

# Fire safety architecture - measuring the process of orientation

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## Key words

Architecture, Fire Safety Engineering, Evacuation, Clearance time, Self-rescue, Orientation, Perception, Space

## Introduction

The problem is that evacuation during instances of fire takes too much time, especially in high-rise buildings. Several reasons lie behind this phenomenon [1]. Within the domain of Self-rescue, this experiment solely involves the aspect of orientation.

A fictional design (see figure 1) for a high-rise office building and museum assumes fire escape optimisation with a widening of the route along the facade or widening within the core of a tower.

The corresponding hypothesis states that, regardless of their projection, escape routes which widen while going down considerably shorten the perilous period of clearance.

In addition, the two fundamentally different ways of circulation (entrance) in a given volume i.e. building envelop are to be compared [2].

## Questions of research

Of interest are:

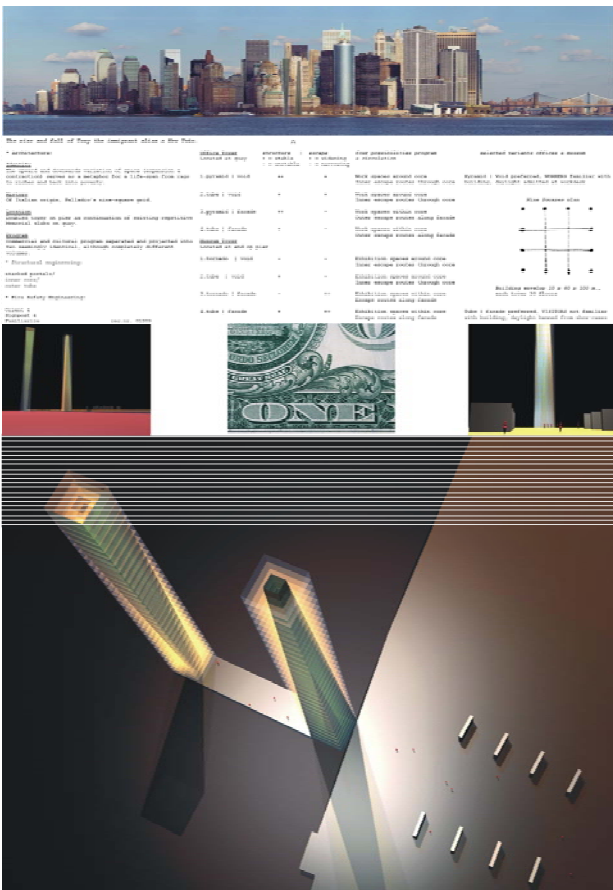


Figure 1. Architectural model of the two towers, 10x10x100m. each.

Do widening escape routes indeed shorten the evacuation time? Which flight goes faster, a flight along a façade with sight on the surroundings? Or in fact a flight through an atrium while having visually contact with other persons (part of the crowd) trying to escape?

Other issues to be researched will be:

Does fleeing through relatively high, shallow, curved and bright spaces go quicker? Is flight along relatively 'warmly decorated', light colored and soberly furnished routes more efficient [3]?

## Sort of research

A two-folded approach implies the following:

The intention is empirical research with an inductive character. From specific observations of behavior an attempt is made, on the one hand, to deduce general rules. On the other hand it is presumed, as a deductive hypothesis, that possibilities for orientation indeed shorten the time of escape during the hazard of fire.

Given the fact of applied and not purely scientific research, it will not be like a survey. Instead the study will be characterized as explorative (case study) and also as testing (hypothesis). Depending on the number of measurements, in first instance the research will be qualitative in nature. Therefore only limited statistical calculations will be necessary. Registration of human behaviour during the evacuation process of way-finding will provide an insight into the psychological perception of spatial information.

The objective naturally is a neutral result, due to the application of a fitting methodology and adequate focus [4].

## Method and implementation of research

Precise measurement is achieved as follows:

Behavior of PC-operating, serious gaming, persons is monitored while they run through the Virtual Design looking for a way out (filming eye movements and changes in bodily functions such as heart beat). The actual path taken through the various spaces in the model is tracked as well. A shorter way-finding time implies a shorter clearance time in reality.

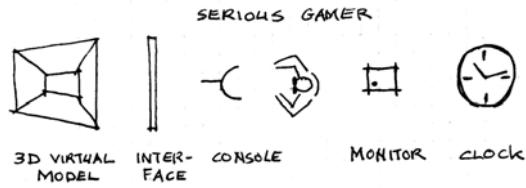
The variable of research is hence flight-duration, for which a clock is observed. The trustworthiness of the measurement is easier to deal with than its validity.

Moreover, relevant questions regarding orientation i.e. the mental condition of subjects before and after the tests will be put forward and compared with the actual outcome.

The present architectural sketch will be transformed into a Preliminary Design which hence fort will be converted into a semi realistic environment using advanced visualization and gaming techniques.

Subjects will explore the virtual interior and exterior through computer interfaces. They will interact with computer screens, sitting on stools behind gaming consoles and shall be wearing special glasses.

Via this non-direct method (registration of behavior) the mental process of orientation is measured (see figure 2).



**Figure 2.** Set up of measuring the interaction with virtual environment.

### General constraints

Realistic model (Architectural Preliminary or Definite Design transformed into real-life visualization);

Representative measurement (large enough number of subjects);

Applicable (paper questionnaire and usable protocol for professional architects as result).

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### References

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