CORE WORKS · 2021—2026

PORTFOLIO.



01 **PROFESSIONAL PRACTICE**

Experience · Product · Strategy

02 **PP ARM —— PHYSICAL INTELLIGENCE SYSTEM**

Interaction · Robotics · Human–Machine Experience

03 **SSNHL CARE —— Health Services System**

Research · Behaviour · Emotional Experience

04 **THE VOICE of THE SEASON —— Innovation in Cultural Communication**

Sound · Culture · Multisensory Experience

LINK: HTTPS://WWW.SUMMERBGM.COM/

夏楚尧 / XIA CHUYAO

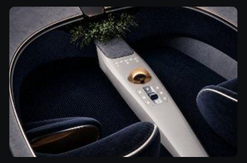
2021 — 2026

Professional Experience

Automotive Experience Designer · Department System & Process Interface · Shenzhen

Interior and in-cabin experience design for BYD, Denza and Yangwang programmes; assistant to the Design Director for about three years; link between styling and the Engineering Institute's process.

4.5 yrs	6	12	iF 2023	10 × 3	2024
IN INDUSTRY Interior & Experience design	PRODUCTION PROGRAMMES Major design contribution	PATENT APPLICATIONS 7 published · 5 pending	SEAL DM-I INTERIOR Project Participation	CENTRES × DEPARTMENTS under a procedure I drafted	ASSISTANT ENGINEER Industrial design title



Future Cockpit R&D Platform · Primary Initiator & Core Lead

2025

Took the proposal to company-level approval: budget, dedicated R&D resources, project registration — the Design Centre's only approved forward-looking styling proposal in 2025. Wrote its styling specification.



Production Vehicle Design · Research to manufacturing

2021 – 2026

Yangwang U8 · Denza N7 · Seal 06 DM-i · Han L · Qin L · Yuan PLUS. Denza N7 gear-shift: tooling-ready Class-A data in Alias, in mass production with a design patent. Seal DM-i interior: iF Design Award 2023.



Vehicle Styling Design Control Procedure · Lead Drafter

2022 – 2023

Stages, review gates, inputs and data requirements for 10 centres and 3 departments; closed the CMF, component and HMI development-flow gaps that caused late-stage rework.



Denza Brand Experience & Service Design · Experience strategy

2023 – 2026

Flagship in-cabin strategy from 10+ user and competitive findings, endorsed by the Denza Product Director; Butler Mode and Welcome Mode in production; contributed to the Denza Brand White Paper.



Dynasty Concept Car · 24 Solar Terms · Cockpit experience

2023 – 2025

Translated the 24 Solar Terms into a spatial, audiovisual and interactive cockpit experience; progressed to concept-car presentation and public release.



BYD Global Design Centre · design team

DENZA N7 · 2023 — IN PRODUCTION

Production Vehicle Design-N7 (Shift relationship)

A solution developed based on the needs of Tengshi's user base

The first proposal carried over a conventional lever. After working it through with electrical engineering, we agreed to replace it with a new interaction, and sales and marketing reached the same conclusion on their own.

Starting from user perception, access to the controls, and tactile feedback, I reviewed the traditional controls used in the initial version. I also discussed new operating methods with the electrical engineering, marketing, and sales teams. I was mainly responsible for defining the interaction and design aspects, and helping to find a common agreement between user needs and engineering requirements.



Conventional lever: a shape inherited from the mechanical gearbox



Denza N7 · image © Denza

START
Conservative proposal
Carry over the lever

CONFIRM
Sales & marketing
Analyze the Tenshi user base in collaboration with other departments

TURN
Electrical engineering
Talked it through; agreed on a new interaction

MONTHS
Validation
Repeated market and engineering validation

DELIVER
Class-A data & tooling
My Alias surfaces released; in production

DENZA N7 · 2023 — IN PRODUCTION

Production Vehicle Design-N7 (Shift relationship)

From a drawing to a part on a production car

I took the N7 gear selector from interaction intent to the final Alias Class-A data released for tooling. Surface data, delivered to engineering and manufacturing teams for R&D and mold development. This design has already been put into use,Relevant design patents were formed.



Denza N7 production interior · image © Denza

FOUR STAGES, TWO OF THEM MINE

01 **Form & interaction** — Main
Replaced the traditional stalk; defined silhouette, sections and the surface the hand meets.

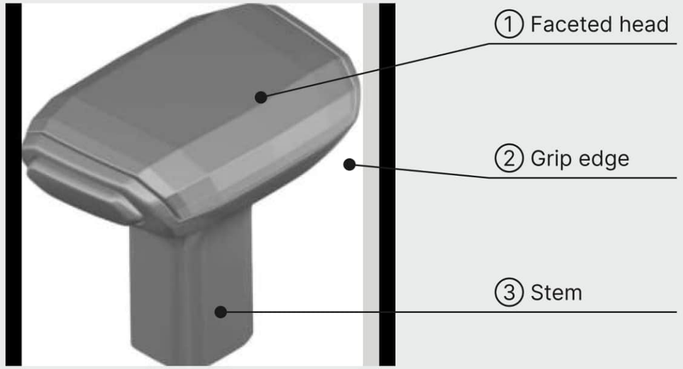
02 **Alias Class-A data** — Participate
Modelled and delivered the final tooling-ready surfaces.

03 **Structure & tooling** — ENGINEERING
Released to engineering and manufacturing.

04 **Production** — IN VEHICLE
Mass production on N7.

DESIGN PATENT

PATENT VIEW



CN 308209307 S
Design patent · filed 14 April 2023

MY ROLE

I see the gear shifter as the interface between people and vehicles: from the perspective of understanding,Reach paths to tactile feedback, gradually implemented into verifiable interactions and creationsType.


Research board · 2023

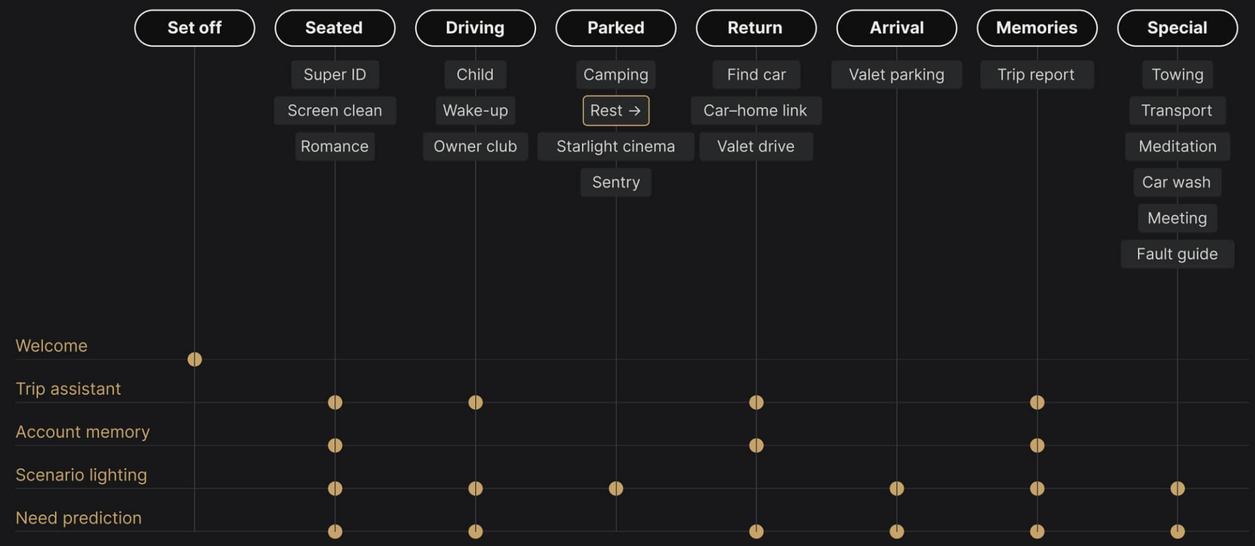

Finally

Production Vehicle Design-DENZA (Interaction & Experience Design)

A brand promise, broken down into behaviours a car can actually perform

From preliminary research to the 2022 butler service plan, I transformed Denza's brand experience into specific usage scenarios, then defined trigger conditions, status switching, and system parameters through the demand section. Here, service maps and rest modes are used to showcase how experiences enter development.

BUTLER SERVICE MAP · EIGHT STAGES × MODES · FIVE THREADS THAT RUN THROUGH ALL OF THEM





Multi-screen casting · zone-locked voice



Passenger screen · own app space

The shipped screens changed over many rounds; traces of the original proposal remain. Images © Denza.

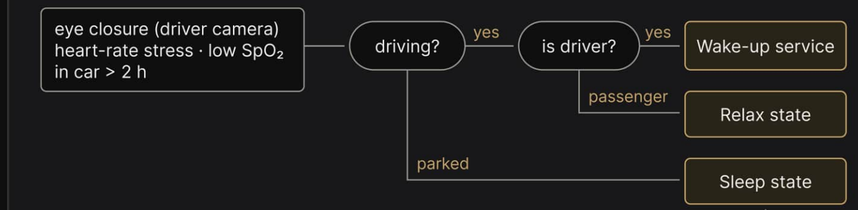
Efficient predictive start, quick adjustment

Fluid one chain from leaving home to arrival

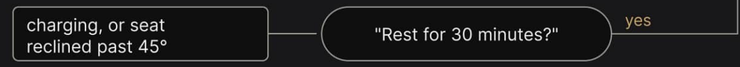
Warm the car notices the person first

REST MODE REQUIREMENT V1.0

TRIGGER A · FATIGUE DETECTED



TRIGGER B · PREDICTED NEED

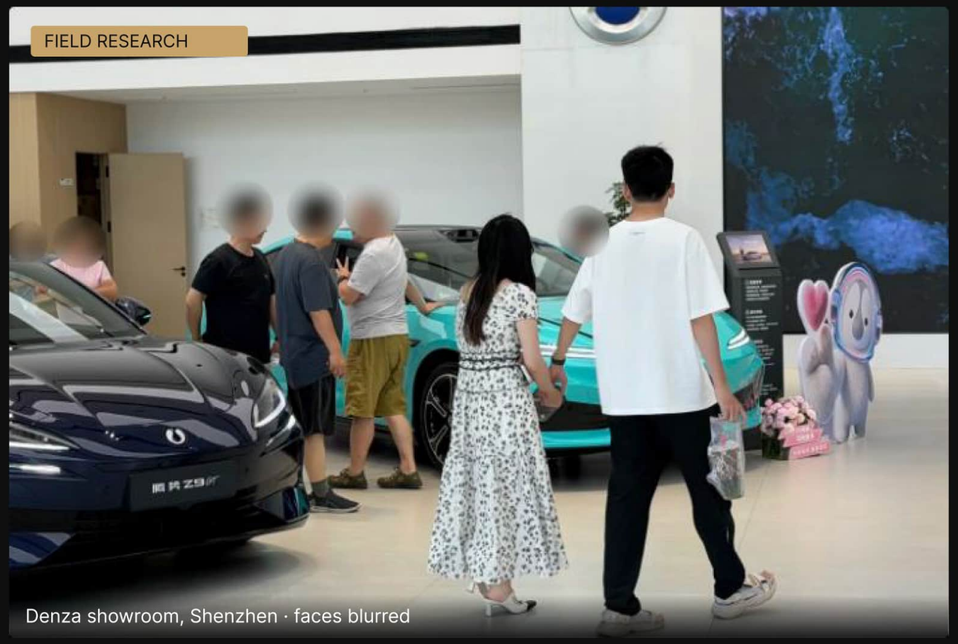


	RELAX STATE	SLEEP STATE
Seat back	unchanged	fully reclined, ~5 s
Leg rest	unchanged	raised, ~5 s
Seat climate	follows the air-con: ventilation when cooling, heating 36–38 °C when warming	
Massage	lowest level, 15 min	off
Light	ambient turns warm and dims; breathing effects stop	
Exit	alarm · PAD · voice · pulling away; switching mode keeps the seat settings	
Wake-up	blind opens, light cools, citrus scent, seat returns slowly	

> **Safety rule.** A collision or other incident forces wake-up: every setting restored within 15 s.

Design sells part of a car. The rest is how people are looked after.

I wanted Denza's service to be genuinely good, so I went where buyers are: one-to-one conversations with users, and a full day working the sales floor at a BYD dealership in Futian, Shenzhen, explaining our design to families beside the sales team.



Denza showroom, Shenzhen · faces blurred

WHEN
Days before Spring Festival 2023;

WHERE
One store selling Dynasty, Ocean and Denza; GAC and Geely nearby, BMW and Mercedes further on

WHO CAME
Families, not individuals, often straight after lunch nearby

BRAND POSITION
Denza had only just become independent, caught between BYD and Mercedes

ONE FAMILY, THREE DIFFERENT QUESTIONS
Paraphrased from my field notes

Father	"Is the seat comfortable? What discount can you give?" Middle-aged men looked at seats and price first
Son, early 20s	"The UI looks a bit old." Rarely came alone; usually accompanying a parent
The family	"We go out together a lot, and there are many of us." Gatherings and trips with a big household
Everyone	"Good quality, good value." Some wished for better looks and smarter services

WHAT I TOOK AWAY

01 **Badge matters less than care.** Northeastern families who had moved south, and Cantonese locals, cared little about the BYD–Mercedes gap and liked luxurious design.

02 **The buyer is a family.** One purchase, several people, each looking for something different.

03 **Design is one reason a car sells.** The whole experience, down to the salesperson's attitude, decided the order.

→ CONCEPT


Mood · service that surrounds each person

A brand and a car that look after the whole family **like a butler**.

Efficient predictive start, quick adjustment

Fluid one chain from leaving home to arrival

Warm the car notices the person first

TODAY	WITH A BUTLER
features scattered across screens; each person on their own	one continuous service around the whole family

→ NEXT: THE SERVICE MAP AND MODES

STYLING DESIGN CONTROL PROCEDURE · 2022 — 2023 · LEAD DRAFTER

Vehicle Styling Design Control Procedure· Lead Drafter

Styling at this scale fails for organisational reasons, not aesthetic ones. Two centres define "finished" differently. A gate is passed without the department that owns it in the room. The schedule absorbs the difference. As lead drafter I defined the stages, review gates, responsibilities, input and data requirements and the master schedule; introduced a **Styling Design Issue List** Ten centres, three departments.

> It turned styling from a negotiation into **a schedule**

INTERIOR DESIGN PROCESS · SIX PHASES, EACH WITH AN OWNER AND AN EXIT GATE

◆ exit gate

STRATEGY	PROPOSAL	DATA	CLAY	PARTS	DQ
kick-off · project input	sketch · rendering	CAS · A-surface	model · paint · CMF	detail · seat	design quality
Design centre + engineering	Interior design	Interior + digital + engineering	Interior + CMF + modelling	Interior design	Interior + DQ + engineering

Sketch — Render 1
Render 1 — Render 2
Render 2 — Eng. analysis

OK / NG at every step;
NG returns to the previous step

CAS 1.0 — CAS 2.0 — CAS 3.0
NG

Engineering inputs 3D layout data
one week before CAS starts

1:1 clay — A 1.0 — A 2.0 — A 3.0 — Hard model

1:1 sections checked before clay starts,
updated as the clay changes

ISSUE ESCALATION

Studio eng. — CDC — Director

key issues → core questions →
major problems, decided by the director

A GATE, AS WRITTEN: THE ENGINEERING MEETING

WHEN	Weekly, fixed time, one or two days before the project meeting
WHO	Project management, design management, engineering supervisor, CDC, studio engineer, data designer
LED BY	Studio engineer: classifies each problem; issues that affect the design go up to the director
OUTPUT	Every issue leaves with a data-input owner and date, and a modelling-change owner and date

AMBIGUITIES THE PROCEDURE REMOVED

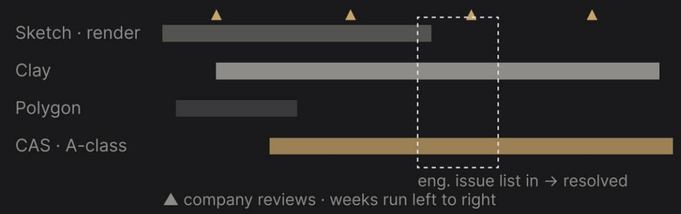
01 When engineering data arrives
Fixed: one week before CAS starts, not "when ready"

02 Who owns a surface between versions
Fixed: named owner per node, per department

03 What "passed" means at a gate
Fixed: OK / NG with a defined return step

04 Who decides when departments disagree
Fixed: a written escalation path to the director

KEY-TIME CHART · SCHEMATIC





Original procedure documents · details withheld (BYD internal). Diagrams on this page are my redrawings.

FUTURE COCKPIT · FORM · 2025-26

Future Cockpit R&D Platform

When the car drives itself,the cabin becomes a garden you can sit in

Once nobody has to drive, the cockpit becomes a room. I took the reference from Monet's water garden at Giverny and asked how much of that calm a vehicle interior can carry.

01 Oval lounge— seating and trim run as one continuous ring

02 Console as a bridge— a table between the seats, not a barrier

03 Garden on the centre line— planting under the windscreen, light through leaves

Personal extension of early Future Cockpit sketches, developed after leaving BYD; not a BYD design. Sketches and models by me; renders AI-assisted; reference images third-party.



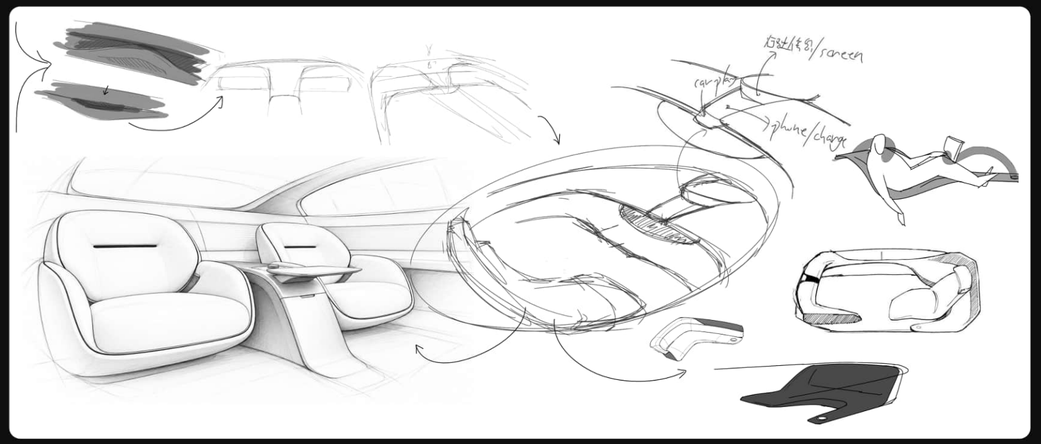
Oval lounge · console on the centre line · garden under the windscreen

01 REFERENCE


Giverny water garden


Bridge form

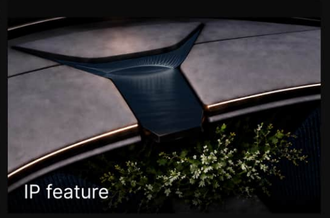
02 SKETCH



03 PROPOSAL


Console and lounge


Front view


IP feature

FUTURE COCKPIT · INITIATION & ENGINEERING

From the interfaces in the cockpit,to the relationship between humans and intelligent devices

At BYD, I initiated the Future Cabin Platform project, helping to secure company approval, budget allocation, and specialized research resources for this initiative. After leaving the company, I continued my research on how devices can be integrated into cabin systems and how they should interact with people's daily activities – when space is provided for smart devices, how should they participate in people's everyday activities?

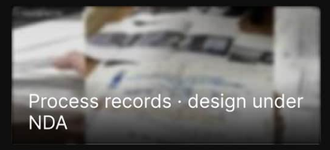
AT BYD · 2025 · PRIMARY INITIATOR AND CORE LEAD

Department	Design centre	Business unit	Company approval
proposal	review	review	Budget · R&D · Registration

OPTIMISE
improve today's experience in current development

INNOVATE
combine candidate technologies around one scenario

EXPLORE
study immature options and define the work left



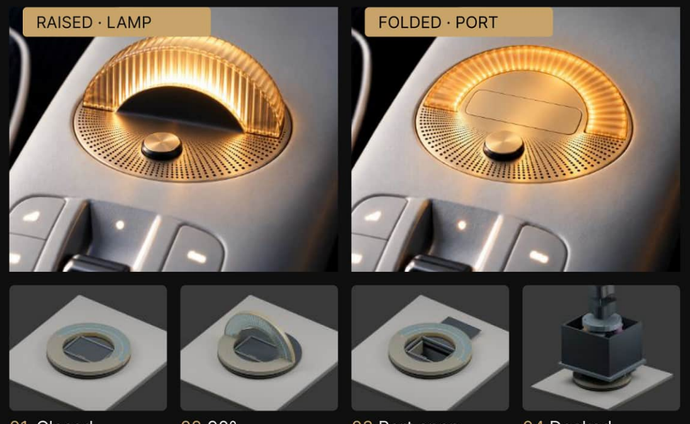
Assessed:fragrance · intelligent chassis · in-cabin VR · smart surfaces · projection I also wrote the Future Cockpit styling specification: form features, emotional interaction, technology adaptation, stage gates. The design centre's only company-approved forward-looking styling proposal that year.

Two highlights, read from one cabin

Personal extension after BYD · Blender models by me · renders AI-assisted

01 FLOATING BRIDGE
ONE PORT, MANY DEVICES

When the bridge structure is raised, it functions as a light source; when folded down, the proposed power and data interfaces become visible. I use a robotic arm as a means of connecting the device to the cockpit space. This raises another question: After being connected, what kind of support can it provide for the body?



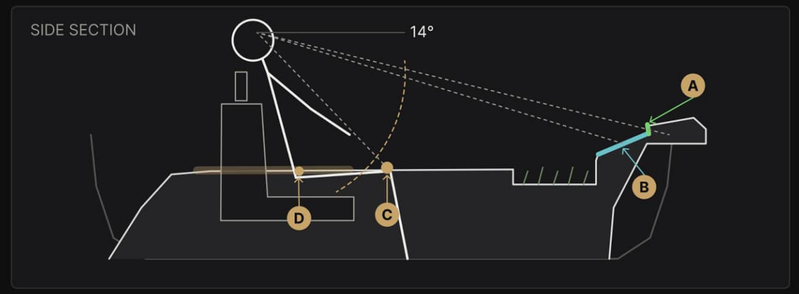


45° cabin view · PP ARM robotic arm docked in the bridge port

02 FRONT DISPLAYS
TESTED FOR L4

A Y-shaped glass splits into a glance fin and a connector screen. Checked in Blender with three body sizes: both sit well in view, but at 1.8–2.0 m they are out of reach, so control moves back.





A Fin-Key information B Connector · view only C Knob D Buttons

01 **GLANCE** A & B 02 **CONTROL** B+ C + D 03 **DOCK** AI + Phone

Therefore, I launched a independent project called PP ARM to explore how digital intelligence can provide physical support through adaptable physical interfaces, and how it should approach, touch, and withdraw, so that people always have the option to make choices.

02 PP ARM —— PHYSICAL INTELLIGENCE SYSTEM

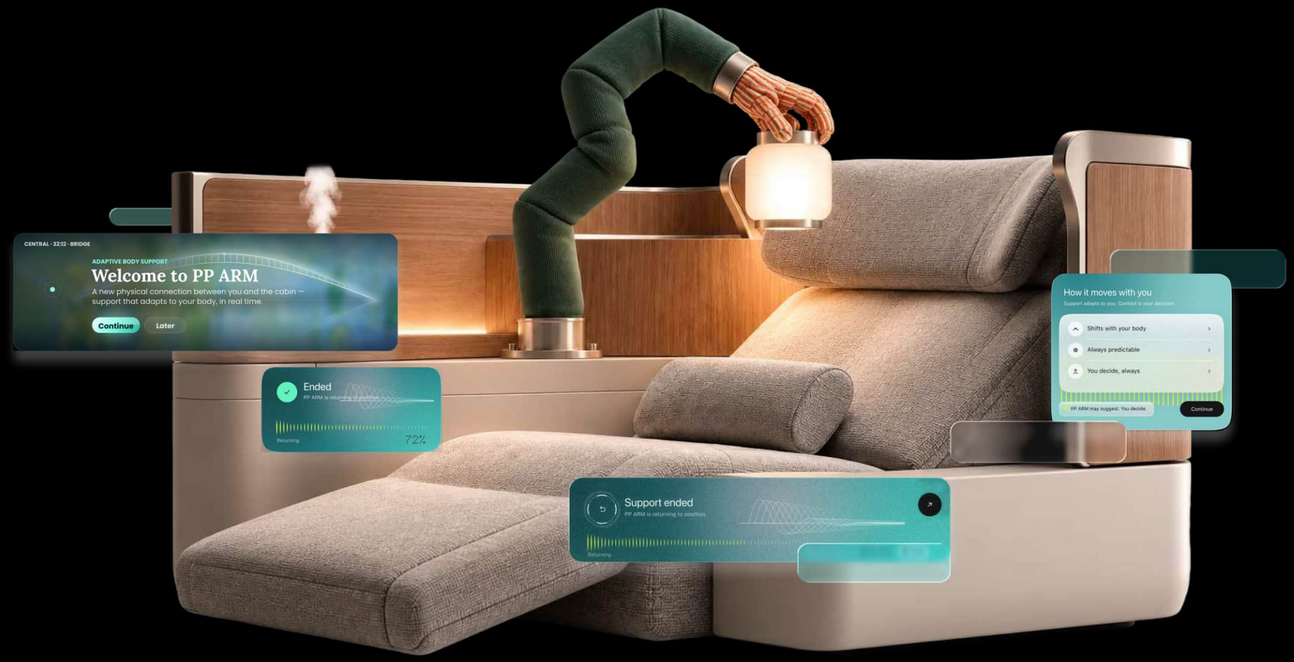
Technology enables behavior → Form follows relationship → Motion becomes language → Contact is negotiated → Relationship becomes adaptive.

Concept

Exploring how physical AI can establish legible, person-led and adaptive relationships with the human body.

Keywords

ADAPTIVE SUPPORT	HRI design
LEGIBLE BEHAVIOR	System design
EMOTIONAL ROBOTIC ARM DESIGN	Industrial design



BACKGROUND — FUTURE CABIN

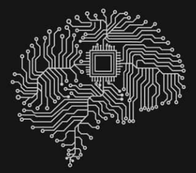
FROM DRIVING SPACE TO LIVING SPACE





AI ERA

The use of AI models is the watershed between traditional cockpits and smart cockpits.



Traditional Era

- Passive Interaction
- Functional Solidification

Transition Stage

AI → Complete the task

The 17-inch screen in the 2012 Tesla Model S replaced physical buttons with touch controls, but it still relied on a fixed program and could not learn user habits.

- Electronic Functionality
- Function Overlay

Future Cockpit

AI → Changes space → Improves people's psychological experience

- Proactive Service
- Continuous Evolution
- Scenario Creation

Problems During The Transition Phase

Driving Space
↓
Living Space
↓
Human Activities Increase
↓
Physical Needs Increase
Current AI focuses on Information
↓
Body Support is Missing

SAE L4-L5
System takes driving
↑
Expanded In-cabin Activities
Work · Rest · Socialize
↑
Higher Body & Space Demand

Smart Cabin Innovation
Screen · Voice · OTA
↑
Optimize Info Interaction
↑
Existing Pain Points
Distrust · Friction · Bias

Embodied Cognition
Body-shaped cognition
↑
Tactile Research
Touch impacts mood
↑
Comfort = Well-being
Prerequisite

Research Insight

When driving is automated, body becomes main cabin interface

Design Opportunity

↓

Embodied Interaction

Future cabins still provide limited support for users' physical needs.

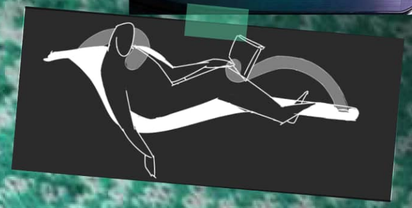
PP ARM explores how intelligent cabins can extend from digital interaction into physical interaction with the human body.

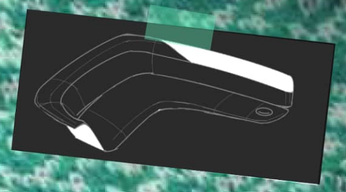
Traditional cockpit HMIs can convey information through screens, sound, lighting, and more; Once the system gains a movable mechanical body and enters the occupant's private space, the core question cannot be limited to "whether it can move to the target position".

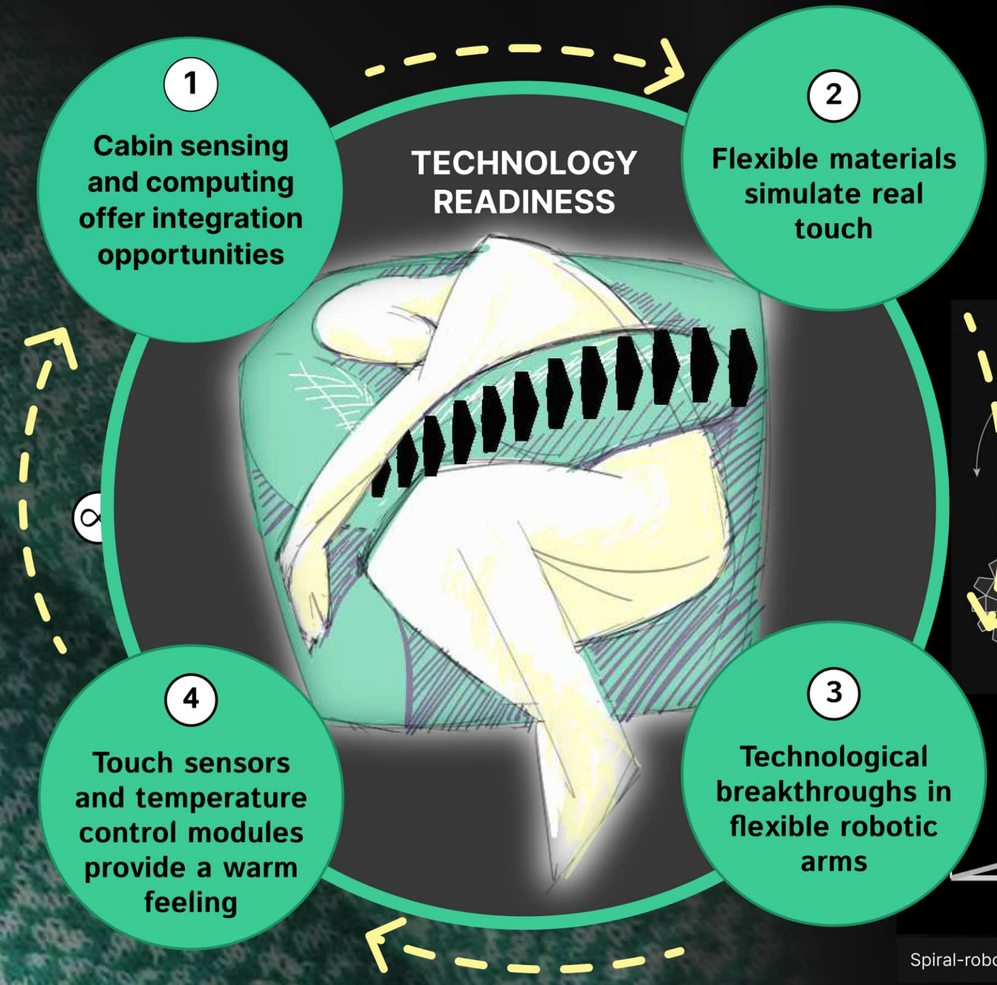
DESIGN ENTRY — TECHNOLOGY READINESS

Technology trajectories are converging, opening a plausible design window for physical interaction inside the cabin.

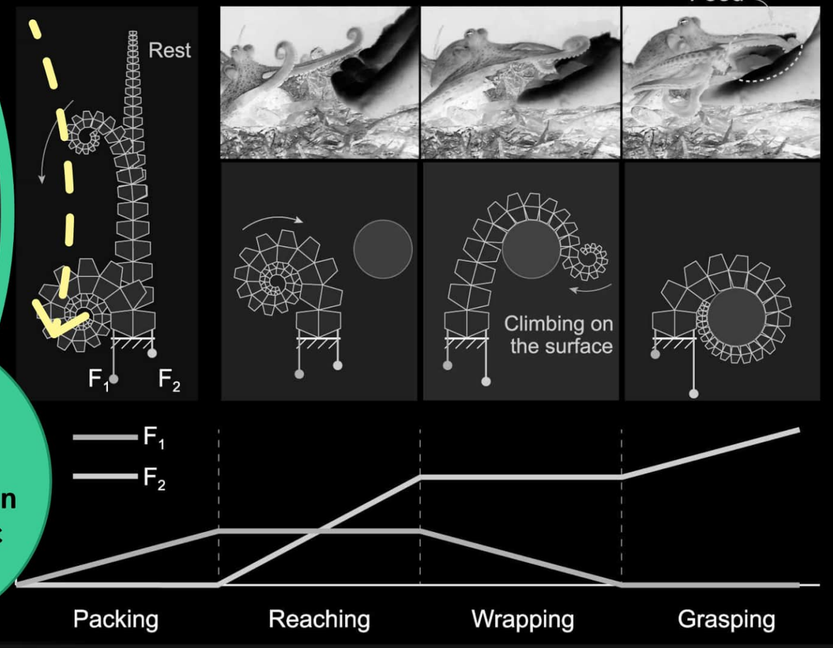












Spiral-robot figures: Wang, Freris & Wei · SpiRobs · arXiv:2303.09861

DESIGN WINDOW — **PLAUSIBLE**

SENSING + CONTEXT + COMPUTING × **MOVEMENT + COMPLIANCE + PHYSICAL CONTACT** — **PHYSICAL INTELLIGENCE**

The cabin already has eyes, ears and intelligence. **What if it could also gain a body?**

DESIGN PROPOSAL

ADAPTIVE BODY

Changes its geometry around the user.

PHYSICAL SUPPORT

Creates and relocates support around the body.

SOFT CONTACT

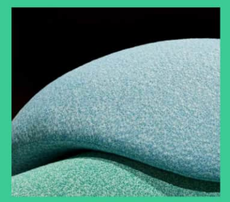
Uses compliant surfaces to create gentler physical contact.



















Design Description

The materials used in everyday scenarios and the styling are more stylish, reducing the mechanical cold feel and enhancing the overall cabin experience

FORM FOLLOWS RELATIONSHIP

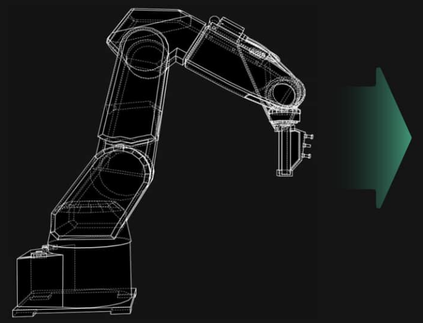
01 CONTINUOUS BODY

I did not want PP ARM to look like a machine that had simply been placed inside the cabin.

Traditional form composition

Mechanical Detail → Capability → Futuristic

Traditional robotic arms often express their capability through exposed joints, rigid segmentation and a strong mechanical presence. But when a robotic body begins to approach and support people, I believe its form should communicate something different.

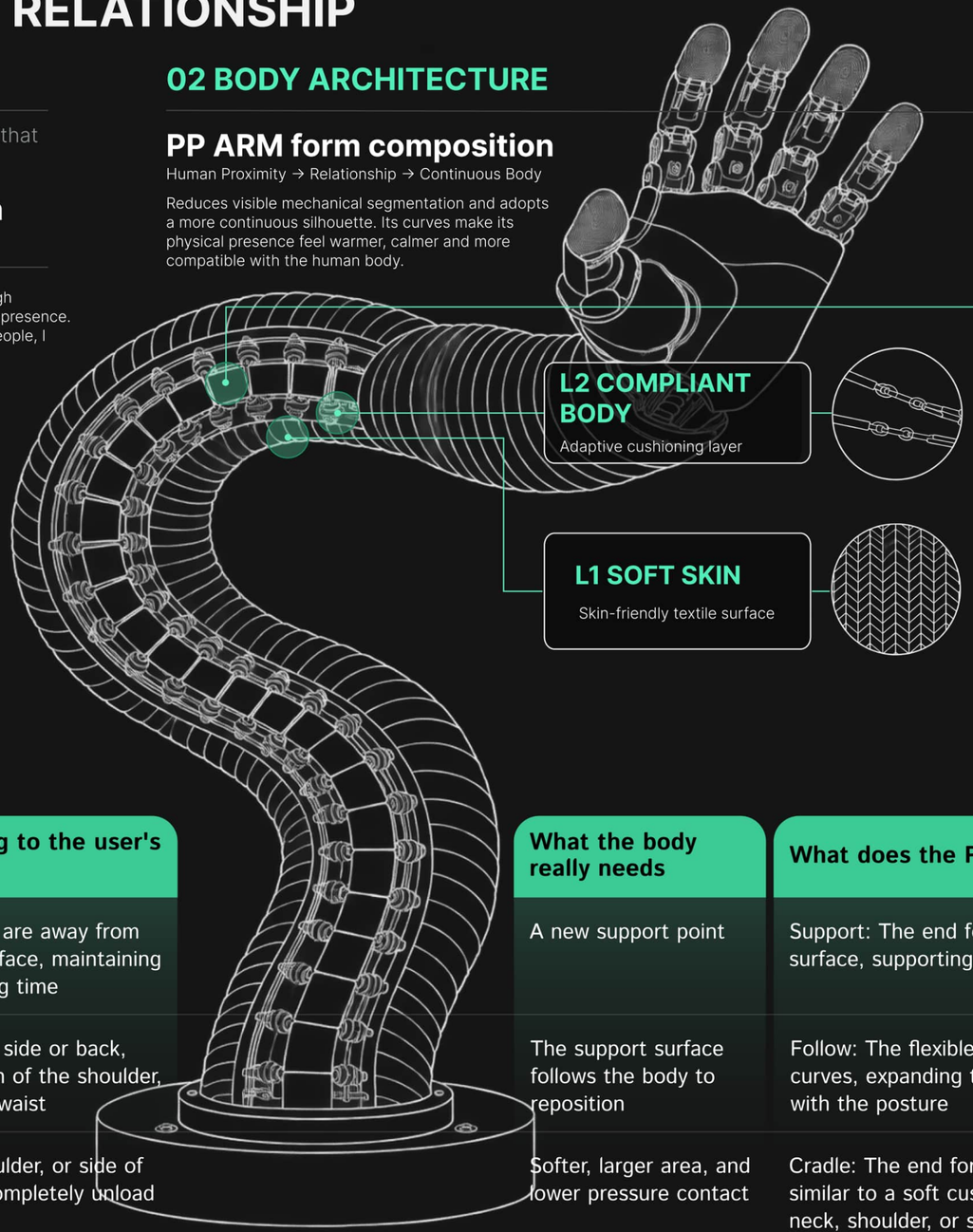


02 BODY ARCHITECTURE

PP ARM form composition

Human Proximity → Relationship → Continuous Body

Reduces visible mechanical segmentation and adopts a more continuous silhouette. Its curves make its physical presence feel warmer, calmer and more compatible with the human body.



01 STRUCTURAL PRINCIPLE

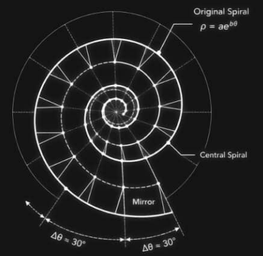
Bio-inspired spiral geometry realized through segmented architecture.

· **Elephant Trunk**



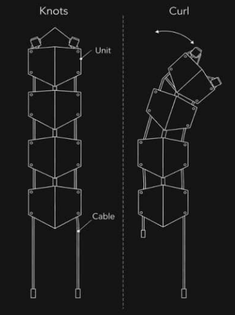
· **Seahorse Tail**





02 MOTION MECHANISM

Differential tendon tension controls the direction and degree of bending.



03 LENGTH COMPARISON

Four lengths tested for in-cabin use

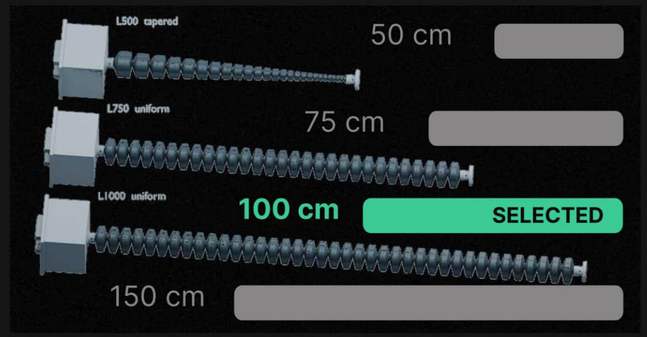
Exploratory prototype comparison to be recorded in the next in-cabin test.

100 cm

SELECTED FOR THE CABIN

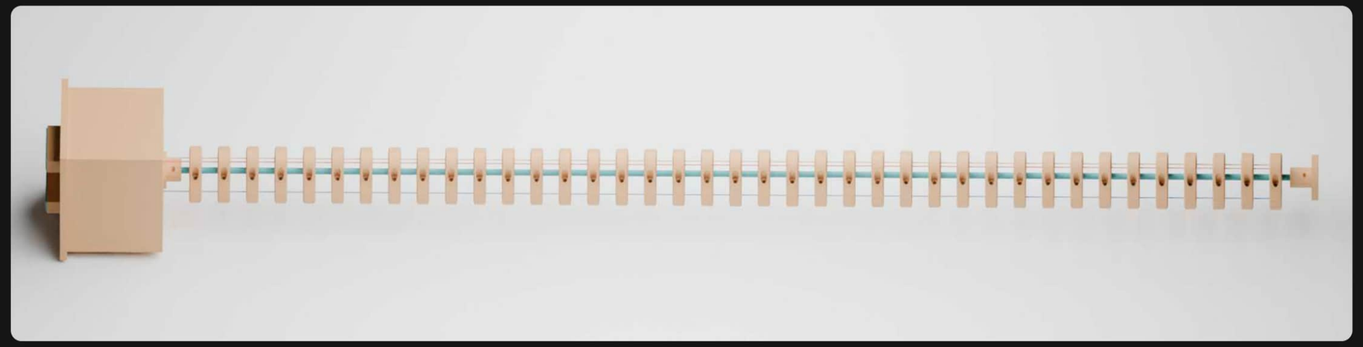
Length study on real prints → see Build — From Model to Prototype.

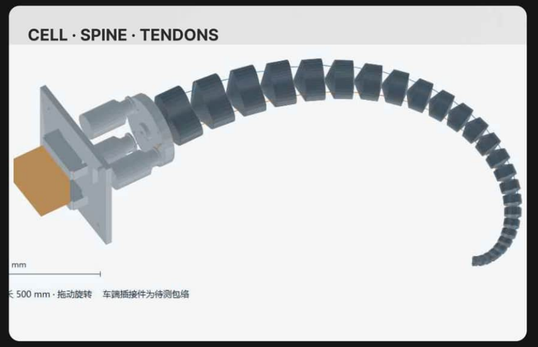
Body Status	What is happening to the user's body	What the body really needs	What does the PP ARM end provide
01 Unsupported / Lack of Support	Forearm, elbow, etc. are away from the fixed support surface, maintaining the posture for a long time	A new support point	Support: The end forms a wider, stable support surface, supporting the forearm/elbow
02 Leaning / Posture Change	The body tilts to the side or back, changing the position of the shoulder, upper arm, and side waist	The support surface follows the body to reposition	Follow: The flexible end conforms to the body's curves, expanding the contact area and adjusting with the posture
03 Resting / Relaxing	The head, neck, shoulder, or side of the body wants to completely unload	Softer, larger area, and lower pressure contact	Cradle: The end forms a wide contact surface similar to a soft cushion, supporting the head, neck, shoulder, or side of the body



MODEL TESTING

A 100 cm &50cm hybrid arm, modelled in Blender, 3D-printed, assembled and bend-tested by hand

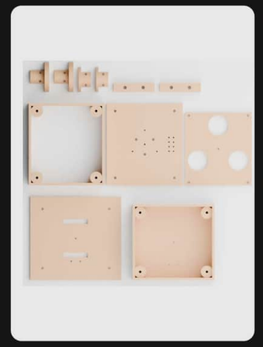




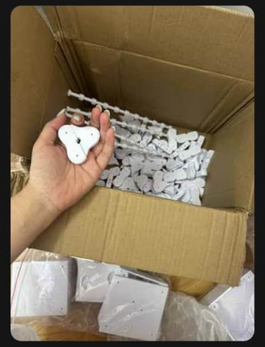


Render vs prototype CAD → printed structure → fabric-covered prototype. Cabin trials explored physical support; the articulated hand remains a future development.

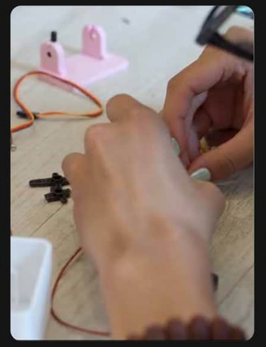
PROCESS



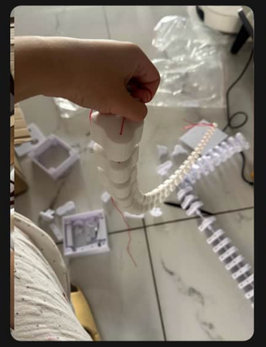
01 Print plates
78 cell halves



02 Printed cells
sorted for assembly



03 Fit check
base, screws, clearance



04 Actuation
servos pull the tendons



05 Text
Functional testing



06 SOFT SKIN
Inflatable foam + textile fabric

SELECTED PROTOTYPE · 100 cm



Physical prototype · seated contact trial

100 cm

4 lengths were tested

By comparing cockpit fits and support positions for four arm lengths, we chose the 100 cm solution. With both door side and center console mounting positions, its reach covers the main support positions for front and rear passengers in this test. In contrast, the 50 cm solution lacks coverage, while the 150 cm plan occupies more cabin space. The 100 cm model achieves a more suitable balance between support coverage, installation adaptation, and space occupation.

---

39 PETG cells
upper + lower halves, 78 printed

4 TPU 95A spine modules
bending happens in the soft spine

3 tendons, Ø1 mm
differential pull sets direction

95 printed parts
Lengths of 50-150cm can be freely combined

Mainly tests user acceptance and cockpit interaction patterns, with carrying capacity tested in the next lever

Structural basis: SpiRobs (arXiv:2303.09861). PP ARM development: cabin length, PETG / TPU assembly, textile contact and user interaction.

REAL-SCENE TESTING

How PP ARM makes physical support readable, then acted out in a real cabin

SMART CABIN — SENSE + INTERPRET → PP ARM — EXPRESS + SUPPORT ↔ HUMAN — RESPOND + DECIDE

01 · PROTOCOL V1

PREMISE

POSTURE ≠ INTENTION

Body State / Cabin Context

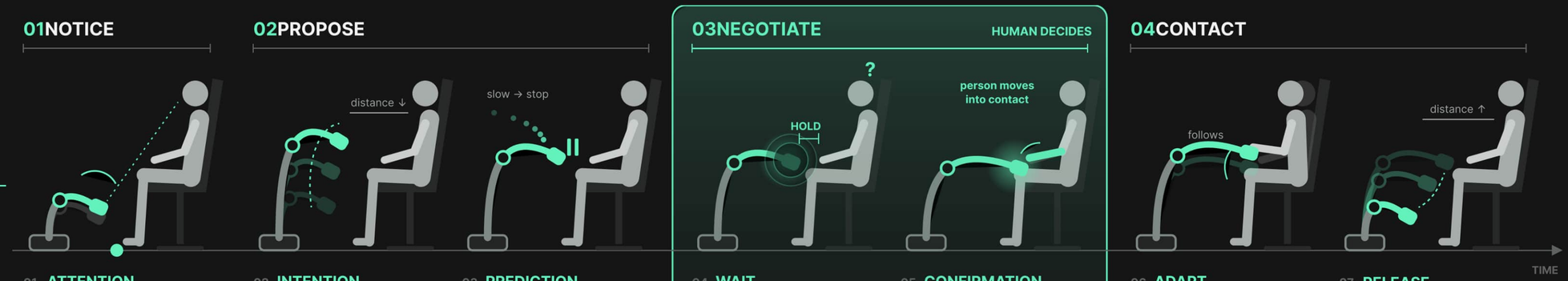
↓

Potential Support Opportunity

↓

≠ Permission for Contact

Detecting a support opportunity does not mean permission to make physical contact.



01 ATTENTION	02 INTENTION	03 PREDICTION	04 WAIT	05 CONFIRMATION	06 ADAPT	07 RELEASE
Orientation Change	Peripheral Approach	Decelerate + Pause	Hold Distance	Human Accepts Contact	Contact Relocates	Distance Increase + Retract

MOTION CUE → HUMAN MEANING

Each motion parameter is read as one meaning.

DIRECTION	DISTANCE	SPEED	PAUSE	CONTACT	WITHDRAWAL
→ Attention	→ Intention	→ Prediction	→ Waiting	→ Confirmation	→ Release

02 · IN-CABIN TRIAL

5 participants · ages 26–70 · Wizard-of-Oz: an operator moved the 100 cm fabric-covered arm along the protocol

Rear seats × 3 / front passenger × 1 / driver seat × 1



01 & 02 NOTICE Sensing targets

Head, shoulder, elbow, forearm — what the cabin reads.



03 PREDICTION Confirmation

The arm waits; the hand reaches in to accept.



04-05 PREDICTION Gently touch

Support while using a phone.



05 CONFIRMATION Getting even closer

Support while using a phone.



06 ADAPT Complete trust

Support relocates as the body unloads.

METHOD Exploratory qualitative trial · human-operated motion and cue interpretation · observer-recorded feedback · no automated recognition, standardised scores or load data.

Findings:User testing – MechaTerror Valley test

FINAL INTERACTION

Three findings, three destinations — each observation changes the v2 protocol

SMART CABIN — SENSE + INTERPRET → PP ARM — EXPRESS + SUPPORT ↔ HUMAN — RESPOND + DECIDE

03 · TEXTING FINDINGS

01 Soft support was valued

P01 / P02 / P03 / P05 · observer notes

Positive descriptions of support or comfort.

→ KEPT IN V2 · soft contact at each position

02 Intent and exit were unclear

P01 / P02 · observer notes

P02 opened arms to accept; the operator read it as refusal.

→ 04 ITERATION · CHECK state

03 The cabin needs to work as a system

P02 / P04 / P05 · observer notes

State cues, front-seat space and the hand need refinement.

→ 06 SCREEN × MOTION sync

04 · ITERATION · FROM FINDING 02

BEFORE · V1

One ambiguous cue = refusal

Open arms / move → Withdraw — support lost

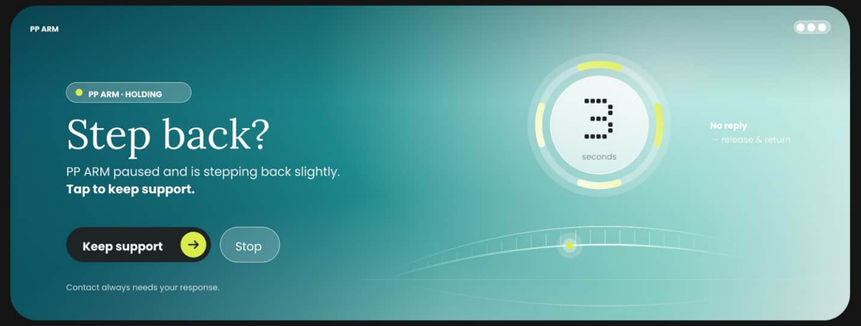
AFTER · V2 PROPOSED

Ambiguity is not refusal

Ambiguous cue → CHECK — hold · step back ≤ 5 cm; screen asks · 3 s

Tap Keep → stay · Stop / "no" → withdraw · no reply → withdraw + Restart

Candidate settings, not yet tested.



NEW · B1 CHECK — central screen, shown while the arm holds and steps back

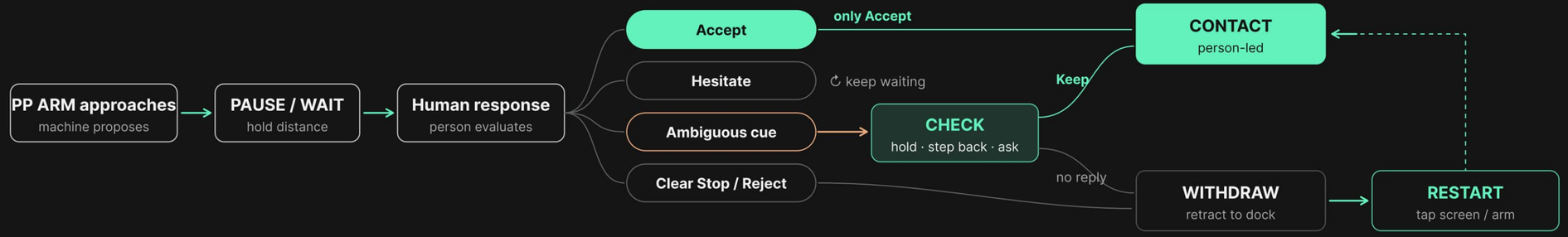
05 · FINAL INTERACTION · PROTOCOL V2

WAIT → HUMAN DECIDES

PERSON-LED CONTACT

The machine proposes. **The person decides.**

v2 adds CHECK and Restart.

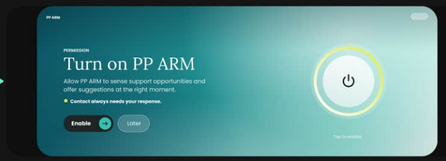


06 · SCREEN × MOTION · FROM FINDING 03

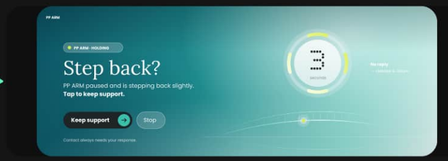
each state is shown on screen and expressed by the arm at the same time



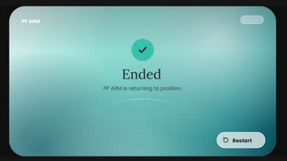
UNDERSTAND Screen: introduction
Arm: stays docked



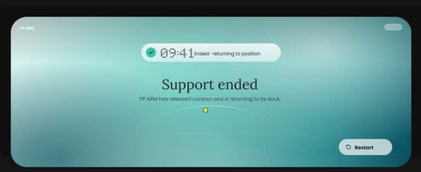
CONSENT Screen: enable · permission
Arm: stays docked



CHECK · NEW Screen: "Step back?" · 3 s
Arm: holds + steps back



RELEASE Screen: ended
Arm: releases contact



RETURN Screen: returning · Restart
Arm: retracts to dock

Follow-up: after the arm's intent was explained, the same misreading was not observed in the second session; CHECK itself remains untested.

Proposed v2 — to be validated in the next trial.

SUMMARY

GIVING AI A BODY ALSO MEANS GIVING IT BEHAVIOUR.
When intelligence gains a physical presence in human space, movement, contact and withdrawal become part of the interface. PP ARM explores how this relationship can remain adaptive, legible and person-led.

ADAPTIVE SUPPORT

Support position and geometry change with the human body.

LEGIBLE BEHAVIOR

Direction, distance and pause make machine intention understandable.

PP ARM

HUMAN-COMPATIBLE PHYSICAL AI

Person-Led Contact

The system can propose physical support, but the person determines contact.



03 SSNHL CARE —— HEALTH SERVICES SYSTEM

An Early Response & Emotional Support Experience for Sudden Hearing Loss

Concept

To address the gap between the “onset of symptoms” and “taking action” in cases of sudden hearing loss, a digital health experience is designed to help users identify risks, act promptly, and receive appropriate support.

Keywords

UX
Behavioral decision-making,
Health experience,
Service systems



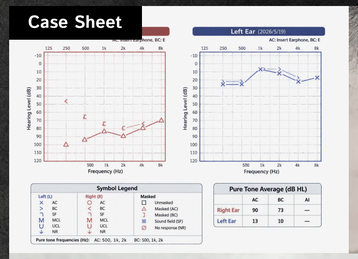
BACKGROUND

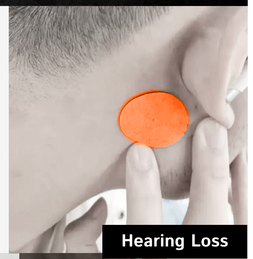
This project began with a real case study that happened around me:

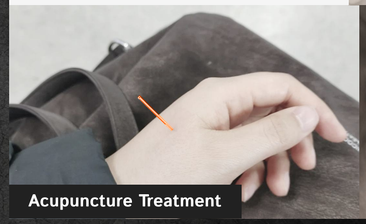
Earlier this year, a close friend of mine experienced sudden hearing loss. I had always known him as an optimistic person who tended to deal with stress on his own. The day it happened, he went to the hospital by himself without telling any of us.

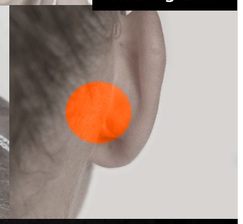
About a month later, he casually brought it up over dinner, almost as if he were telling a joke. But his hearing has not fully returned to normal. Tinnitus and occasional hearing problems still affect his daily life.

From A Personal Experience To A Health Issue That Deserves Attention











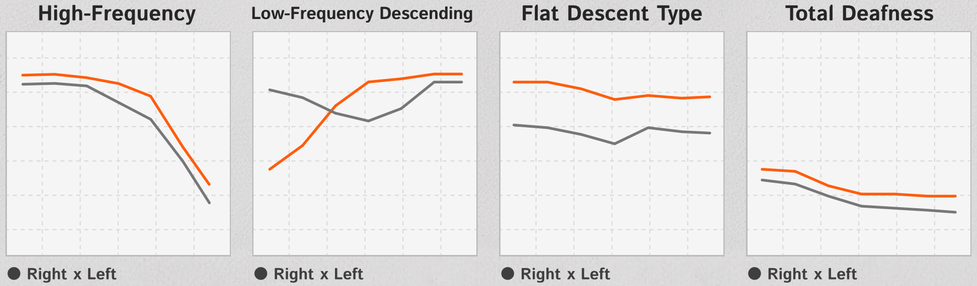
What is SSNHL

Sudden Sensorineural Hearing Loss (SSNHL), also known as sudden deafness, is a rapid loss of hearing that usually occurs within 72 hours. It most often affects one ear, although both ears can be affected.

This type of hearing loss involves the inner ear, auditory nerve, or the brain's hearing pathways. It may also come with tinnitus or dizziness. In around 90% of cases, there is no identifiable cause, and about 32%–65% of people may recover some or all of their hearing on their own.



Patterns of Hearing Loss：



Reflection and Exploration



My friend's experience first drew my attention to SSNHL. As I learned more about the condition, I realized that its impact can be significant, while its early signs are not always easy to recognize.
The challenge of SSNHL does not begin only with treatment. An earlier problem is whether people can recognize that a sudden hearing change deserves timely attention and know what to do next.

When hearing suddenly changes, do people know what to do?

Unlike an obvious physical injury, a sudden hearing change may appear only as ear fullness, quieter sound or an unusual change in one ear. These symptoms can easily be interpreted as fatigue or temporary discomfort, leading some people to wait.

Is it temporary discomfort, or a sign to seek medical help?

Official data

2.4 - 74/100,000
Reported annual incidence across regions in China (actual rate may be higher)

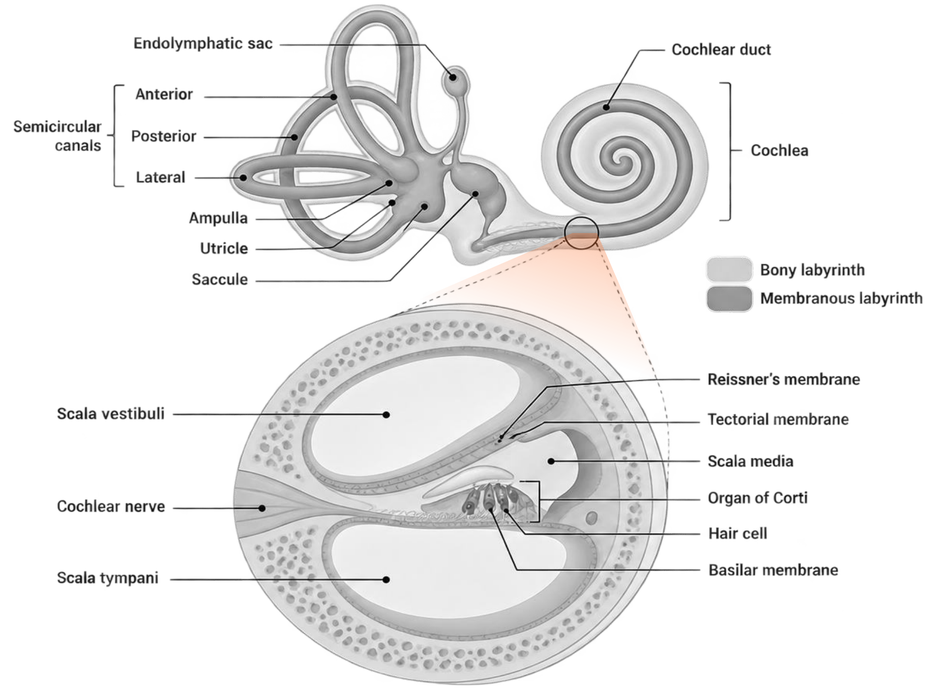
41 years old
Median age of onset in multi-center studies in my country (18-65 years)

27 - 400/100,000
Annual incidence rate reported abroad

2.3%
The percentage of bilateral sudden deafness (1.7%–4.9% according to the literature)

**Evidence/References on this Page：AAO-HNSF Clinical Practice Guideline: Sudden Hearing Loss (Update), 2019:*

Inner Ear and Cochlear Anatomy

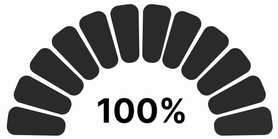


RESEARCH METHOD

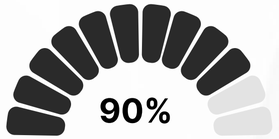
Identify problems through user surveys and user research.

10 semi-structured interviews

- 4 face-to-face + 6 remote interviews
- Participants with lived experience of sudden hearing loss
- Focus: symptom recognition, interpretation, decision-making and care-seeking journey



Notice Hearing/Ear Abnormalities



Ear Fullness / Signal Distortion



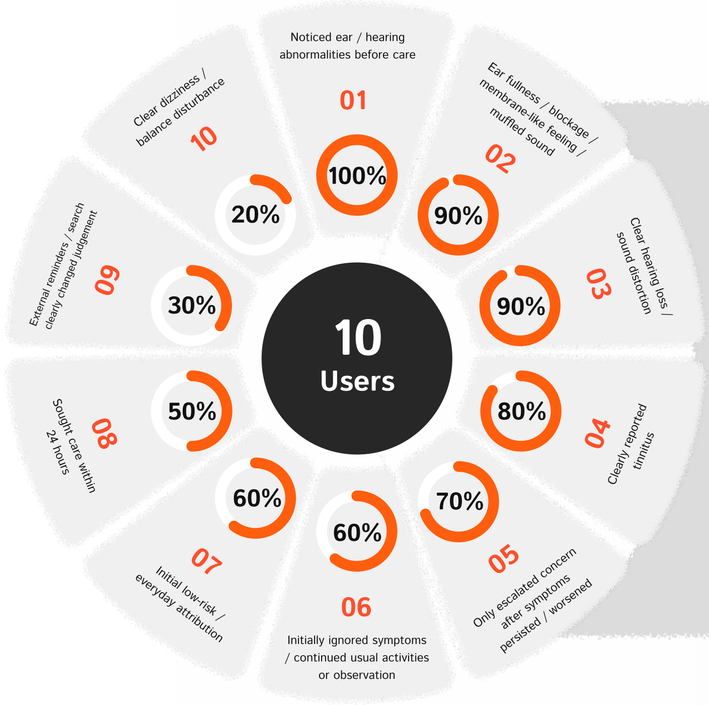
Seek Medical Help Within 24 Hours



Reassess Upon External Prompts

RESEARCH FINDING

The research discovers the commonalities and individual differences among individuals



People cannot correctly interpret the signal

"People Don't Care?"

The healthcare pathway does not always communicate urgency effectively.

In my early research, I found an important pattern.
The real problem is not simply:
People don't know about sudden hearing loss.

It is:

People don't know when their symptoms are serious enough to act

When hearing changes happen, people often explain them in everyday ways:
"Maybe I didn't sleep well."
"Maybe my ear is blocked."
"I'll wait a day and see if it gets better."

This creates an important gap between noticing a change and seeking medical help: The Recognition–Action Gap

Recurring tinnitus

→ Thought it was just stress
→ Went to work as usual the next day
→ Sought medical help on Day 3 after noticing hearing loss

Tinnitus + blocked ear

→ Thought it was heatstroke
→ Coworkers questioned it & friends suggested seeing a doctor
→ Still thought, "It's probably not serious"
→ Finally got checked on Monday

Blocked ear and tinnitus

→ A friend had experienced sudden hearing loss before
→ Quickly recognized the risk
→ Sought medical help the next day and was referred to another hospital

Persistent tinnitus

→ Did not think it was serious
→ Symptoms did not improve
→ Recognized the risk of sudden hearing loss
→ Sought medical help

RESEARCH SUMMARY

A·FAMILIAR ATTRIBUTION
"Just stress/heat stroke/fatigue"
Mori Hanako

→

B·NORMALIZATION
"Observe first / continue with the original thing"
Mori · Hua Zi · Leaves

→

C·SELF-DISTANCING
"It shouldn't be that serious."
Hua Zi

→

D · REASSESSMENT TRIGGER
Persistence / Aggravation / Confirmation by others / Transcendental reference
Sen · Huazi · Xiao Ming · Ye Zi

→

Previous knowledge changes action threshold.
Lack the capacity to recognize a vague anomaly as a signal that warrants immediate action.

DESIGN OPPORTUNITY

From Recognition to Action — journey mapping & intervention design

TRADITIONAL JOURNEY

1 - SUDDEN CHANGE
Sudden abnormal hearing

2 - INTERPRET
explanation / hesitation

3 - MEDICAL ACTION
Medical treatment/examination

WAIT 01 · BEFORE MEDICAL ACTION
Recognition–Action Gap

USER	DESIGN CAN PROVIDE
"I don't know if this change is serious." "My ear just feels blocked." "Maybe I'm just tired." "Should I wait another day?"	→ Capture the moment → Contextual Check-in → Hearing Check → Action Guidance

4 - TREATMENT
Treatment in progress

5 - UNCERTAINTY
Recovery result unknown

6 - RECONNECT
Adapt/Reconnect with daily life

WAIT 02 · DURING TREATMENT & RECOVERY
Medical Care–Daily Life Gap

USER	DESIGN CAN PROVIDE
Treatment → Waiting → Uncertain *Repeated attention → anxiety* *Uniquely adaptable*	→ Recovery Check-in → Structured Record → Emotional Check-in → Visual Support/Reconnection

DESIGNED JOURNEY - Experience structure after design intervention

01 | BEFORE CARE : Recognition → Action

USER NOTICE
Users proactively detect hearing abnormalities

HEALTH CONTEXT
Optional triggers in health situations

HEARING CHECK-IN
Turn vague feelings into events worthy of further confirmation

SYMPTOM CONTEXT
What happened / was it sudden / when did it start

HEARING TEST
Use existing abilities to confirm current hearing status

- Pure-tone hearing test
- Left / Right ear result
- Current audiogram

ACTION GUIDE
Context + Test Result → Meaning → Next Step

ACT
take appropriate action

- Record the start time of abnormalities and subjective changes
- If there are sudden or persistent abnormalities, seek professional hearing assessment.
- Bring the results and timeline along when communicating with the medical staff

PROFESSIONAL CARE
Assessment / Audiometry / Diagnosis / Treatment

02 | AFTER CARE After medical treatment: Recovery → Daily Life

ACTION GUIDANCE
After the medical treatment, resume daily recovery support

SYMPTOM
Subjective experiences: hearing problems, tinnitus, ear fullness, and dizziness

PROGRESS
Timeline: Medical consultation / Follow-up examination / Recent changes /

EMOTION
Anxiety / Loss of control / Isolation / Alienation

CHECK-IN | **RECORD** | **SUPPORT**

AGENCY → RECONNECT → DAILY LIFE

Core changes before medical

BEFORE
Perceive → self-explain → wait → re-judge

AFTER
Multiple input → Check-in → Context + Test → Actionable Meaning → ACT

Design function
Organize scattered and fuzzy abnormal signals into action basis.

TECHNOLOGY SUPPORT

Technology becomes meaningful only when it reduces uncertainty and supports action.

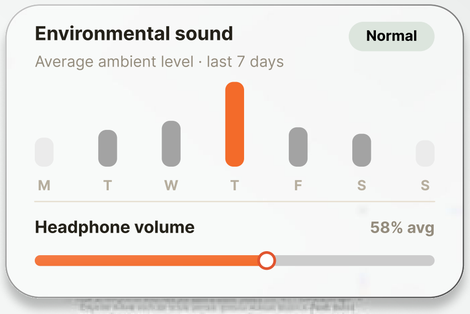
Like SSNHL itself, the need for support may remain almost invisible until a critical moment. The system stays quietly embedded in existing devices and health services — ready to surface when hearing changes require attention.

01 | WHAT THE SYSTEM CAN KNOW

The information we can obtain

HEADPHONE EXPOSURE

- Headphone audio exposure records



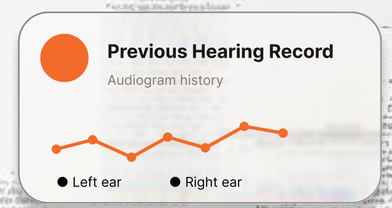
WATCH

- Environmental sound context
- Heart-rate context



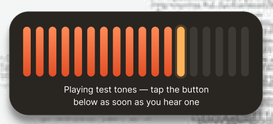
iPHONE / HEALTH

- Previous hearing records
- Audiogram history
- User-reported hearing changes



User Input

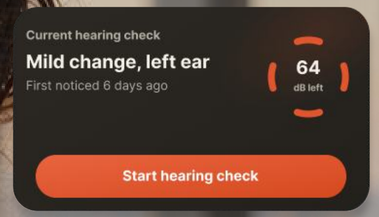
- What changed?
- Which ear?
- When?
- Sudden / gradual
- Tinnitus / fullness / dizziness



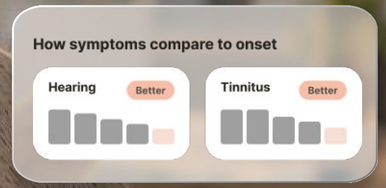
02 | WHAT THE SYSTEM CAN DO

Convert the input information into a format that users can understand and act upon.

Organize scattered changes into an understandable state

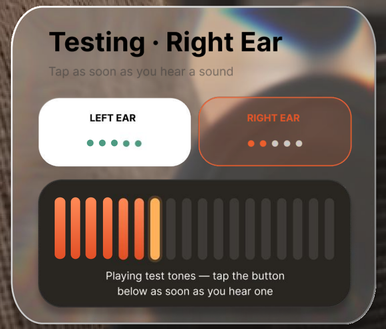


Put current changes into the historical record to understand them



03 ACTION GUIDANCE

Turn detection and context into the next steps



FROM CONTEXT TO ACTION

Few extra burden + Clear actions

DESIGN INTERVENTION

ENTRY A | Regular Active Entry Point

01 | HEALTH

Hearing Health

↓

Current Hearing Health Overview

↓

Start Hearing Check

"I Feel Something's Wrong With My Ears, So I'd Like To Get Them Checked Out."

ENTRY B | Contextual Check-in

02 | ENVIRONMENT

ENVIRONMENTAL SOUND

HEADPHONE EXPOSURE

PREVIOUS HEARING RECORD

USER-REPORTED CHANGE

↓

PHYSICAL CONTEXT

↓

CONTEXTUAL CHECK-IN OPPORTUNITY

CONTEXTUAL CHECK-IN

01
HEARING CHECK-IN
Confirm what changes have occurred.

02
HEARING TEST
Using existing hearing testing capabilities

03
RESULT + GUIDE
Transform results into actionable meaning

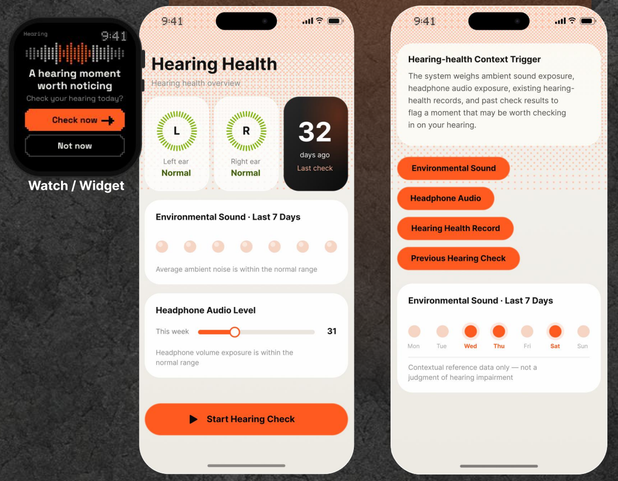
04
PROFESSIONAL CARE
Assessment / Audiometry / Diagnosis / Treatment

05
RECOVERY CHECK-IN
Low-burden record recovery status

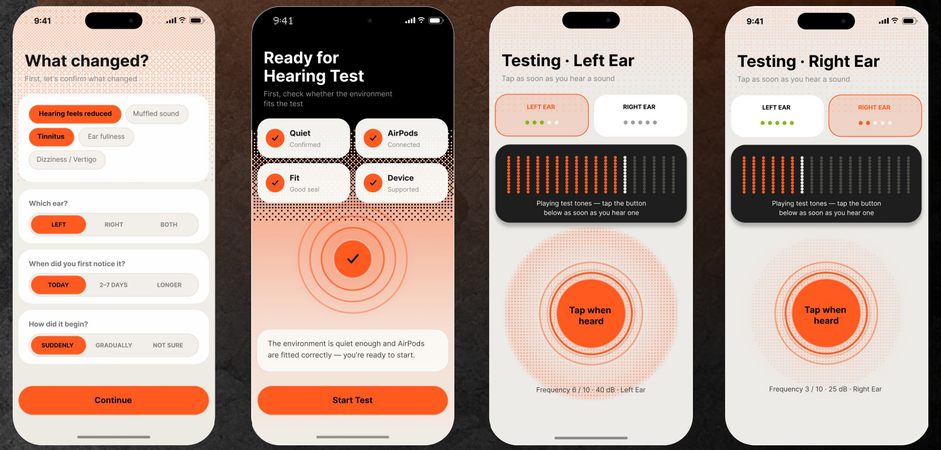
06
STRUCTURE + REVIEW
Organize timeline & facilitate follow-up consultations

07
AGENCY + RECONNECT
Emotional support / Visual pause / Return to daily routine

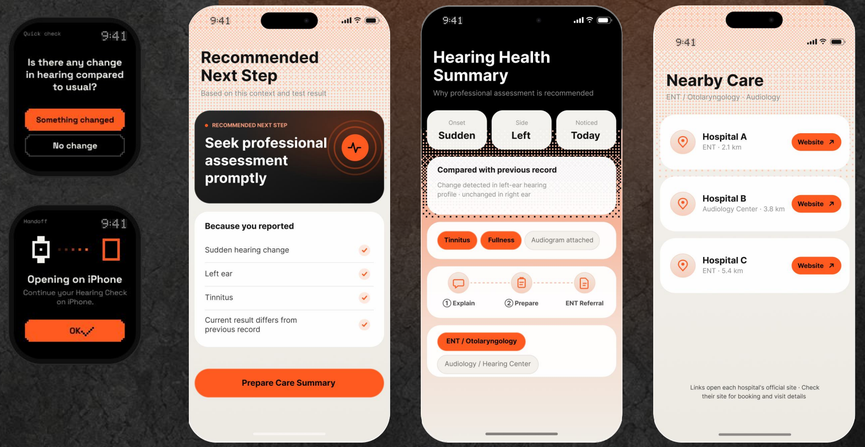
Two Entry Points



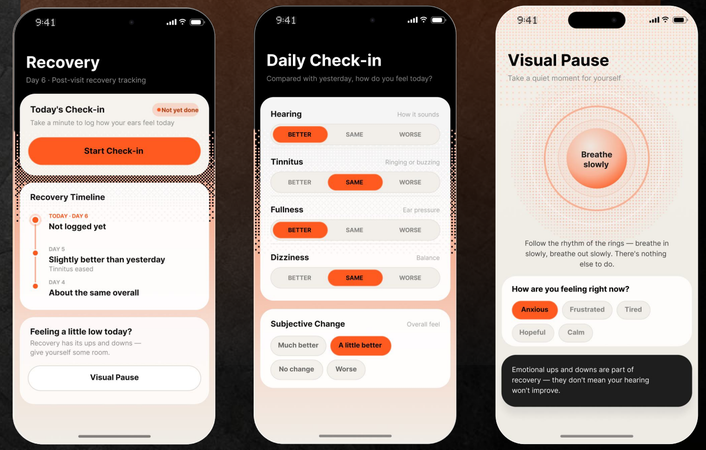
Hearing Check Protocol



Action Guidance → Healthcare Connection



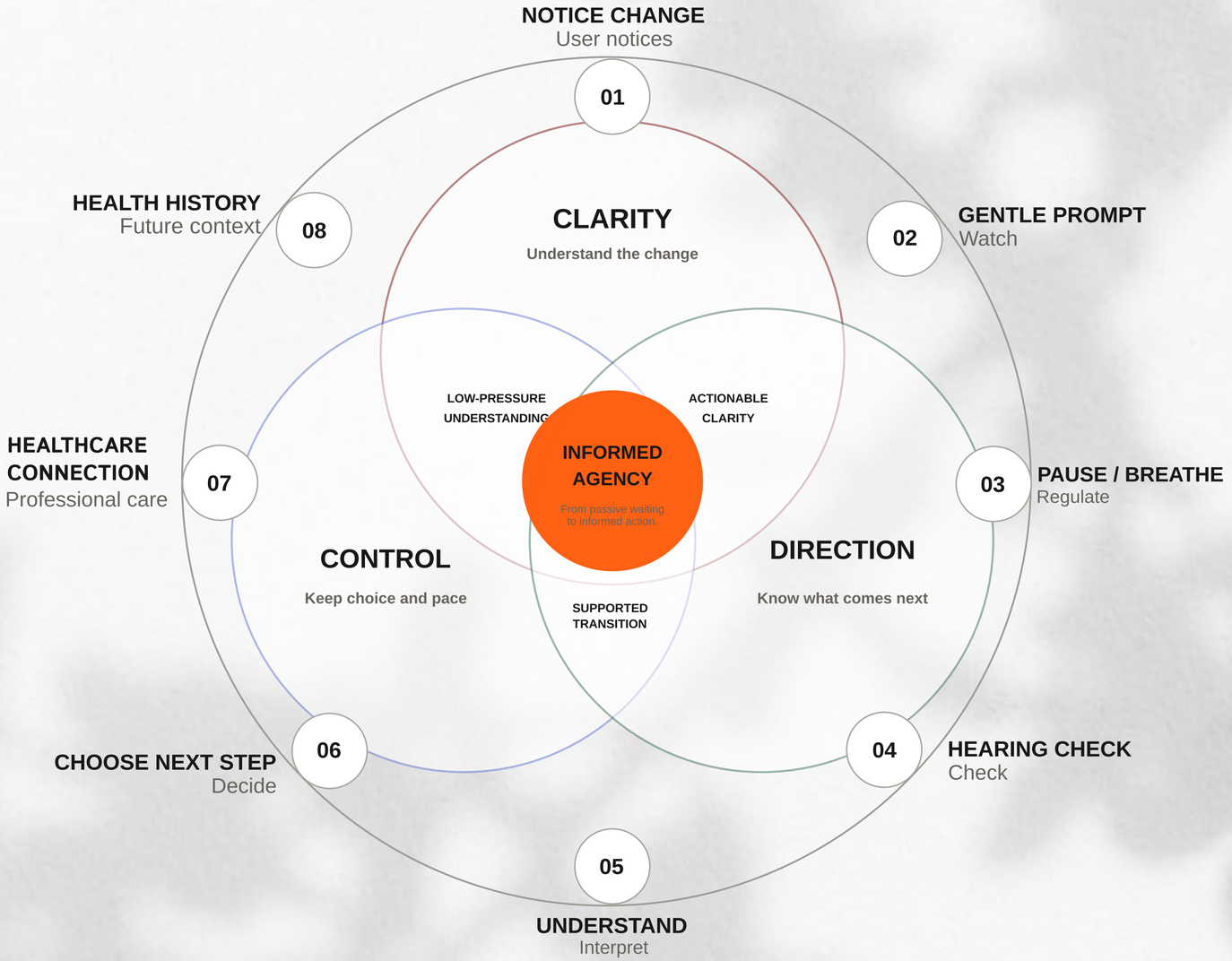
Recover Support



DESIGN FEEDBACK

01 RECIPROCAL FEEDBACK

User input changes the system response; the response helps shape the next choice.



02 WHAT THE UPGRADE CHANGES

The original notice-and-wait pattern becomes a sequence of understandable, optional, and actionable touchpoints.

BEFORE

NOTICE → SELF-INTERPRET → WAIT / OBSERVE

The user notices a change, but still lacks a clear reason to act now.

AFTER

NOTICE → PAUSE → CHECK → UNDERSTAND → ACT

Each touchpoint answers a different question:
What changed? → Do I need a moment? → What is my current hearing state?
What does it mean? → What should I do next?

03 RECIPROCAL INTERACTIONS

The system does not simply tell the user what to do; each step is an input–response–choice exchange.

USER NOTICE	Fullness / tinnitus / sound change	→	System structures symptom context
SYSTEM INVITES	Gentle Watch prompt	→	User continues or chooses Pause
USER STATE	Heart rate as interaction context	→	Motion adapts; emotion is not diagnosed
USER CHECKS	Symptoms + Hearing Test	→	System provides actionable meaning
SYSTEM GUIDES	Recommended next step	→	User chooses professional care

04 THE VOICE OF THE SEASON

By capturing and translating the natural sounds associated with the twenty-four solar terms, invisible seasonal changes are transformed into visual, auditory, and multisensory experiences that can be experienced.

RESEARCH FINDING

Sound offers a way to reconnect with this changing natural rhythm. Birdsong, cicadas, rainfall, and silence do not simply represent a season—they reveal how one season gradually becomes another. This project translates these changing sounds into visual and spatial experiences, exploring a new way to perceive the passage of seasonal time.

Poetry → Sound → Form → Scroll

Poetry sets the scene and order; sound characteristics inform the forms.
Houdini generation and Song painting references organise the visual sequence.

Keywords

Sound · Culture · Multisensory Experience



RESEARCH FINDING

Modern Life Alters Human Perception

◆ A Scroll Written In Verse

During sound sequence design, layered textual logic elevates sound visualization beyond superficial effects, prompting audience reflection. Poetic scripts add narrative depth and completeness to the audio work.

Centered on summer solar terms, ancient poems documenting seasonal customs and ancient livelihoods serve as core materials.

Poetic scene

Six summer poems describe seasonal customs, animal activity and changes in weather.

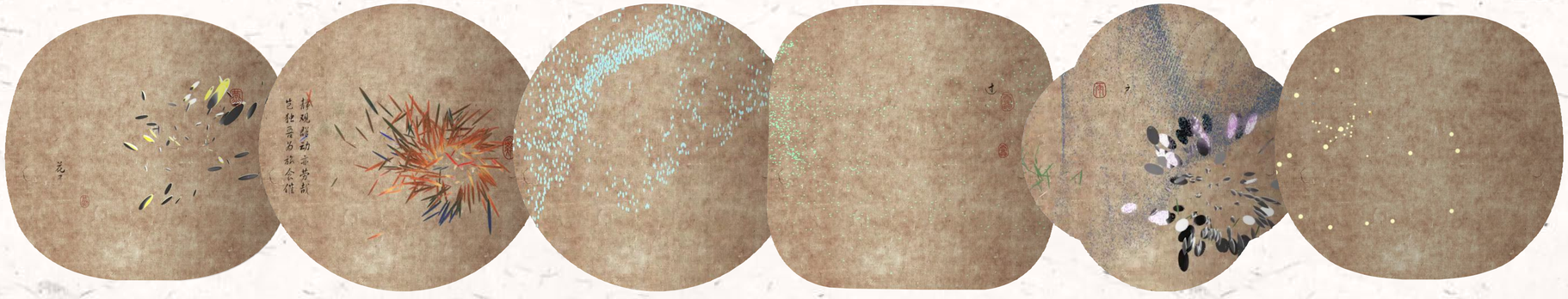
Poetry decides which sounds enter, and when.

Sound selection

The script identifies cues such as birdsong, frog calls, insects, wind and rain.

Order of events

The poet's viewpoint gives those sounds a sequence and a shared seasonal setting.



立夏	小满	芒种	夏至	小暑	大暑
Start of Summer	Lesser Fullness	Grain in Ear	Summer Solstice	Minor Heat	Major Heat
Swallows / bees	Rooster / frog / rain	Birdsong / wind / rain	Cicada / storm	Wind / bamboo / rain	Fireflies / grass / wind
泥新垂巢燕间闹 花尽蜜蜂稀	鸡唱未鸣圆未缺已 蛙鸣蛰初鸣数雨昧雨来还	渌沼涟汙花连放 炎风暑雨情	处处闻蝉蝉响 须知五月中	倏忽倏温风至 因循不循暑来	流光堪在珠玑列 为火不生榆柳中

Script table: Dong Zheng

DESIGN STRATEGY

From Nature to Experience: Sensory Transformation through Seasonal Changes

Volume / scale

Larger volume settings inform larger forms.



Houdini render

Frequency / sharpness

Higher-frequency cues inform sharper forms.



Houdini render

Waveform / deformation

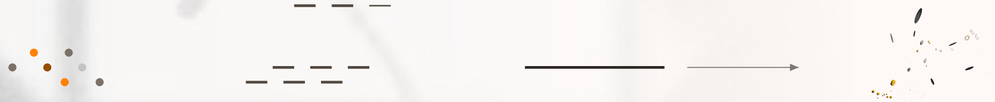
Waveform cues inform the degree of deformation.



Houdini render

Duration / structure

Short sounds favour points; longer sounds favour lines.



Houdini render

Dot size encodes the 1-5 setting • 1 • 3 • 5

	Source	Volume	Sharpness	Duration	Deform.	Texture
	Animals					
	Oriole	3	4	2	5	Fleece
	Hawk	2	2	2	3	Fleece
	Sparrow	3	3	2	4	Fleece
	Rooster	5	4	3	4	Fleece
Metal	Cricket	3	4	1	3	Lacquer
	Bee	3	5	1	2	
	Cicada	4	5	2	2	Silk
	Frog	4	2	2	2	Smooth / watery sheen
	Environment					
	Warm wind	1	3	5	1	Gauze
	Great Heat wind	3	3	5	1	Cloth
	Rain	4	4	1	2	Jade beads
	Stream / pond	2	2	2	2	Jade / watery sheen
	Bamboo leaves	2	3	1	1	Matte
	Wheat field	2	3	3	1	Continuous lines

Values 1-5: author-defined design settings. Texture: art direction.

A shared rule creates variation; art direction gives each form its character.

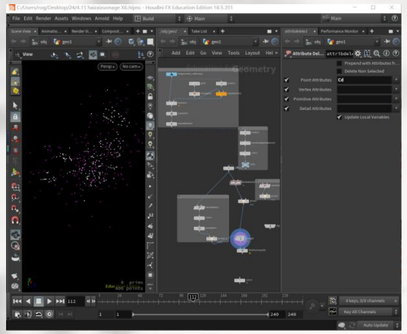
FROM GENERATION TO PAINTING

Procedural forms gain narrative meaning through art direction

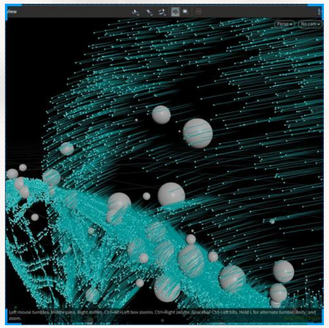
The production pipeline joins rule-based generation with decisions about composition, material and narrative timing.

01 SOURCE	02 SETTINGS	03 GENERATE	04 ART DIRECTION	05 SEQUENCE
Poems + sound assets	Four rules + texture	Houdini modelling	Song painting + seals	Sound + verse + image

Real production evidence



Original node network
Houdini workspace.



Initial visual model
Procedural generation before art direction.

SOURCE ANIMATION / RENDER SEQUENCE



13.0080



13.0110



13.0300

A documented change in direction

01 GENERATION ALONE

The thesis records that raw generated forms lacked the desired warmth and narrative expression.

02 DIRECTIONS EXPLORED

The project explored splash-ink, light ink-and-colour and Song painting before choosing the final visual direction.

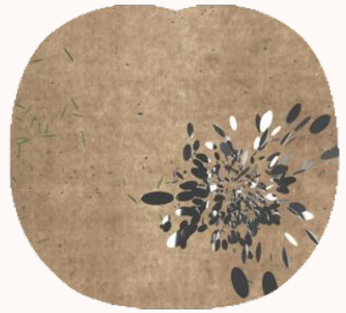
03 DIRECTION RETAINED

Song painting offered the restrained composition, colour and surface texture sought by the project.

Materials: Chuyao Xia. Camera: Dong Zheng. Narrative, sound, form exploration and editing: collaborative.



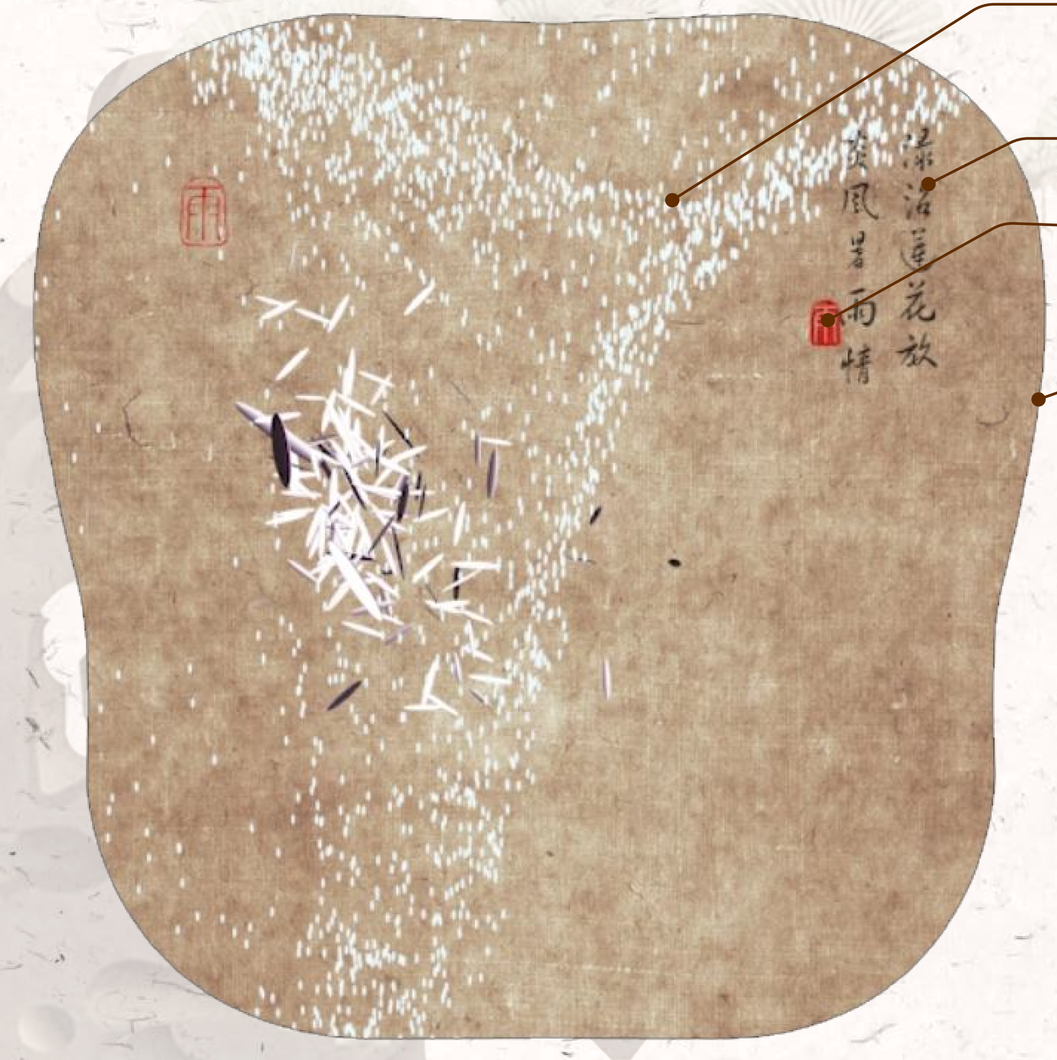
Song painting reference



Final visual vocabulary

INSIGHT Generation supplies the form; art direction and timing connect it to the poem.

EXPLORING SOUND PARAMETERS



Main Subject: Rain Sound Visualization Model

Annotation Symbol: [Rain] Seal

Original Poetic Text: Hot Wind, Storm, Clear Sky

Visual Layer: Song Painting Texture & Artistic Modeling

Settings

Volume	Sharpness	Duration	Deform.
4	4	1	2

Verse

The verse gives the same sound a named seasonal setting.



Seal Carving [Wind] | Self-designed



Seal Carving [Rain] | Self-designed



Seal Carving [Bird] | Self-designed

Form

Small visual elements form a dispersed field on the painted surface; the table specifies a jade-bead texture.

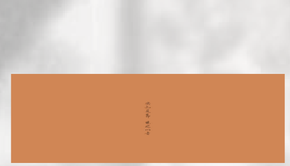
Final effect: Trigger synchronized encoding across three sensory channels — sight (seal), hearing (sound), and cognition (poem reading) — enabling audiences to fully grasp the design intent.

Take the video clip for the Grain in Ear sound visualization as an example: in this segment, birds fall silent and insects pause their chirps, leaving only pattering summer rain. The core visual element is the rain sound visualization model, paired with its narrative line — Hot wind, storm, clear sky.

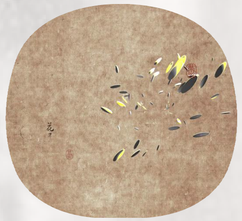
On the right side of the frame, a carved seal “Rain” is placed beside the character “rain” in the poetic line; an intaglio “Rain” seal also appears to the left of the rain visual model. This layout connects visual forms, audio cues and poetic text for viewers, establishing clear, precise correspondence between visual assets and narrative writing.

INTERACTIVE EXPERIENCE

VIDEO LINK https://www.summerbgm.com/project-03.html



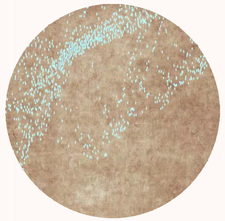
片头
Opening



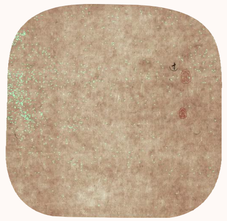
立夏
Start of Summer



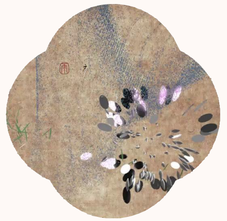
小满
Lesser Fullness



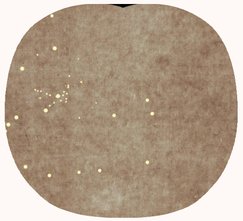
芒种
Grain in Ear



夏至
Summer Solstice



Minor Heat



大暑
Major Heat

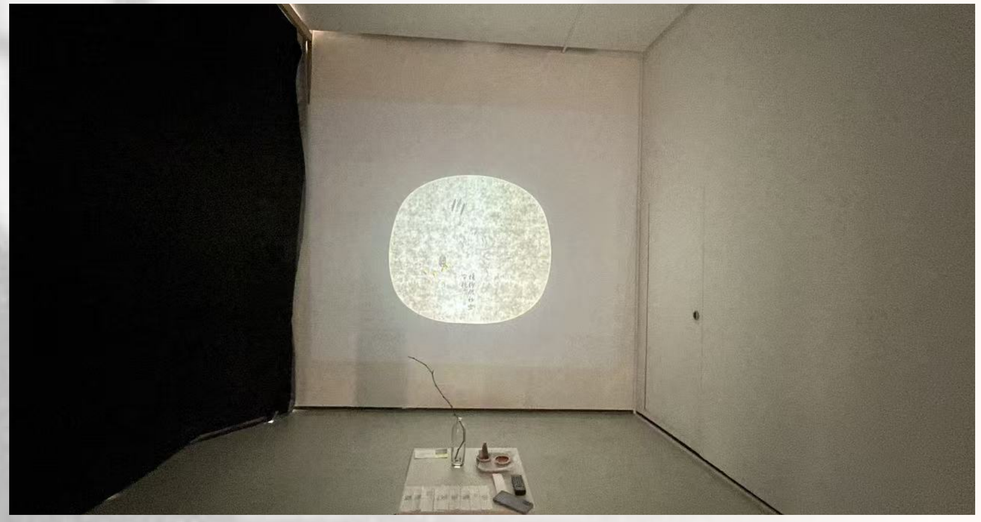


片尾
Epilogue

0:00 1:00 2:00 3:00 4:00 4:43

0:12 0:36 1:12 1:36 2:36 3:12 3:48 4:24

Projection display



Construction



Exhibition hall construction&Equipment arrangement



Exhibition

CHINESE / GAN JUE

18-28 Jan 2022 South China Art Museum

Users can experience the changes of seasons in a real environment.
The moon of ancient times is no longer visible today; yet this moon once illuminated those people from long ago.

Recognition



Chinese Sensibility Art Exhibition

Participant | Organizer: South China Museum of Art



Chinese Sensibility Art Exhibition

Participant | Organizer: South China Museum of Art



24 Solar Terms Creative Exhibition

Participant | Organizer: Beijing Municipal Bureau of Cultural Heritage

FURTHER DESIGN—— INDUSTRIAL VALIDATION

Seven-Screen Interaction

Temporal Narrative	Front Screen	Side Screens	Rear Screen
Roof Screen Seasonal Sky	Landscape & Time	Poetry & Storytelling	Shared Reflection

Cultural Perception Framework

Environmental signal → Semantic mapping → Multisensory translation → Interaction → Reflection → Cultural resonance

	01	02	03	04
The scroll	Poetry + sound	Poetic context	Form + seal + verse	Six-chapter sequence
The cockpit	Solar-term theme	Experience direction	Seven-screen content	Coordinated mode

My Role

Automotive Experience Designer
Responsible for translating the [Cultural Perception] into an intelligent cockpit experience for the BYD Dynasty-D Concept.

Led Overall experience, solar-term mode development and presentations.
Contributed Visuals, promotional film production and launch communications.





What is shown in the video is the Rainy Season of the 24 Solar Terms, namely Guyu.

Project film / portfolio https://www.summerbgm.com/project-03.html