

A LESSON FOR
INTERDISCIPLINARY
PROJECTS

Design Thinking Under Uncertainty

*A plausible problem is a
starting point — not yet a
defensible design decision*

From Campus Wayfinding to Ubiquitous Positioning

A campus journey, a city-scale question

Mengyun LIU

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Which claim would you invest in first?

A baseline decision – not a test of prior design knowledge. Keep your initial answer.



Where would you start – and why?

- A student on a first visit cannot find a seminar room.
- You have one week to explore the problem.



GATE



BRIDGE



BUILDING



ROOM

A Improve location accuracy

B Standardize venue data

C Define a useful service for this task

Write A / B / C / “not enough evidence” + one reason.

“Not enough evidence” is a fair answer – if you can say what would change it.

Three decisions you will learn to make.

One case that moves from a campus journey to a city-scale question – two short studios and one individual exit ticket.

01 Frame the need

Connect a human need to evidence and identify an assumption behind it.

02 Design to learn

Define what a useful service must deliver, then choose a test that could change your design.

03 Transfer & reflect

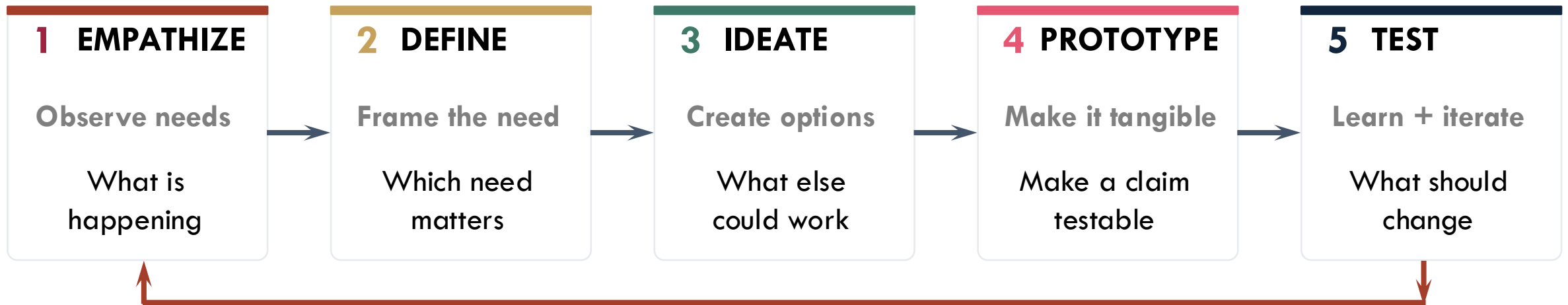
Take the reasoning to a new setting and revise your original decision.

The product is a defensible next decision – not a specification for a whole city.

Five modes. One disciplined learning loop.

Design Thinking combines human-centered framing, creative exploration, and iterative learning.

▪ FAMILIAR MODES – FLEXIBLE ENTRY POINTS



New evidence may send us back to the need, map, stakeholders or service boundary.

Today: compare explanations, expose assumptions, and decide what to learn next.

Mode names: Stanford d.school, Design Thinking Bootleg. The modes are not a mandatory sequence.

01

Frame the need

**What deserves to
become the problem?**

IN THIS PART



Separate observation from interpretation.



Compare plausible explanations.



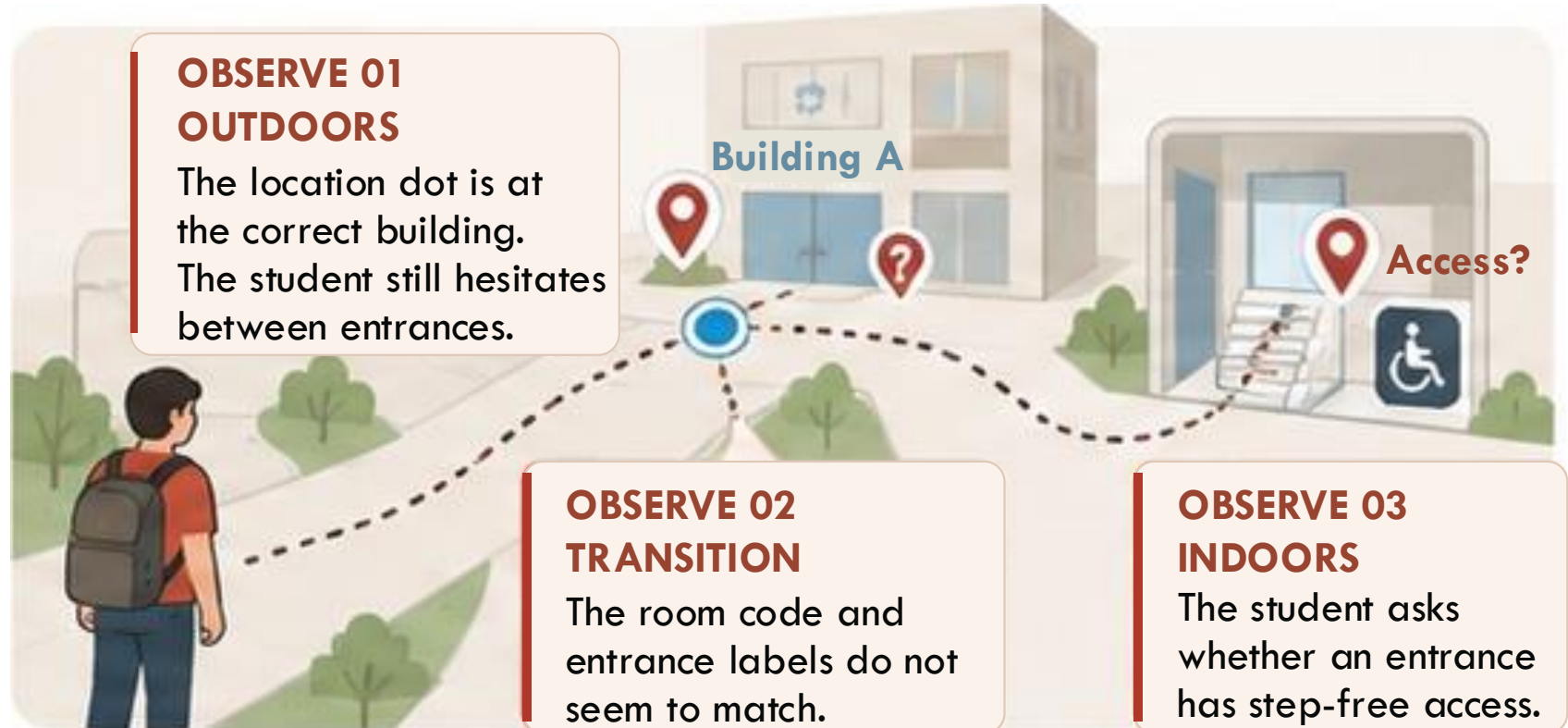
Frame an outcome without fixing the tool.

A working locator. An unresolved journey.

Inspired by the localization research field. All observations here are constructed for learning.

A closer look at the task:

The same student needs to reach the right seminar room — through an accessible entrance.



The task is not “use the app”. It is to arrive correctly, accessibly, and with appropriate confidence.

One observation can support several frames

A frame is an interpretation that directs what we build and what evidence we look for.

CANDIDATE FRAMES

PREDICTION WE COULD CHECK

Location error



Hesitation follows an incorrect location estimate.

Interpretation gap



Hesitation continues even when the location is correct.

Access uncertainty

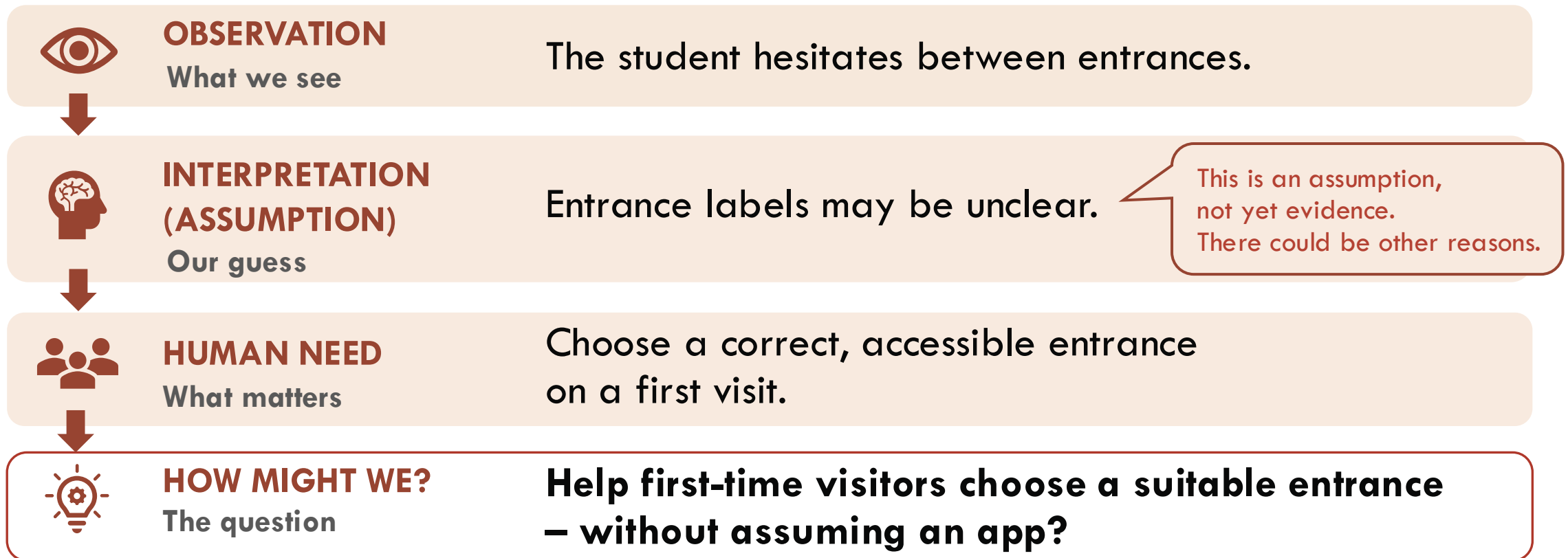


The choice changes when access information becomes clear.

No winner yet – all three frames stay on the table, and we keep testing.

A reframe changes the model, not just words

An attractive HMW is not enough: connect it to an observation, an inference, and a desired outcome.



Framing as a proposed mechanism for creating value: Dorst (2011), the core of design thinking and its application.

Studio 1: make your frame defensible

Use the evidence packet. HMW = How Might We. No design expertise or device is required.

3 minutes

In pairs.

One shared HMW,
one observation,
one assumption.

Studio 1 / make your frame defensible

45 sec Write one HMW question independently

75 sec Compare frames. Agree on a human outcome

30 sec Partner challenges: “What are you assuming?”

30 sec Revise the HMW and write down your assumption

A strong answer says both “why this need?” and “what might make our frame wrong?”

Two good-sounding questions are not equally useful

A worked example for feedback — not the only valid answer to the case.

SOUNDS HUMAN-CENTERED

“How might we help students feel less stressed?”

Human language — but:
which task,
which situation,
and what evidence?

MORE INVESTIGABLE

“How might we help new students identify a suitable entrance on a first seminar visit?”

User + context + outcome
Solution remains open
The inference stays provisional

Human-centered means attending to tasks, contexts, constraints, and experiences — not just feelings.

Critical thinking is a check, not a brake

The same three questions work at every stage: frame, test, revise.



Run them on the frame you just wrote.

CLAIM

What do we know, and what are we assuming?

OTHER CAUSES

What else could explain the observation?

REVISION

What finding would change our decision?

Diverge without dismissing ideas too early, decide without confusing plausibility with evidence.

02

Design to learn

Which test would change our decision?

A design decision is only as strong as the assumptions behind it.

IN THIS PART



Create alternatives with different mechanisms.



Match the prototype to the claim.



Decide what would count as disconfirming evidence.

From one campus to a whole city

The same discipline, scaled up: one positioning standard for very different spaces, applications, and users.

Shopper in a mall



A fast fix to
the right storefront.

Visually impaired user



Trustworthy,
accessible guidance.

Hiker in a country park



Works where
signals are weak.

Emergency responder



Reliable
when it matters most.

Delivery robot



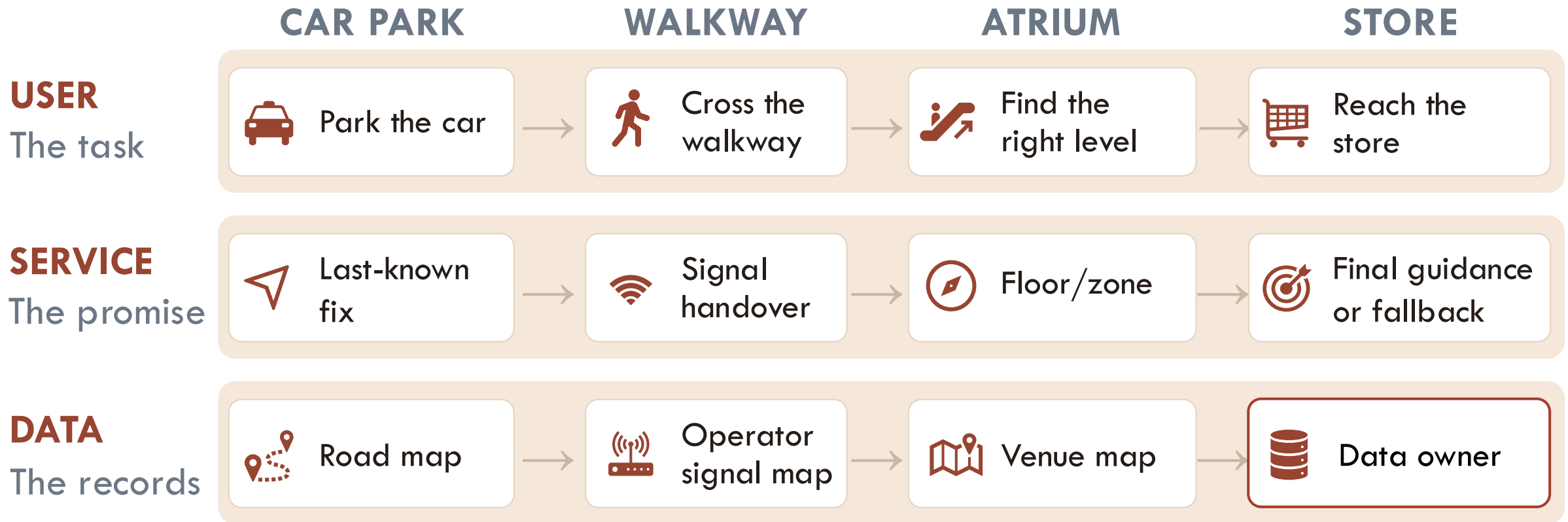
Low power,
all-day operation.

Same capability – different spaces, different users, different definitions of success.

Ubiquitous positioning is not one problem – it is a family of problems.

One journey, three system layers

A shopper's trip to a store – seen as the user's task, the service promise, and the data records.



When every stage has a different data owner, one shared standard is a decision – not a default.

Test the assumption that could sink the idea

Which assumption could sink the whole standard – not just the easiest feature to show?

WEAKER SUPPORT

STRONGER SUPPORT

**High
consequence
if wrong**

Test early

One standard fits all spaces – unproven.

Verify / monitor

Critical, but supported by prior evidence.

Start with a belief that is consequential and weakly supported.

**Low
consequence
if wrong**

Defer

The icon style is preferred.

Low priority

Low-stakes and already supported.

Qualitative heuristic.
Not a numeric risk score or a validated scale.

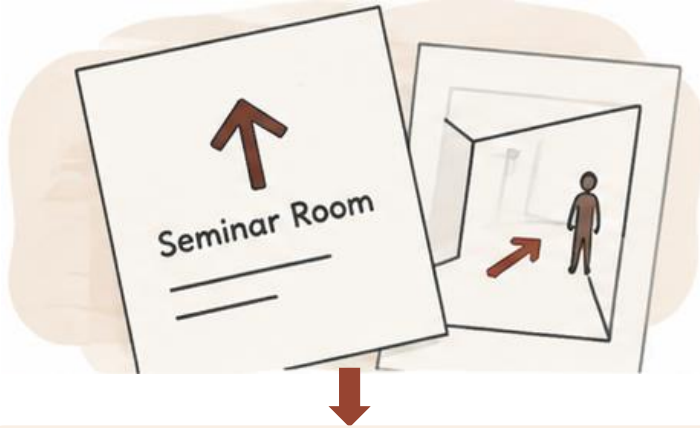
Ask: if this assumption fails, would we write a different line in the standard?

Match the prototype to the claim

Different claims require different prototypes – and different evidence.

1 People understand a sign

Does the design help users interpret where to go?



Paper prototype or role-play

Observe how users interpret the sign.

2 Position estimates improve

Does the system reduce location error in this environment?



Instrumented field benchmark

Compare measured location error (e.g., against a reference).

3 The journey is usable

Can users with relevant access needs complete the task?



Journey trial with relevant users

Observe whether participants can complete the journey accessibly.

Test the claim in one scenario – before generalizing it into a citywide standard.

Evaluate the system at several levels

Accuracy is necessary for some claims, but not sufficient for a human-value claim.

HUMAN OUTCOME

Can this person complete the task, accessibly, with appropriate confidence?

SERVICE QUALITY

Correct floor or entrance · uncertainty disclosed · graceful fallback

SYSTEM PERFORMANCE

Accuracy · availability · continuity · latency · cost · data freshness

A claim at one level needs evidence from the levels below it.

Match metric, sample and task to the inference you intend to make.

Studio 2: write a learning contract – for your scenario

Pick a scenario card from the city family. Plan a pilot – do not run it.

3 minutes

Same pair.

Pick one

scenario card.

45 sec CLAIM: We believe _____ because _____.

60 sec CONTRAST: Change _____; hold _____ fixed.

45 sec OBSERVE: If _____, favor _____; otherwise revise.

30 sec CRITIQUE: Does this distinguish explanations?

Compare two groups: why are your contracts different? That is why one standard is hard to write.

A small test can be useful – and limited

Keep task conditions comparable. Recognize familiarity, selection, and observer effects.

WORKED PILOT – PROPOSED, NOT RUN

Current labels vs room-matched labels. Keep the task and correct location fixed.

Record first entrance choice + explanation. No coaching; fresh participants or balanced order.

What it can do

Reveal usability issues.

Generate evidence about a mechanism.

Fewer wrong choices supports the label hypothesis; no improvement weakens it. Neither result is proof.

What it cannot do

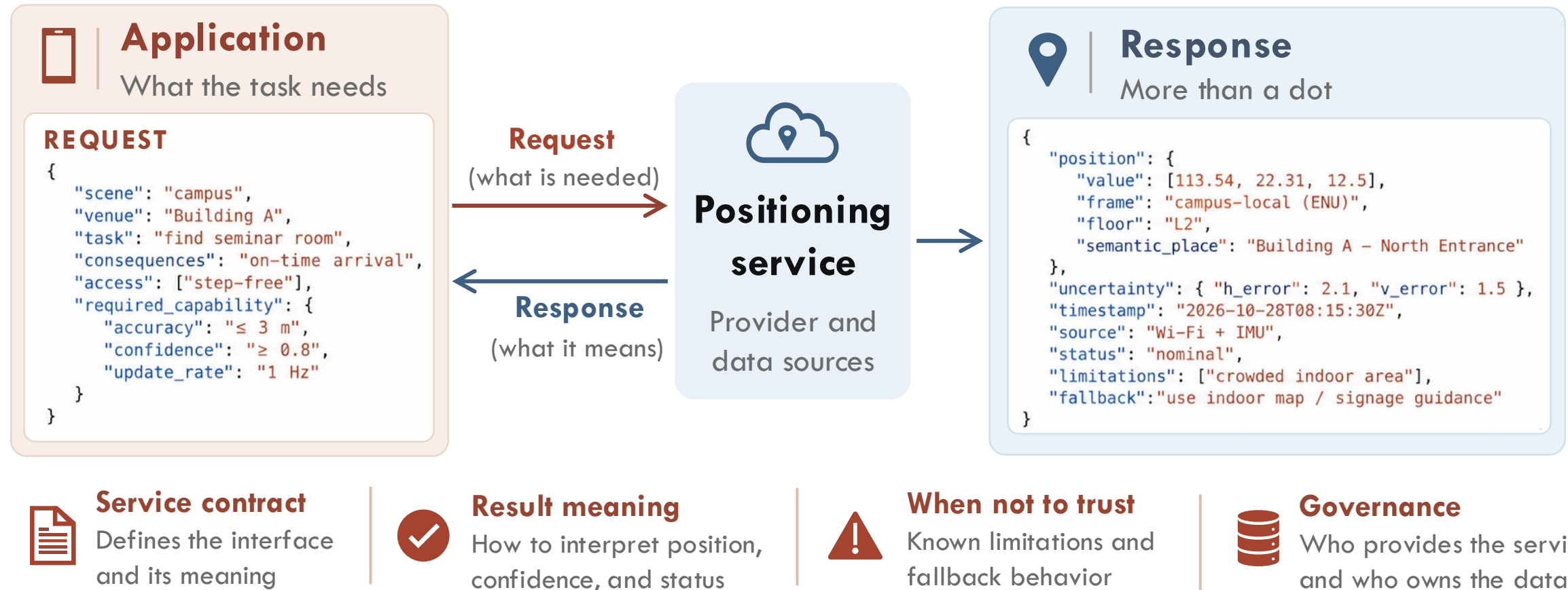
A few volunteers do not establish general efficacy.

Recruit for the question.

Plan before collecting data. “N = 3” is not a universal validation rule.

Standardize a service contract, not just coordinates

A common request / response pattern makes provider outputs more interpretable.



The standard must communicate what is known, what is uncertain, and what to do next.

New evidence. Would you keep your frame?

Take 20 seconds to annotate your pair's learning contract — then compare.

“The system was accurate. It sent me to an entrance with stairs.”

— *wheelchair user, pilot debrief (synthetic). Would your current test notice this failure?*

KEEP?

Only if the evidence supports the current frame.

REVISE?

The cue, the task, or the target users?

REFRAME?

From “met the target” to the right, accessible action.

A pilot can hit its accuracy target and still fail the user. Recheck what “success” means.

Confidence is not the same as success

Human-centered does not mean optimizing a feeling while ignoring performance or access.

LOW CONFIDENCE

HIGH CONFIDENCE

**Not correct /
not accessible**

Lost and aware

Not suitable — but at least honest.

Confidently wrong

The dangerous case: confident, and incorrect.

**Correct +
accessible**

Successful but uncertain

Acceptable, but fragile.

Successful and confident

The goal.

Primary: a correct, accessible action. Secondary: appropriate confidence and recovery from uncertainty.

03

Transfer & reflect

Can you transfer this to learning with AI?

IN THIS PART



Move from a polished output to learner capability.



Separate a research claim from its evidence.



Show what changed in your own decision.

Beyond accuracy: three questions for one sensing system

The reframe you practiced – on a campus, then on a city – is the move my field is trying to make.

THE GOOD

Does sensing help someone take the right, accessible next action?

THE BAD

Where can the model fail?
Bias, fragility, unclear cues, or opaque inference?

THE UNKNOWN

What might the system infer or enable beyond the intended use?

Accuracy matters – but it is not the whole human-value claim.

Sources: Santini (USI), “What the Body Can(not) Tell”; PerCom 2026 Keynote, “Beyond accuracy: The Good, the Bad, and the Unknown in Sensor-Based Human Behavior Modeling.”

The same discipline you just practiced is the discipline the research community needs.

Use AI to widen options, not invent evidence

AI can suggest possibilities. User evidence must still come from investigation.

AI can help us think of more possibilities.

USE IT TO

- Propose alternative explanations.
- Challenge a weak test plan.
- Explore different solution mechanisms.

It cannot turn a plausible story into user evidence.

DO NOT

- Invent interviews or participant reactions.
- Hide synthetic origins.
- Upload private data without permission.

Keep provenance, consent, and responsibility visible. AI suggestions are hypotheses, not observations.

Exit ticket: revise your original decision

Return to your campus baseline on slide 2 – then check your scenario card from Studio 2.

2 minutes

Write individually.



FRAME

State the human outcome and the context.

KEY BELIEF

State the key assumption that might fail.

TEST

Choose an observation that separates explanations.

REVISION

State what would change your decision.

Would you write the same standard line for both? A better-supported answer is the goal.

Transfer the same reasoning to an AI learning tool

Teacher-designed criteria – use them to self-check your exit ticket.

TRANSFER EXAMPLE / AI LEARNING TOOL

Need: ask effective questions independently.

Assumption: coaching builds transferable skill.

Test: after support is removed, compare performance on a new questioning task.

If only assisted prompts improve – revise the claim about independent learning.

Evidence-linked frame

A plausible alternative

**A diagnostic test
and a revision rule**

Today's answer shows immediate reasoning. Delayed, unassisted transfer needs a later assessment.

Better questions. Better tests. Better standards.

From a campus case to a city-scale standard – and from answers to accountable judgment.

**From a campus to a city,
from answers to standards.**

01 FRAME

A need linked
to evidence

02 TEST

A claim matched
to a test

03 REVISE

A standard open
to evidence

Do not only ask “Can we build it?” Ask “What would justify building it?”

Thank you for your attention

Mengyun LIU

amylmy910@gmail.com

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Q & A

FRAME · TEST · REVISE