Crowd Simulation Regarding Social Group Behavior

Master seminar

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Where I Started

- **<u>Goal</u>:** Incorporate socio-psychological factors in a crowd simulation

Emotions **Personality traits**

Social behavior

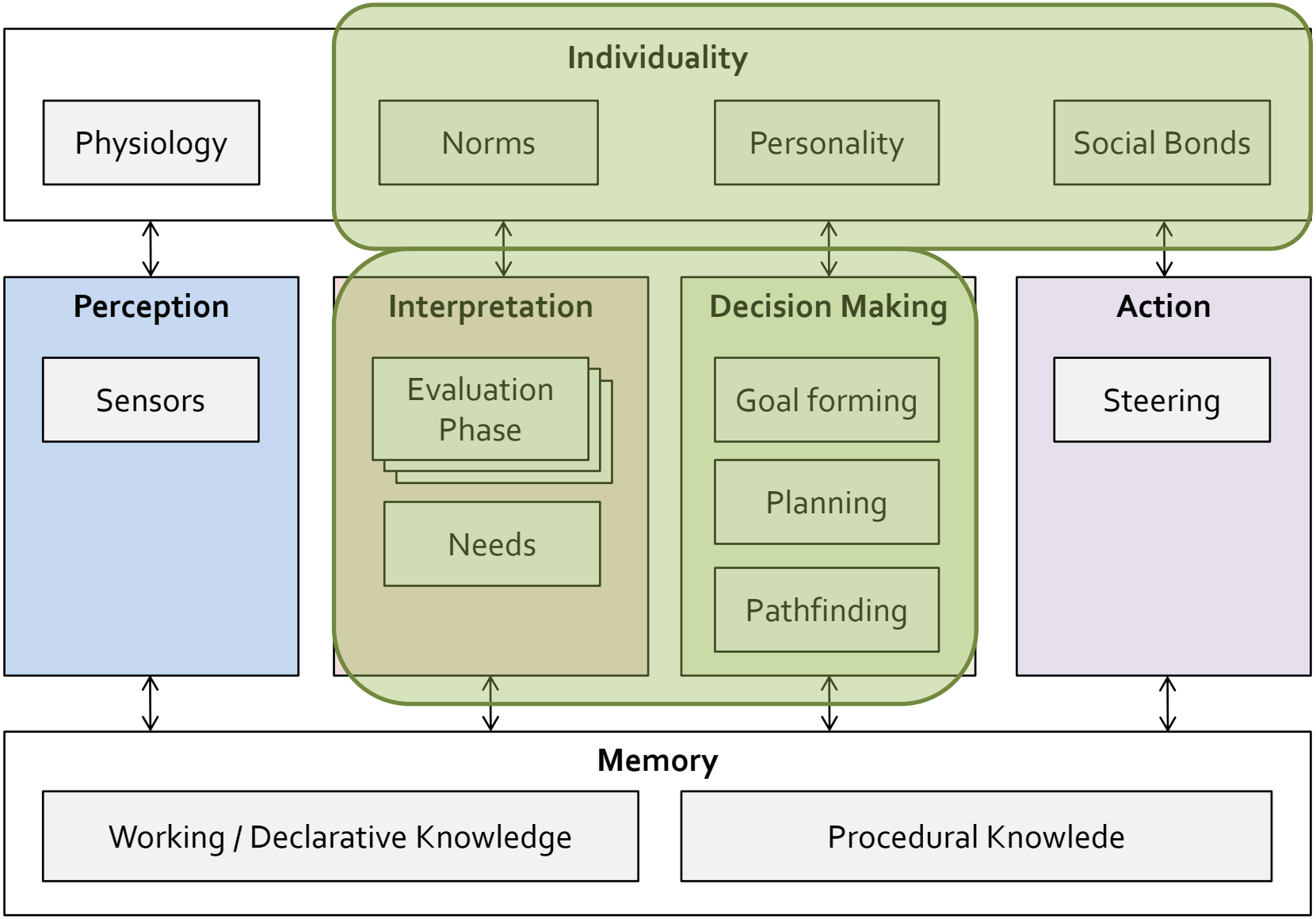
Norms

Motivation

Preliminary Work – AW1 / AW2

- AW1
  - Fundamentals of human behavior in crowds
  - Emotions, Personality traits, social behavior

- AW2
  - **Idea:** WALK as a testbed for different socio-psychological theories
  - Conception of an agent architecture incorporating human factors


Individuality
Physiology
Norms
Personality
Social Bonds
Perception
Sensors
Interpretation
Evaluation Phase
Needs
Decision Making
Goal forming
Planning
Pathfinding
Action
Steering
Memory
Working / Declarative Knowledge
Procedural Knowlede

Current Work – PJ2

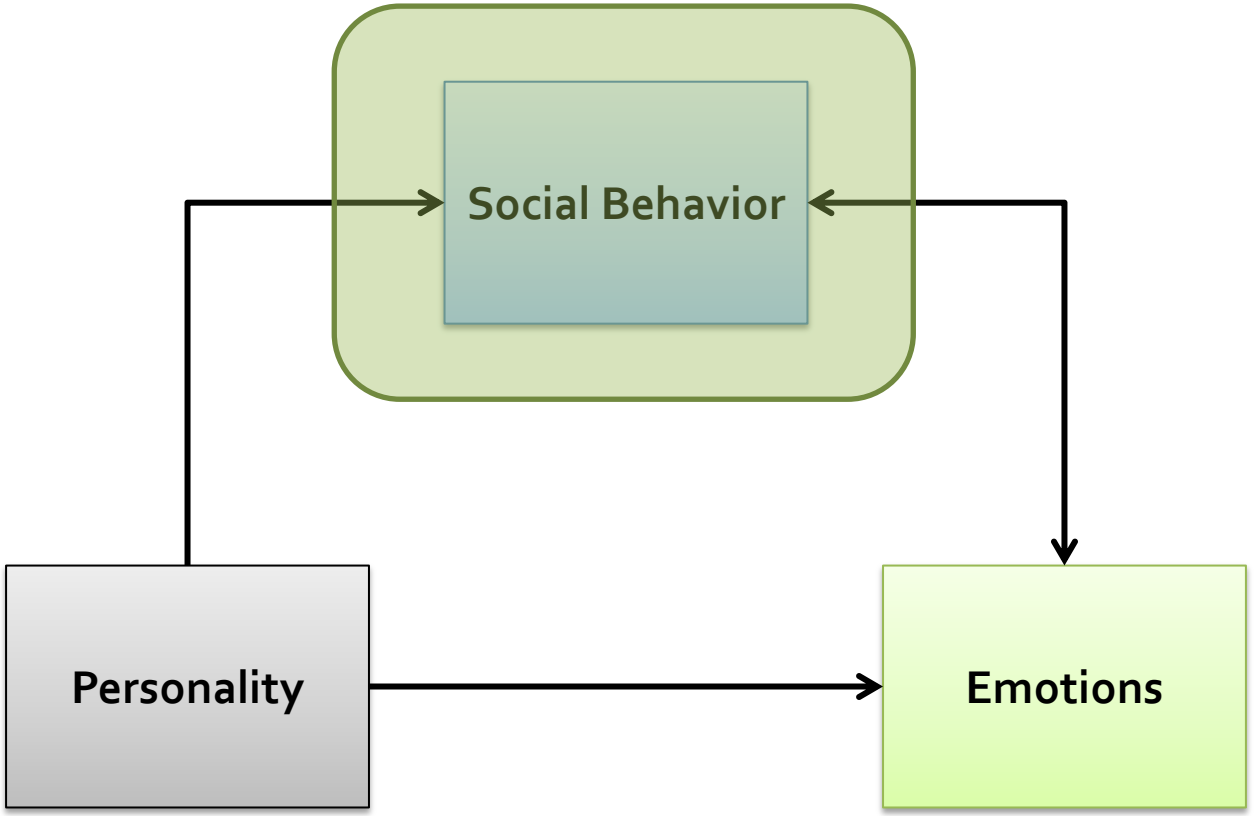
- Implementation of different **experiments**
  - Test scenarios
  - Social factors inside the agents
- **Analysis of parameters** determining agent movement and their weights
- Steady **refinement** of agent implementation

What I Want to Do

What I want to do

Create an **appropriate model** to incorporate **socio-psychological factors** in an agent-based pedestrian simulation based on **psychologicial theories**.

Socio-Psychological Factors



Social Behavior (I)

- **Group behavior** is a key factor of crowd movement:
  - People in public gatherings are usually not just **single individuals** [4]
  - People in social groups will stay **together** [5, 6]
  - Social groups have a **significant effect** on crowd movement and evacuation times [7]

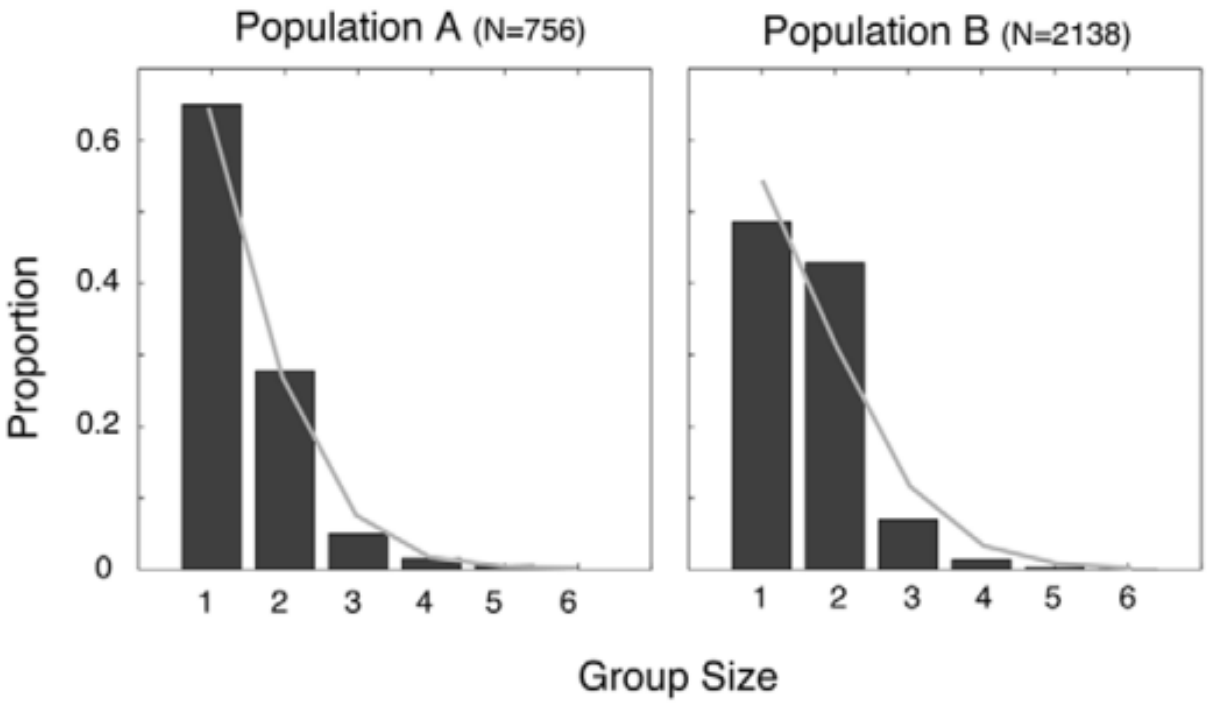
Social Behavior (II)

- Validation: Groups can be identified in videos

[11]

Social Behavior (III)

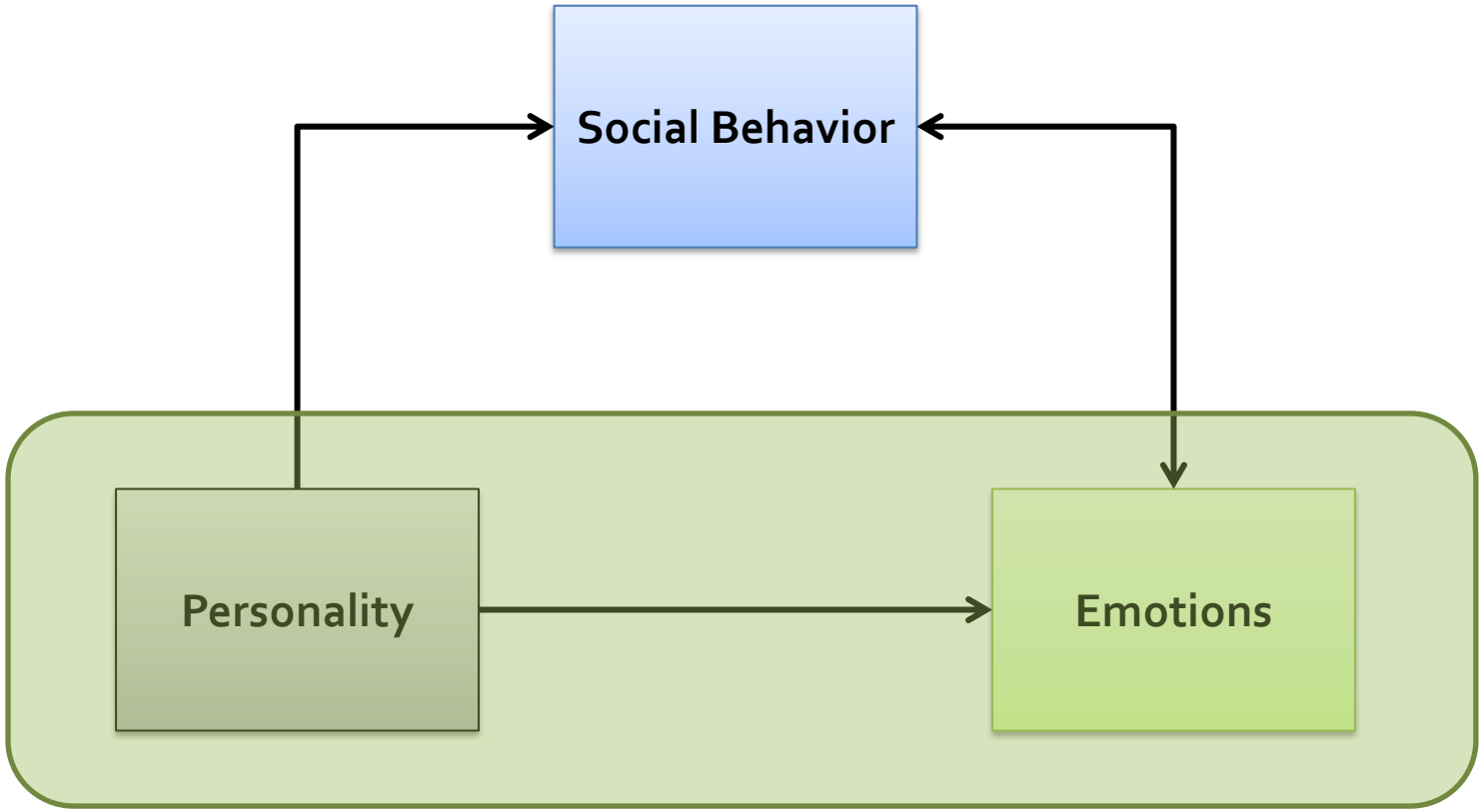
- Empirical data: Distribution of group sizes known [8]



[10]

A: Collected spring 2006 in a public place in the city of Toulouse, France
B: Collected spring 2007 in a crowded commercial walkway on a Saturday afternoon

Socio-Psychological Factors



Socio-Psychological Factors

- Social behavior, emotions and personality **interact**:
  - When faced with imminent danger to life some people may act as individuals again [9]
  - Personality influences in which extend people stick to groups and their role in the group

- I will consider social group behavior as **the central aspect**

Personality & Emotions

- Personality
  - Only some aspects of personality are of interest evacuation scenarios (e.g. coping behavior)
- Emotions
  - Only some emotions are important for evacuation scenarios (e.g. fear, aggression)
  - Many differing theories [3]
- Both are hard to validate [1, 2]

Research Questions

- Which factors determine group behavior?
- How big is the impact of different factors on the the simulation result? (→ **sensitivity analysis**)
- How does an appropriate model for social behavior look like?

Approach

Approach (I)

- **Analyze** which **factors** determine agent behavior and their weight

Approach (II)

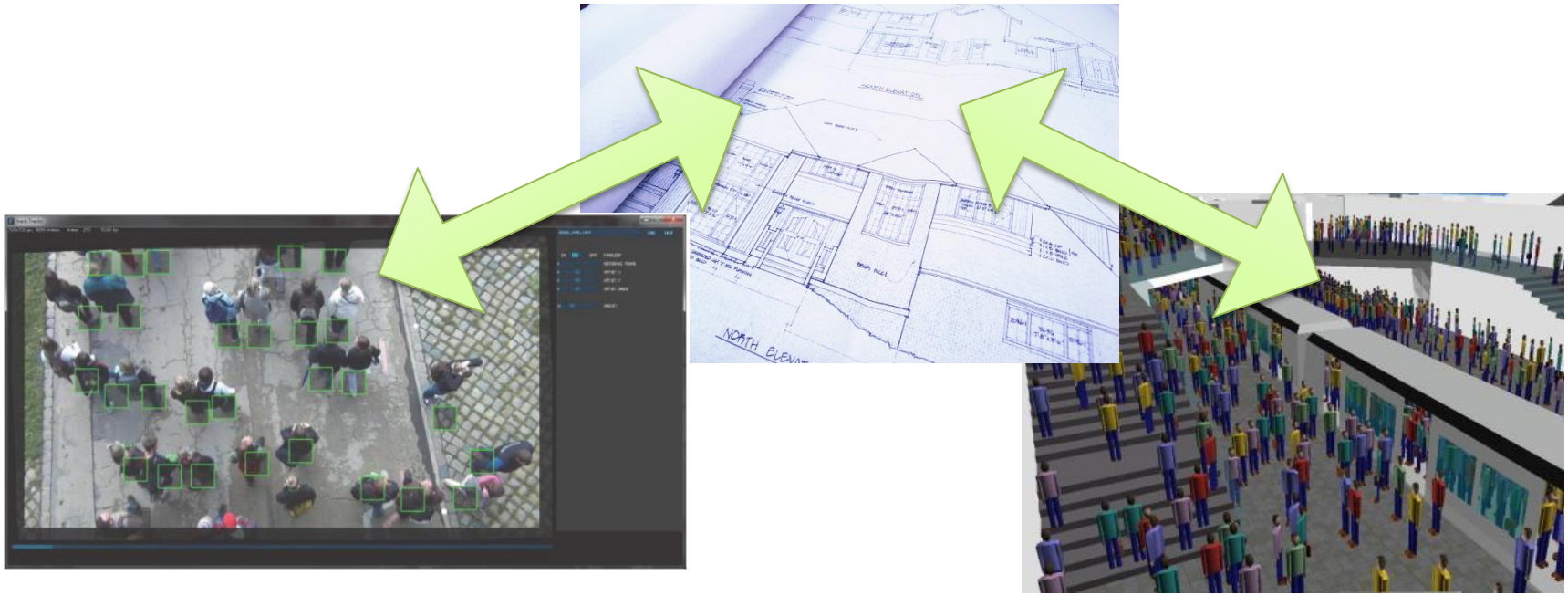
- **Compare** existing computational models [12, 13] with reality

Approach (III)

- Develop a **social behavior model for WALK** based on the results:
  - Factor analysis
  - Experiments with existing models

Approach (IV)

- **Validate** my social behavior model
- **Compare** it with existing ones



Requirements

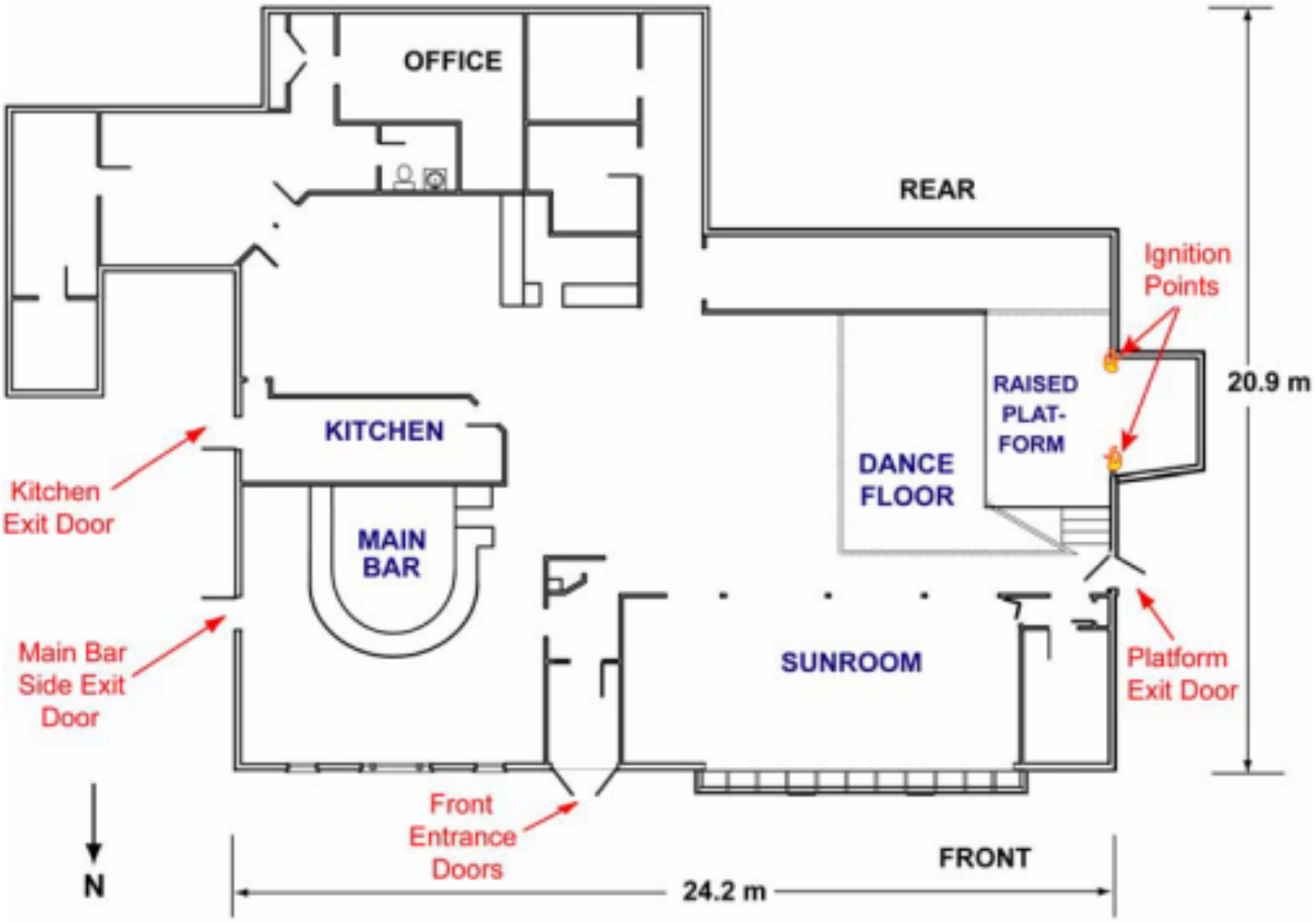
- Base assumptions on **psychological theories**

- Find a model which **explains why** people behave as they do (in contrast to imitate just visible phenomenons)

Scenarios

Scenario Requirements

- Building structure
- Danger propagation
- Age / gender distribution
- Crowd structure
  - Group sizes
  - Types of groups (e.g. families)
- Fatalities
- Number of occupants using each exit
- Movement patterns (→ Video data)



Floor plan of The Station nightclub [14]

Risks

Risks

- Imprecise descriptions of existing models
- Insufficient validation data
- Complexity: Modeling touches many different areas (goal forming, pathfinding etc.)
- Maybe social groups models collide with aim to distribute simulation

Thanks for your attention!

Literature (I)

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Literature (II)

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Figures

Slide 1: http://www.londonnfp.com/lnfp/images/family.jpg

Slide 19: http://www.tunnels.mottmac.com/scaled/34f9f2f5.jpeg

Slide 26: http://www.fiduciarytechnologiesinc.com/files/risk2.jpg