# Two Paths, One Summit

Viewing Art Creation and Technical Research from the Double Diamond Model

Zejun Huang

About Methodology

Double Diamond model, one of the most classic approaches in product design, will serve as the framework to explain the process of creating a product design. I will then compare this with the process of creating an art installation, highlighting the differences between the two. Through this, I aim to explore the relationship between art and science.
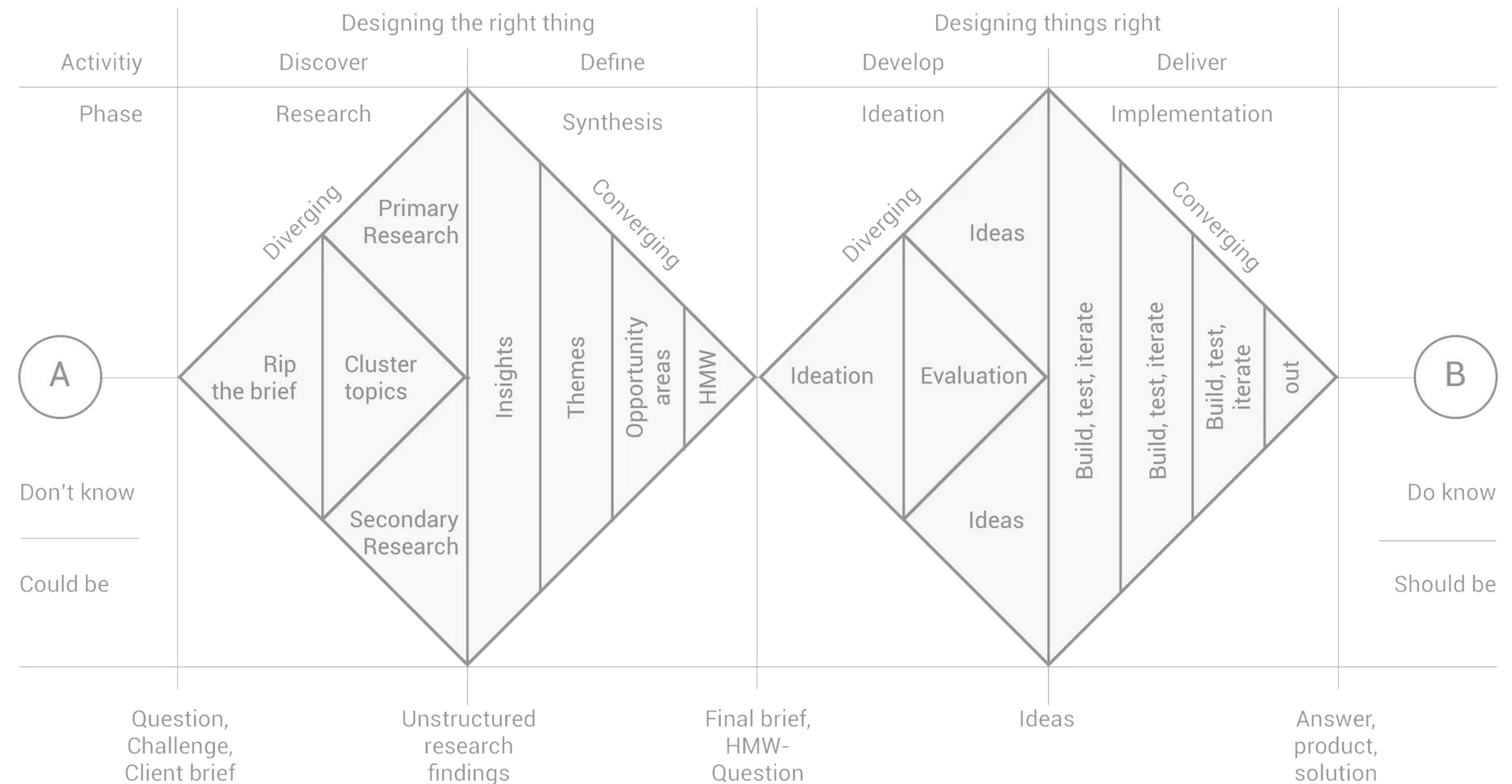
.Art

For artists, this phase is like "Pure Research" without a clear end goal. They seek inspiration through exploration and experimentation.

.Technology

Product designers uncover the problem's essence and identify design opportunities through user interviews, competitor analysis, and data analysis.

Discover

The discovery phase can be understood as a period of exploration, where the focus is on divergent thinking and gathering information. During this stage, we delve into the essence of the problem, compiling all potentially relevant information we can associate with it.

Discover

Background

As of 2023, China accounted for approximately 18% of the global visually impaired population, making it one of the countries with the highest number of visually impaired individuals. Among the positions offered by Chinese employers to people with disabilities, only 5.51% are suitable for those with visual impairments. For a blind person living in China, massage is often their only career option.

Documentary: Blind But Not Masseur

2.2 billion
People worldwide are visually impaired or blind over

17 million
Visually impaired in China over

93%
Massage therapy is the most common job for blind people in China.

7%
Emerging professions (primarily IT professionals and technical specialists)

The basic employment situation of people with visual disabilities

言语残疾 19.75%
听力残疾 22.66%
肢体残疾 50.83%
视力残疾 5.51%
智力与精神残疾 1.25%

N/A	Level 1	Level 3	Level 2	Level 4
15	90	93	131	252

Visual impairment level

35-40Y	30-35Y	25-30Y	>40Y	<25Y
46	69	121	143	202

Age group

MA PS	N/A	HS/TSS	BA	AD	Junior high school
7 30	53	102	122	132	135

Education level
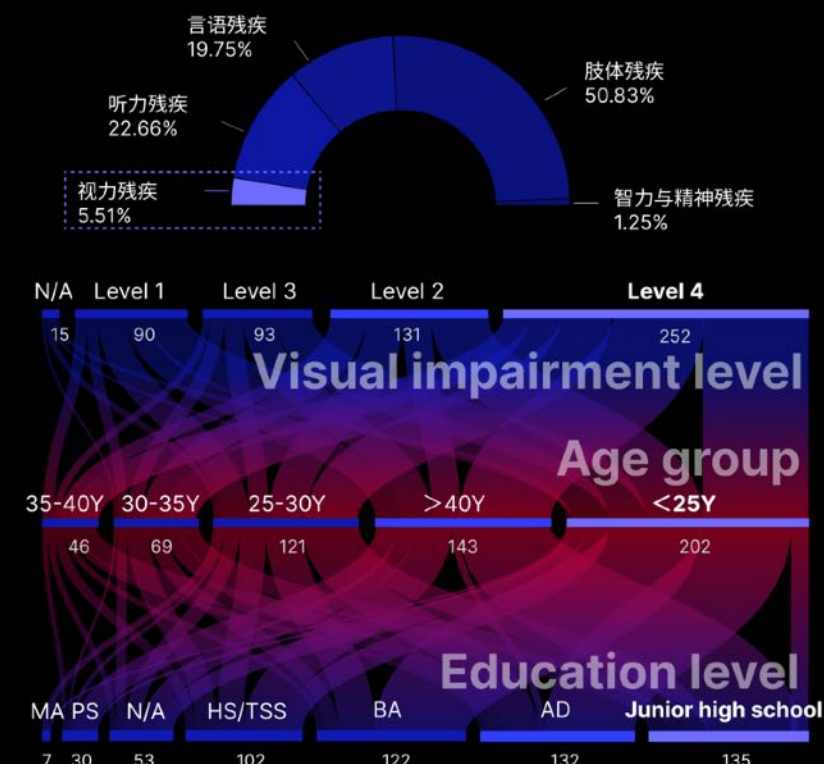
Employer Profile: Few Positions, High Barriers.
Among the job listings provided by employers for people with visual impairments, only 5.51% are positions specifically supporting this group. This directly reflects the limited job market for the blind.
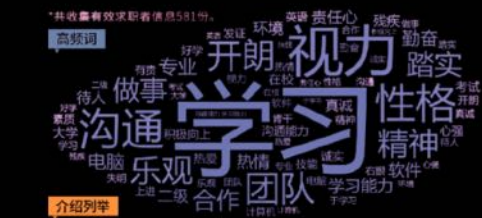
Job Seeker Profile: Willing to Learn, Full of Hope.
Among job seekers with visual disabilities, there are two distinct groups: young people with higher education and middle-aged individuals with only basic education.

Due to visual impairment, they need to spend more time mastering tools and acquiring skills.

"I may have lost at the starting line, but I don't intend to lose in effort."

User interview

The developers visited a school for the visually impaired to study students and teachers, aiming to understand career interests and job challenges.

Mr. B (low vision patient)

"I don't like watching videos because I can't see what's happening on the screen. If the tutorial only shows actions, I don't understand. But with voice explanations, I can follow. I prefer voice guidance when learning online, step by step. I can't learn from videos alone."

Problems encountered during online self-learning:
Visually impaired individuals cannot understand tutorials through videos and rely on audio explanations.

Miss Z (Totally Blind)

"The old school had limited space and few models. In physics, the teacher lacked tools, so we only briefly touched a model. He often traveled, skipping topics like optics and electricity, only covering the main points."

Problems encountered during offline teaching:
Lack of assistive hardware tools
Insufficient teaching resources
Inadequate number of teachers
Disjointed teaching content

Accessible Programmer (Totally Blind)

"I am currently a massage therapist, but I enjoy programming. I have been self-learning programming for 10 years."

"Researching is hard for me because 90% of websites aren't accessible, making it difficult for blind people to use them. There are also few tutorials for the blind, and most blind programmers do it out of interest, not as a career."

Accessible Programmer (Totally Blind)

"I was a massage therapist but learned programming in my spare time. Now, with a friend's recommendation, I work as an accessibility programmer."

Blind School Teacher (Totally Blind)

"My blind students show interest in fields like writing, music, and psychology. However, most end up pursuing massage or music, while fields like mathematics and Chinese have few job opportunities, despite blind Ph.D. candidates."

Insight

Through interviews with visually impaired individuals, I learned that many are reluctant to pursue massage as a career. They have diverse professional interests, such as music, programming, and counseling. However, they face several challenges in entering these fields:
• Skill Gaps: Limited accessible resources make learning difficult.
• Employer Bias: Employers often underestimate their abilities.
• Mobility Issues: Travel challenges hinder access to on-site jobs.

Let me use a recent project as an example to illustrate what needs to be done in each of the four stages. This project aims to help visually impaired individuals find employment. We conducted research on the blind community in China and found that most face significant employment challenges, with many limited to working as massage therapists. We then carried out in-depth, face-to-face interviews to identify and confirm the specific issues they encounter.

Define

We'll Show You to How We Work, But Before That Let Us Do The Intro !

At this stage, both artistic creation and technical research begin to become more focused on practical application. For artists, this phase is about **refining the initial ideas and inspirations into a clear conceptual framework** or design direction. In technical research, this phase is more systematic, as researchers **analyze the problem, clarify the research objectives, formulate hypotheses, and design experiments**. The key in both art and technology is to distill the broad insights or ideas from the Discover phase into **a clear, actionable plan** or solution direction. Both fields need to refine and crystallize what was discovered, ensuring it is feasible and relevant.

Case study

Research revealed that the main challenges for visually impaired individuals are skill acquisition and employer acceptance. To broaden their career options, developers analyzed existing platforms for employment and learning.

Skills Learning and Education Resource Platform

ICEVI	Hadley	Bookshare A BENETECH INITIATIVE
Teachers at the School for the Blind	Visually impaired	Visually impaired
Online tutorials, global education support, and policy advocacy	Video tutorials mainly focus on daily living skills for the blind	Platform for reading and knowledge acquisition
Policy-focused, limited user experience	Tutorials lack interactivity, hardware support, and employment help	nsufficient vocational training and employment support

Vocational Training and Employment Support Platform

宜生无忧 助残就业·共同富裕		Vision Australia
Disabled people and enterprises	Disabled people	Visually Impaired Australians
Crowdsource unwanted jobs to people with disabilities	Share job information and offer government support for start-ups	Provide offline vocational training and counseling
Limited training and few jobs of interest for the blind	Assessments don't suit the blind; lack of personalized support and practical training	Geographic limits and insufficient online resources.

- Target Grop
- Functions
- Drawbacks

1. Currently, there is no platform offering self-learning courses in areas of interest for blind people.
2. No platform combines online job skills and hardware support for the blind
3. Tools to assess the blind's vocational abilities are lacking
4. No algorithm matches the blind with suitable jobs

Platform Concept

Self-learning tutorials for blind individuals
- Create standardized courses
- Tailor to blind individuals
- Use multisensory cues
- Include voice guidance

Skill Assessment & Grading:
- Implement skill evaluation
- Grade abilities
- Guide blind individuals' career paths
- Offer company hiring incentives
- Increase workplace inclusion

Learning assistance hardware
- Provide supportive tools
- Enhance learning
- Focus on the visually impaired

Side Jobs & Entrepreneurship:
- Match with side jobs
- Align with skills and interests
- Break employment barrier
- Enable selling creations

List of occupations suitable for the blind

We further investigated which professions are suitable for blind people and can capture their interest. The results show that music is an area where many blind individuals express interest and possess talent.

Adam Ockelford
- British musicologist
- specializing in music cognition.

Young blind children, including those with disabilities, may **show more interest in music** than sighted peers.

Jessica Phillips-Silver
- Music neuroscientist
- specializes in rhythm perception and brain development
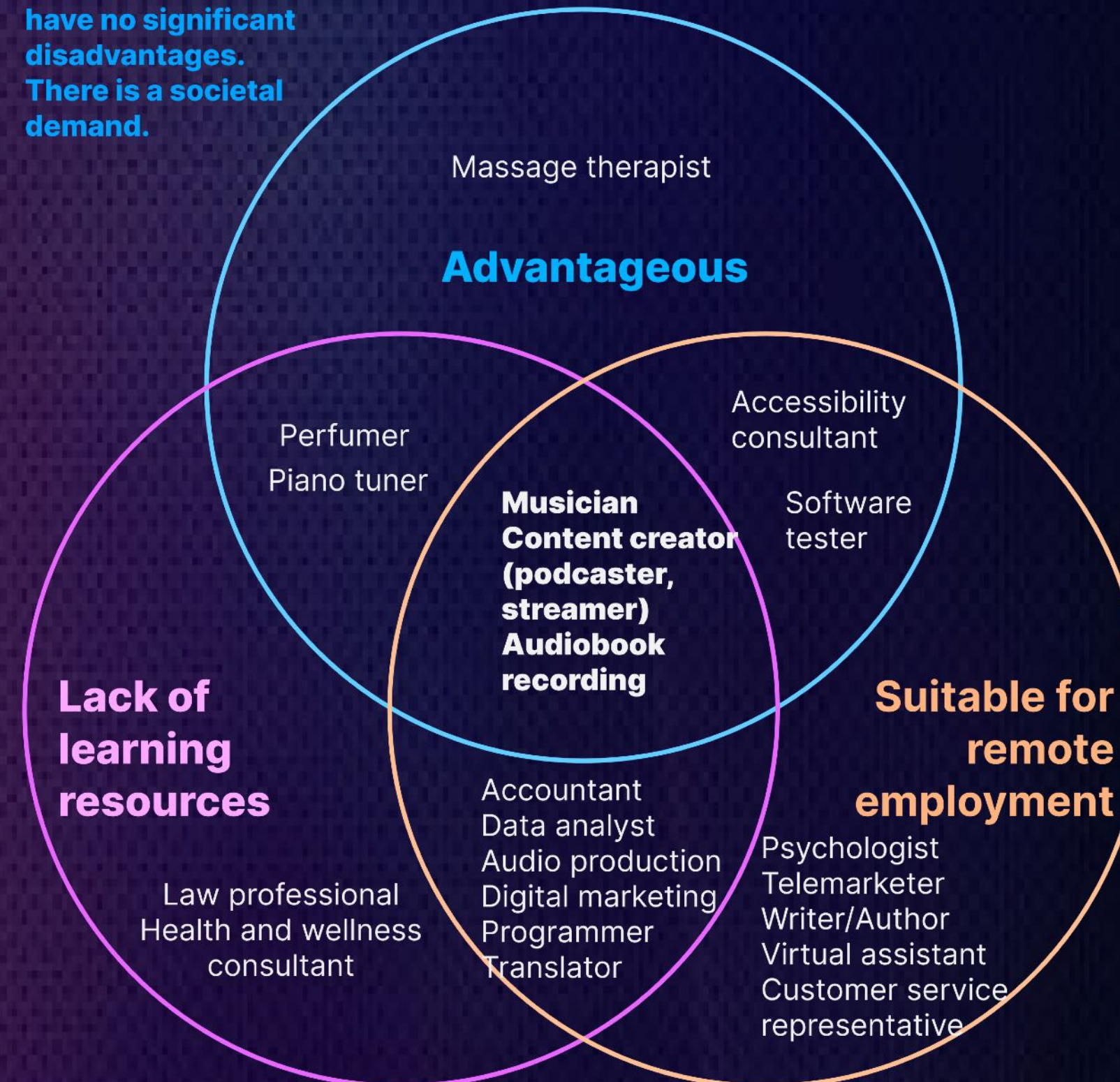
In blind individuals, **hearing and touch** occupy visual brain areas, with brain plasticity linking visual and auditory cortices, **boosting other senses and musical talent**.

Ockelford, A., & Matawa, C. (2010). Exceptional musical abilities in blind children.

Phillips-Silver, J., VanMeter, J. W., & Rauschecker, J. P. (2020). Auditory-vestibulomotor processing

Blind individuals have no significant disadvantages. There is a societal demand.

Advantageous
- Massage therapist

Lack of learning resources
- Perfumer
- Piano tuner
- Law professional
- Health and wellness consultant

- Musician
- Content creator (podcaster, streamer)
- Audiobook recording
- Accountant
- Data analyst
- Audio production
- Digital marketing
- Programmer
- Translator

- Accessibility consultant
- Software tester

Suitable for remote employment
- Psychologist
- Telemarketer
- Writer/Author
- Virtual assistant
- Customer service representative

Data source: China Disabled Persons Employment and Entrepreneurship Network Service Platform

First-hand research - v

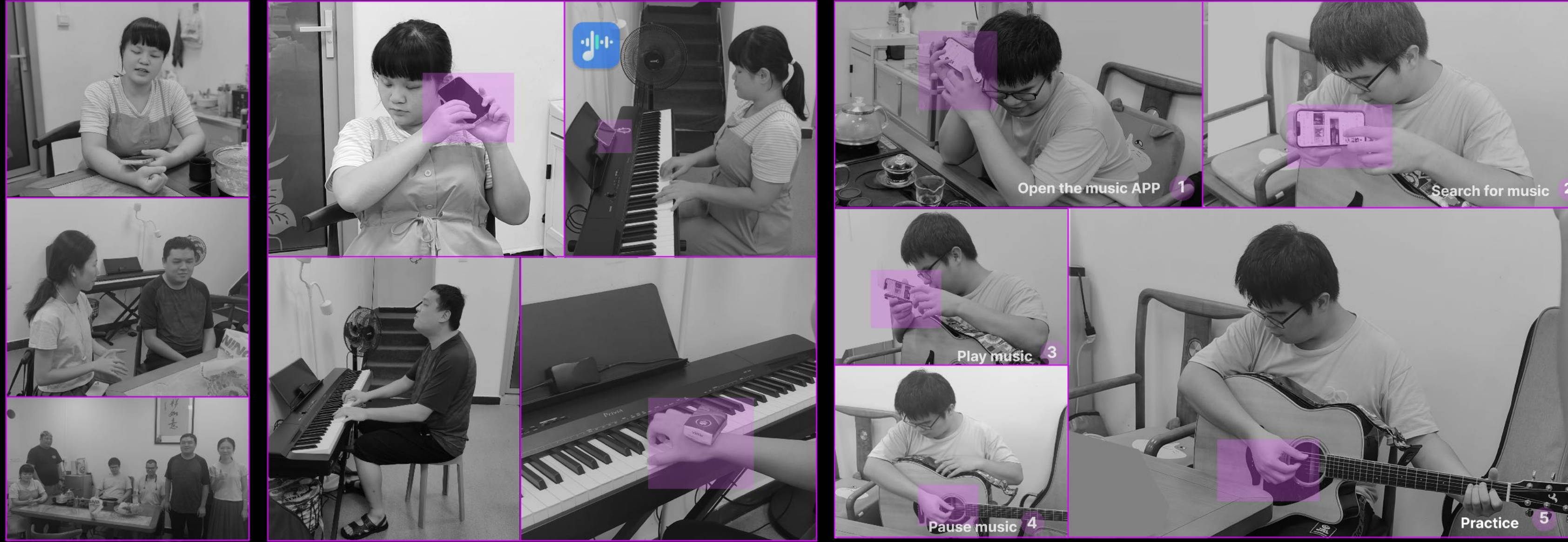We visited a blind music studio, where they ob

Painpoint Inductio & Solutio

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- Beginners do not unders
- Teaching videos are diffi people to understand
- AI sheet music interpreta lengthy
- Frequent dragging and p playback
- Lack of Braille sheet mus the blind
- Timely correction and fee needed during practice
- The quality of online she
- Hiring someone to read s and practice is expensive
- The channels for booking performances are relative

# First-hand research - visiting a blind music studio

We visited a blind music studio, where they observed blind individuals playing instruments and learning new songs.

Open the music APP 1
Search for music 2
Play music 3
Pause music 4
Practice 5

Painpoint Induction & Solution Dedection

During interviews with blind individuals, we found that blind beginners often struggle with learning the guitar because they need hands-on guidance to correct finger placement. As a result, we focused on the challenges blind people face when starting to learn the guitar.

- Beginners do not understand fingering
- Teaching videos are difficult for blind people to understand
- AI sheet music interpretation is too lengthy
- Frequent dragging and pausing during playback
- Lack of Braille sheet music teaching for the blind

Teaching Guidance

- Multisensory prompts for fingering
- AI recognizes video actions and provides narration explanations
- Optimize the expression of voice-based sheet music reading
- Automatic segmented playback for practice

- Timely correction and feedback are needed during practice

Correction Feedback

- Monitor and determine if the finger position is correct
- Provide feedback and guide the finger to the correct position
- Repeat practice until correct before continuing the tutorial

Teaching Resources

- The quality of online sheet music varies
- Hiring someone to read sheet music and practice is expensive

- Collaborate with music publishers/professional volunteers to convert sheet music into audio
- AI-powered automatic sheet music extraction

Commercial Resources

- The channels for booking commercial performances are relatively limited.

- Expand collaboration channels and promote campus partnerships

Blind Guitar Fingering Correction Device
- Tactile Feedback

Online music learning tutorials
- Voice tutorials
- AI posture monitoring
- Segmented practice playback
- Crowdfunding sheet music reading service

We conducted First-hand research and identified several specific issues, such as Teaching videos are difficult for blind people to understand and the need for timely correction and feedback during practice. We categorized these educational resources into four areas: instructional guidance, correctional feedback, educational resources, and commercial resources. Overall, we addressed these specific challenges through a Blind Guitar Fingering Correction Device and an online music learning tutorial. Of course, the presentation process also incorporated some data visualization techniques, which is also a part of aesthetics.
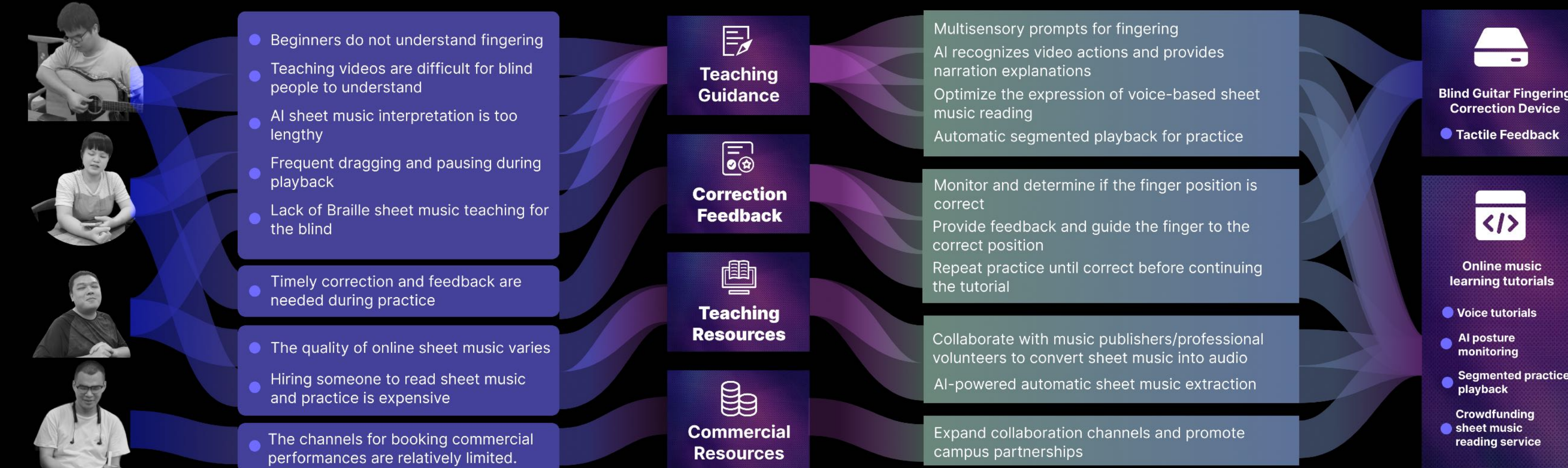
Develop

In art, the develop phase involves continuous experimentation and revision to form the final piece.

In technology, it includes prototype development, technical implementation, and testing.

At this stage, both art and technology may have different solution options and version iterations.

System Map

· Improve learning efficiency
· Increased access to employment opportunities
· Increase self-confidence and independence

· Reduce Recruitment Risks
· Gain policy support and incentives
· Enhance social responsibility image

- - → Financial flows
——→ Operational support
——→ Submodule feedback
——→ System feedback

kol knowledge sharer

blind users

Paid purchase
Upgrading job skills
Income
Sharing Courses

Matching the right job

Entry fees, brokerage fees

Provide reference for hiring

Employers & Businesses

Development and maintenance expenditures
technology enabler

Online Tutorials & Hardware

Career Competency Assessment

system

Side Hustle Recommendations

Employment opportunities

Adjusting policy indicators

Policy, resource and educational support

Funding, resources, educational support

Blind schools & training institutions

Entry fee

Sharing Courses

advertising placement

Government

Technical development team

Bookshare
A BENETECH INITIATIVE

Non-profit tissue

Merchants & Partners

· Expanding Educational Resources
· Enhancing Teaching Effectiveness

· Developing new markets
· Continuous product optimization

· Gain self-fulfillment
· Realize the value of life
· Increase your influence

· Promoting the Employment of Blind People
· Reducing the cost of social support

Service Blueprint

Stage	Discovery	Registration & Login	Skill Assessment	Learning & Traini
Evidence	Ads & Social Media	app	Skill Assessment Questions	**Interactive Hardware** / Audio Courses
Costumer Journey	• Discover the platform via referrals or social media • Download the app, visit the home page	• Follow voice instructions to complete registration	• Conduct a comprehensive skill assessment • Choose a suitable tutorial	**Purchase supporting learning tools** • Use audio tutorials or hardware to assi • Take a skill test after course completio
Line Of Interaction				
Frontstage Actions	• Social media promotion & referrals	• Voice-guided registration	• Generate test reports • Match suitable tutorials	• Coordinate product and shipping in
Backstage Actions	• **Partner** promotion support		• **Reviewer: Assessments & report review**	• **Schools/Organizations/Volunteers:** provide resources • Logistics Service • After-Sales Service
Line Of Internal Interaction				
Support Processes	Marketing Customer Service Partner Network	Platform Tech Support User Assistance	Assessment System Data Storage Standard Updates	Tutorial Development Hardware Maintenance Course Updates

For the software part, we completed system design and service design.

	Learning & Training			Teaching Sharing & Interaction	Work Upload & Sales		Rating & Side Job Recommendation	
	Interactive Hardware	Audio Courses	Skill Certification	Knowledge-Sharing Community	Work Display Page	Transaction Page	Skill Assessment Questions & Report	Job Recommendation Page
...uestions								

| ...ehensive
...tutorial | **Purchase supporting learning tools**
Use audio tutorials or hardware to assist learning
Take a skill test after course completion for certification | | | Publish tutorials
Interact with other visually impaired users | Upload works, set prices for sale | | Conduct a comprehensive skill assessment
View recommended side jobs, apply for suitable positions | |
| ...t reports
...e tutorials | Coordinate product and shipping information | | | Publish tutorials page | Product and shipping communication | | Match suitable jobs/side gigs | |

| ...ssments | **Schools/Organizations/Volunteers: Develop courses, provide resources**
Logistics Service
After-Sales Service | | | **Reviewer: User content review** | **Platform Admin: Manage uploads, display, and transactions**
Logistics Service
 | | **Companies: Update job listings**
Job Matching System | |
| ...ystem
...tes | Tutorial Development
Hardware Maintenance
Course Updates | | | Course Review System
User Feedback | Payment System
Transaction Management | | Job Database
Matching Algorithms
Policy Support
Corporate Collaboration | |

10

Tactile feedback ring

How to learn to play guitar for beginners ?

二品 一品
三品 三品 二品 一品
四品
456弦 P

3弦 2弦 1弦
m a ch

每一品丝分隔指板为12品   旋钮   琴头
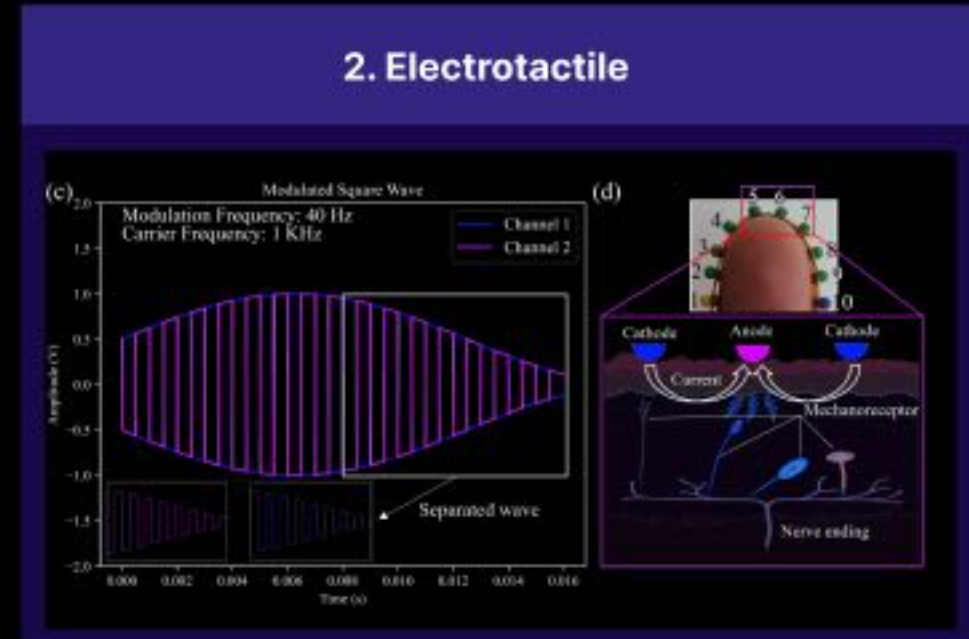
六线谱

读作"4弦二品"
读作"3弦零品（空弹）"

左手负责按"品"，右手负责拨"弦"
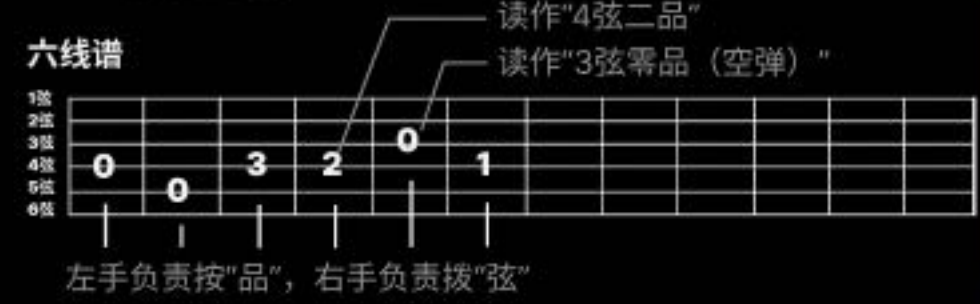
因为不同和弦手指负责的品会变动，所以要求吉他演奏者左手依靠上下左右位移调整手型。对于视力正常者尚且有难度。因此，为了更好的辅助盲人纠正手型，需要硬件去提醒正确手型的位置。

Comparative testing of haptic techniques - preparation

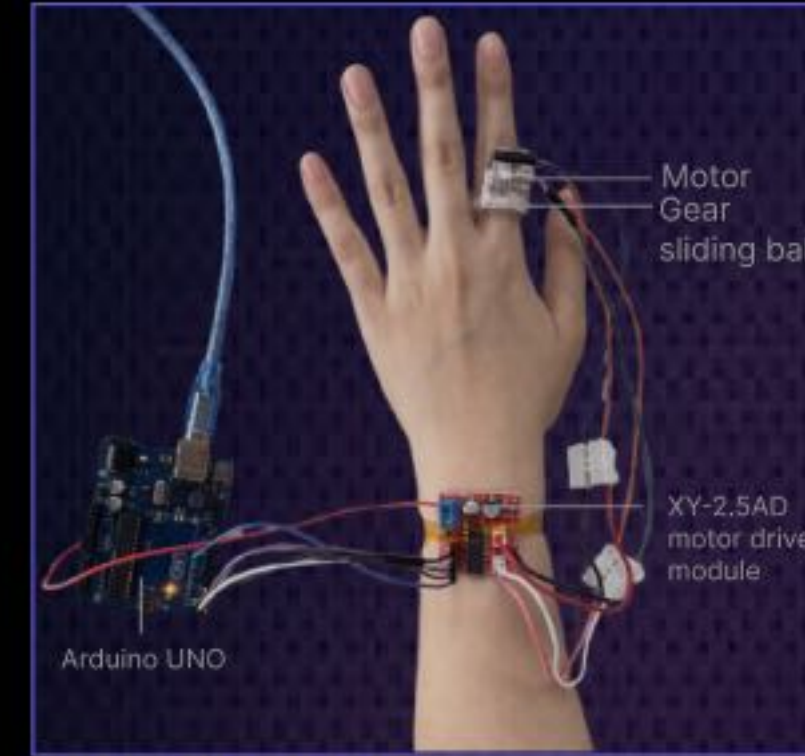开发者通过收集文献和资料，对滑动、电触觉和震动三种触觉反馈形式进行了模拟。

1. Slide

Small gear 0.3M 8齿

齿条
slide ball
Small gear 0.3M 8齿

2. Electrotactile

Modulated Square Wave
(c) Modulation Frequency: 40 Hz
Carrier Frequency: 1 KHz
Channel 1
Channel 2
(d)
Cathode Anode Cathode
Current
Separated wave
Mechanoreceptor
Nerve ending

3.vibration

Tactile technology test

The developers had five participants test each of the three forms of haptic feedback and collect their experiences and feedback.

Test A Slide

Motor Gear sliding ball
XY-2.5AD motor drive module
Arduino UNO

Tester 1   The test subjects closed their eyes to simulate a blind person
Tester 2
Tester 3

Length mismatch

Limitations: Sliding gear is larger and can't fit different hand types.
由于齿轮传动的特性，指环只能做成硬质的固定形状，因此无法贴合不同的手形，开发者认为此局限性无法改进

Test B Electrotactile

Anode
Cathode

Tester 1
Tester 2
Tester 3

I can't feel the direction.
You Xiangning

This electrical sensation feels a bit uncomfortable.
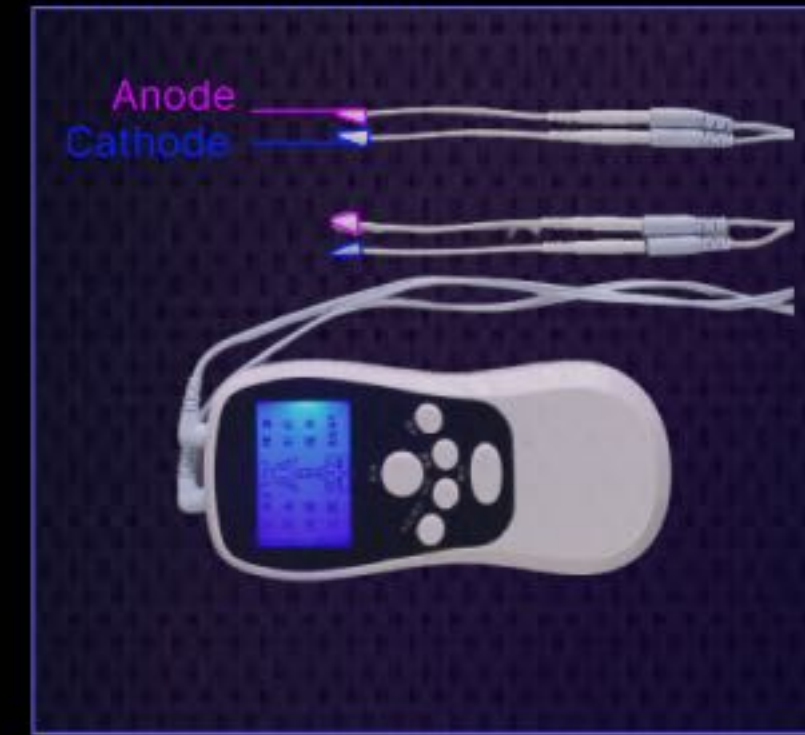
Limitations: ：电刺激触感随机性较大，触感令人不适
此方法如需调整电刺激程度需要定制fpc，开发成本较高

Test C Vibration

vibration motor

Tester 1
Tester 2
Tester 3

The vibration range is a bit broad, making it hard to distinguish between front and back directions.
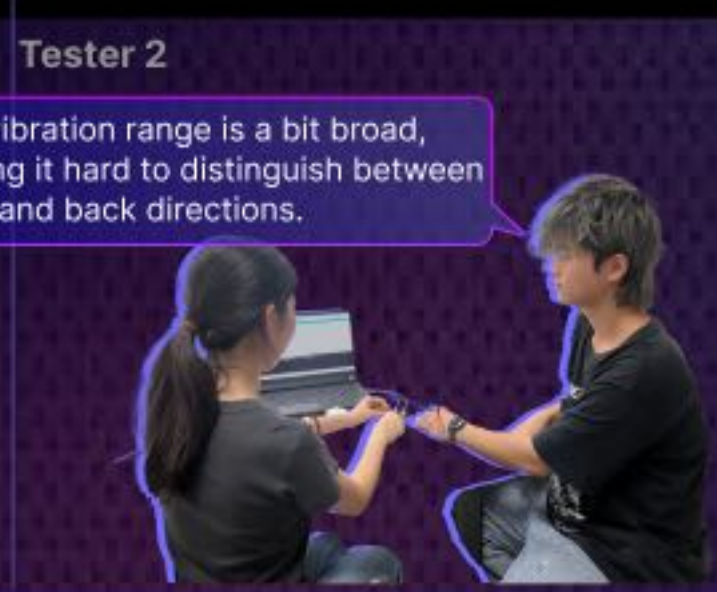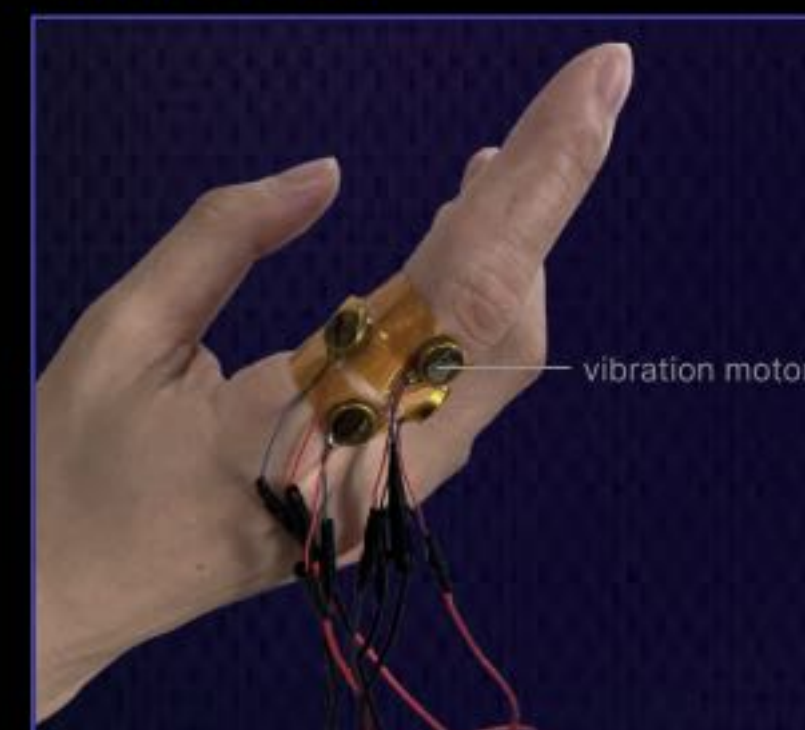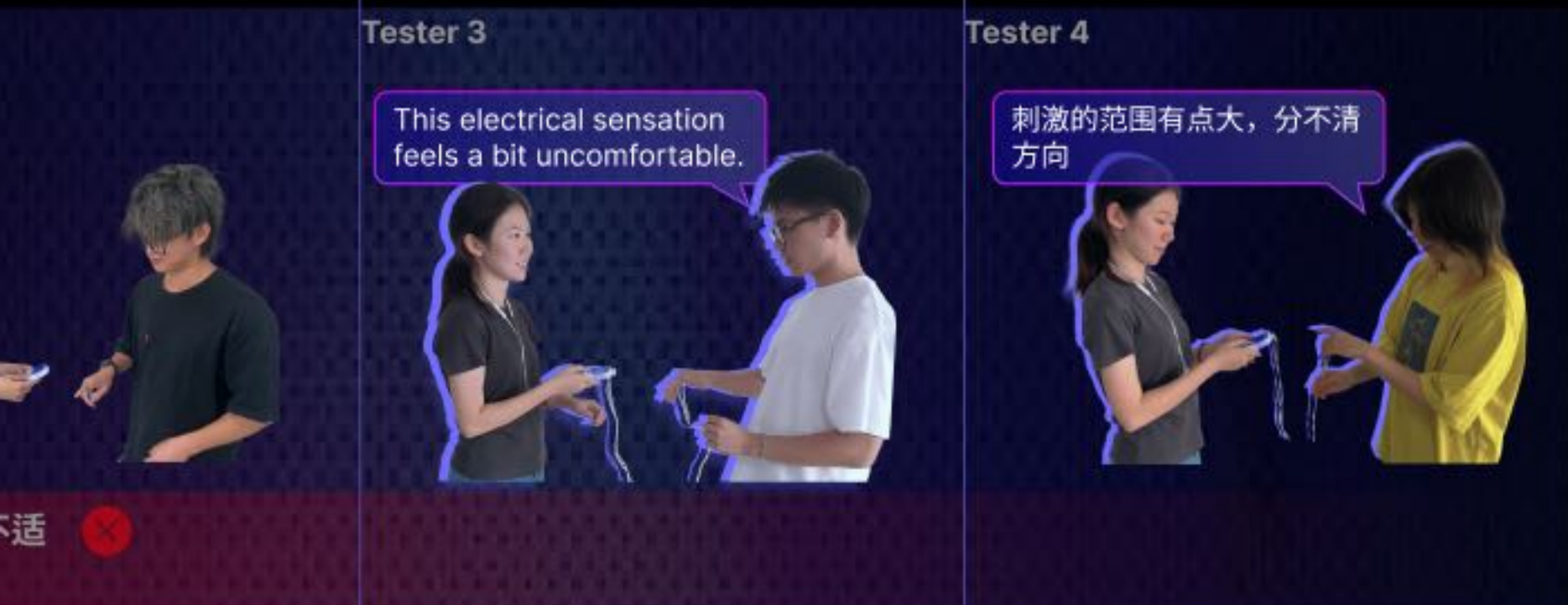
Limitations: ：震动范围不精确，一个电机震动会影响周围震动   **Improvement direction:** 如何隔离震动
开发者认为此方法虽然存在局限性，但是其灵活性较大，能够贴合适应不同的手形，有改进的空间。

Form and material exploration

开发者通过搜集文献资料，进一步探索**如何使得震动反馈更精准的改进方法。**

1. Amplitude[1]

• Recommended Voltage:
2.5V to 3V (around 50-60% of the motor's rated power)
• Peak-to-Peak Amplitude:
round 0.5 to 1.0 mm

2. Frequency[2]

• Optimal Frequency Range: 150 to 250 Hz.

(To achieve around 200 Hz with a typical Arduino board, use a PWM setting between 40-60% duty cycle)

3. Duration[3]

• Pulse Duration: Start with a pulse duration of 200 to 300ms per cue.
• Rest Time: For repeated cues or sequences, add a rest time of at least 100 ms between pulses.
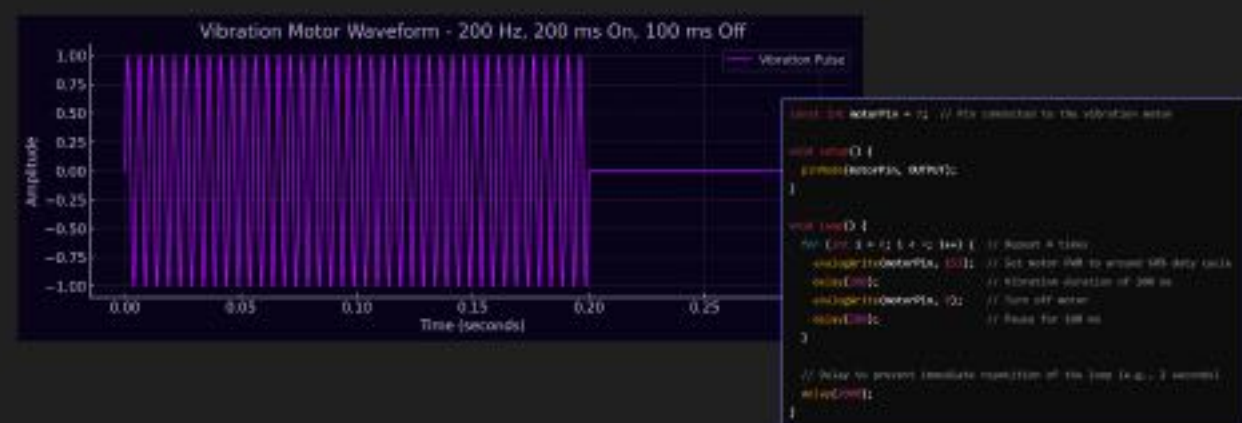
4. Isolation of Motors

• Spacing: Ensure each motor is at least 5 mm away from adjacent ones.
(This separation helps to reduce vibration transfer between motors)

硅胶　　　　　　聚氨酯

[1] Van Erp J B F. Guidelines for the use of vibro-tactile displays in human computer interaction[C]//Proceedings of eurohaptics. 2002, 2002: 18-22.
[2] Stepp C E, Matsuoka Y. Vibrotactile sensory substitution for object manipulation: amplitude versus pulse train frequency modulation[J]. IEEE Transactions on Neural Systems and Rehabilitation Engineering, 2011, 20(1): 31-37.
[3] Alves de Oliveira T E, Cretu A M, Petriu E M. Multimodal bio-inspired tactile sensing module for surface characterization[J]. Sensors, 2017, 17(6): 1187.

For the hardware aspect, we used computer vision to identify errors in finger positioning and designed three solutions: gear transmission, electro-tactile feedback, and vibration feedback. These methods guide the user's fingers to the correct position. We then asked users to evaluate these three options.
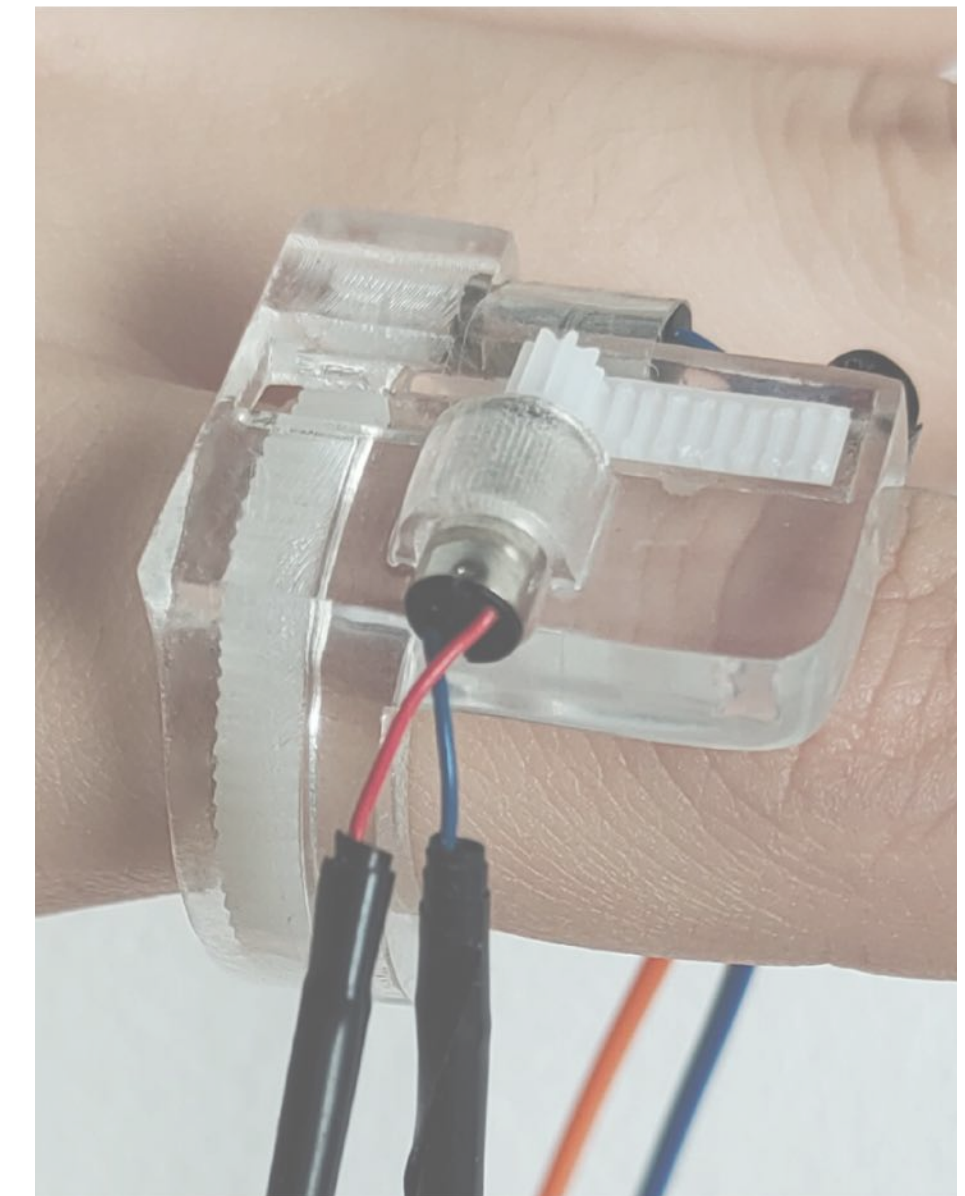
Deliver

IMAGE

Arts

For artists, this is when their work is finalized and shared with an audience through exhibitions or displays.
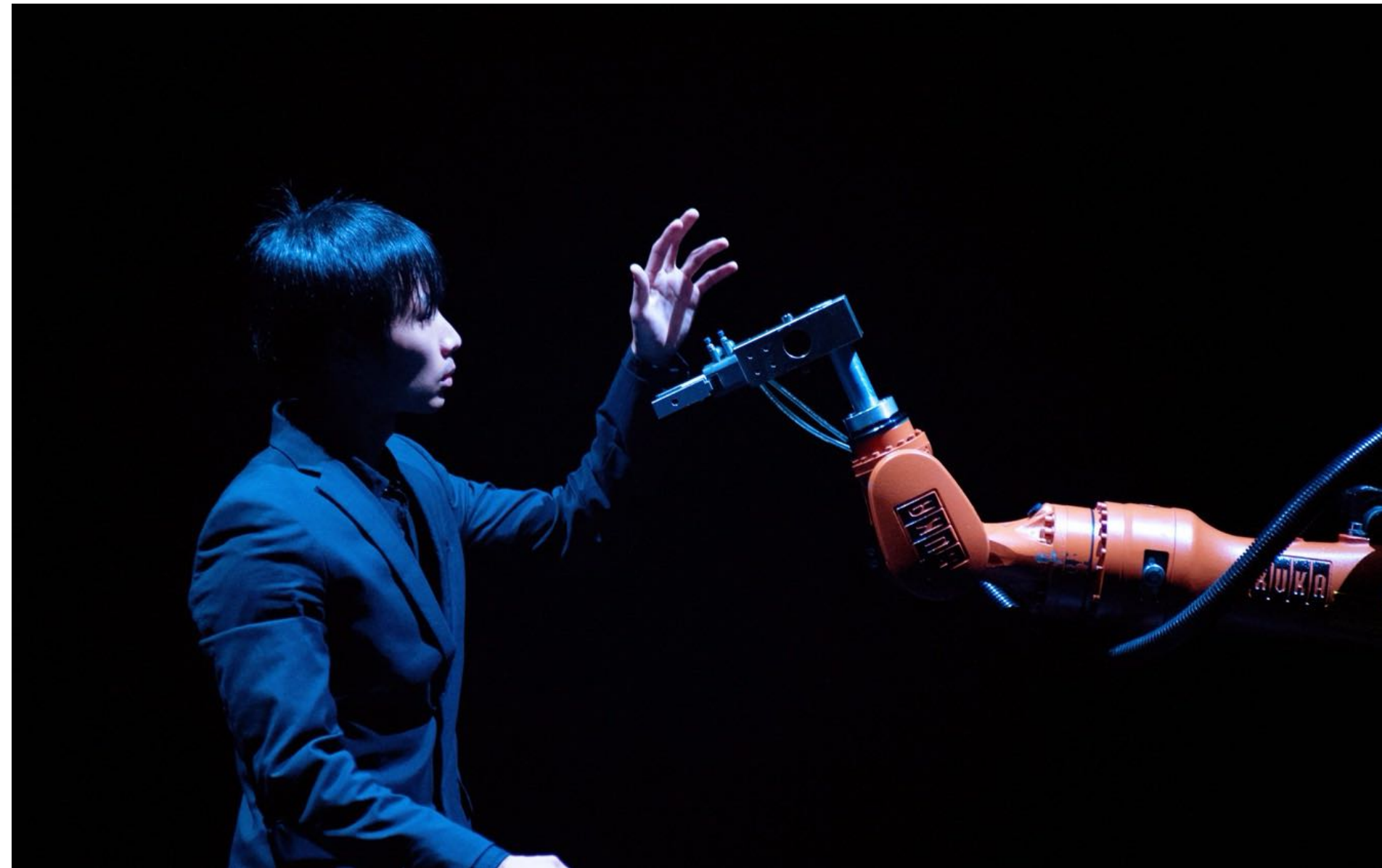
Technology

Technical researchers develop the final product to ensure its effective use in the real world.

In the final delivery phase, we conducted user testing and selected vibration feedback as the best solution among the three options. Next, we will further refine the product design, ensuring that it not only meets functional requirements but also adheres to aesthetic standards.

Skipping the First Diamond in Art Creation

In art, sometimes we skip the first diamond and start directly from the second one, expanding and narrowing down the ideas. This happens because the process of defining the theme and solution is completed quickly. For example, in one of my art projects, I first conducted experiments within a 25*25 area
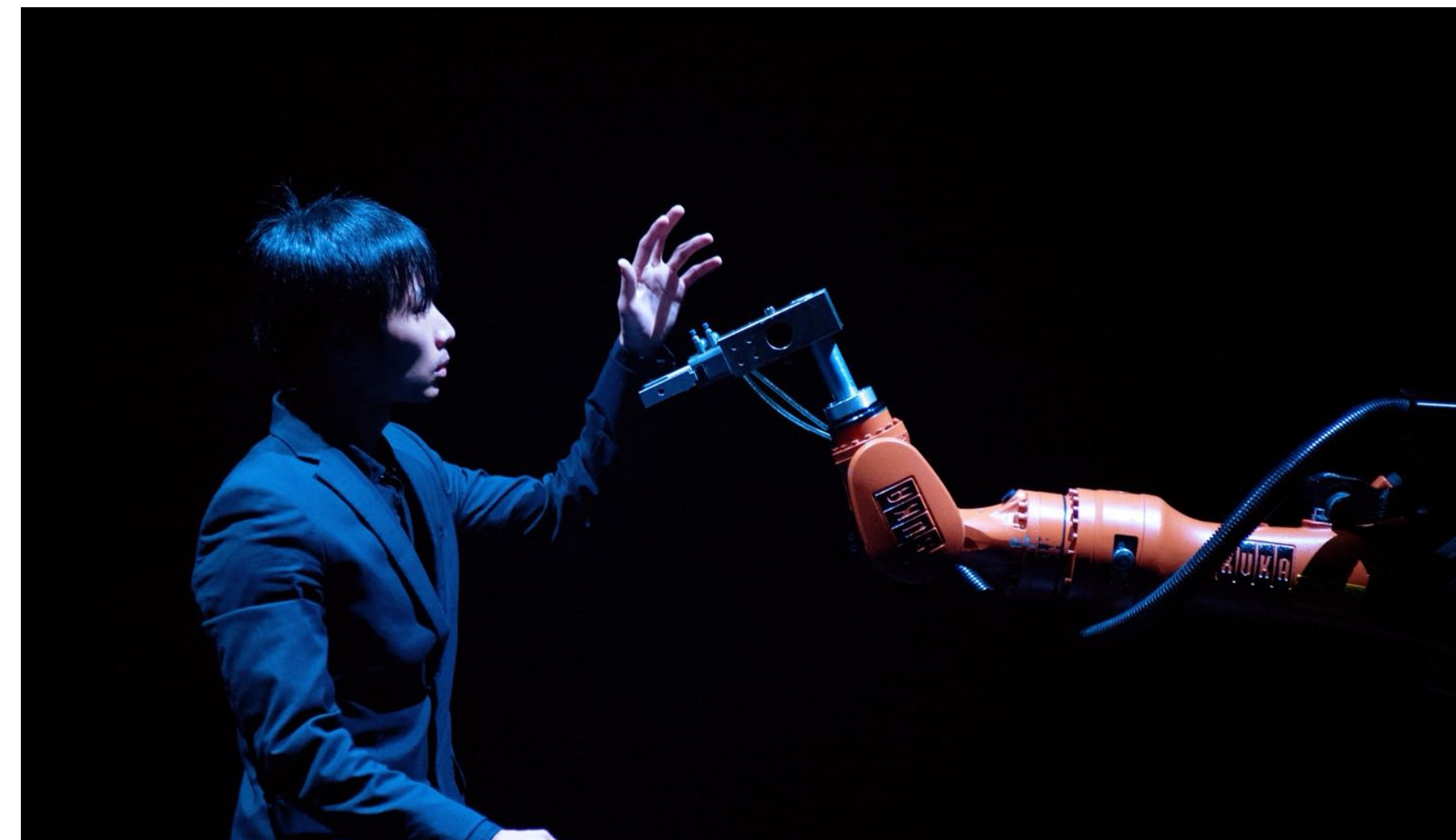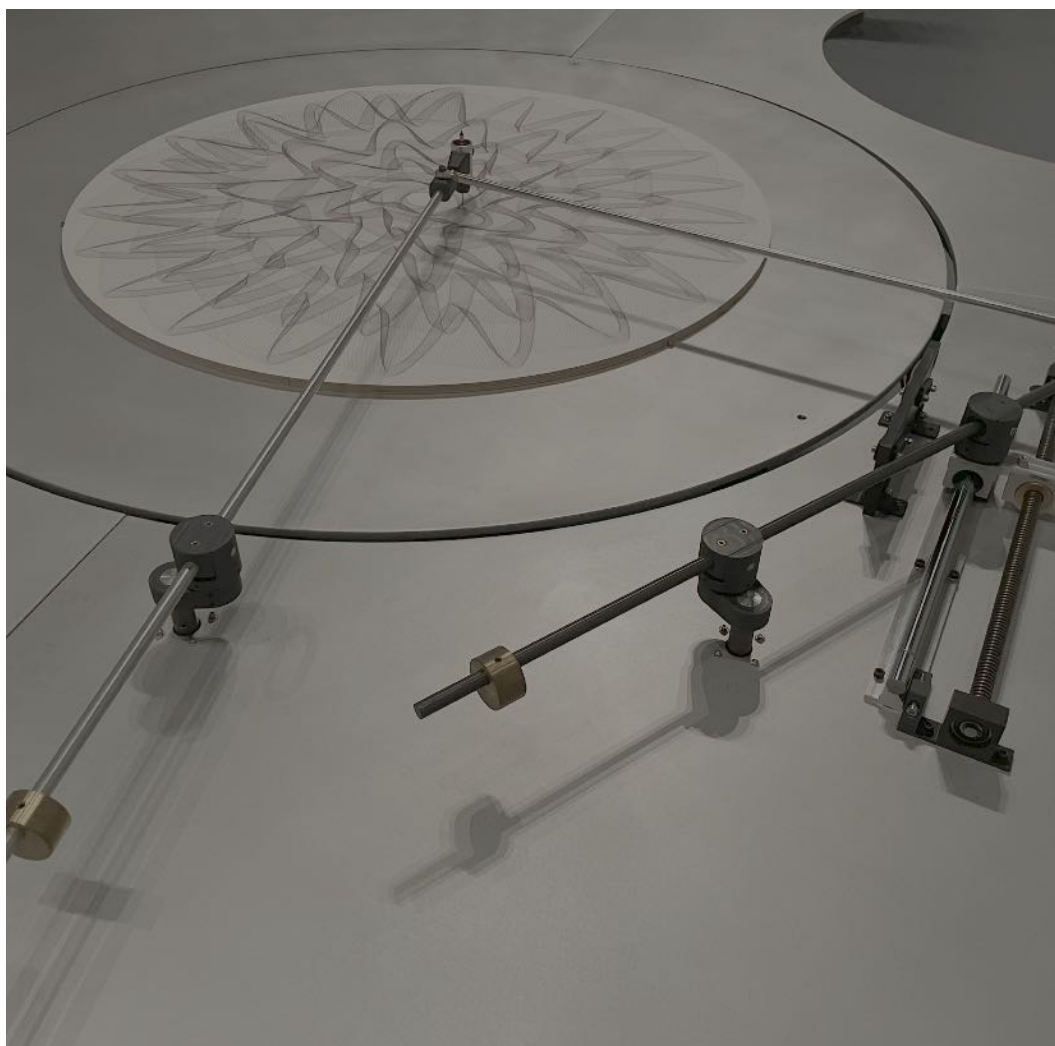

Starry Sky

Light

Jellyfish

Clouds
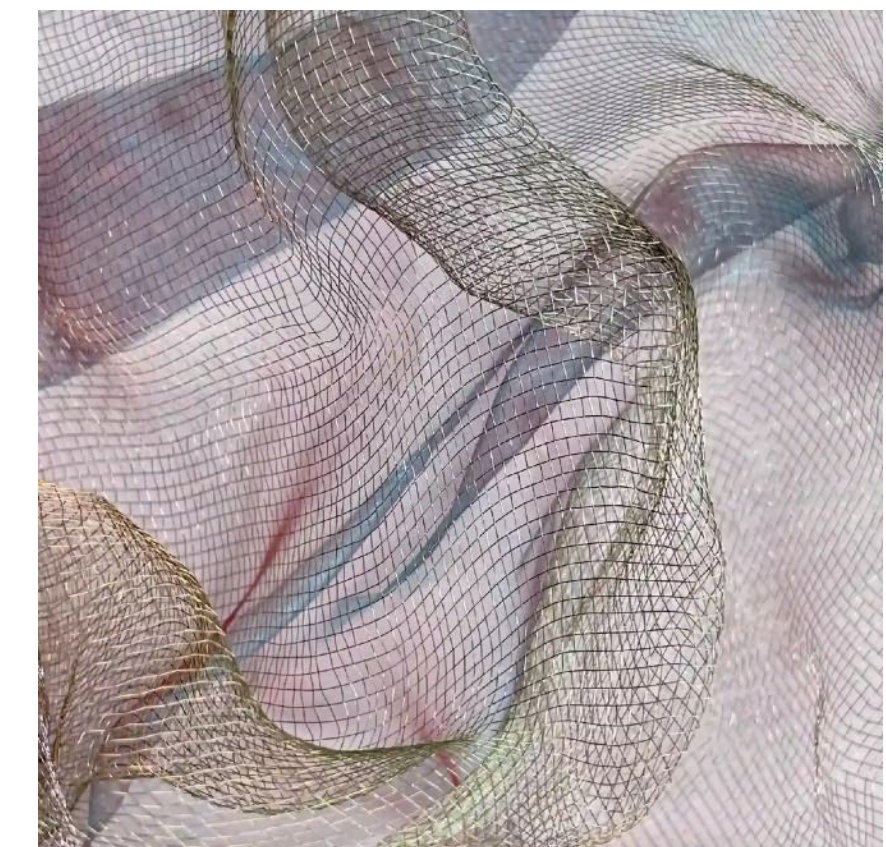
Final Project

Then selected the most satisfying

experimental sample to complete

the **final project**.

Fusion of arts and technology

Finally, I want to say that The Double Diamond Model has shown us that, while art and technology may seem distinct, they are two paths leading to **the same summit of creativity and innovation**. After we've explore so many pst exhibitions, we find Art and technology are **not isolated**; they are **intertwined**. Artists use technology like robotic arms to **push the boundaries of expression**, and engineers **draw inspiration from art to create products**. For example, industrial designers must ensure that the appearance of a product follows aesthetics and art.

Arts and technology shape the world in ways we often don't realize, proving that the fusion of these fields holds endless possibilities for the future.