

Lost in abstraction

The COMPLEXITY of real environments vs the ASSUMPTIONS of models

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- EVACUATION MODELS ARE SOME OF THE MOST COMPLEX PROGRAMS USED IN FIRE ENGINEERING
- THEY CLAIM TO PREDICT HUMAN BEHAVIOR AND ITS STABILITY OVER THE LIFETIME OF A BUILDING IN A WIDE VARIETY OF FIRE SETTINGS
- THEY OFTEN CONTAIN HIDDEN IMPLICIT ASSUMPTIONS ABOUT THE EVACUATION ENVIRONMENT

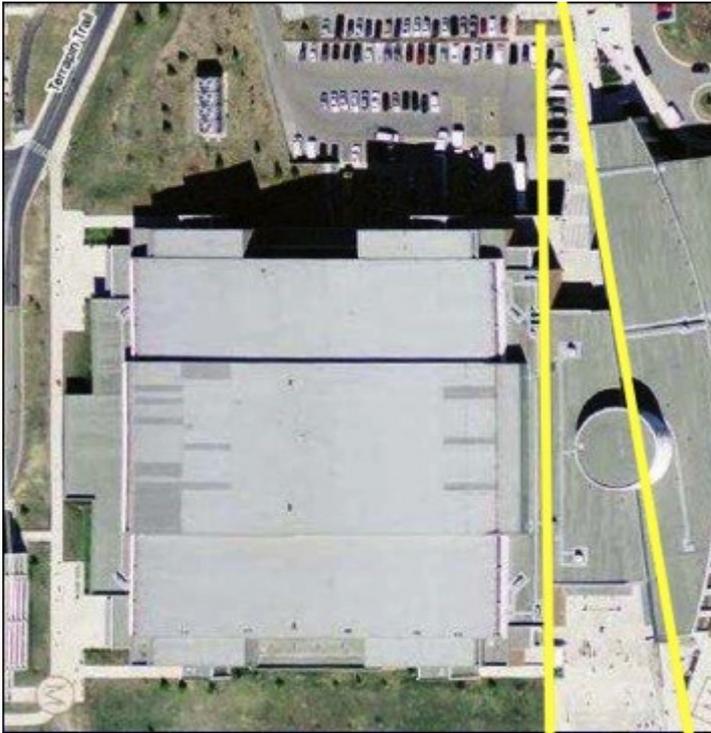
- DESIGNERS ROUTINELY ASSUME CONVENTIONAL BUILDINGS, STANDARD REACTIONS AND NORMAL WAYFINDING AIDS
- THIS CASE STUDY ILLUSTRATES SOME OF THE KEY FEATURES THAT TEND TO BE LOST IN THE PROCESS OF ABSTRACTION

CODE COMPLYING SIGN?



DESIGNERS ASSUME
compliance with a code
+
mathematical evacuation
modeling provide safety

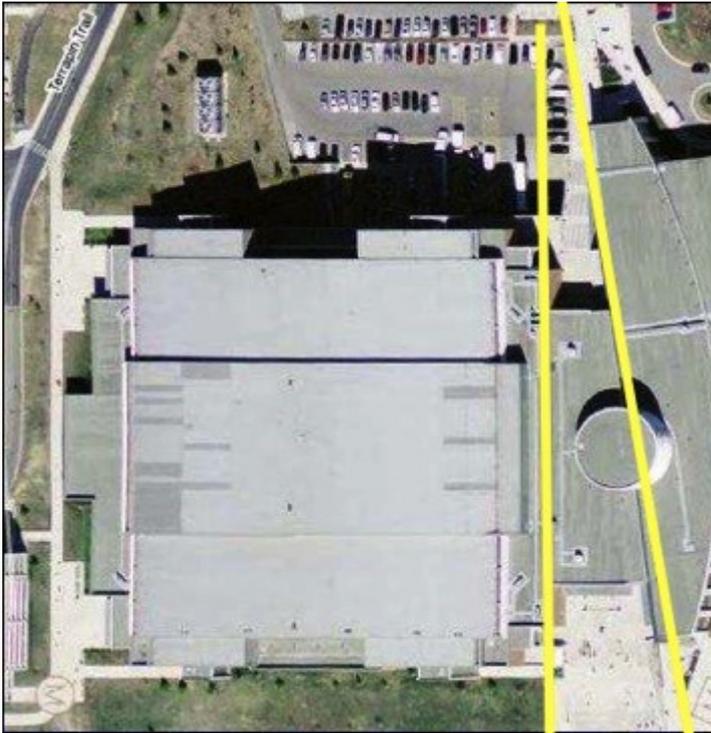
PBD + Code Compliance



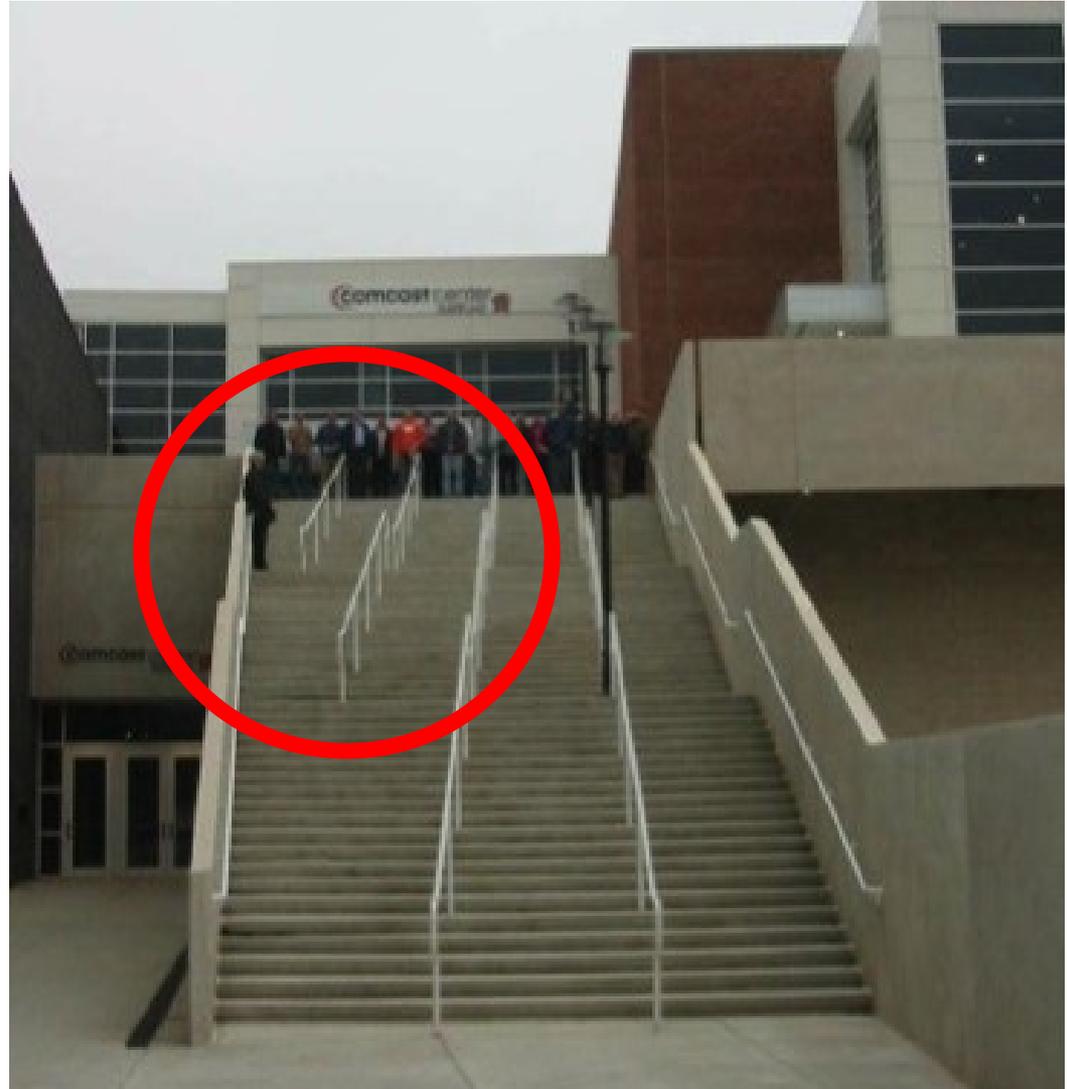
Comcast Center, University of Maryland



PBD + Code Compliance



Comcast Center, University of Maryland



All models are
INTELLECTUAL ABSTRACTIONS
of a problem

How do you model?



London Museum of Natural History (2014)



List of problems:

- cultural confusion
- bottlenecks
- wayfinding difficulties
- pushchairs and objects
- wide range of different people
- crowds
- unusual walking conditions
- blocking of exits
- smoke
- unpredictable human behaviors

“Walking speed”



Vatican Museums, Rome

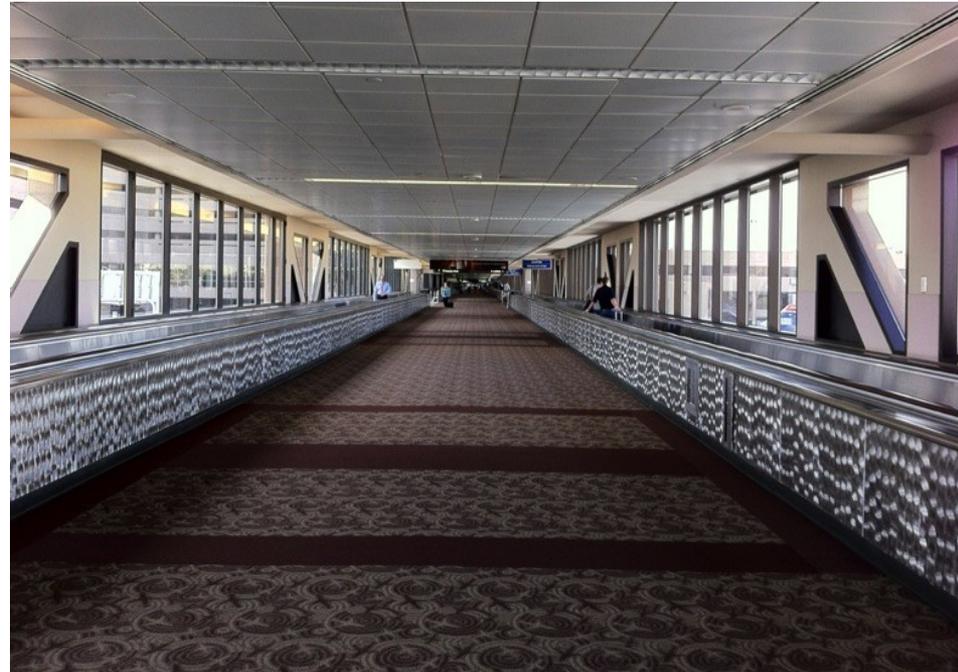


London City Hall

Wayfinding



Uffizi Gallery, Florence, 1765



Phoenix International airport, USA

Human factors



Uffizi Gallery, Florence



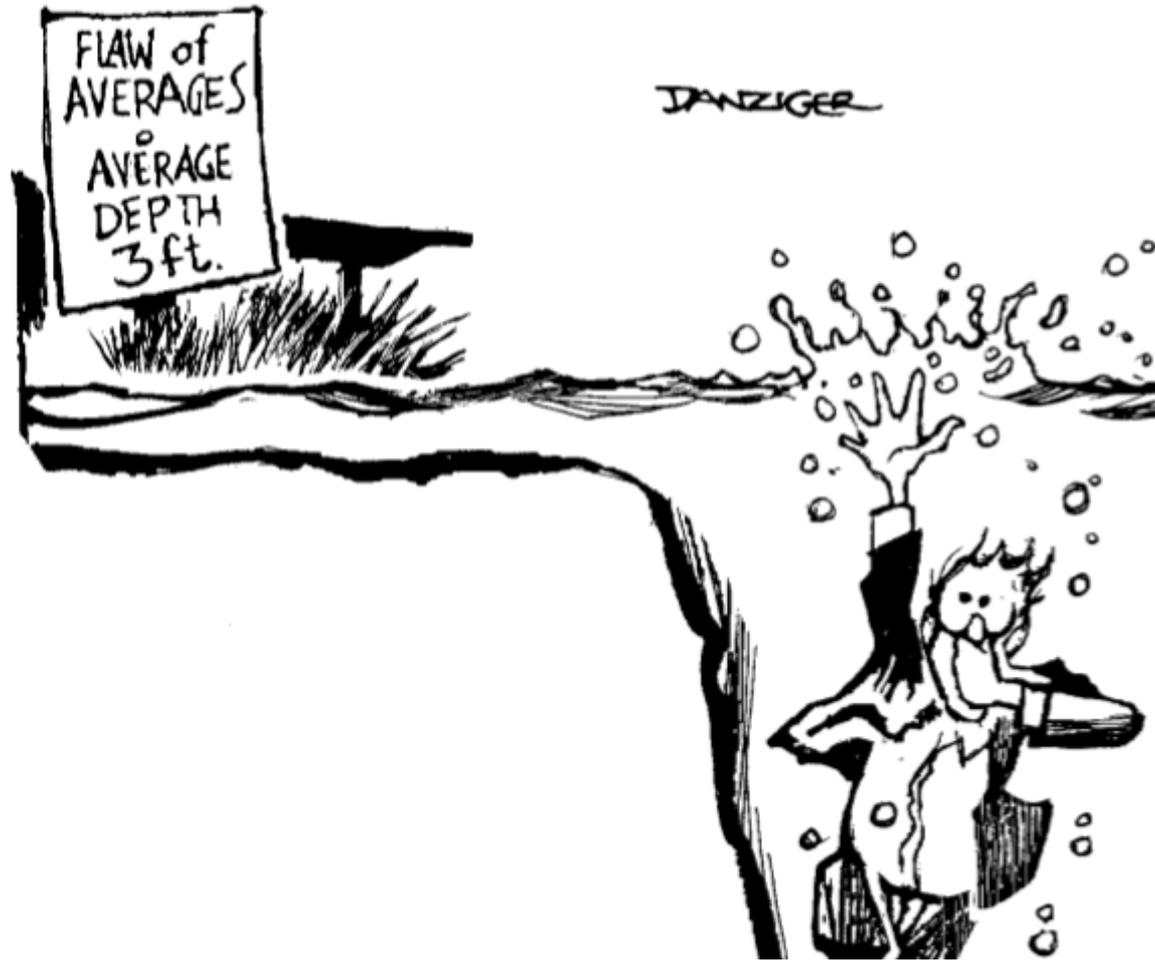
People sleeping in an airport

People and their goods



People waiting for their luggage in an airport terminal

Unsupported Engineering Judgment



Savage, S.L., The Flaw of Average, Why We Underestimate Risk in the Face of Uncertainty 2012

Temporary changes



Victoria and Albert Museum, London

Temporary changes



Victoria and Albert Museum, London

Temporary changes



Victoria and Albert Museum, London

Unpredictable human behaviors



Uffizi Gallery, Florence, 1765

INEFFECTIVE SOLUTIONS



Tokyo International Forum, 1997



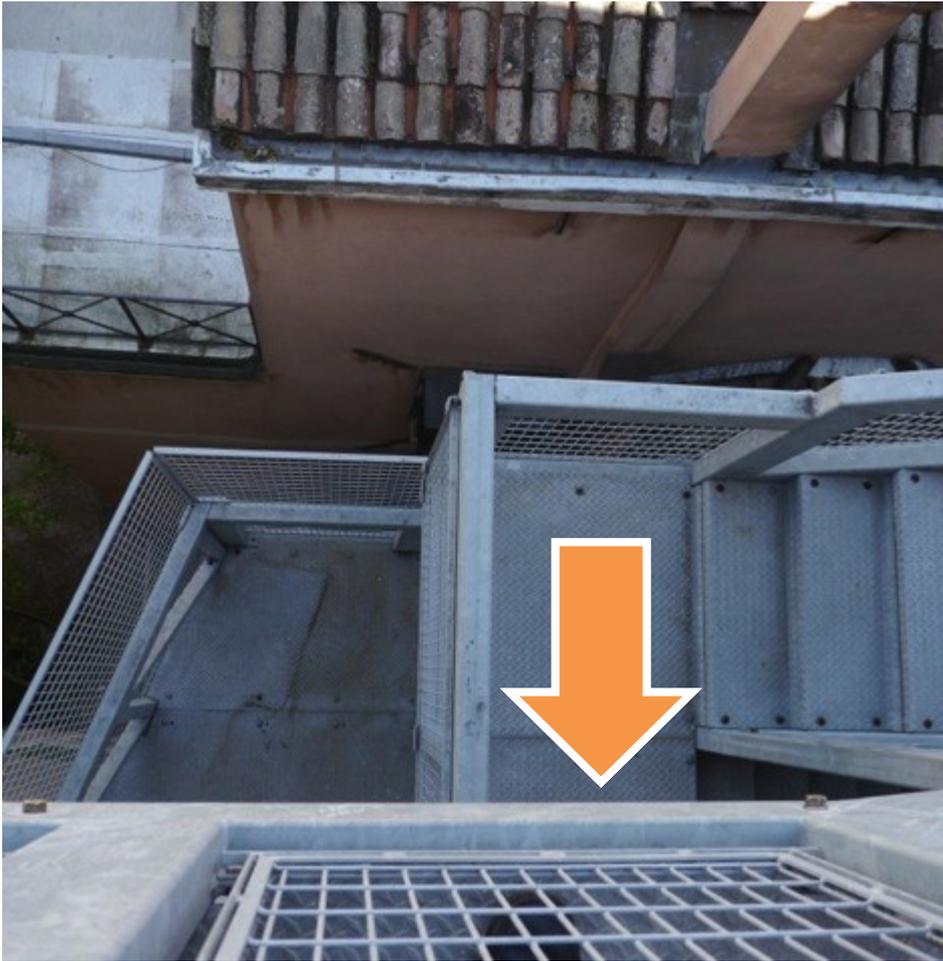
Tate Modern, London, 2000

Visibility and comprehensibility



Charlotte Airport, NC, USA

Would you go back into the building?



Ca' Rezzonico Venice



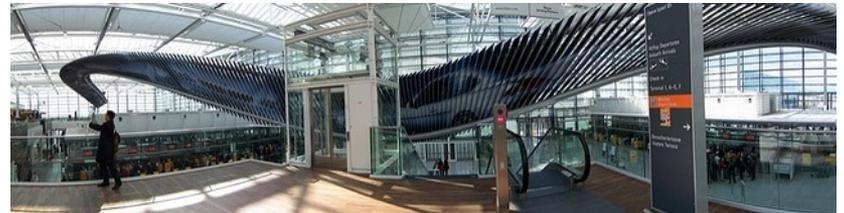
Dynamic controlled evacuation

(Carattin, Brannigan, 2012)

Dynamic evacuation decisions
Staff



Consistent, visible, landmarks
Building



Dynamic environmental info
Signs



- ENGINEERS NEED TO CONSULT OTHER PROFESSIONS ON THE DIFFICULTIES AND PROBLEMS OF PREDICTING HUMAN BEHAVIOR
- ASSUMPTIONS THAT BEHAVIOR IS RELIABLE AND PREDICTABLE CANNOT BE MADE WITHOUT A FAR STRONGER RESEARCH BASE

- ASSUMPTIONS USED IN MODELS SHOULD BE EXPLICIT TO PREVENT MISUSE OR MISTAKES
- IN CONVENTIONAL BUILDINGS LARGE MARGINS OF ERROR (SAFETY MARGINS) ARE A POSSIBLE RESPONSE TO UNCERTAINTY
- IN UNUSUAL BUILDINGS MODELS MAY HAVE LIMITED PREDICTIVE ABILITY

“As far as the laws of mathematics refer
to reality, they are not certain;
and as far as they are certain, they do
not refer to reality”

Albert Einstein

Addresss to Prussian Academy of Sciences (1921)

Q + A

Acknowledgment

Some photographs courtesy of Ruth Dayhoff
and Vincent Brannigan