

Speech text:

I am from the department of engineering physics. The title of my speech is "Bottled Sun: a Way to Developing New Energy Sources".

Last week, our fellow classmate Qixuan have delivered a speech about the environment, focusing on energy conservation. Today, I want to show another path to treat environmental problem instead of saving energy. There is an idiom in China "Develop resources and reduce consumption.". In addition to reduce the energy consumption, we can look for solutions from another perspective - developing resources. Imagine we could develop a clean energy source that is as inexhaustible as the air, the world's energy crisis would be completely solved, and people's perception of environmental issues would change fundamentally. Seeking an infinite and clean energy source is not a pipe dream; in fact, such energy does exist, and that is nuclear fusion energy.

The sun is the biggest energy source in the human world. Why is the sun burning, emitting large amounts of light and heat constantly? It's because nuclear fusion reactions inside the sun continuously provide it with energy. Nuclear fusion is the process of two light nuclei becoming a heavier nucleus. Achieving controlled nuclear fusion is like putting a sun in a bottle. In order to keep this man-made sun burning, three conditions need to be met: one is high temperature, one is high pressure and the other is a sufficient confinement time. At such a high temperature, a new state of matter called plasma is created, which is different from solid, liquid, or gas. The most promising device to achieve fusion reactions is called tokamak. It uses a magnetic field to confine plasma and heat it to the target temperature.

If the technology of controlled nuclear fusion is available, energy will no longer need to be conserved. The nuclear fusion fuel stored in the oceans is enough to meet humanity's energy demands for billions of years. In addition, fusion energy is clean enough. Nuclear fusion neither emits greenhouse gases nor produce waste, causing no harm to the environment. Although controlled nuclear fusion has enormous potential, this technology is not yet ready for application. Researching nuclear fusion requires a large amount of funding to construct devices, even beyond the capacity of a single country. Some people joke that achieving controlled nuclear fusion is "always, always 30 years away." However, I believe that in the future, controlled nuclear fusion technology will make the world a better place.

That is what makes my major special. Thank you.

✧ **Speech 17: Thermal power generation: Cherishing old friends when embracing new friends.**

Speaker: 崔嘉骏 # Energy and Power Engineering

Question Masters: 徐启轩 杨天明

Speech text:

Good morning, everyone. I'm Cuijiajun from Weiyang College. And my major is energy and power engineering. When we talk about energy these days, many of you may think about the clean energy like wind power or solar power, which develops very fast in recent years, as chencong mentioned last week. But today, I want to talk about the traditional side of our major, the side that you may think they will fade into history.

Perhaps you have heard a joke that students majoring in energy and power engineering are good at burning the boiler. In fact, that is not a joke, nearly one third of professors in our major are doing research about how to burn the boiler, which is the essential step for the thermal power generation. Thermal power generation is our old friend, which plays an important role in human civilization in the last century. In my view, facing the new era, it will continue to play the indispensable role and develop with time rather than fade into history.

First of all, it is critical to maintaining energy safety, especially for China with abundant coal. Thermal power generation accounts for over 60% of total electricity generation in China in 2022. We all know that the new energy like wind power and solar power is green and without carbon, but it has one killer disadvantage: fluctuation. They rely on the weather too much. If it's cloudy today, then the solar power couldn't work anymore. In these situations, we need the more reliable electricity supply——thermal power generation ——to cut the peak and fill the valley in order to secure the power grid and guarantee electricity for daily use. So we often regard the thermal power generation as the keystone of the energy system. Take a real example, Sichuan suffered extreme drought in the summer of last year, which results in a short supply of electricity since 70% of electricity generation is come from hydroelectricity in Sichuan. So many thermal power plants that had once been not in service restarted to ensure that everyone could stay in the room with air-conditioner comfortably.

Second, in order to build a world of sustainable development, we are also improving our boiler. Nowadays, thermal power plants are no longer big smoky chimneys as you may imagine. We

control the emission of pollutants and we even capture the carbon dioxide from smoke to reduce the climate change. Besides, the boilers are not only used for burning coal, they can also be used for burning the clean fuels like hydrogen or ammonia. These clean fuels are been considered as the next generation fuel for thermal power plant.

In conclusion, the update of the energy is just like the revolution of our society. When we are embracing the new things, don't forget about our old friends. Maybe they will adjust themselves for the new era. Maybe they will come out at some important moments, just as the saying goes: a friend in need is a friend indeed.

That's all. Thank you!

### ✧ **Speech 18: Integrated Circuits: Smaller Scale, Greater Power**

Speaker: 勾天润 # Electronic Engineering

Question Masters: 魏衍芑 杨依龙

Speech text:

In 1946, the first electronic digital computer, ENIAC, was born in the University of Pennsylvania. Here are some parameters: it was 30 meters long, 6 meters wide, 2.4 meters high. Just imagine such an electronic monster, it was too big to be carried in a bag or to be adopted in household, which is common for computers we use today.

From ENIAC to personal computer today, a smaller scope means it's much handier to carry and use the computer. Actually, behind this revolutionary change is the development of integrated circuits, which mean an assembly of electronic components, fabricated as a single and small unit capable of collecting, processing and transferring information.

Smaller scope, but more importantly, greater power. Facing an era of information explosion, IC contribute especially by revolutionizing the way we do computation. ENIAC could only compute 5000 times of add operation a second, but the CPU made by intel in my computer can perform million times better than that. ChatGPT fascinates us with magical capacity, but few people know how much OPENAI has to pay NVIDIA for the great amount of computation done on NVIDIA's GPU. Google also has designed its own product named TPU, focusing on nothing but just AI model computing. I just mentioned CPU, GPU, TPU, and the common part "PU" stands for

“processing unit”. They are all a special kind of processor, the most complicated category of IC. They are small but powerful, endowing us with high computing power in this era flooded with information. AI researchers construct amazing models and write beautiful code at the level of software, but if it weren't the efficient hardware, these powerful processors, AI would just be castles in the air.

Smaller scope, greater power, that's the aim of IC and also what's special about my major. I just talked about computation, but apart from that, ICs also store data, transmit signal and help charge electrical energy. Each of these functions is vital to modern daily life, and corresponds to a specific research area. Electronic engineers are always pushing forward the boundary of these domains for smaller scope and greater power.

Thank you.

#### ✧ **Speech 19: Mechanical Engineering May Not Be As You Think**

Speaker: 王骞成 # Mechanical Engineering

Question Masters: 秦跃 杨天明

Speech text:

When it comes to mechanical engineering, what do you think? Big machines making loud noises in factories? Workers tightening screws? Well, those are indeed part of mechanical engineering, but they're too limited. In fact, even the term "mechanical engineering" itself is limiting. I believe a better way to describe it is "manufacturing". So, what is manufacturing? It includes everything from large vehicles like cars, airplanes, and ships, to the small chips inside our phones. It's about changing the physical world to fulfill our desires and create a better life.

You might think that mechanical engineering is an outdated product. It is from hundreds of years ago, the time of the first industrial revolution. But actually, that's not true. It really keeps pace with the times. Let's take a look at someone I admire in the business world—Elon Musk. He recently introduced the second generation of their humanoid robot called "Optimus," a big improvement over its previous version. The rapid development of the humanoid robot industry has driven the upstream component industry. Can you guess what part is in high demand? Electric motors. They are used to control the joints of humanoid robots. And since a humanoid robot requires at least forty motors, it has led to increased market value for many domestic motor manufacturing companies.

Here's another example: Did you know that biofabrication is also a research area in the Department of Mechanical Engineering at Tsinghua University? In biofabrication, we use 3D printing to create biological structures using cells. I was surprised too when I first heard about this field. It's an expansion of the concept of manufacturing engineering. And it shows it is keeping pace with the time .

Now, let's go back to our first question: What is manufacturing? Before this question, Do you know the definition of mechanical motion? It's the process of an object's position changing over time—in summary, it's displacement.

What does the displacement results in? It turns something without value into something valuable, disorder into order, and natural into artificial . In summary, the result of displacement is development. This is the role of mechanical engineering—to bring about progress, transforming the objective world to fulfill subjective desires.

So, I believe that mechanical engineering may be the most complementary field to philosophy. While one seeks to understand the world, the other desire to change it. They are opposite but unified and inseparable fields.

Thank you, everyone!

## ✧ **Speech 20: Environmental Engineering -- A Major Sustaining Us and Reshaping Me**

Speaker: 胡舒涵 # Environmental Engineering

Question Masters: 罗艺轩 徐启轩

Speech text:

These days, environmental protection has become an important issue. But when Your parents' vehicle can't go on the road due to traffic restrictions, when the factories in your hometown are forced to shut down, when one day, you start your own business, you have to pay environmental protection tax regularly-- you may come to think that, Environmental Engineering is making our lives more inconvenient, and holding back the pace of human progress.

But here I am, as an environmental engineer, building this model to help you think more clearly. If the advancement of human civilization can be quantified, like these strings of number on the slide.



The mission of all other majors, is to add more “0” to the end of the string, to making it bigger and bigger, while Environmental Engineering, is to hold on to the first digit “1” that represents the environment, without which, all things we have achieved is just zero. It’s true that in the short term, environmental protection slows down economic progress, but in the long run, it’s committed to the sustainable development.

That is what’s really special about my major. While sustaining you and me, Environmental Engineering has also reshaped my philosophy of life thoroughly.

I used to be shut up within the circle of private interests, but in the process of learning how to solve the Interregional, International and Intergenerational environmental problems, I began to be acquainted with concepts like regional collaboration, global conventions, as well as long-term planning. That’s to say, environmental education exposes me to the whole outer world and a longer view of time.

Then every time I think of people whose hometown is submerged by rising sea levels and the uncertain future of this planet, I find that everything I have been worried about myself just vanished into the air. I came to realize, set in the midst of powerful nature, my private world is a rather small one. And that realization really gives me peace of mind, and faith to move forward.

### ✧ **Speech 21: Exploring new physics: The Role of Advanced Scientific Instruments in Modern Physics**

Speaker: 黄春阳 # **Physics**

Question Masters: 勾天润 宋浩喆

Speech text:

Good morning, everyone! I'm 黄春阳, a student of Physics. Initially, I thought the great physicists of history had discovered most of the fundamental laws governing the universe, with very little to discover. However, I soon realized this assumption was incorrect. Today, I'd like to discuss how advanced scientific instruments are expanding our knowledge and the controversy about great scientific instruments.

First, let's talk about the expansion of our knowledge. As science and technology evolve, our understanding of the universe continually grows. In each era, this understanding has its limits. Nowadays, we are pushing these limits into extreme environments—be it extreme cold, enormous

scales, or incredibly minuscule dimensions. It's in these extreme conditions that physicists discover new laws of physics. To explore these realms, we rely on great scientific instruments.

Consider the realm of the extremely small, for example. Understanding the fundamental components of matter is a significant challenge in physics. If we examine ordinary materials, like this microphone, at a deeper level, we see molecules, atoms, electrons, and beyond. Currently, we believe quarks are among the most basic constituents. Our goal is to understand the laws governing quarks.

To study such minute particles, we need high-energy particle collisions. These collisions, under specific conditions, can break down particles into even smaller components for analysis. The greater the energy of the collision, the smaller the particles we can potentially observe, the greater the instrument we need to build.

However, the challenge lies in the cost of scientific equipment. Our latest instrument, the CEPC, is valued at a staggering two billion dollars – roughly the budget of the Beijing Olympics. This investment could fund numerous other scientific research projects and contribute to broader social development. Therefore, even with its great potential, figures like 杨振宁 remain critical of such massive expenditure in this field.

In conclusion, the field of physics is still active. It continuously faces and overcomes various challenges, enhancing our comprehension of the universe.

## ✧ **Speech 22: Economics: a concise description of the world**

Speaker: 唐雨珂 # Economics

Question Masters: 钱善民 扈心航

Speech text:

Hello, everyone. My name is Yuke. I am from school of economics and management, majoring in economics.

When talking about economics, a typical stereotype is money. It seems that economics students will make a lot of money upon graduation. However, our core mission is actually to grasp human society's rules in the simplest way possible.

Unlike mathematicians and physicists, who research natural phenomena, economists look into human phenomena, probing the fundamental logic of human society in a simplified form. Essentially, economics offers us with a collection of fundamental ideas that serve as the framework for understanding how individuals and societies make decisions. For example, as more people seek to buy houses in Beijing, the increasing demand exceeds the relatively consistent supply, driving prices to unthinkable levels. People may also consider the opportunity cost. Imagine, what will you do if you do not use these money to buy a house? Maybe you can spend them on traveling around the world, or buy a Rolls Royce. These things you give up in order to afford a house would be the opportunity cost of this purchase. The scenarios appear complex, but the core idea is simple: there is always an “invisible hand” pushing you to do everything.

However, the world may not as perfect as economists think. There are a lot of frictions and other intricate factors in reality that make this hand less efficient than in theory, such as information asymmetry, search costs and regulatory constraints. People themselves are not always rational beings. In fact, this is where economists are most chastised: Many people argue that economic theories are founded on too many assumptions, making the model too simple to align with the real life. However, in the first step, we hope to ignore the frictions and unrelated aspects in the real world in order to capture the fundamental logic, much as physicians do. Then, when we gradually let go of these assumptions, we can become closer to the real world. Just think about the housing market. The most simplistic hypothesis holds that every individuals in the market is rational. They only consider their marginal expenses and return. Nonetheless, the sunk costs, such as pre-paid retainers, may have an impact on them. They may even be motivated by the purchases of others and make foolish selections. As a result, we incorporated these psychological aspects into our "rational man" assumption, resulting in the formation of a new sub-discipline known as behavioral economics.

Based on this mixed nature, we don't just study abstract concepts; we apply them to real-world circumstances. The uses of our knowledge are boundless, whether it is addressing financial challenges, making policy decisions, or developing commercial strategy. Our research findings will not only help us understand today's challenges, but will also prepare us for tomorrow's.

Therefore, I invite each one of you, regardless of your major, to explore the intriguing world of Economics. It is not merely academic theories; they are dynamic forces that drive the engine of our global society.

Thank you.

## ✧ Speech 23: My stories with CE

Speaker: 刘昊天 # civil engineering

Question Masters: 吴晨聪 王骞成

Speech text:

Hello everyone. I'm Liu Haotian from the department of Civil Engineering. Last week, two of my classmates shared the basic content of civil engineering with you, so today I want to tell you some stories about me and civil engineering.

When I was very young, it was still the age of civil engineering. High-rise buildings grew like bamboo shoots from the soil, and civil engineers made a lot of money. So one day after the final exam, my dad asked me, "Civil engineering at Tsinghua is very good, do you want to go there?" I said I didn't want to. Why can't I find a job in the office instead of working under the sun. Then he asked me again, "But do you want to go to Tsinghua?" I said how could I, I can't get in. Finally, 12 years later, I stand here, speaking to you.

I thought it's probably a kind of destiny. I started to think about what I could learn here. At first, I was very excited because there were a lot of classes with interesting names. But as I studied, I found something was wrong. Why was I always doing PPT and writing very stupid reports. So I spent my freshman year in confusion. Then it was my second and third year, I started to take relatively professional courses, but still mainly focused on mechanics. Theoretical mechanics, material mechanics, fluid mechanics, structural mechanics...There were so many mechanics. But I still didn't know how to design a house. I began to feel annoyed. On the one hand, I was struggling like a drowning person in various seemingly professional courses, on the other hand, I still felt that I knew nothing.

Later, I began to accept this. The civil engineering that we see in our daily life is mostly about production process. This industry is already familiar to us, so even if I am not proficient, I can easily learn it during work. There are also many parts that we are not familiar with, such as disaster prevention, earthquake resistance, fire prevention, high-strength concrete, etc. In fact, more scientific research is needed for these aspects, and it's normal to have many unknown things in the research. So I am slowly reconciling with myself now. In fact, to some extent, life is like civil engineering that I study. In CE I study this, I study that, and finally I will build a structure. In daily life, I encounter this, I encounter that, and finally I will build myself. So it is this process itself that

gives the greatest significance. Perhaps when I look back after ten years, I will be grateful for these once lost days.

### ✧ **Speech 24: What's Difficult About Getting Things Moving?**

Speaker: 秦跃 # Mechanical Engineering

Question Masters: 胡舒涵

Speech text:

Good morning, everyone. Today, I am glad to share some interesting insights I have gotten in my three-year major study. My major is Mechanical Engineering, which seems to be a discipline that functions everywhere in our lives. At first, I thought every item with a real physical body could be the target for mechanical engineers, like the blackboard, the desk, the door, and even the camera. But is it true? Not really. Do you have an idea about which item in the room is most “mechanical”? You can look around and think about it for a while. ... From my knowledge, this projector screen is most mechanical. The reason is that it can move by itself which we call dynamic. So dynamic is the most crucial feature of mechanical items and 90 percent of our courses in my undergraduate years is to ensure this function of our design. But maybe you will have a question about it: Is there any challenge to make a thing move? Unfortunately, the answer is yes. Let me explain with an example.

Imagine you want to design a fan. You need a shaft (轴) with high rotating speed to provide a cool breeze, and you also need to place it in a certain position in your structure. Making the shaft rotate is simple as you can use a motor to drive it, but there are many other problems we need to consider to make it move correctly and safely. For example, how do you support the shaft's weight when it is moving fiercely / without any unstable friction or conflict? that's exactly where the bearing (轴承) counts. In my hand is a special type of bearing which we call thrust ball bearing (推力球轴承). Its working way makes it easier for you to learn why they could support rotating shafts efficiently. The upper layer will follow the rotating shafts while the lower one is in close contact with the still base shell. The speed difference is divested by the flexible balls inside perfectly. Also, the whole weight of the shaft is loaded on the bearing and transmitted to the base shell. Without this little item, we can not make a lot of things move correctly and safely, but this is just one of the numerous problems we are considering to get things moving.

So in conclusion, I just want to convey a point of view: what mechanical engineers want to do is just to make things move efficiently and safely in every piece of equipment. No matter it's a robot dog or a fan. That is why this major fascinates me. I love sports and moving and motion always will bring some interesting and unique things to happen.

Thanks.

✧ **Speech 25: Crucial Role: an Example of how the Finance Industry functions**

Speaker: 杨依龙 # 专业名 Finance

Question Masters: 唐雨珂

Speech text:

Good morning, everyone! I'm Yilong, currently a senior student from the School of Economics and Management. Today I'm more than glad to share with you my insights into the unique field of finance. Finance is considered one of the most popular undergrad majors and is recognized as one of the most profit-making industries. Nevertheless, some people who are unfamiliar with finance may cast doubt on the necessity of the industry.

Frankly speaking, finance is at the heart of every business. However, the industry is so broad in its range that it's impossible to cover every important value of it in three minutes. Therefore, I want to elaborate on a specific example of how the finance industry functions and creates social benefit. The example is called investment banks. Investment banks play a crucial role in the financial system by facilitating the flow of capital, and the major and irreplaceable function of them is underwriting and issuing securities.

I suppose you or your parents have traded stocks in the A-shares before. But have you ever thought about how those outstanding stocks originate? Actually, the liquidity of them wouldn't be made possible if there weren't the investment banks to provide support. In order to offer a place where firms who need capital inflow with public investors who have money in hand and long for investment, the regulatory authorities approved the establishment of SSE (证券交易所). However, how should we decide which companies to be eligible for public fund raising and securities offering? In order to achieve that, the government granted several investment banks with the franchise to underwrite those securities offering and earn a percentage of fee as a result.

In order to facilitate the deal and earn the money, we have to do two things in general. Firstly, we use our professional competences to investigate into every aspect of the target company. This can ensure the quality of the company's earnings, give confidence to the investors, and foster trust between buyer, sellers and regulators. Secondly, banks will source some cornerstone investors who are interested in buying the stocks. Once establishing the sell-buy relationship, the deal will launch

and both sides will benefit from the capital flow. This is a typical example of how finance industry helps with capital re-allocation and investment efficiency.

For example, in my last internship at an investment bank, we successfully sponsored a commercial real estate firm to make a public security offering for 4.1 billion CNY, during which I contributed to the investigations in order to satisfy the regulator's standard of offering. We create a lot tangible impact for the client firm and also the investors, which I really take pride in.

I hope my elaboration help you get to know more about an application of finance and the tangible value of it. Thank you!

### ✧ **Speech 26: The Counter-Intuitive Mindset in Aerodynamics**

Speaker: 邢周豪 # Aerospace Engineering

Question Masters: 阎禹辰

Speech text:

Good morning! I am Zhouhao Xing from School of Aerospace Engineering. Most of us have taken flights before. As the fastest and safest commercial means of transportation, aircraft evolves along with aerodynamics. But unlike other disciplines, the most featured thing in aerodynamics is the counter-intuitive mindset.

This mindset plays an important role in aerodynamic design. For example, when we talk about streamlined shape like the upper image, we usually say it will result in low drag (阻力), while the lower one seems to result in high drag. However, things turn to be different when speed becomes higher, exceeding Mach 5, that is to say 6000 kilometre per hour. The upper one will experience extremely high drag. In the early 20th century, trials on this kind high-speed aircraft, called hypersonic aircraft, were all designed like the upper one, as intuition told us. But they all failed. An American scientist Allen came up with a counter-intuitive design called 'blunt-body', just like the lower one. He said that only blunt shooting stars could travel through the atmosphere and reach the ground, so hypersonic aircraft should be blunt, too. This idea suddenly broadened the horizon of the designers, and with no doubt, it succeeded. The counter-intuitive mindset helped him create a new theory.

This mindset is also beneficial to our own practice. This summer I was participating in an aircraft

design competition, to carry tennis balls with size limitation on wings. Intuition to increase the lift (升力) to carry more is to enlarge the wings, but we could not. So, what we did was carving slots between flaps and main wings. The upper image is the aircraft we developed, and please notice the orange part. By doing so, the lift increased tremendously and we were able to carry more than 200 tennis balls at a time. To better understand of what we did, you may just think about the shape of wings of an aircraft when it is landing. There are also slots between the flaps and the main wings. Counter-intuitive mindset helps us draw inspiration from life and optimises the seemingly normal work.

In conclusion, the charm of aerodynamics is the counter-intuitive mindset, to jump out of the trap of our mind. When we encounter problems in life that are hard to solve, why not think more divergently and counter-intuitively, then your horizon will be broadened and your heart will be enlightened. Thank you!

#### ✧ **Speech 27: Algorithm for Computers and Algorithm for life**

Speaker: 魏衍芃 # Computer Science

Question Masters:

Speech text:

Let's imagine that you are waking up in the morning and attending this class, Beijing's winter mornings are too cold, you definitely want to choose the fastest way to reach the classroom. I believe many of us may regularly go along 学堂路 or go across 北馆. But you can take a shortcut when you have trouble choosing your route, just by opening a navigation APP and letting it decide.

But what is a navigation APP doing when calculating the shortest path? That would be an algorithm's job.

First, we need to mathematically model this problem so that the computer can understand, and then, we need to design an efficient way to handle the problem. Simply enumerating every possibility is not enough because our cell phone does not compute infinitely fast. When it comes to going to the airport, you may have trillions of possible paths, way out of what our computer could handle. Actually, we can avoid enumerating with the help of an efficient algorithm.

So, the goal of designing an algorithm must be to design an efficient way to solve realistic problems. Well, That was my understanding about algorithm. However I changed my mind after I



took the algorithm design course. Well, a critical problem is that there are so many problems in the world waiting to be modeled and solved, a tiny change in the problem would make the algorithm totally different. Meanwhile, when the problem seems unsolvable, we are unable to know any information other than "We don't know how to solve it".

Algorithm design says that the very least we can do is to categorize the problems, we don't need to really solve a problem, but by categorizing it, we at least understand the difficulty of the problems. The problems are categorized into multiple parts, P, NP, NP-Complete, NP-Hard, each one is more difficult than the previous, currently, we only have efficient algorithms for P problems. But by categorizing, we could explore the underlying relationship of the problems. For example, we currently don't know if P and NP are equivalent, and this is the ultimate problem of algorithm design, even for the Computer Science!

That's how algorithm design increases our knowledge about these problems. It is not only about solving real-world problems one by one, but also about finding a principle among different methods and categorizing what's already been modeled. Learning algorithm is not only about "how to solve a problem", but also about "how to solve problems" and "how to solve every problem". It is not only about exploiting a computer but also about exploiting the possibility of the computer.

#### ✧ **Speech 28: How is lift generated?**

Speaker: 郭鹏翔 # Aerospace

Question Masters: 邢周豪

Speech text:

Hello everyone, I'm Pengxiang Guo, specializing in aerospace engineering. Firstly, I'd like to ask how many of you have been on an airplane? I believe that most people have. Now, how many of you know what makes an airplane fly? In other words, how is lift generated? Some of you might recall this picture from the physics textbook. We call it the equal transit time theory. (等越时理论)

This is a typical shape of an aircraft wing, with the upper surface longer than the lower surface. During flight, the airflow over the upper surface is faster than that over the lower surface. According to Bernoulli's principle, as the speed increases, the pressure decreases. Therefore, the pressure on the upper surface of the wing is lower than that on the lower surface, resulting in an overall upward lift force.

It's a natural, simple, and straightforward explanation that has convinced many people and even made its way into physics textbooks. However, this is not a correct theory and has led to confusion for many students.

There are two clear counterexamples. Think of a kite. Its airfoil is a flat plate → top and bottom exactly the same length and shape, and yet they fly just fine. This theory also does not explain how airplanes can fly upside-down which happens often at air shows. The longer surface is then on the bottom!

Another explanation for lift is Skipping Stone Theory. Lift comes from the "impact" of air on the lower surface of the wing, somewhat similar to "skipping a stone on water."

In fact, these two explanations are the most common ones for lift. However, both are incorrect or incomplete. Even today, there is no final conclusion in the academic community on how lift is generated. Various explanations have been proposed, but the debate focuses on which explanation is more fundamental.

If we want a professional explanation, we can consider the Kutta-Joukowski theorem. This involves a lot of specialized mathematics and mechanics knowledge and is not intuitive, so it's not suitable for popularization.

When it comes to natural laws, people often like straightforward and decisive statements like "a straight line between two points." However, in reality, a specific physical phenomenon is much more complex and abstract. Lift is a typical example—it's so complex that students in aerospace majors spend a semester to understand just the basics. The debate about lift is not at the technical level, as the technical aspects of lift generation are well understood. It's about the non-technical level— which explanation is more fundamental, easy to understand, and as comprehensive as possible.

A simple description of a complex issue with broad popularization value and profound expertise. I believe this is the charm of the lift problem.

### ✧ **Speech 29: From PN Junction to a Screen**

Speaker: 孙博闻 #

Question Masters:

Speech text:

[完成演讲后填写]

### ✧ **Speech 30: “Beyond Hero's Journey”: The Characters in Movies**

Speaker: 姜乃源 # 专业名 Film and Television Communication

Question Masters: 唐雨珂

Speech text:

I think everyone here knows Plato's "cave metaphor": a group of people bound to a cave, facing the wall and unable to turn back. The only thing they can see is the projection of what is behind them. Since they had never seen the real thing, they mistook the shadow for the real thing.

Well, even though my undergraduate major is philosophy, I'm not going to talk about philosophy today. I'm about to study film and television communication in the future, so in reference to Plato's cave metaphor, today I want to talk about the fascinating, fictional movie stories and their characters. In a way, stories and characters are the just like shadows on the walls of Plato's cave, which are not real but seem like our real lives. These characters can reveal who we are, what we love, what we fear, what we dream of, and what we fight for. That's why they are told and loved by generations of people.

Great screenwriters often write a great story by creating a great character. I think some of you may have heard of "Hero's Journey", which is a classic character creation rule summarized by Hollywood screenwriters. It means that the hero of the story is called upon to leave his home and go on an adventure. After going through many challenges and trials, the hero eventually overcomes the difficulties, wins the victory, and returns to his or her home. Such a narrative template has been applied to countless classic Hollywood films, such as Star Wars, The Wizard of Oz, and so on. But we know that Hollywood doesn't dominate the global movie market anymore, right? There are so many movies that are not telling the "Hero's Journey" story. Screenwriter Anthony Mullins has thus written a book, Beyond the Hero's Journey, which proposes a more diverse range of character arcs.

According to Mullins, in a movie story, a character is constantly faced with changes and conflicts in both the external world and internal world. Often in movies, it is the external environment that changes first, and this change forces the character to change his insides, such as his attitudes, thoughts, and emotions, allowing him to make difficult choices that are different from those he has made in the past.

Different from the most classic "hero's journey" narrative, in most cases, the character is complex, and the changes that occur in the world at the moment may not have changed the character internally, and the character sticks to the choices he or she has made in the past. Until an important issue is in front of him, he finally makes a different decision and changes his past self - Mullins calls this the optimistic arc of changing characters; and there are other times when characters are faced with escalating conflict, and they struggle to do something to escape from the situation, but they are often at the mercy of things they can't control, and so they do not make the right choices. Every "seemingly right choice" pushes them into the abyss of death and destruction—that is a "pessimistic arc of changing characters".

In Mullins' character arcs, we see characters who are more complex and closer to the real world—not all of them can be heroes, but they write stories that are even more touching and powerful than the Hero's Journey. After all, not everyone can be a hero in real life, right? Nevertheless, even we are not heroes, we are precious. Just like the characters in the movies with their different arcs are still liked by us.

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### **Supplementary Example 1**

Note: The speech is about positive psychology.

#### **Original:**

Undoubtedly, nowadays more and more young people have mental health problems, but when we face these problems, our focus is often on how to alleviate pain and reduce negative emotions, instead of how to create happiness and joy. The unique of positive psychology is it focuses on "create happiness" rather than "fix pain". It is more concerned with how to help us ordinary people create happiness and avoid falling into depression, so the focus is on a larger group of people. "I'm so annoyed by a bunch of things lately." "I can't finish catching up with DDL." "The pressure is making me breathless." These are the complaints we always hear, rarely will you hear someone tell you that they have everything going perfectly well. What exactly is happiness? Is it random or is it traceable? How can you become happier? Positive psychology uses scientific principles and methods to study happiness and the

positive psychological qualities of human beings. It broadens people's perspective, leads them to ask positive questions, and guides them to find ways to "create happiness" rather than "fix pain".

**Revision:**

Undoubtedly, nowadays more and more young people have mental health problems: "I'm so annoyed by a bunch of things lately"; "I can't finish catching up with ddl"; "The pressure is making me breathless". These are the complaints we always hear, and rarely we hear someone tell us that they have everything going perfectly well. When we deal with the complaints, our focus is often on how to alleviate pain and reduce negative emotions, instead of how to create happiness and joy. The unique of positive psychology, however, is it focuses on "create happiness". It is more concerned with how to help us ordinary people create happiness and avoid falling into depression, so the focus is on a larger group of people. What exactly is happiness? Is it random or is it traceable? How can you become happier? Positive psychology uses scientific principles and methods to study happiness and the positive psychological qualities of human beings. It broadens people's perspective, leads them to ask positive questions, and guides them to find ways to "create happiness" rather than "fix pain".

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**Supplementary Example 2**

Note: The speech is about the difference between understanding and empathizing. This is a story told by the speaker.

**Original:**

Four years ago I was in Germany attending a summer camp. I had an Indonesian roommate who only took off her mask in dorms, got up early in the morning and prayed three times a day. I was kind of indifferent to her behaviors because I didn't see any point in doing so. Until one day, she unexpectedly opened the door for a boy and got so frightened that she hid into the washroom, shivering, and would not utter a single word. I suddenly realized that something I had overlooked mattered so much to her.

**Revision:**

Four years ago, I stepped into my dorm at a summer camp in Frankfurt and saw three faces with three different colors. This was only my very first shock. I had an Indonesian roommate who only took off her head covering in the dorm, showing her black long hair. I wondered why she insisted on wearing that covering since it must be hot and uncomfortable. But I soon felt comfortable with it, as I understood it is a ritual. I learned to be tolerant until one day, when the girl, without covering her hair, opened the door and found a BOY out there. She got so frightened that she hid into the washroom, shivering, and would not utter a single word. I suddenly realized that I had overlooked something that mattered so much to her, and I finally felt the comfort and protection that head covering had brought to her.

