EVIDENCE BASED DESIGN

User Studies

Lecturer:

Vertr.-Prof. Dr. Sven Schneider

PREDICTIVE MODELS FOR HUMAN BEHAVIOR / EMOTIONS
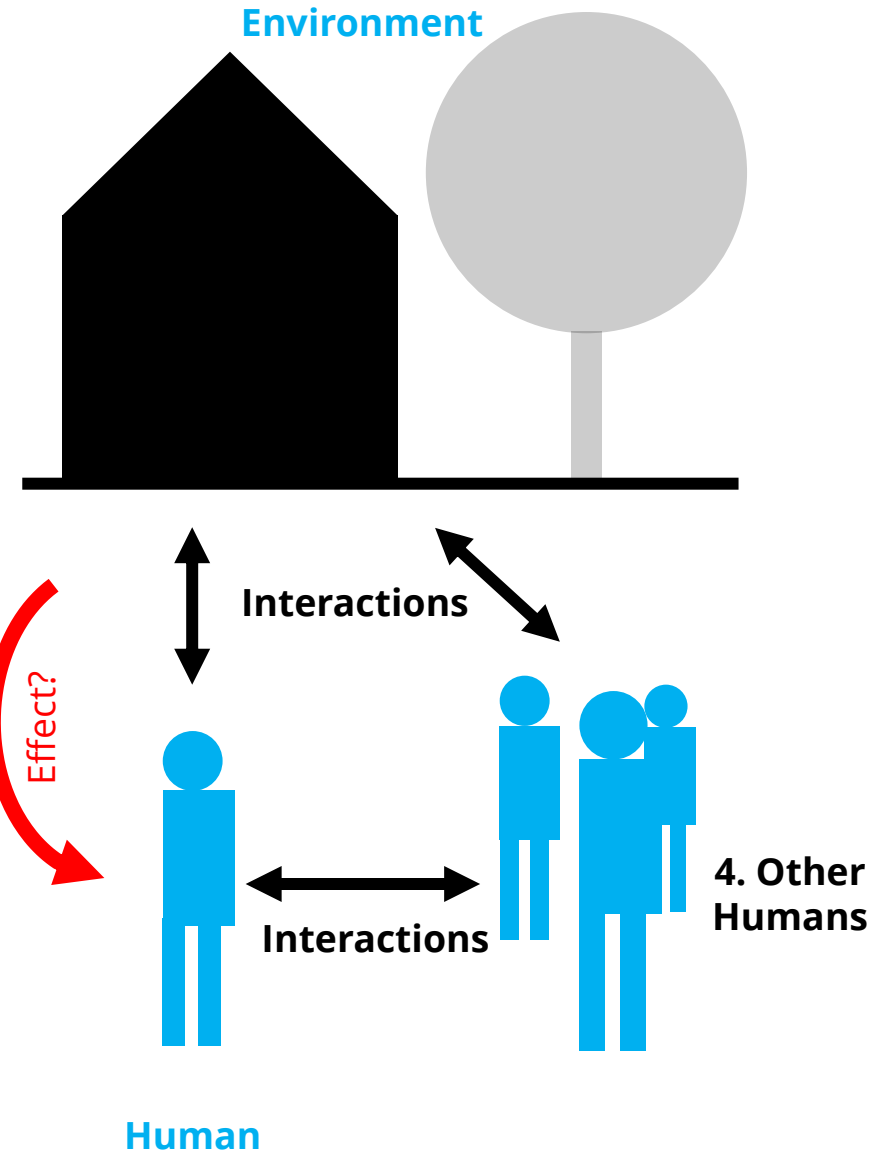## Challenges

Environment

1. Many features

- Geometry
- Color
- Sound
- Smell
- Taste
- Temperature
- Humidity
- ...

3. Dynamics

- the enviroment can change
- humans can change
- humans can change the env.

Effect?

Interactions

2. Individual Differences

- Age
- Gender
- Nationality
- Education
- Culture
- Abilities
- Goals
- ...

4. Other Humans

Interactions

Human

APPROACHING THE CHALLENGES

1. Many features

- Geometry
- Color
- Sound
- Smell
- Taste
- Temperature
- Humidity
- …

Select features

3. Dynamics

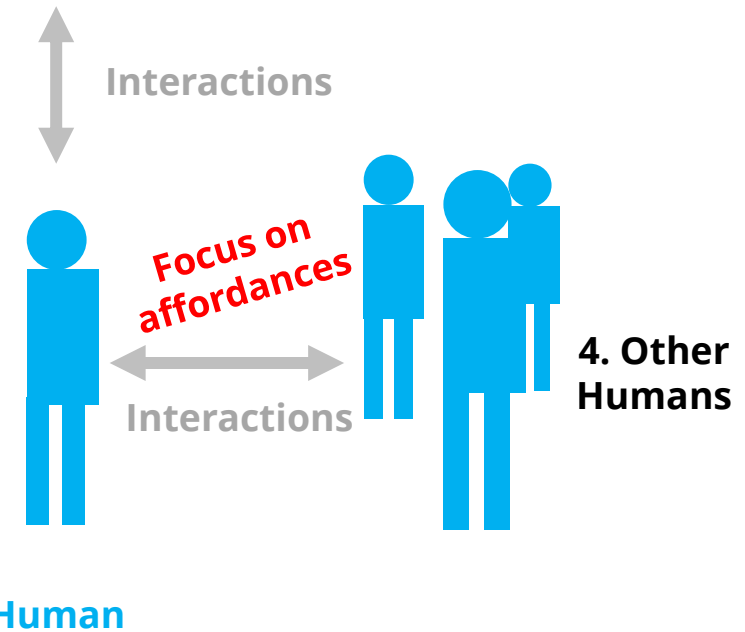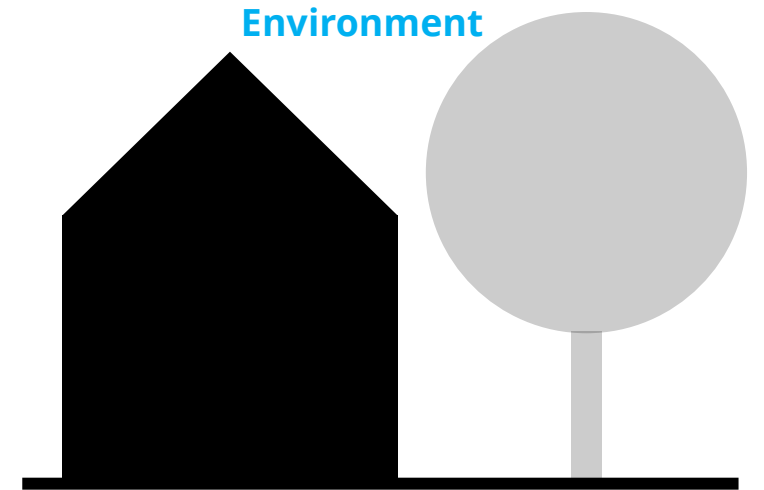- the environment can change
- humans can change

Assume as constant

Environment

Interactions

2. Individual Differences

- Age
- Gender
- Nationality
- Education
- Background Knowledge
- Abilities
- Goals
- …

Select behavior

Focus on affordances

Create groups with similar abilities/interests

4. Other Humans

Interactions

Human

Bauhaus-Universität Weimar   InfAR PLANNING.SYSTEMS   bauhaus ifex

USER STUDIES

Observing how humans behave/feel in an environment
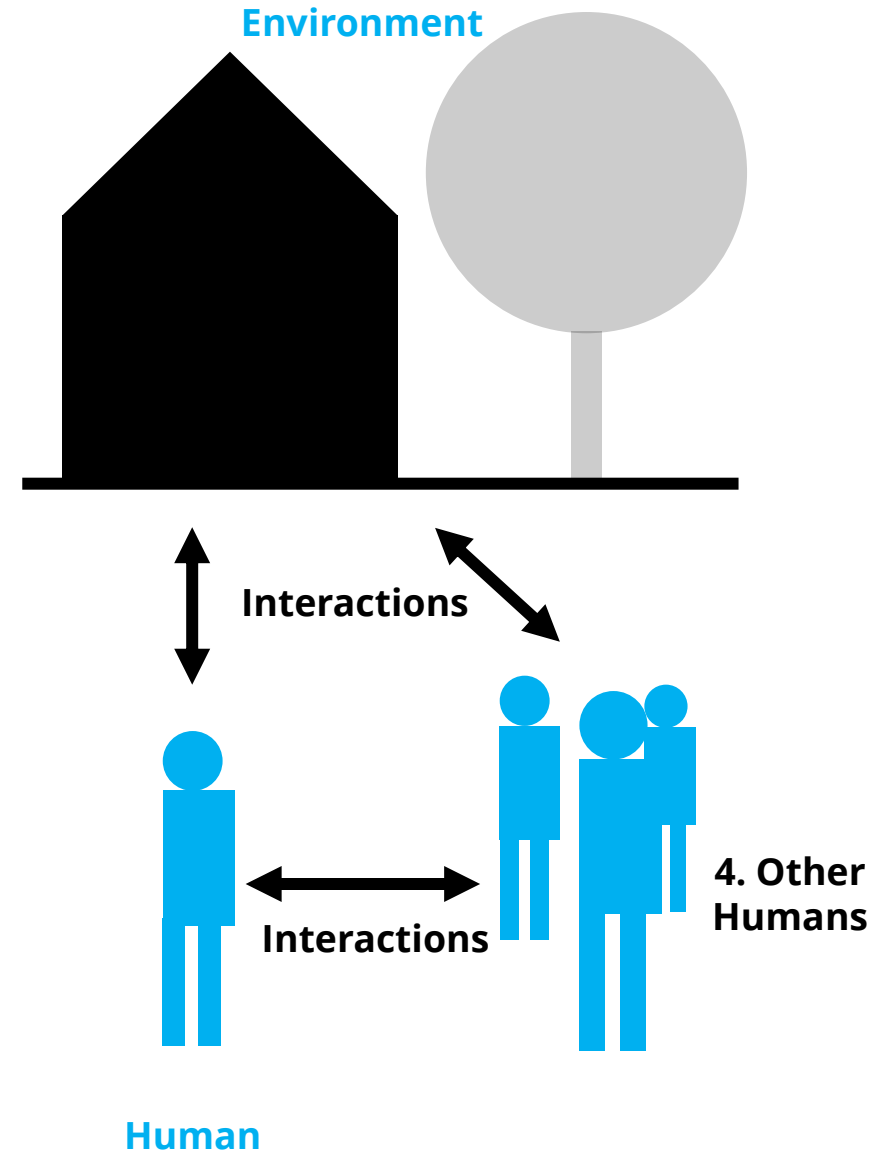
1. Many features

- Geometry
- Color
- Sound
- Smell
- Taste
- Temperature
- Humidity
- ...

3. Dynamics

- the enviroment can change
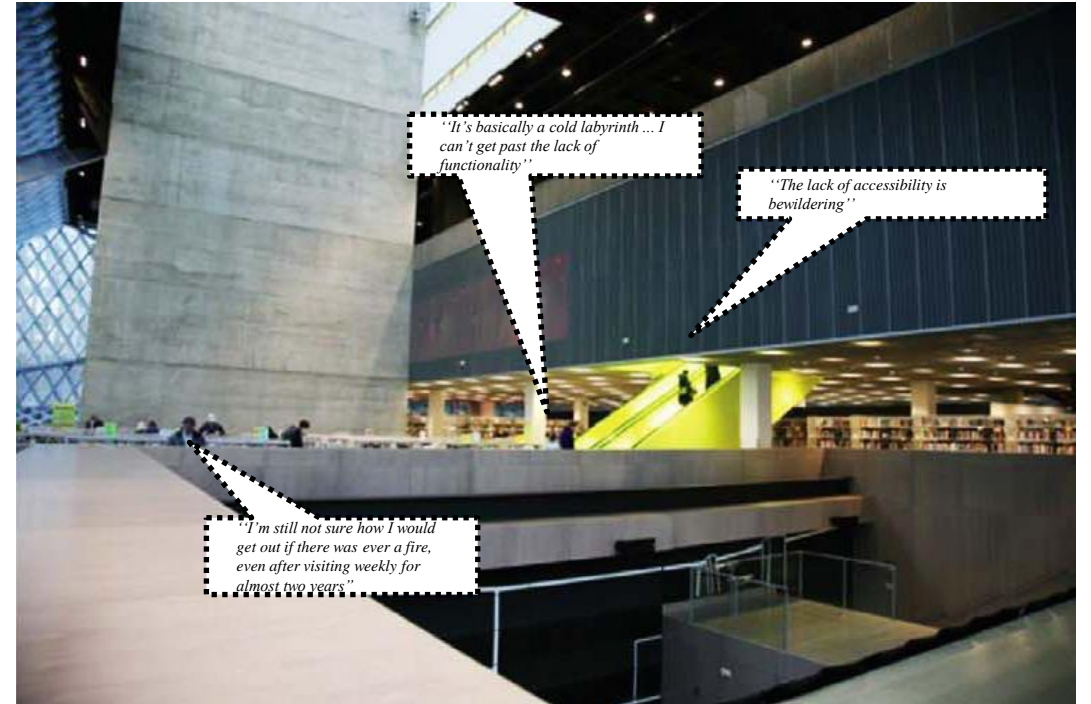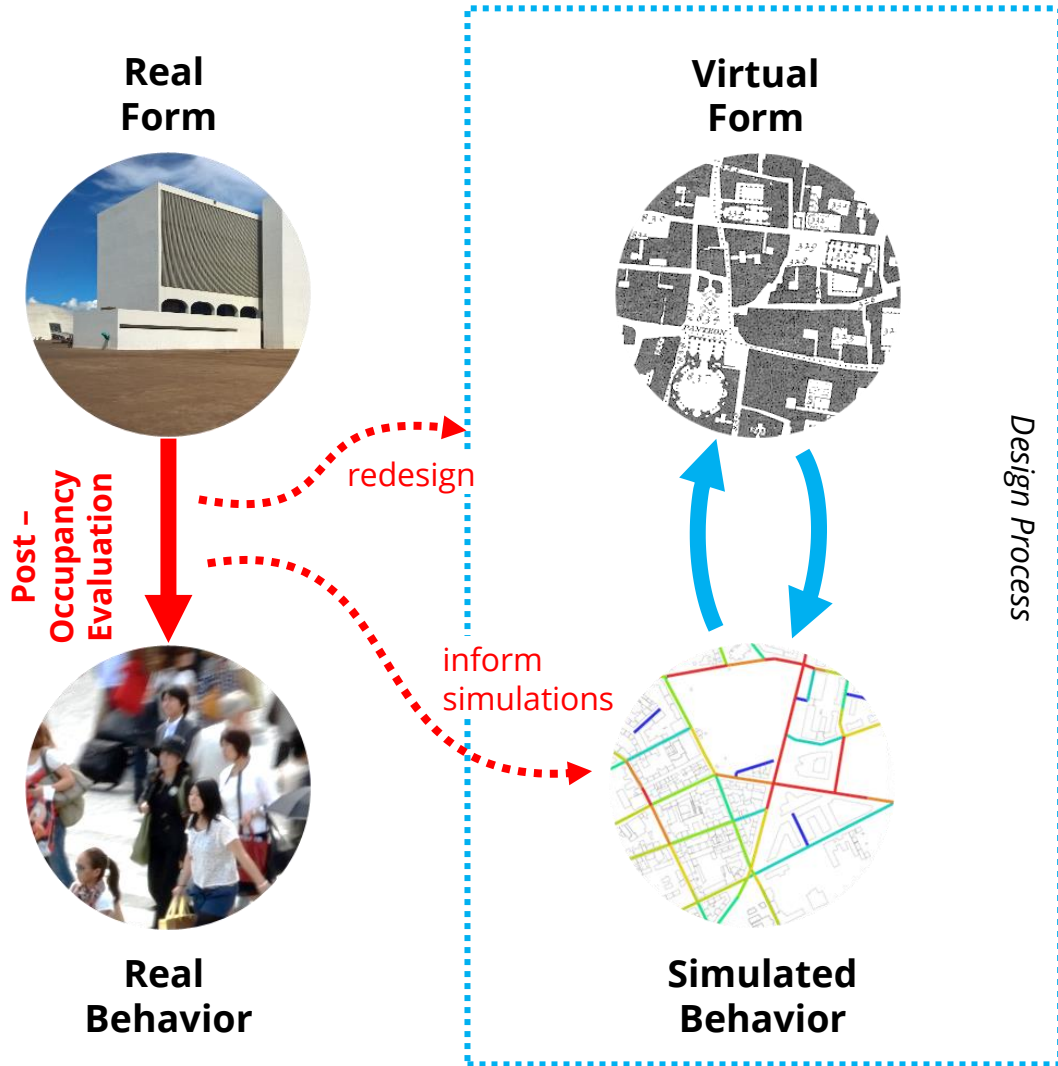- humans can change
- humans can change the env.

2. Individual Differences

- Age
- Gender
- Nationality
- Education
- Culture
- Abilities
- Goals
- ...

Environment

Interactions

Interactions

Human

4. Other Humans

USER STUDIES
Pre- and Post Occupancy Evaluation

USER STUDIES
Pre- and Post Occupancy Evaluation

Real Form

Virtual Form

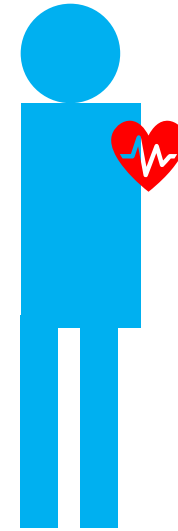**Real Function**

Simulated Function

Design Process

Redesign

Pre - Occupancy Evaluation
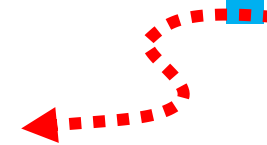
USER STUDIES
Types of Data

Physiological Data

Behavioural Data
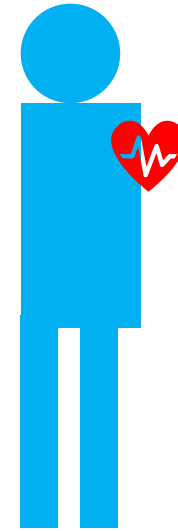
Cognitive Data

USER STUDIES
Types of Data

Physiological
Data

Behavioural
Data

Cognitive
Data
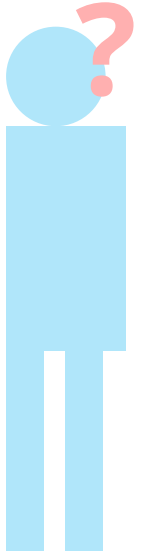
PHYSIOLOGICAL DATA
Methods

Data

Measuring Tools

- Heart Rate
- Blood Pressure
- Body Temperature
- Skin conductance
- Neural activity

- Wristband
- Electroencephalography (EEG)
- Magnetic resonance imaging (MRI)

https://www.emotiv.com
https://www.empatica.com/

PHYSIOLOGICAL DATA - EXAMPLE
Effect on vegetation on stress

A: *Non-biophilic*

B: *Indoor green*

C: *Outdoor view*

D: *Combination*
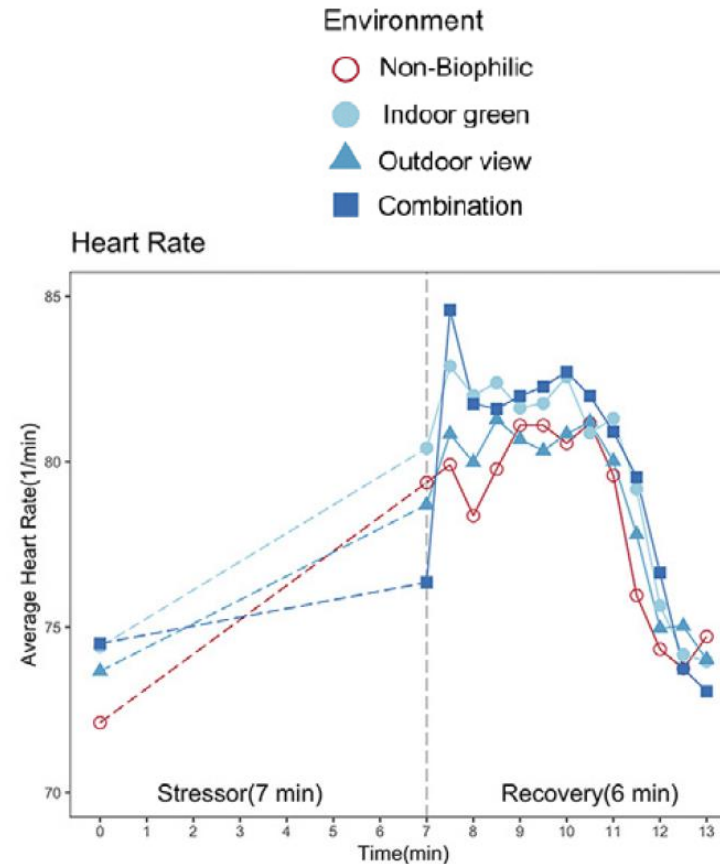
Jie Yina,b,,1, Jing Yuana,1, Nastaran Arfaeia, Paul J. Catalanoc,d, Joseph G. Allena,2,
John D. Spenglera (2020) Effects of biophilic indoor environment on stress and anxiety recovery: A
between-subjects experiment in virtual reality*

Bauhaus-Universität Weimar · InfAR PLANNING.SYSTEMS · bauhaus ifex

PHYSIOLOGICAL DATA - EXAMPLE

Arousal along a path in the city

high

low
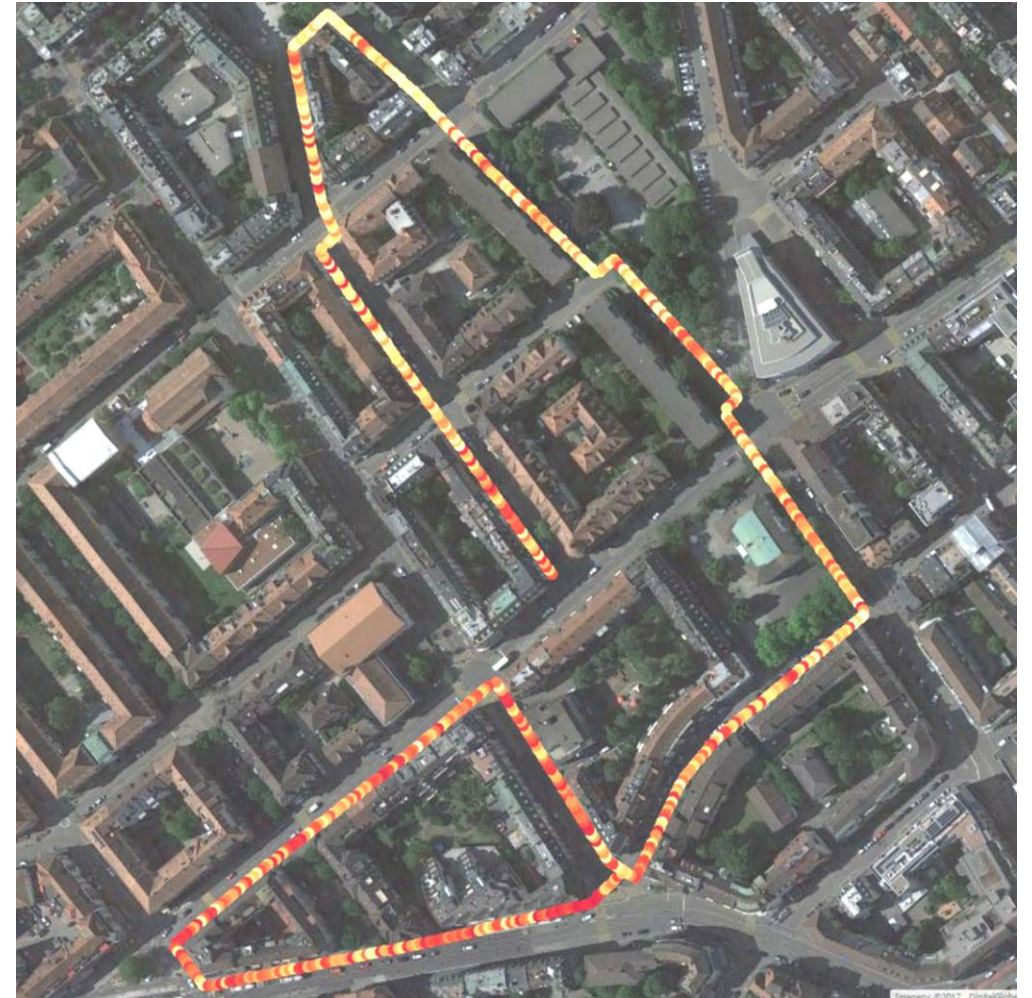
Average Arousal of 20 study participants

Ojha, V. (2017) Pattern Discovery: Human perception of the city dynamics

Physiological
Data
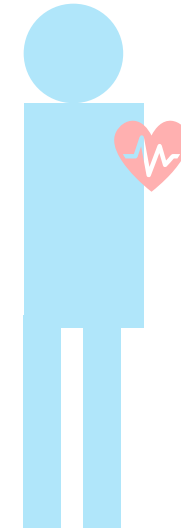
Behavioural
Data

Cognitive
Data

BEHAVIOURAL DATA
Unobstructed Observation

Observer

Record Behavior

Record:
- Moves from A to B
  Stops and looks
  around
- Meets a friend
- Stands and talks
- ....
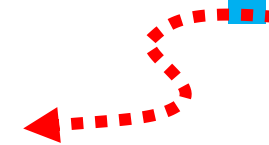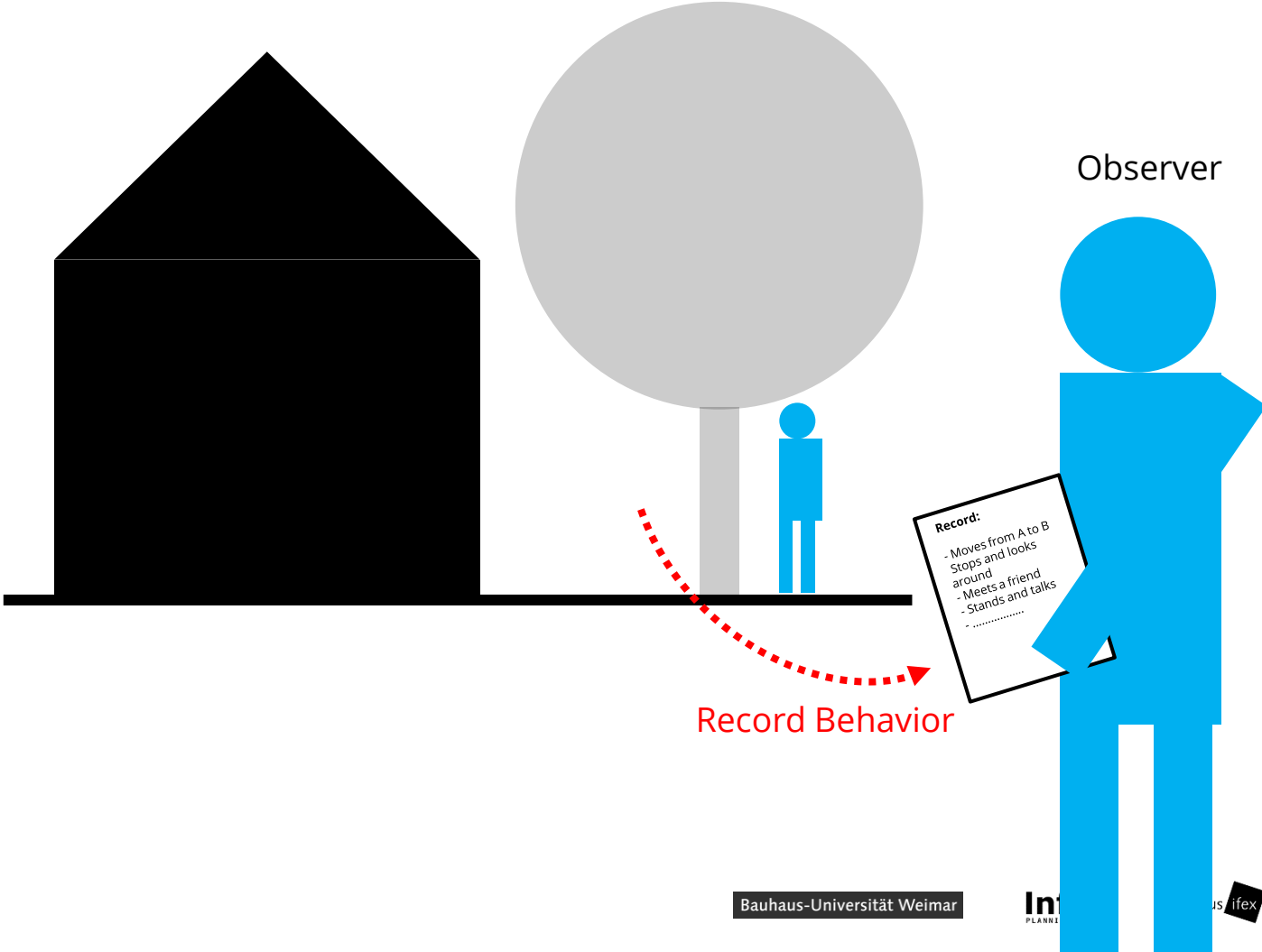
BEHAVIOURAL DATA
Unobstructed Observation

W. Whyte - The Social Life of Small Urban Spaces
https://vimeo.com/111488563

UNOBSTRUCTED OBSERVATION
Tracing Movement
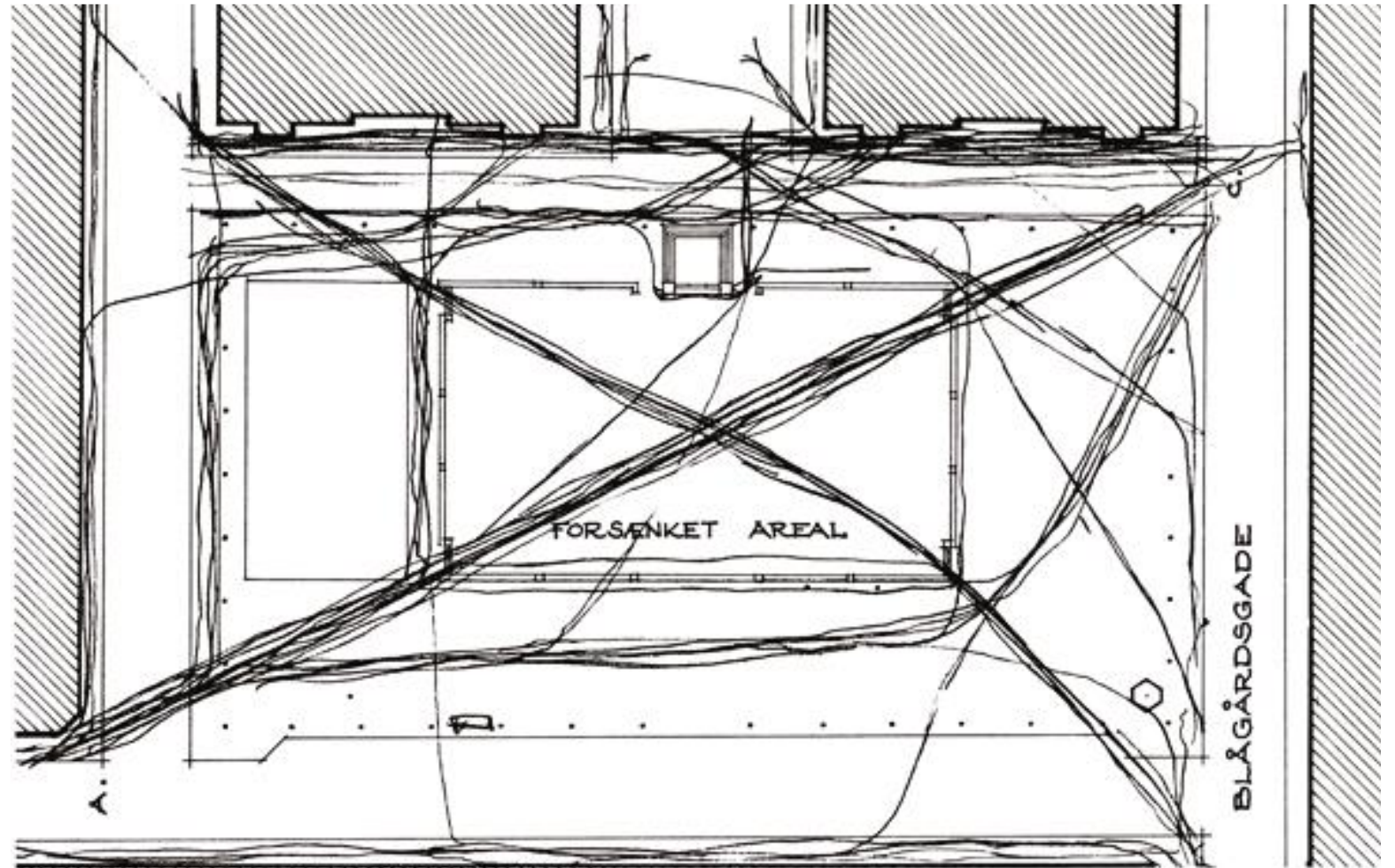
Mapping Traces of people
Gehl & Svarre (2013) How to study public life

UNOBSTRUCTED OBSERVATION
Mapping Stationary Activities

UNOBSTRUCTED OBSERVATION
Mapping Stationary Activities

HEAVY TRAFFIC **MODERATE TRAFFIC** **LIGHT TRAFFIC**

Where people have friends

Where people gather
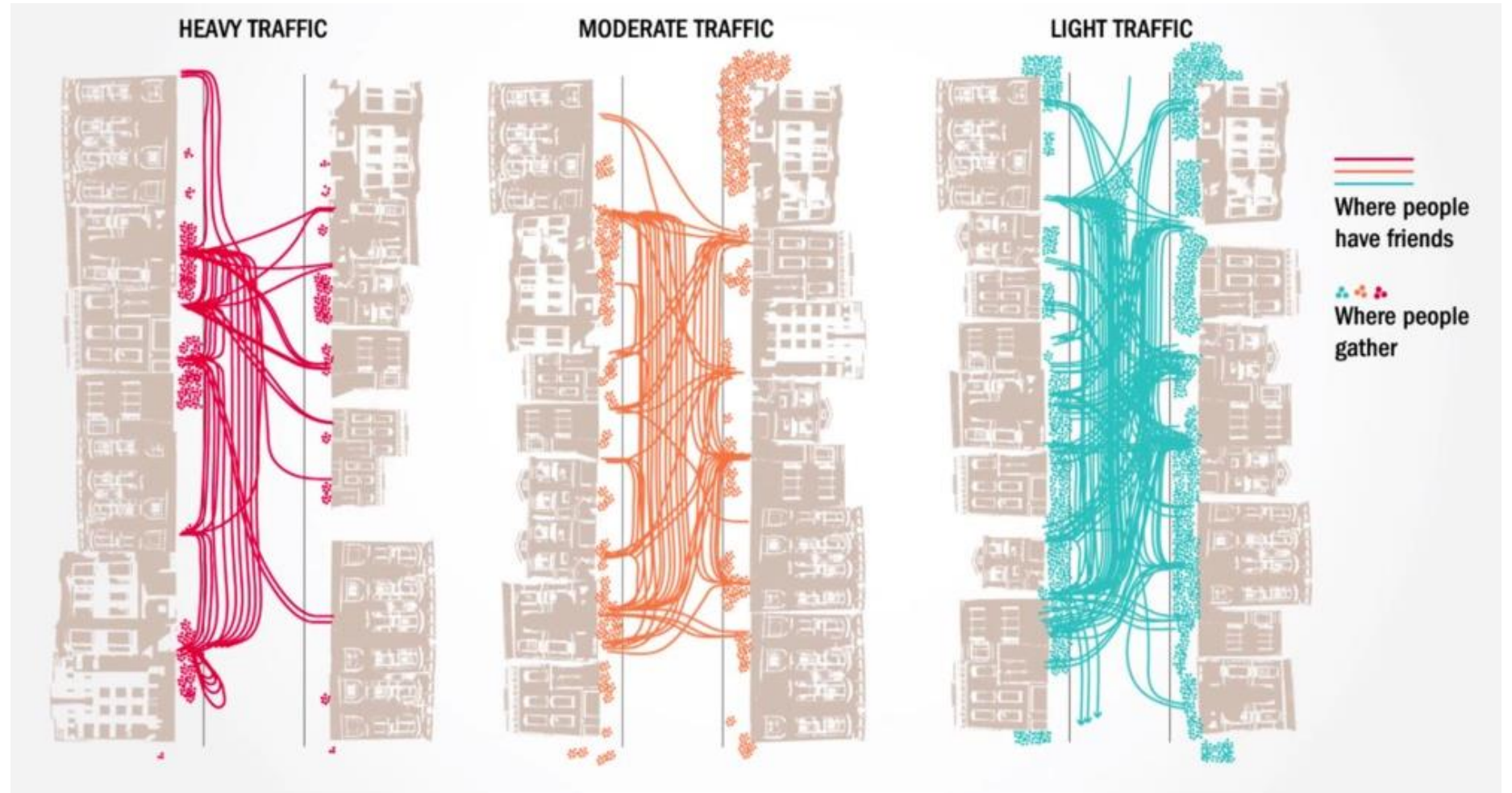
Stationary Activity Rates
Appleyard, D. (1981) Livable Streets
Image from: https://vimeo.com/16399180

Bauhaus-Universität Weimar   InfAR PLANNING.SYSTEMS   bauhaus ifex

BEHAVIOURAL DATA
Task-Based Observation
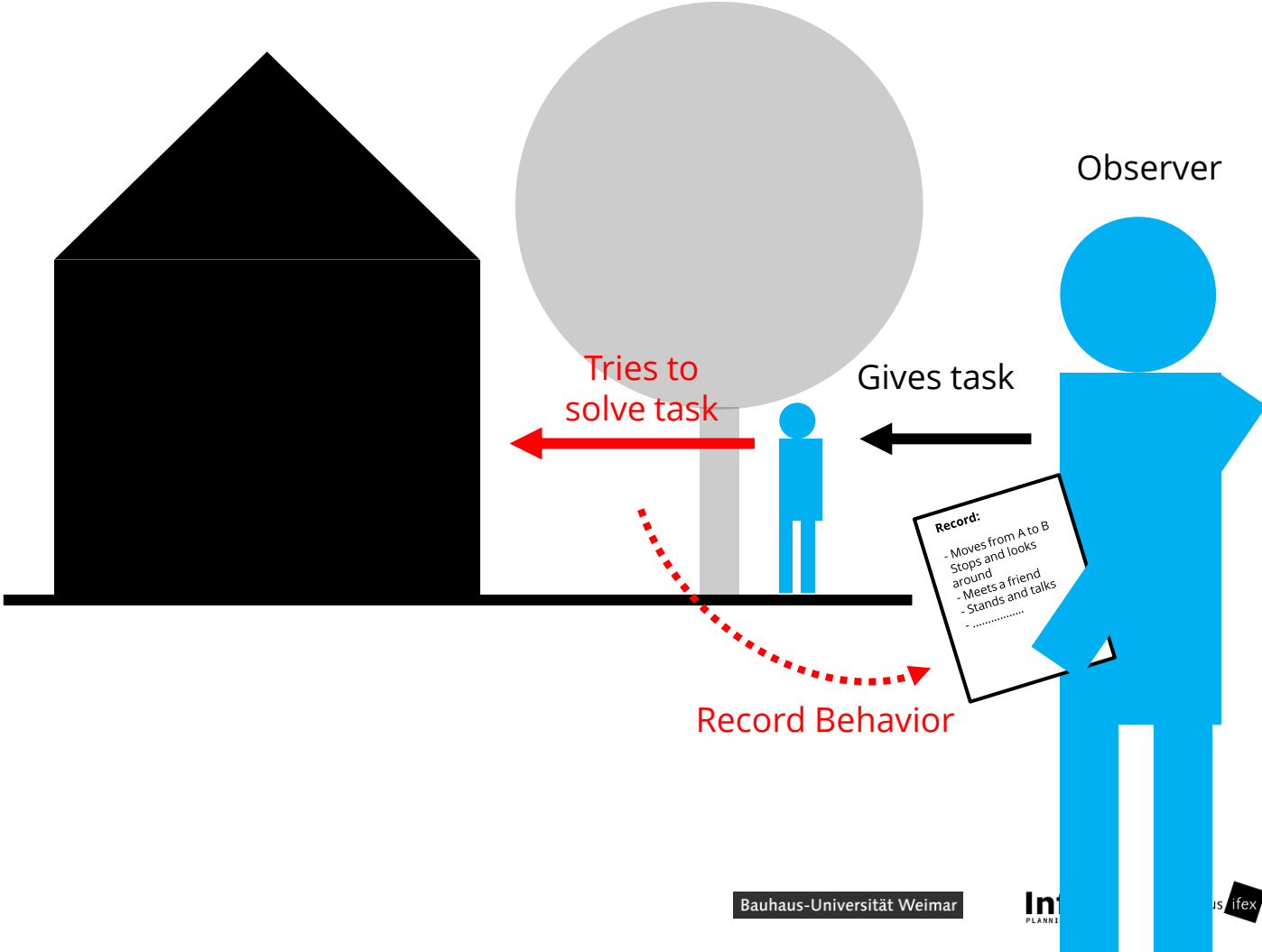
TASK-BASED OBSERVATION
Wayfinding Tasks
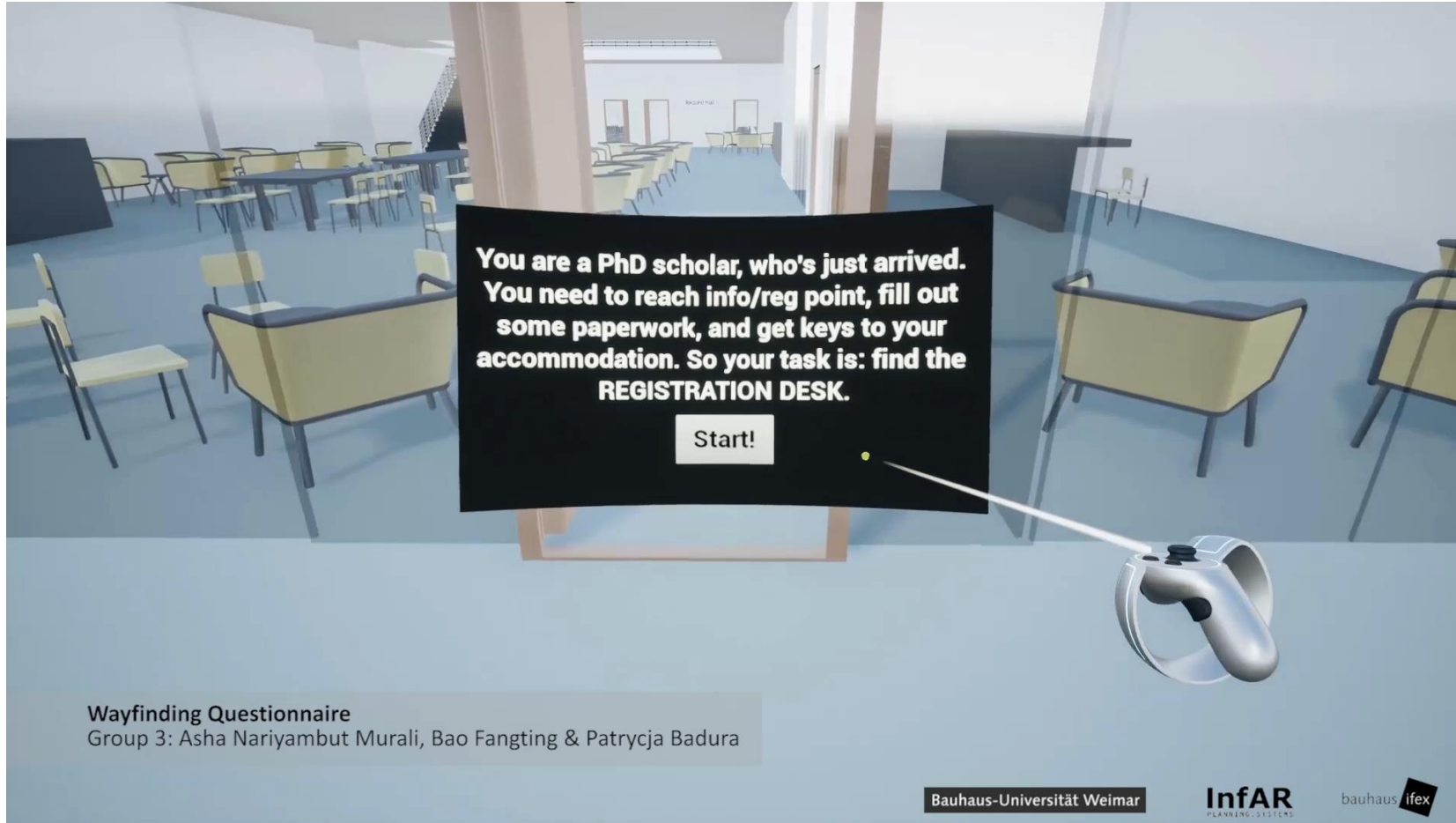
Wayfinding inside the Virtual Environment

Students: Patrycja Badura, Bao Fangting, Asha Nariyambut Murali
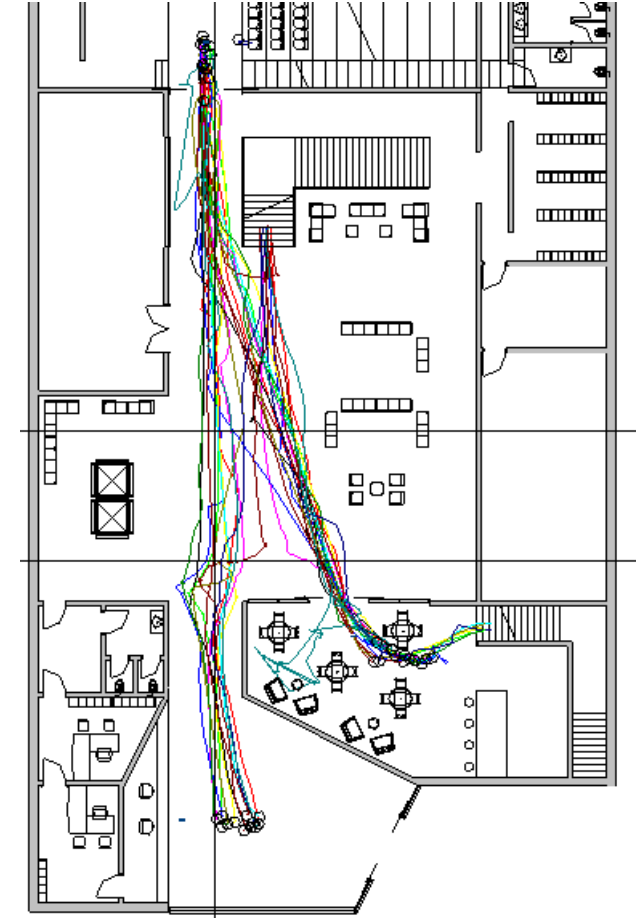
Visualisation in Revit

WAYFINDING TASK
Example: Finding the Entrance to the Station

Ziel

Start

WAYFINDING TASK

Example: Finding the Toilets in the Station
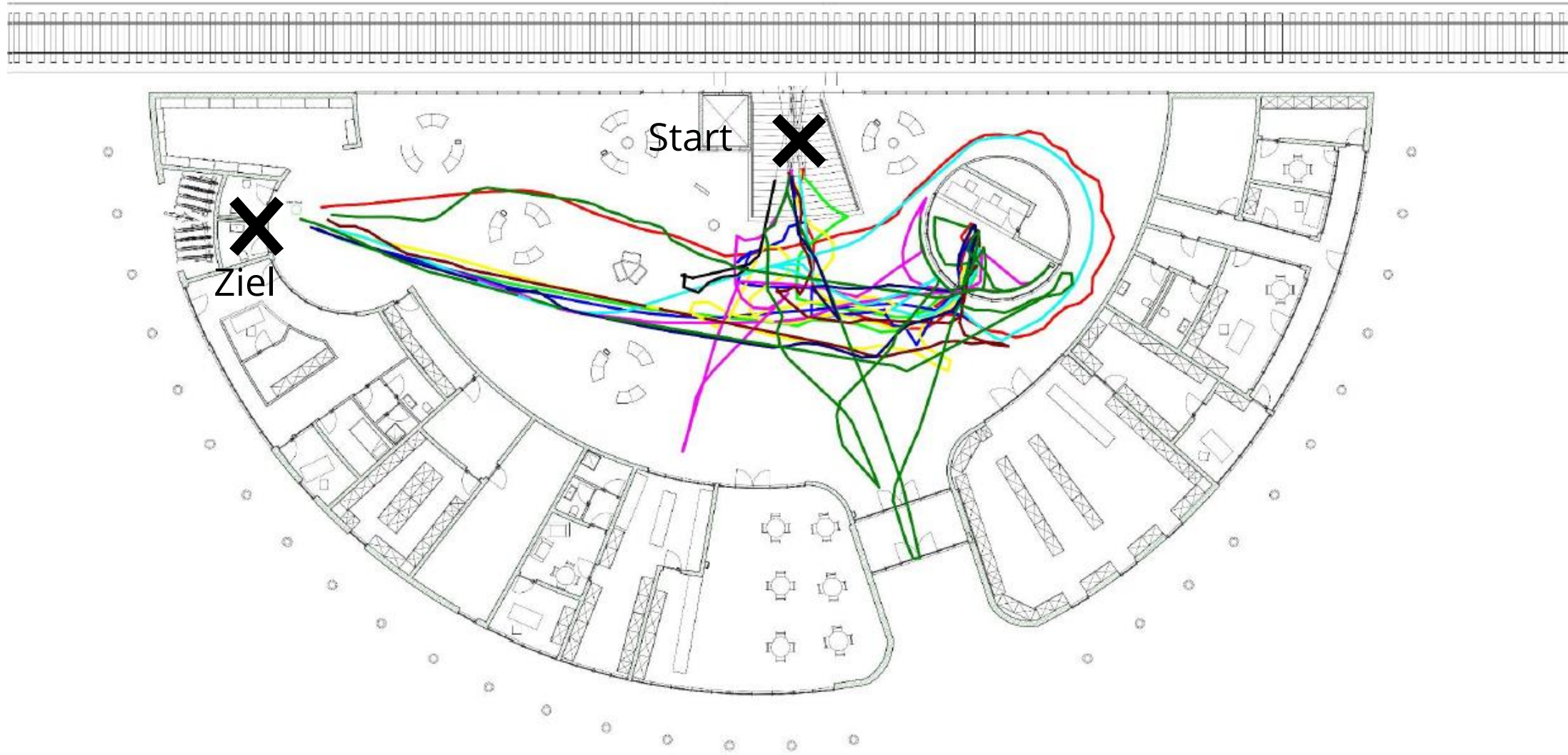
TASK-BASED OBSERVATION
Pointing Task

Your train is 20 min late. You want to rest. Mark three places, where you would like / not like to sit!

POINTING TASK
Example: Seating Preferences for new Furniture for Weimar Train Station

Entwurf für die Umgestaltung der Wartehalle des Weimarer Bahnhofs
Master Thesis Eduardo Rßs

POINTING TASK
Example: Seating Preferences for new Furniture for Weimar Train Station
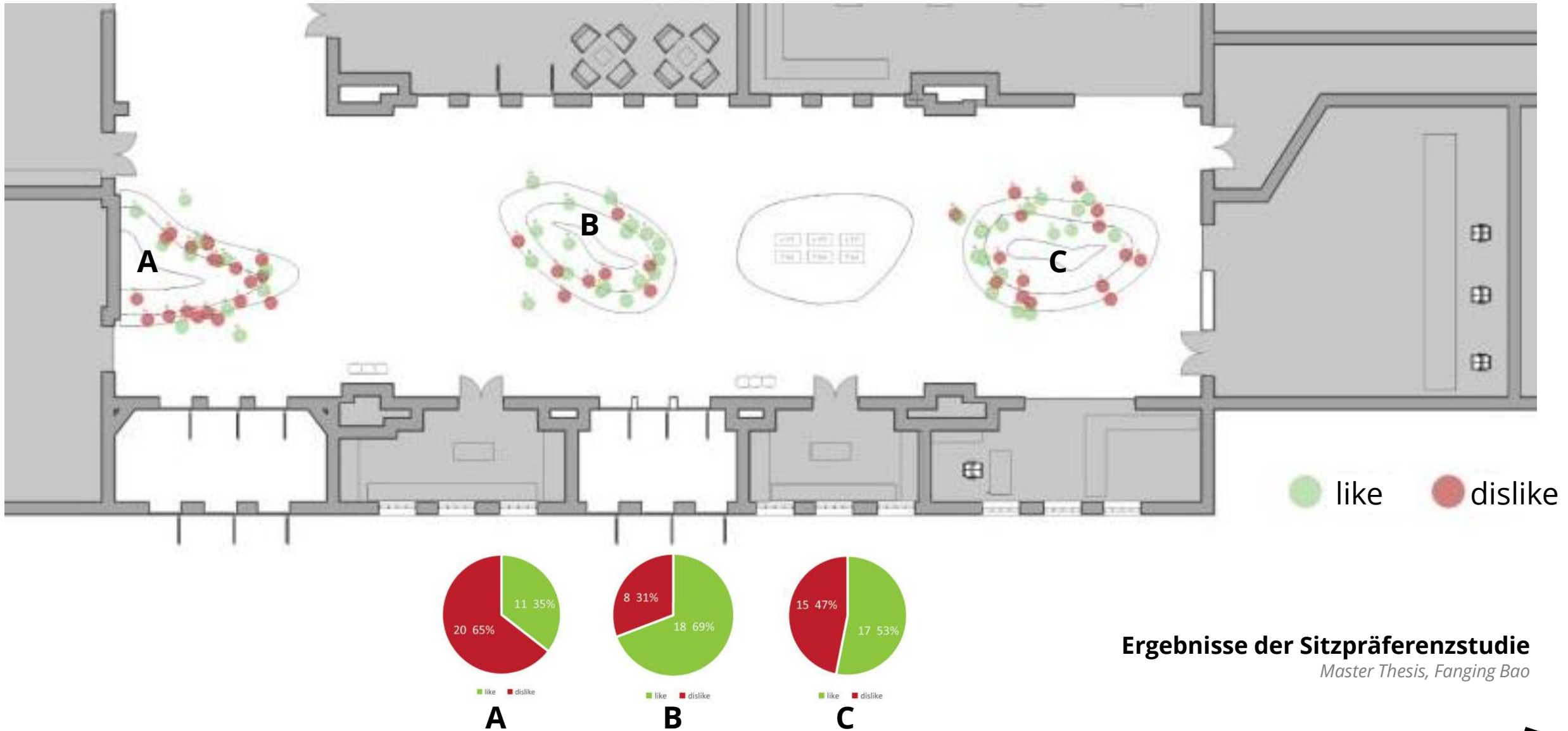
Ergebnisse der Sitzpräferenzstudie
Master Thesis, Fanging Bao

USER STUDIES
Types of Data

Physiological
Data
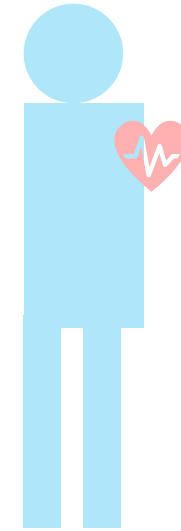
Behavioural
Data

Cognitive
Data

COGNITIVE DATA
Methods

- Interviews
- Questionnaires
- Think aloud

Methods

Why am i standing here?

How do i feel about this place?

And what is it that makes me feel like that?
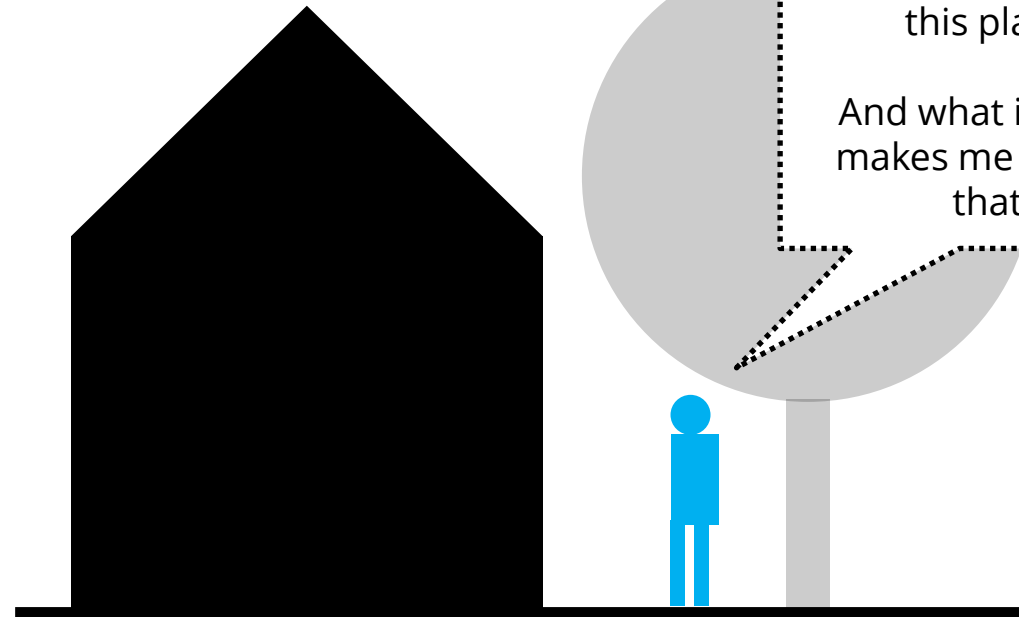
COGNITIVE DATA
Caputuring Experience & Perception

Semantic Differential, used to caputure the meaning of something (e.g. a place).

(originally developed to measure the meaning of words → Osgood, 1952, The nature and measurement of meaning)

Presents opposite word pairs, whereby the participants chose on a certain scale (e.g. 5-point-likert scale)

Complicated	simple
dark	light
private	public
happy	sad
feminine	masculine
warm	cool
informal	formal
soft	hard
heavy	light
small	large
closed	open
smooth	rough
full	empty

Example for a semantic differential
Lawson, 2001, The Language of space

SEMANTIC DIFFERENTIAL
Example – Perception of Urban Space
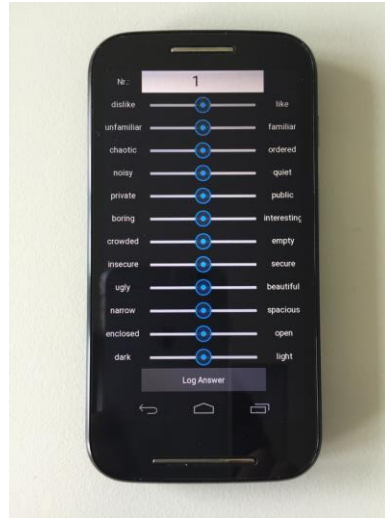
like					dislike
chaotic					ordered
noisy					quiet
private					public
boring					interesting
crowded					empty
insecure					secure
ugly					beautiful
narrow					spacious
enclosed					open
dark					light

Appeal
Like (4.62, [1,5])
Dislike (3.31, [1,5])
Standard deviation
1.30
.51

Mapping of the results (like/dislike)

Bielik et al., (2015)

COGNITIVE DATA
Semantic Differential in VREVAL
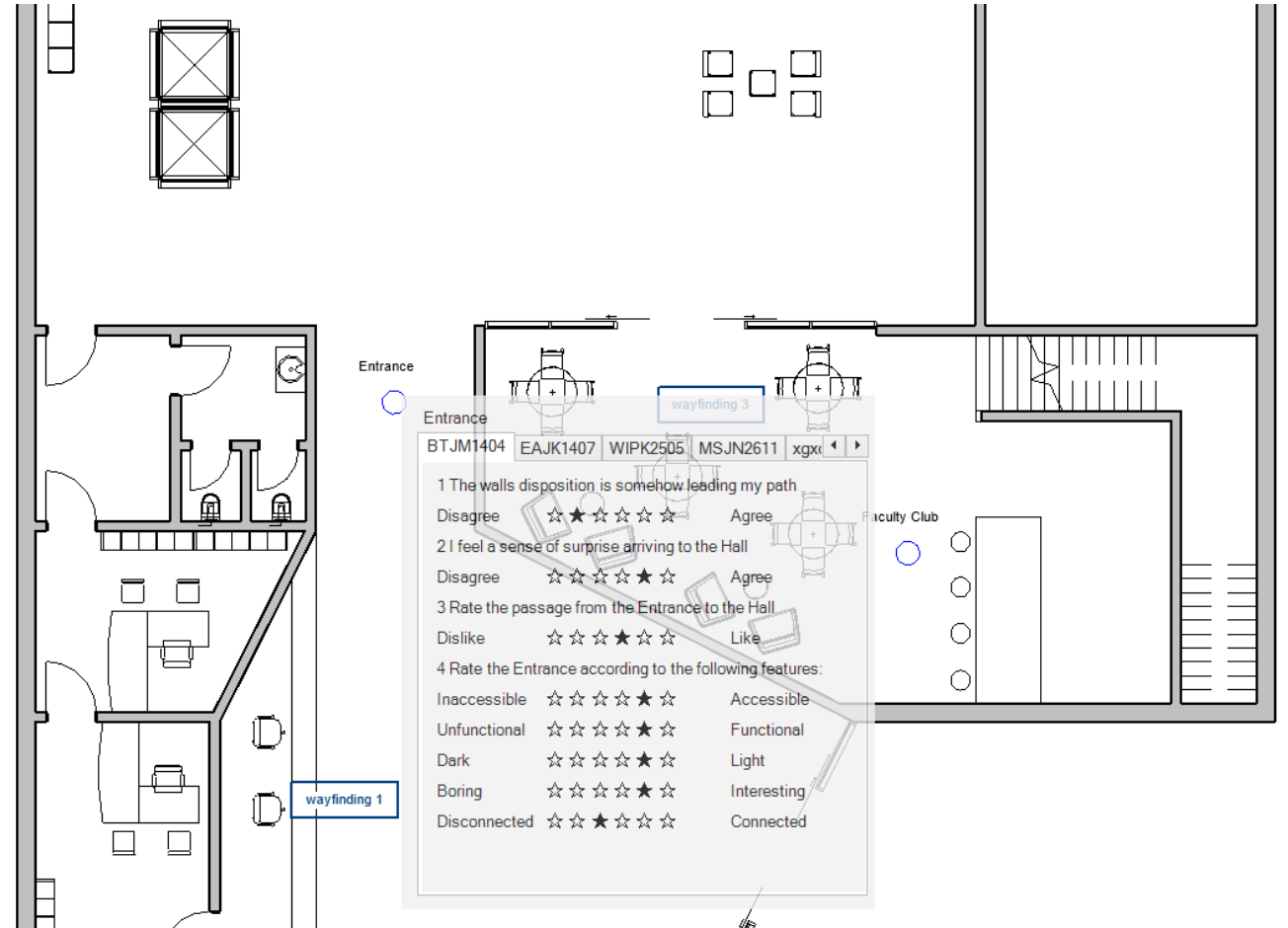
Questionnaire inside the Virtual Environment
Students: Carlotta Di Iesu, Henry Hadathia, Pablo Silva, Bernardo Villagra

Visualisation in Revit

SEMANTIC DIFFERENTAL
Example: Spatial Experience of an underpass

Keine Ladenfronten

Weit	Eng
Verständlich	Verwirrend
Hell	Dunkel
Sicher	Unsicher
Offen	Geschlossen
Interessant	Langweilig

Ladenfronten rechts

Weit	Eng
Verständlich	Verwirrend
Hell	Dunkel
Sicher	Unsicher
Offen	Geschlossen
Interessant	Langweilig

Ladenfronten beidseitig

Weit	Eng
Verständlich	Verwirrend
Hell	Dunkel
Sicher	Unsicher
Offen	Geschlossen
Interessant	Langweilig

Ladenfronten links

Weit	Eng
Verständlich	Verwirrend
Hell	Dunkel
Sicher	Unsicher
Offen	Geschlossen
Interessant	Langweilig

SEMANTIC DIFFERENTAL

Example: Aesthetic evaluation of a building shape

Bewertung des stadträumlichen Eindrucks
unterschiedlicher Bebauungsvarianten

Variant A

Variant B

COGNITVE DATA
Method of choice

„Which of the following variants do you like best?"

METHOD OF CHOICE
Example

„Which of the following variants do you like best?"

Low	Medium	High
8%	22%	13%

Simple Shape

Low	Medium	High
12%	19%	26%

Complex Shape

COGNITIVE DATA
Think-aloud method

THINK ALOUD
Annotations in a Virtual Environment

14: the business hub is not visible from the void. It is in the corner.

15: I didn't even know that faculty club and business hub are connected by this narrow circulation. I fi...

40: acute angle makes it feel a bit smaller than actua...

68: the business hub is hardly visible and accessible. why not combine it with the faculty club?

67: i'd like to have easier access to the coffee. i don't always want to go a detour.

12: Faculty club is easily accessible.

WIPK2505 : 15

Image | Comment

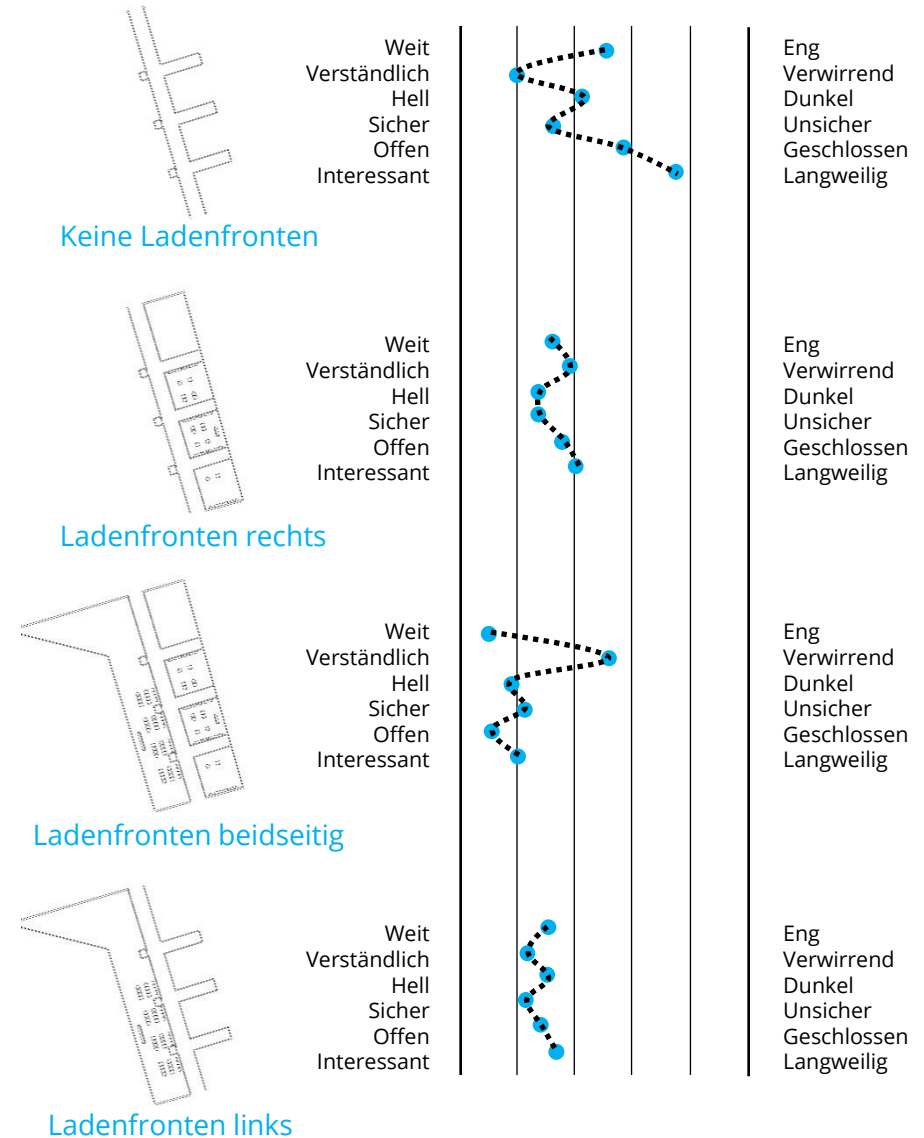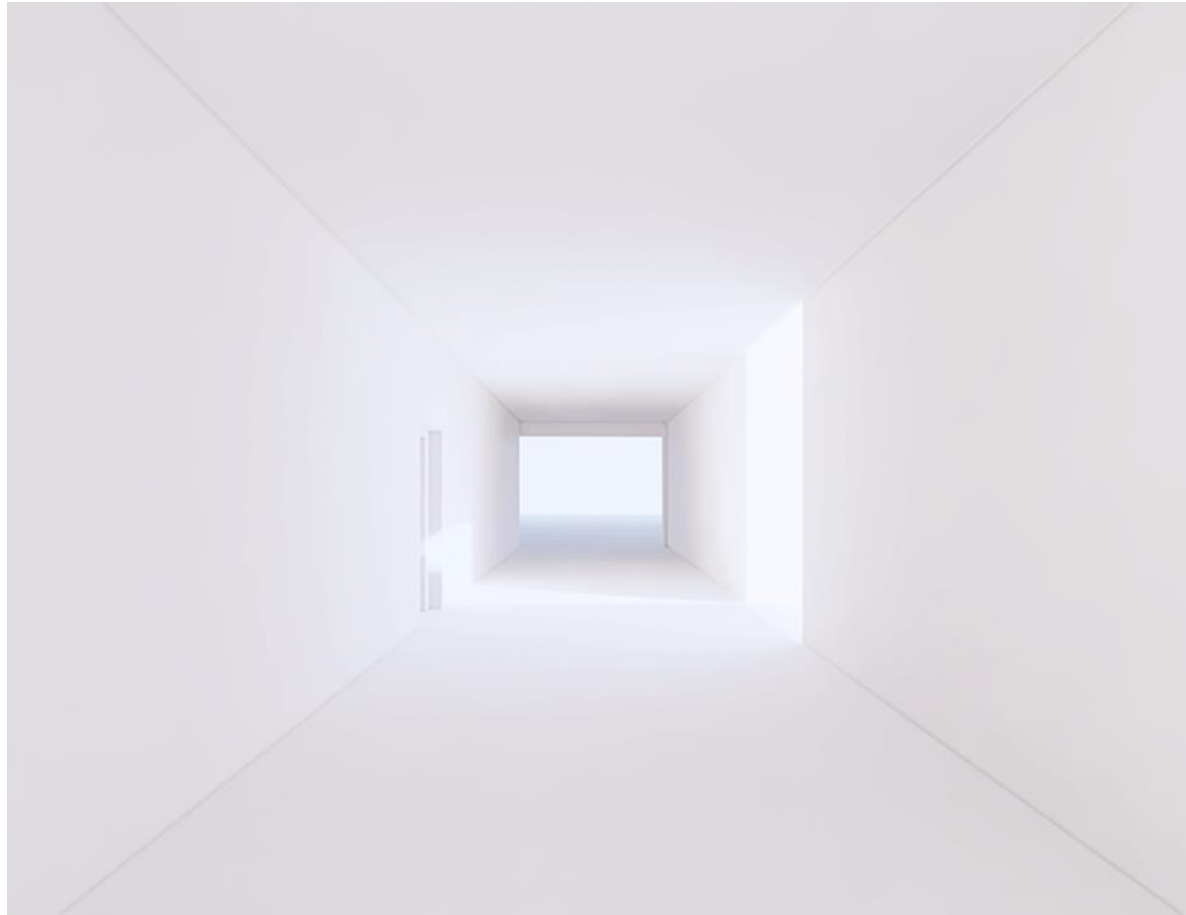69: i dont know why this (although beautiful) tribune is needed here

Annotations inside the Virtual Environment

Students: Carlotta Di Iesu, Henry Hadathia, Pablo Silva, Bernardo Villagra

Visualisation in Revit

THINK ALOUD
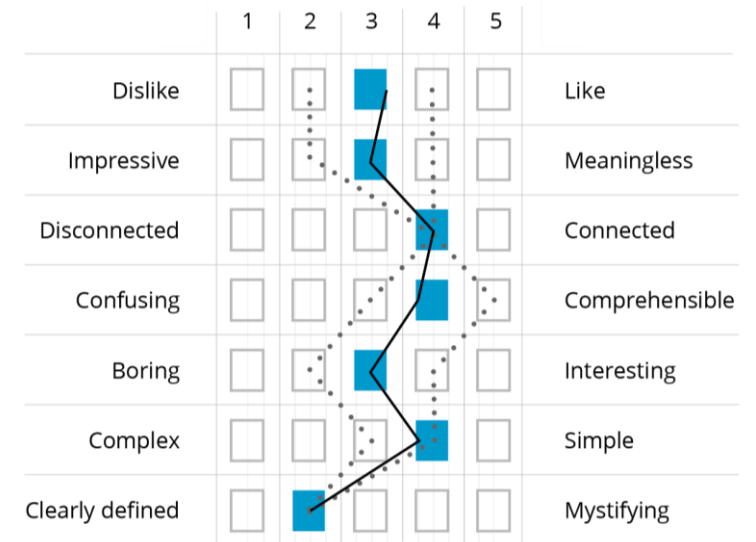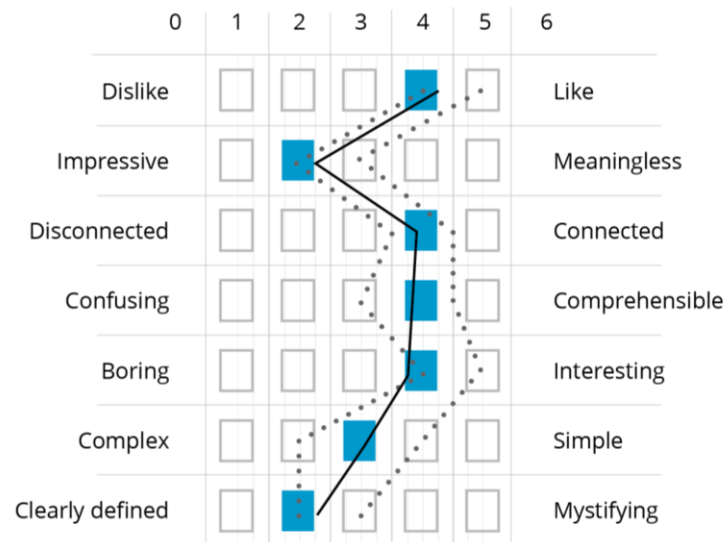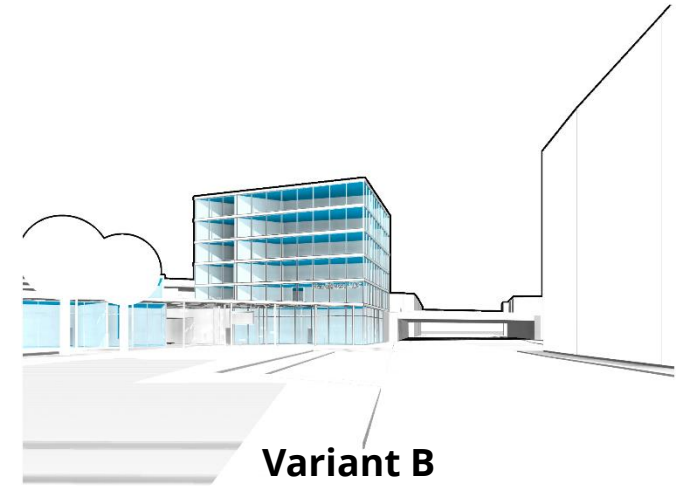## Example

Exhibition space
- The Exhibition space is not very accessible, why not open it to the nice atrium?

Stairs
- The staircase is visible from everywhere. I can easily read the vertical circulation in this building.
- Strang left over space under the staircase.

Lecture and performance space
- Nice and grand space.
- Nice auditorium, with views to the atrium!

Entrance hall
- I like the slanted walls, they gently direct you. The reception is clearly visible, albeit a bit cut off from the rest of the building.
- I can feel the Entrance like welcoming you to the building.
- Narrow passage, imagine many people passing there at the same time.

Toilets
- Privacy achieved beautifully!

Visitors information
- Well recognizable, good controlling point (however, for my taste a bit too controlling, it remembers me a bit on security control in airports).
- Easy to spot.

Faculty club
- Faculty club is easily accessible.
- Why is the cafeteria closed by this glass wall? it would be much nicer if it opens completely to the atrium

Main hall
- Coming from the narrowish corridor the large atrium is a nice "relevation", you can clearly see most of the circulation and get a good view of a lot of rooms and their functions.
- I get the surprise feeling in this spot.
- Very impressive view.
- Good spatial experience.

Visualisation of the annotations
Students: Hussam Chbeib, Julius Morschek, Lucia Guzmán Martínez, Margherita Ghisalberti

Bauhaus-Universität Weimar   InfAR PLANNING.SYSTEMS   bauhaus ifex

USER STUDIES
Challenges?

1. Many features

- Geometry
- Color
- Sound
- Smell
- Taste
- Temperature
- Humidity
- ...

3. Dynamics

- the enviroment can change
- humans can change
- humans can change the env.

2. Individual Differences

- Age
- Gender
- Nationality
- Education
- Culture
- Abilities
- Goals
- ...

Environment

Interactions

Interactions

4. Other Humans

Human
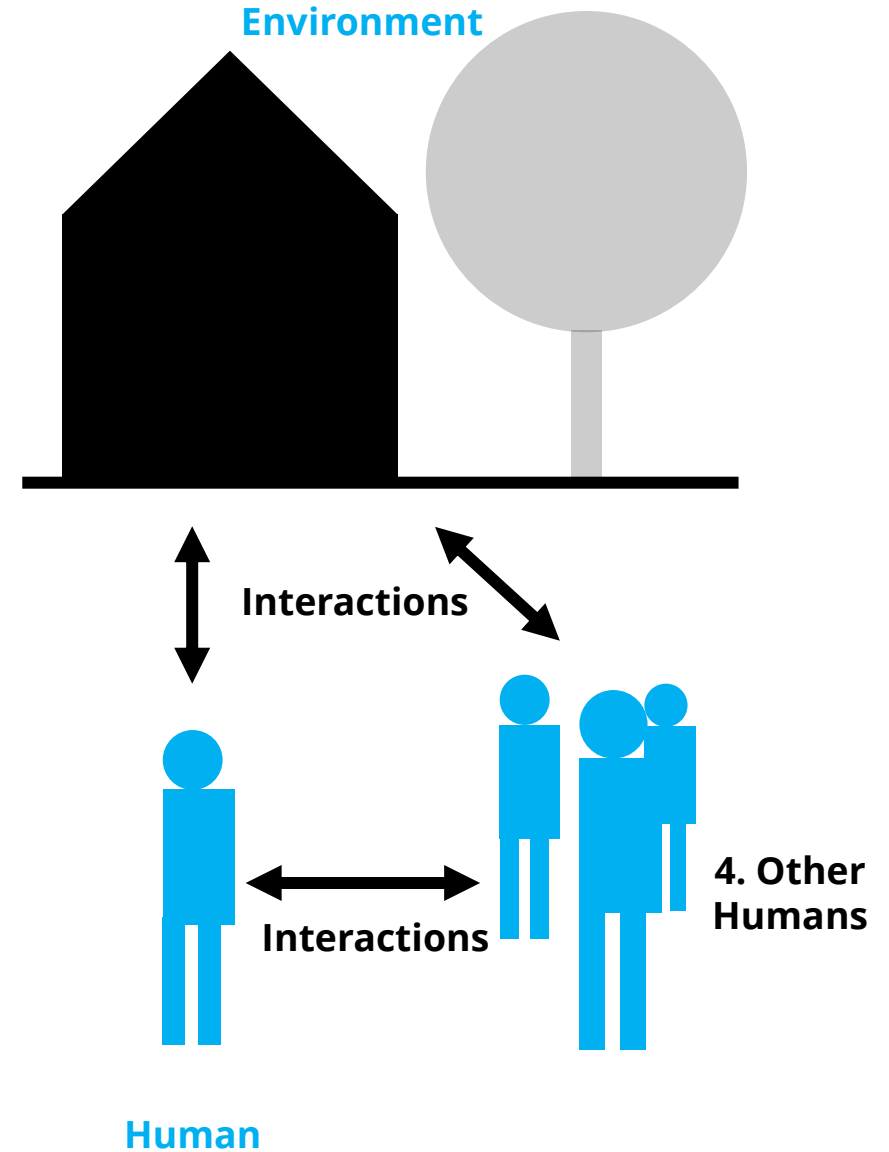
STUDY IDEAS

Alina – Activities on Balcony (**size**, current 1.4 m)
Andrei – Balcony (connection, inside/outside, loggia, light, workspace)

Emanuel – Shape of Room (Perceived Size)

Hatice – Sitting Space in the kitchen

Igor & Stefanie – Parking House Hamburg (ceiling height, <2.5 m), Cluster Appartments

Jordan – Ceiling Height & Window Size / Room Size OR: Change Floorplan Connect rooms differently
Miriam Anna – Position of Kitchen?

Miriam Louisa – Multi-Purpose Furniture in the Hallway

Yuegon – Location of Living Room

USER STUDIES

Some Guidelines

Lecturer:
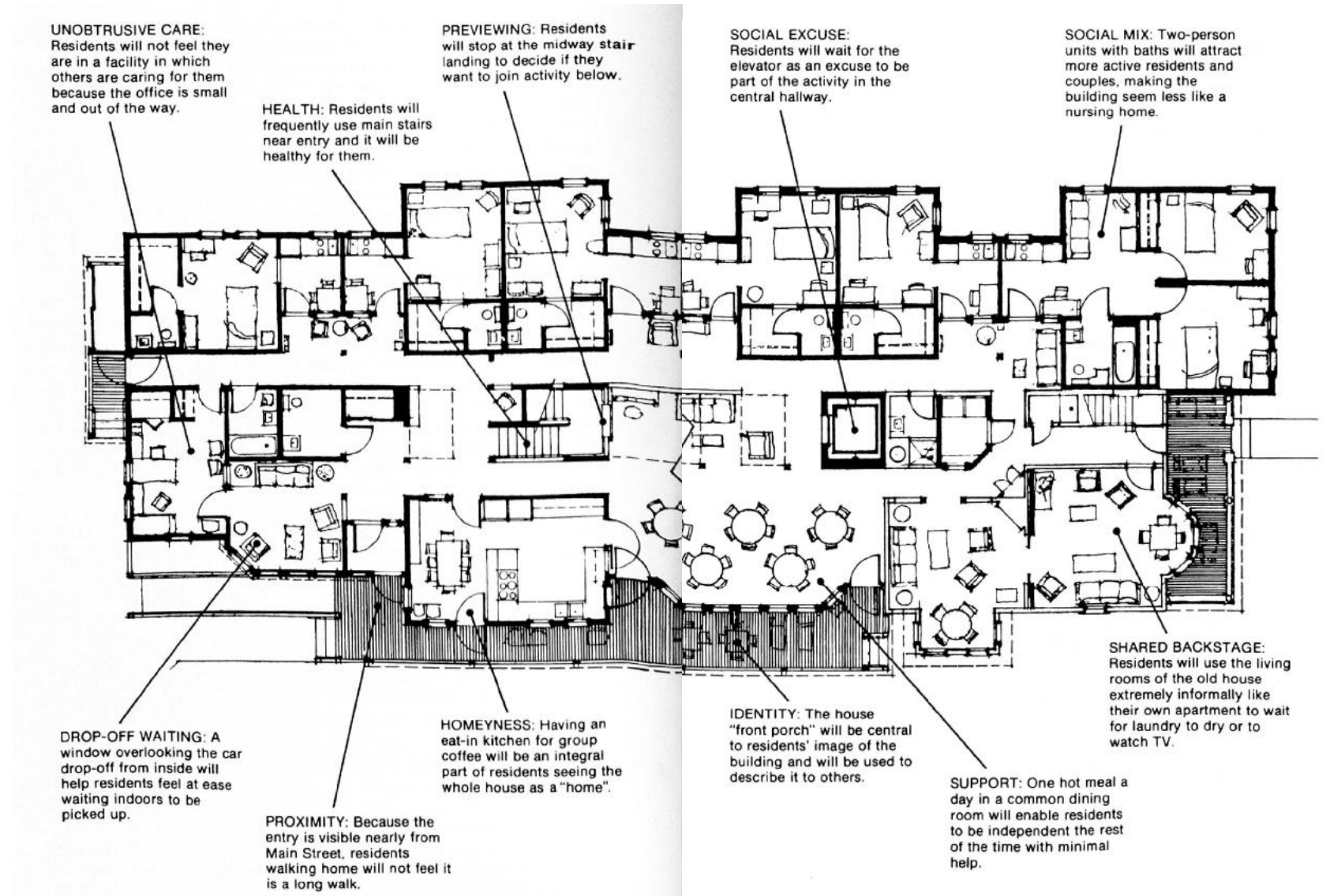
Vertr.-Prof. Dr. Sven Schneider

UNOBTRUSIVE CARE: Residents will not feel they are in a facility in which others are caring for them because the office is small and out of the way.

HEALTH: Residents will frequently use main stairs near entry and it will be healthy for them.

PREVIEWING: Residents will stop at the midway stair landing to decide if they want to join activity below.

SOCIAL EXCUSE: Residents will wait for the elevator as an excuse to be part of the activity in the central hallway.

SOCIAL MIX: Two-person units with baths will attract more active residents and couples, making the building seem less like a nursing home.

DROP-OFF WAITING: A window overlooking the car drop-off from inside will help residents feel at ease waiting indoors to be picked up.

PROXIMITY: Because the entry is visible nearly from Main Street, residents walking home will not feel it is a long walk.

HOMEYNESS: Having an eat-in kitchen for group coffee will be an integral part of residents seeing the whole house as a "home".

IDENTITY: The house "front porch" will be central to residents' image of the building and will be used to describe it to others.

SUPPORT: One hot meal a day in a common dining room will enable residents to be independent the rest of the time with minimal help.

SHARED BACKSTAGE: Residents will use the living rooms of the old house extremely informally like their own apartment to wait for laundry to dry or to watch TV.

Design Hypothesis for a Home for Elderly
Zeisel, J. (2006) Inquiry by Design

Bauhaus-Universität Weimar   InfAR   bauhaus ifex

AVOID BIAS!

Don't try to influence the particpants!

Bias guides participants to choose a certain answer. For the sake of objectivity this clearly must be avoided!

AVOID BIAS!

Don't try to influence the particpants!

Bias guides participants to choose a certain answer. For the sake of objectivity this clearly must be avoided!

Bias in the formulation of questions:

„Do you think this is a comfortable space?"

„How do you like this space?
O It's great!   O It's good   O It's absolutely terrible!"

Does the facade at the waiting area open towards the platforms give a natural feeling of a train station?

	1	2	3	4	5	
Not at all	O	O	◉	O	O	Absolutely Yes.

AVOID BIAS!

Don't try to influence the particpants!

Bias in the selection of cases:

„Which of the two variants do you like best?"

AVOID BIAS!

Don't try to influence the particpants!

Bias in the selection of cases:

„Which of the two variants do you like best?"

PRE-KNOWLEDGE

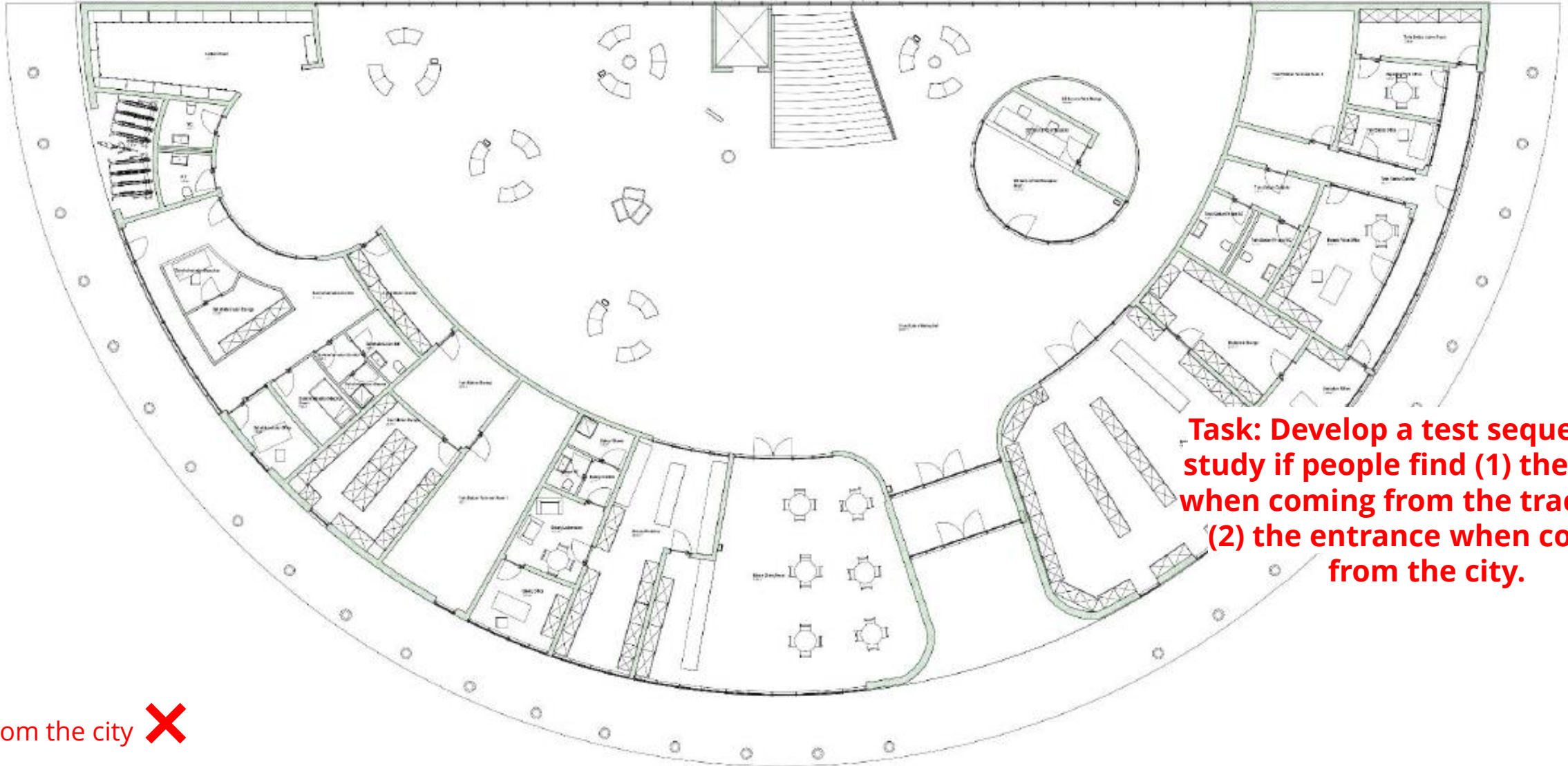## What people know about the task or the building can influence the results!

The knowledge about a building arises
during the study.

**Tasks which are heavily influenced by
the familiarity with the building (e.g.
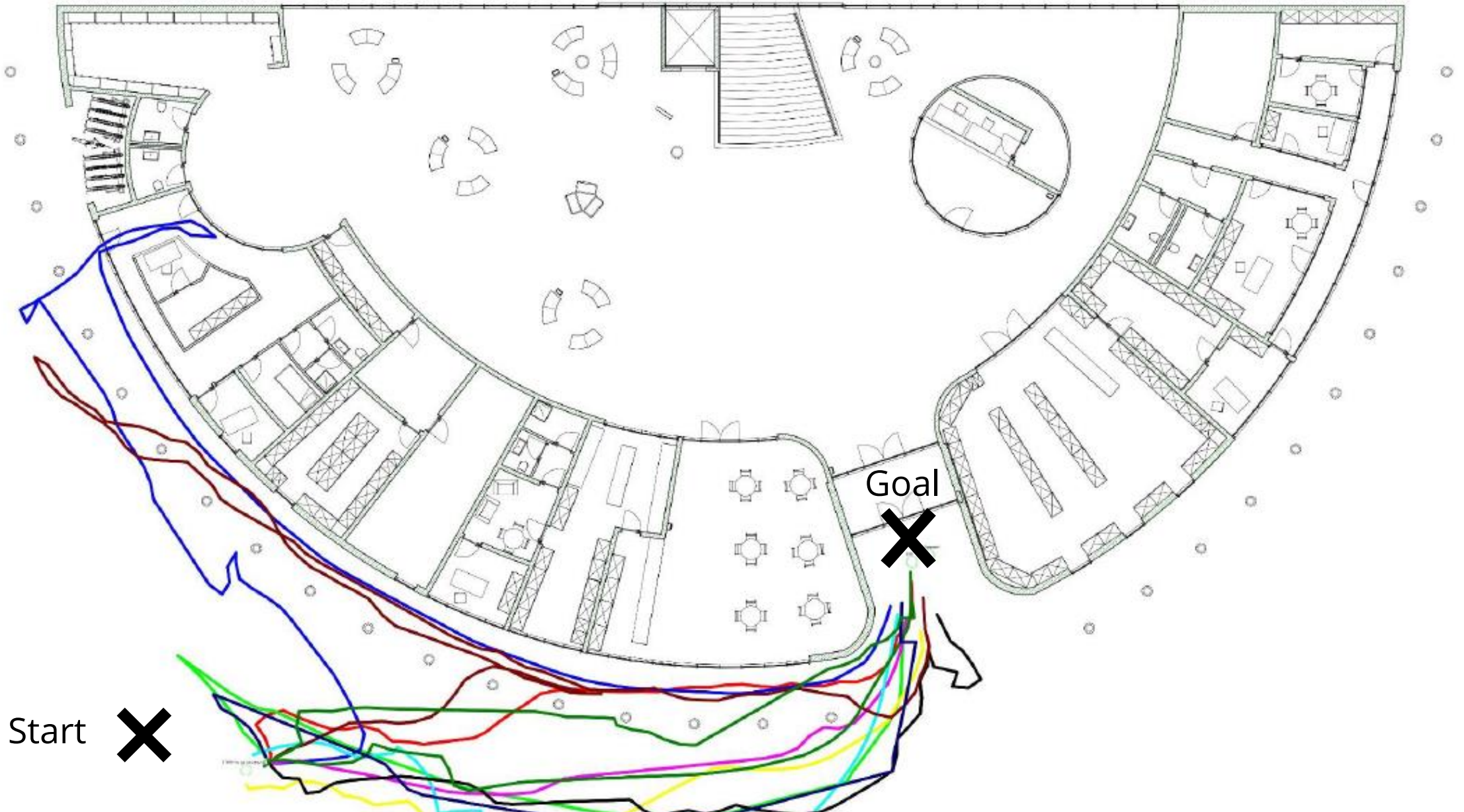wayfinding) should be put in the right
order.**

❌ From the tracks

Task: Develop a test sequence to study if people find (1) the toilets when coming from the tracks and (2) the entrance when coming from the city.
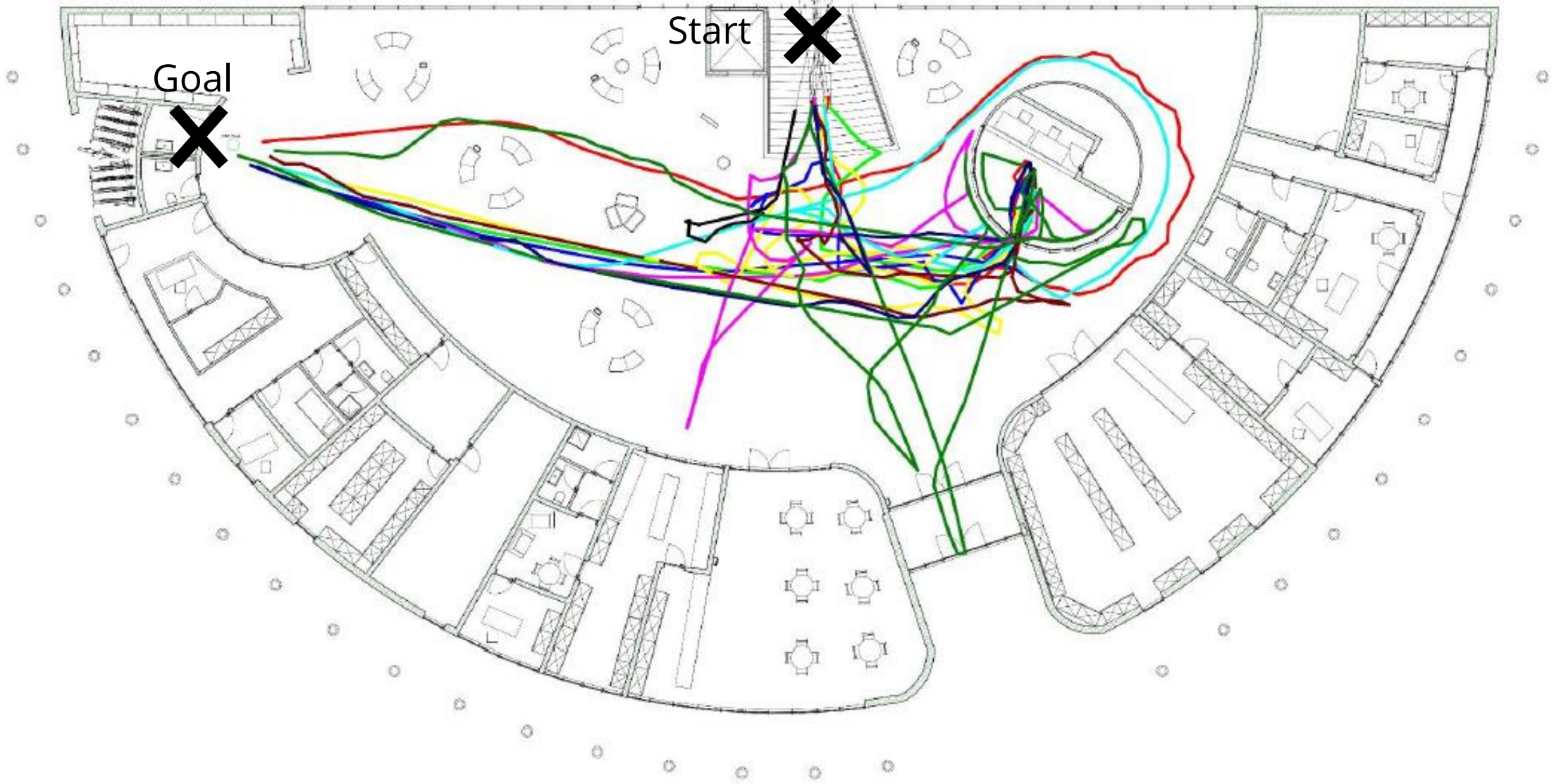
from the city ❌

Goal

Start

Exercise
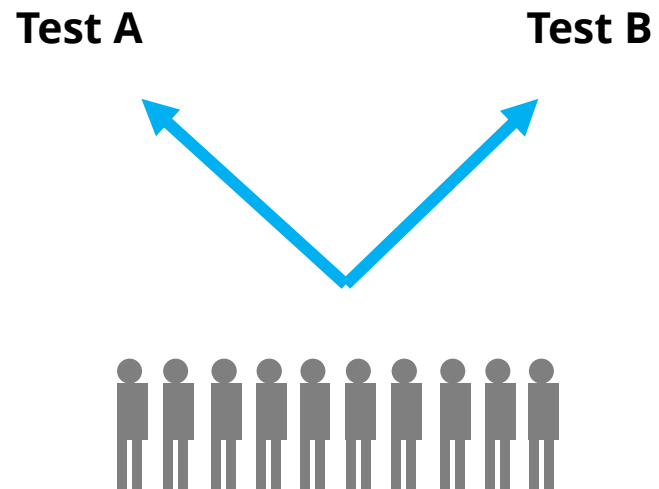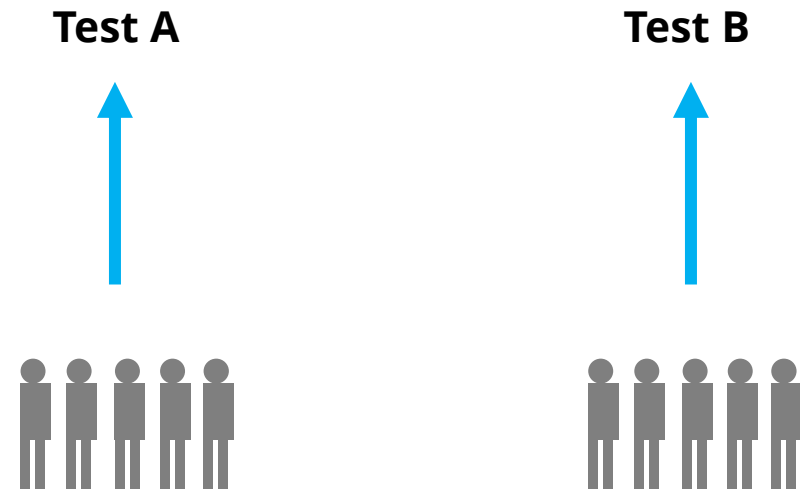
AVOID AMBIGUITY!

Formulate your questions clear & unmistakingly

Bad examples:

„How good is this space?"

→ too vague (what does good mean?)

→ hard to answer (good on which scale?)

„Does the verticality of this interior foster a sense of motion and enlightment?"

→ includes expert language! (verticality, sense of motion, enlightment)

→ different people will understand the terms differently

(also: it is biased, no other option is given)

LEVEL OF DETAIL
Representation of study cases

General rule:

Model as detailed as necessary,
not as detailed as possible!

Figure out, what's really needed for a proper
evaluation and then adjust the design model to it!

https://tim-friedrichs.de/verkaufen/homestaging/