



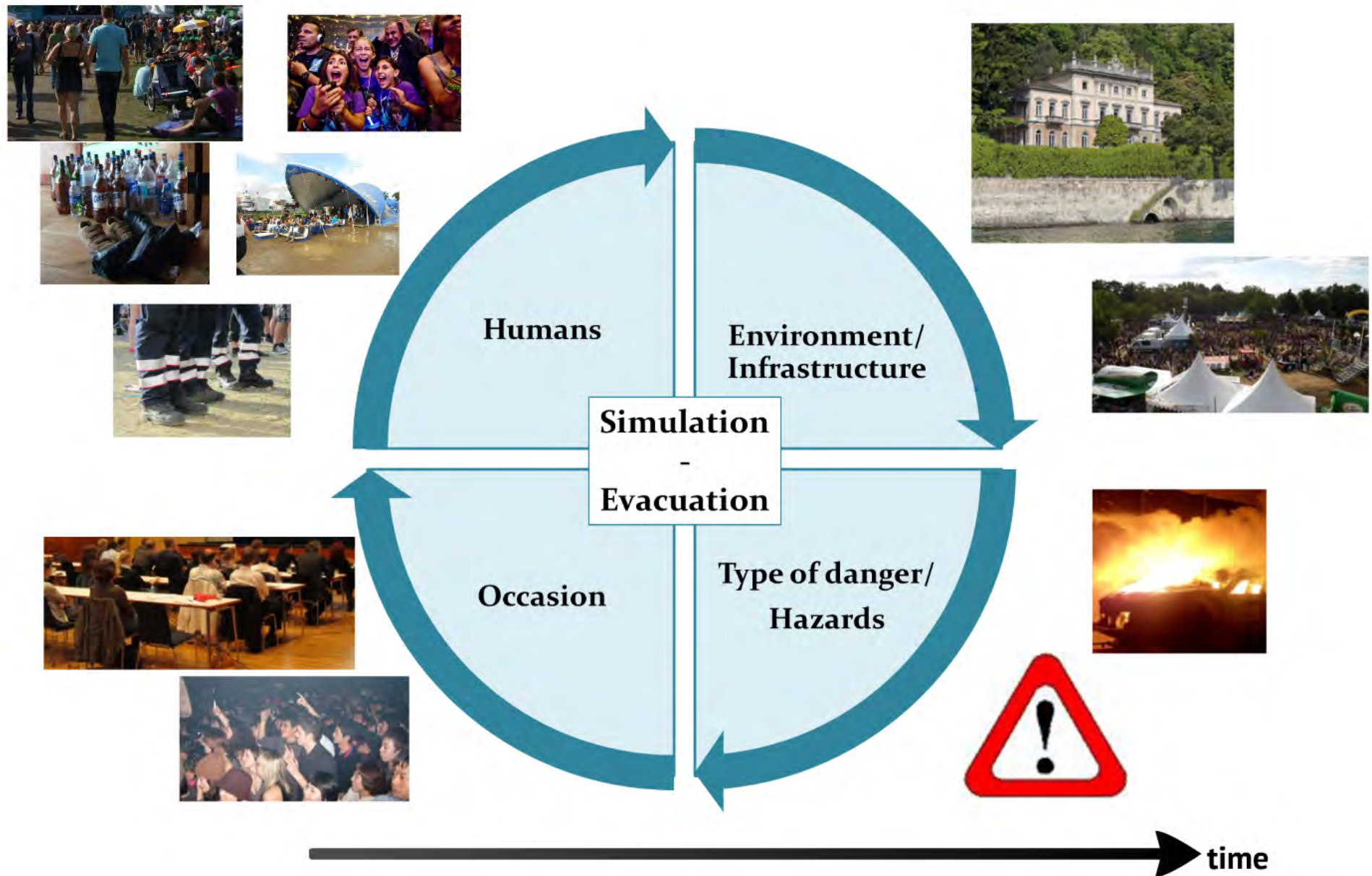
# Human Factors on. Planning an



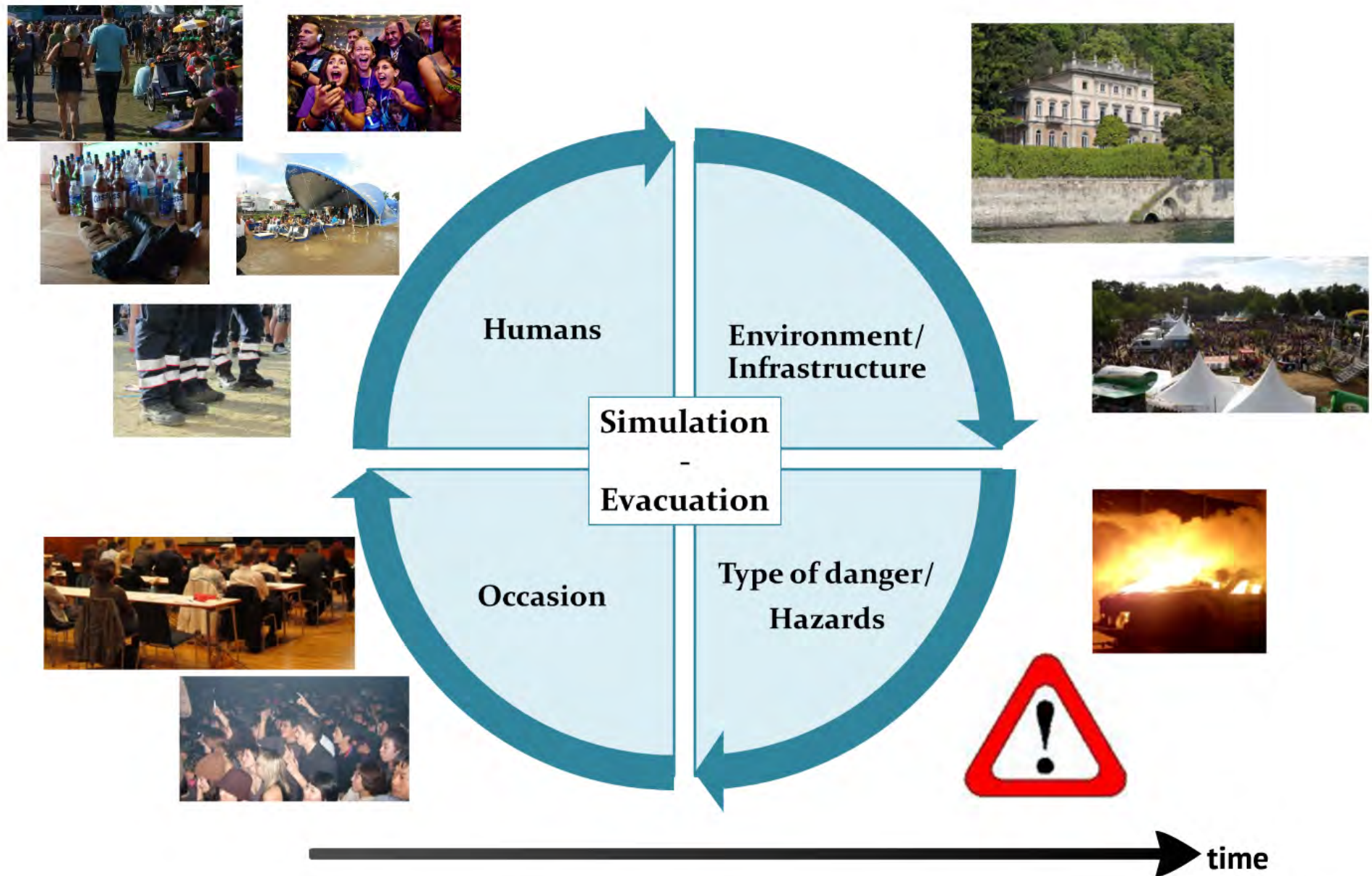
# Human Factors

- Interactions among humans with all elements of socio-technical systems
- Deal with all levels of a system
- Practical application of theory and data









# MYTHS #1

**All occupants decide immediately to exit when hearing an alarm.**





# People Do Usually Not Exit Immediately

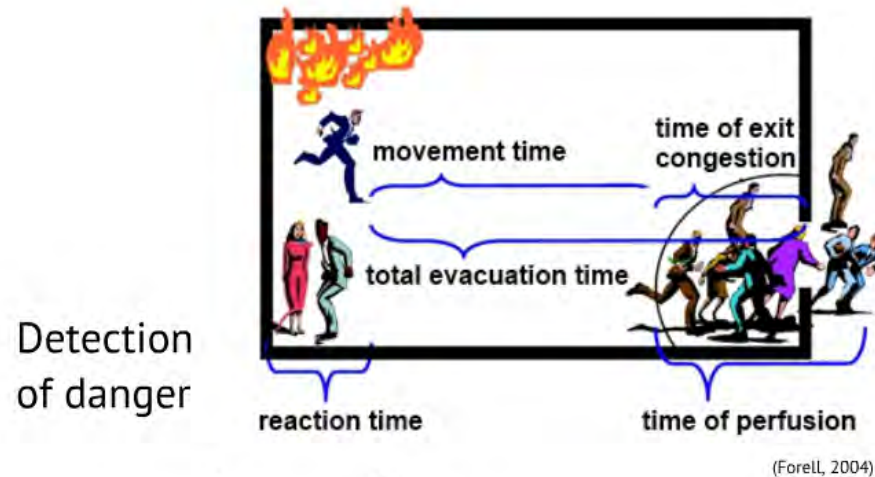
Case studies show: reasons for delays in evacuation depend on individual appraisal, decisions, and motives.

Evacuation delays can be attributed to:

- Recognition of the alarm / threat identification: "What is it? Is that an alarm?"
- Assessment of relevance and actual risk: "Cry-Wolf-Syndrome"
- Threat recognition: "It can't happen to me"
- Need for information and orientation: "Investigation about current situation"
- Commitment to other tasks, e.g. finishing dinner, shutdown computer, ...
- Role, e.g. looking for children, gathering value, ...

e.g. Bresnitz, 1984; Fitzpatrick & Mileti, 1994; McClintock et al., 2001; Kuligowski, 2009

# Reaction Time



## Detection

People must hear, understand, believe, and personalize an alarm or a warning, and then react.

Warning designs need to consider:

- Audibility
- Urgency
- Credibility
- Legibility

## Pre-movement

Self-reported behavior and observations show:

- "Wait-and-see"
- "Information seeking"
- "Get out of here?"
- "Get my stuff"

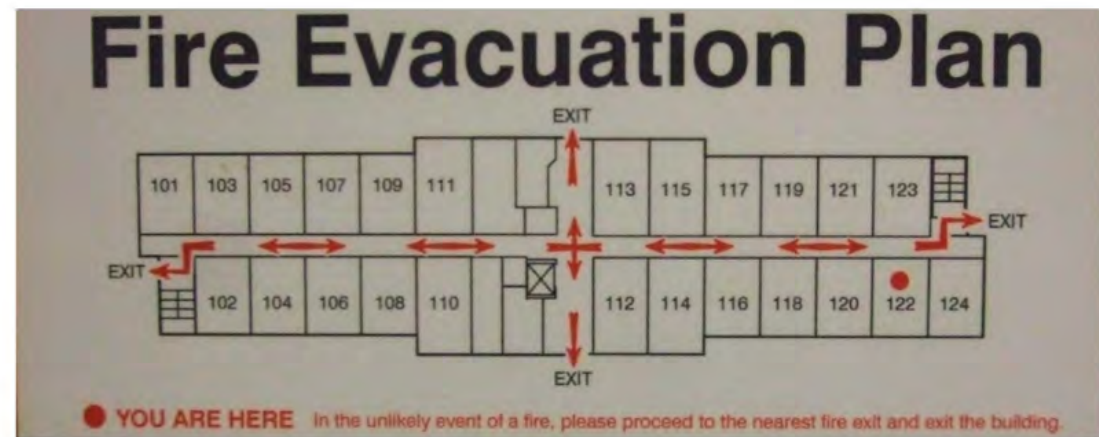
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Hofinger et al., 2014



# MYTHS #2

People use all  
available exits evenly.





## **Distribution At Emergency Exits Is Influenced By:**

- Stress
- Habit
- Social needs and social influences
- Visibility of signs and exits
- Wayfinding strategies

# People Are Stressed in Dangerous Situations



- Perception is narrowed
- Thinking is restricted
- Search for alternative/new ways is limited

"A fast solution is a good solution"

"Get the feeling of control"

# Habit

"Habit loves to perform actions on a regular basis and to repeat well-known routines.

In case of sudden changes, Habit will moan for a while until the new situation will be familiar and feel as it has always been like this."



**Finding new routes is always effort.  
Learned and established routes are preferred.  
No detours  
"Common path of travel"**



# Social Needs and Influences in Dangerous Situations

- Social attachment increases
- Affiliation increases:  
"to be with others/we don't want to be alone"; "social confirmation"
- Social roles and group membership: "Social identity"
- Assistance and helping each other
- Leadership is more likely to be needed and accepted; leadership is crucial

# Follow the Others...



# “Learned Irrelevance” of Emergency Exits





# Emergency Exit - Easy to Find?



**EXIT:**

Guests are advised – "NOT TO" use this "EXIT" in the case of "FIRE"

Once you access this "EXIT" you will "ONLY" be able to "LEAVE" the building from the "GROUND FLOOR"

You will "NOT BE ABLE TO ACCESS" any other floors once you are in this "STAIRWELL"





# Orientation and Wayfinding

Wayfinding is the process of determining and following a path or a route between an origin and destination.

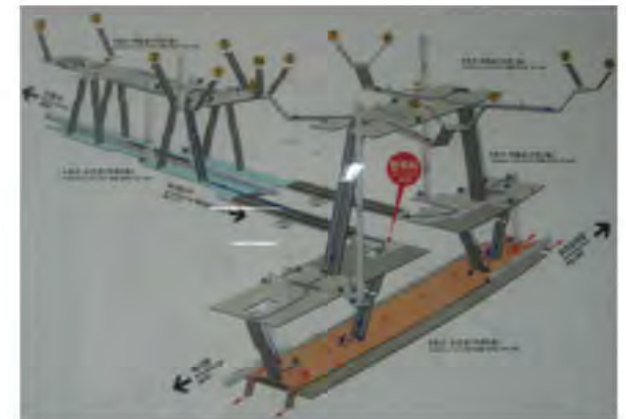
It involves:

- Orientation „Where am I?“
- Defining the goal/destination „Where do I want to go? What do I need?“
- Route choice/Planning „Which way?“
- Route control „Am I on the right way?“
- Recognition of Destination



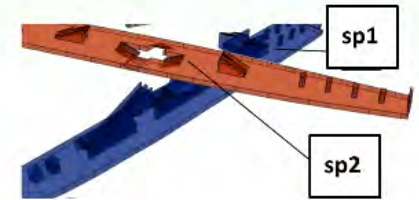
Wayfinding depends upon:

- Definitions of routes, waypoints, landmarks
- Experience, knowledge and memory



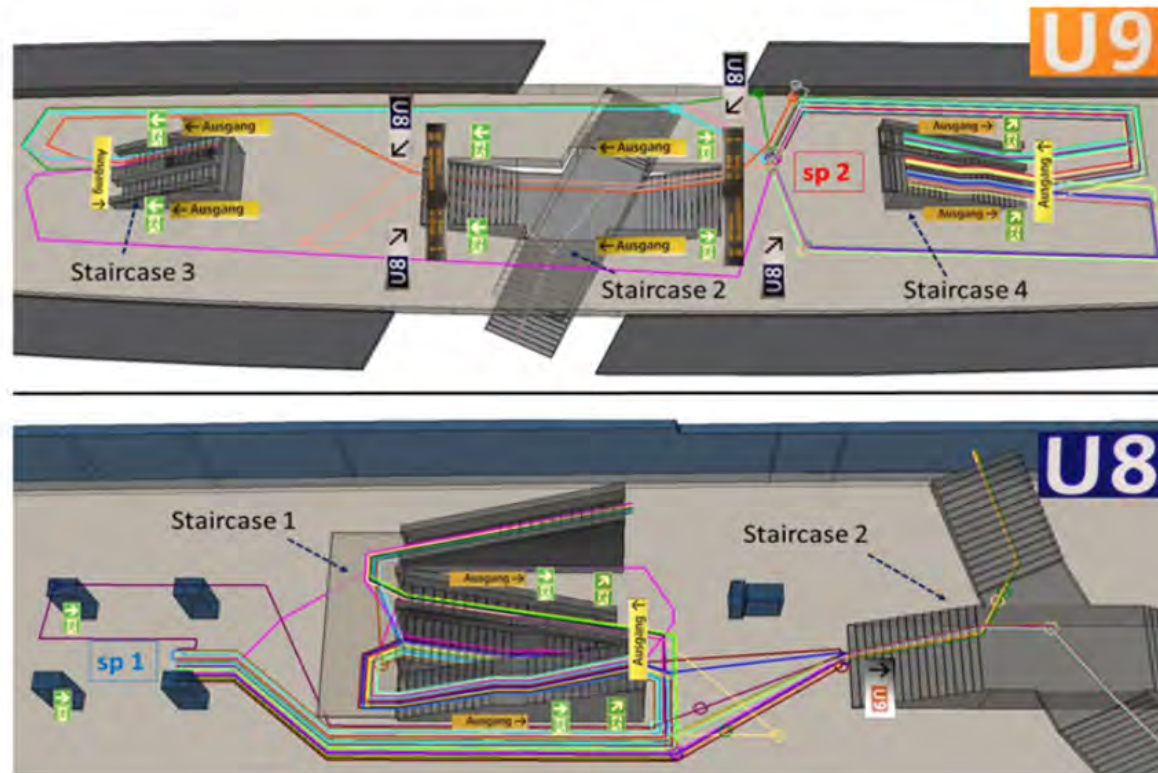
e.g. Lovas, 1994; Golledge, 1994; Richter, 2009; Hofinger et al., 2014

# Wayfinding Strategies



Field studies in a subway station:

“Find a safe exit to the street level”



"Use the way that is known to you"  
 "Use the shortest (convenient) way compensating your impairment"  
 (participated with walking impediments)  
 "Follow the exit signs"  
 "Use the next possible way up that you can see"  
 "Find a position to gain an overview of alternatives before proceeding"  
 "Avoid jamming and use the least crowded path" and "optimize travel time".

e.g. Hofinger et al., 2016; Künzer et al., 2017; Andresen et al., in print

“Use the way that is known to you”

“Use the closest (comfortable) way compensating your impairment”  
(participant with walking impairment)

“Follow the exit signs”

"Use the next possible way up that you can see"

"Find a position to gain an overview of alternatives before proceeding"

"Avoid jamming and use the local shortest path" and "optimize travel time".



# Usage of Emergency Exits

Wayfinding is a complex process involving:

Expectations and knowledge

Influence of signage, landmarks/architecture and other people

Strategies are complex

Strategies might change during evacuation



Salience of emergency exits is important.

Groups determine decisions:

- Group behavior
- Groups slower than individuals
- "Common path of travel"
- Role of Leadership





## MYTHS #3

**People will not move through smoke.**



# People Move Through Smoke

Studies over the past 40 years show:  
People will continue to move through smoke or  
stay in smoke even in worsening conditions.

The toxicity of smoke is underestimated.

"Personally good reasons" are applied :

- Search for further information
- Curiosity and sensation seeking
- Trying to help and warn others
- Fire fighting activities
- Lack of knowledge/motivation
- Conformity
- Moving back into smoke "Getting my things"
- No detours



e.g. Bryan, 1977; Wood, 1980; Proulx 1995; Fahy & Proulx, 2009

# Human Behavior in Smoke

People will move through smoke and stay in smoke.

Smoke is not necessarily a warning signal to evacuate.

Evacuation time might increase in smoke.

- Leadership?
- Guidance and signage of emergency routes and exits
- Fire trainings



# MYTHS #4

**Panic is a common occurrence in emergency situations.**







# True Panic Situations Are Rare

Panic is often used:

- to describe the behavior of people trying to escape
- to describe emotions of fear and anxiety
- as a label or a simple explanation for a complex problem, especially by media (“easy excuse”)

Reasons for mass tragedies that are not panic:

- Density
- Organizational problems
- Lack of information

# The Concept of Panic

- Acute and extreme reaction of fear of individuals
- Loss of self-control
- „Mindless“ behavior
- Anti-social/Non-social behavior
- Emotionally contagious behavior that leads to mass panic

e.g. Quarantelli, 1954; Sime, 1980; Grommek, 2005; Swistilnikow & Grebenikow, 2005; Schadschneider et al., 2008

# Mass Panic - We Need to Know More

Emergencies do not necessarily lead to panic in crowds.

People:

- tend to stay reasonably calm
- may try to help each other
- show altruistic behavior
- Psychological crowds show "social attachment"; form "social identity"

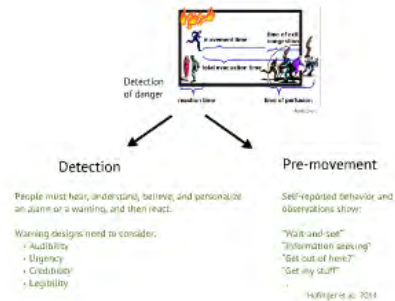
Lack of social rules and roles make disasters difficult to cope with.

Open questions:

- Real mass panics?
- Mass panic vs. mass hysteria?
- How to recognize and prevent panic?

Grommek, 2005; Dynes, 2006; Drury, 2009; Künzer, 2015

## Reaction Time



## Mass Panic - We Need to Know More

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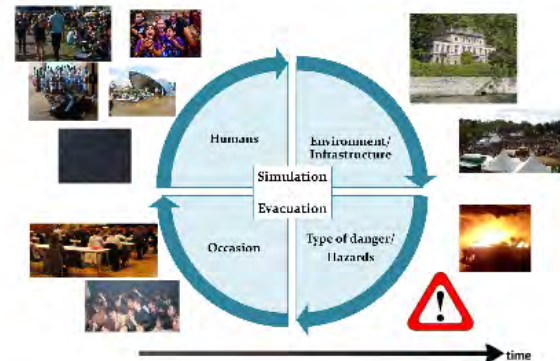
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Grossmann, 2000; Dyer, 1996; Sherry, 1999; Kintner, 1973



## Usage of Emergency Exits

Wayfinding is a complex process involving:

- Expectations and knowledge
- Influence of signage, landmarks/architecture and other people
- Strategies are complex
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# Human Factors in Simulation, Planning and Guidance

Dr. Laura Kuenzer

