RELEVANCE OF DATA IN CONSTRUCTION SAFETY PREVENTION

Alfredo Soeiro
UPorto and ISHCCO

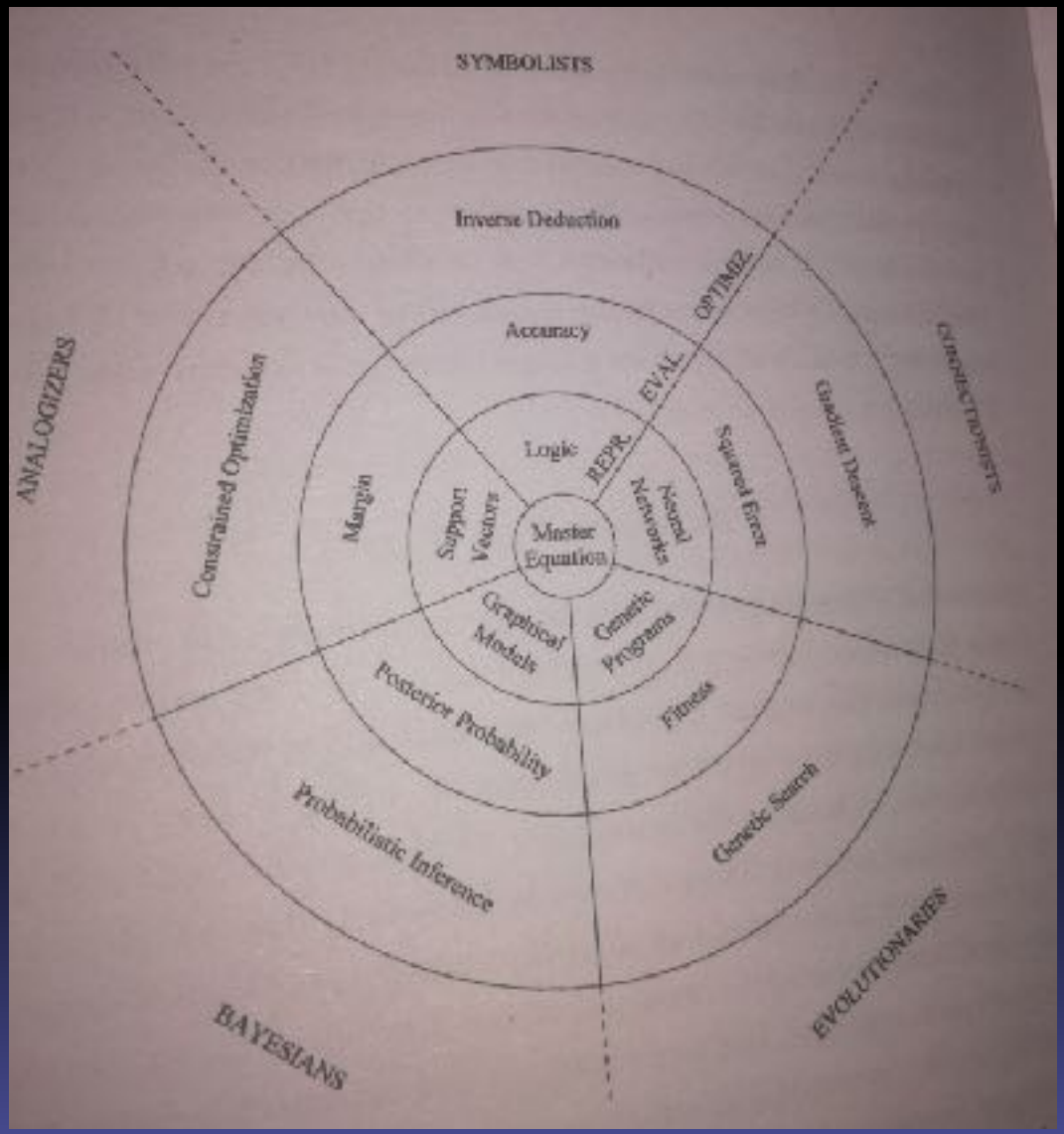
SHO´23 – 20/21 July 2023
Hybrid Symposium
Faculty of Sports, University of Porto, Portugal

Tips

- Data necessary to learn
- Data useful for decision making
- Data essential for understanding
- Data crucial to avoid risks
- Data relevant for prevention
- Data available in digital format
- Data required to machine learning

Machine learning (not AI!)

"The Master Algorithm"
by
Pedro Domingos



3 examples

- 1. Prevention through design
  - Analysis of about 2000 fatal or serious accidents
- 2. Adapt to reality
  - Probability, Gravity and Exposure
- 3. Simulation
  - VR, AR or IR

Coordinator at project preparation stage

- Article 2

Definition

“(e) 'coordinator for safety and health matters at the project preparations stage' means any natural or legal person entrusted by the client and/or project supervisor, during preparation of the project design, with performing the duties referred to in Article 5;”

1.Motivation for study

- Directive 92/57/EEC - Temporary or mobile construction sites
- "Whereas unsatisfactory architectural and/or organizational options or poor planning of the works at the project preparation stage have played a role in more than half of the occupational accidents occurring on construction sites in the Community;"

1.Prevention Through Design

- National Safety Council
- Design for Construction Safety (OSHA)
- Australian Safety and Compensation Council
- Construction Industry Institute
- Construction Design Management Regulations
- Safety Design (HSE)
- Gambatese, Hinze, Baker, Driscoll, …

1.PhD Research

- Bianca Vasconcelos (2009-2013)
- Universidade Porto (Portugal) and Universidade Pernambuco (Brasil)
- Supervisors: Alfredo Soeiro and Beda Barkobebas Jr.
- What is the percentage of accidents that may be prevented during the design and preparation stages?

1.Method

- Analyze fatal or serious accidents
- Define types of design:
  - Structures, architecture and other
- Classify the major causes of the accidents in two groups:
  - Preventive measures possible during design phase
  - Otherwise

1.Accidents analyzed

- Brasil (SFIT) – 675
- Canada (CCOHS) – 940
- USA (FACE, NIOSH, PtD) – 116
- Portugal (ACT) – 203
- United Kingdom (HSE) – 100
- Singapore (WSH Council) – 41
- Pernambuco (U. Pernambuco) - 32

1.Detailed Analysis

- Descriptive information
  - Causes
  - Seriousness
- Analytical information
  - Factor
  - Preventive measures
- Design phase useful
  - Type of design
  - Designer guidance

1.Scheme

1. Descriptive information (accident causes, seriousness of accident)
2. Preventive measures that should have been taken
3. Could design prevent the accident?
4. If no then analysis stops
5. If yes which type of design?

1.Type of Guidelines

55 recommendations for preventive measures

Examples

- Design parapets to avoid temporary guardrails
- Design curved or reinfoced glass/plastic skylights
- Design permanent walkways over sloped roofs

1.Designers Model

1. Integrating guidelines in the design
2. Control checklist to evaluate compliance with model
3. If yes then terminate
4. If not then return to step 1

Main Results

Accidents avoidable in conceptual design phase

35,1%

Accidents prevented at preparation stage

27,2%

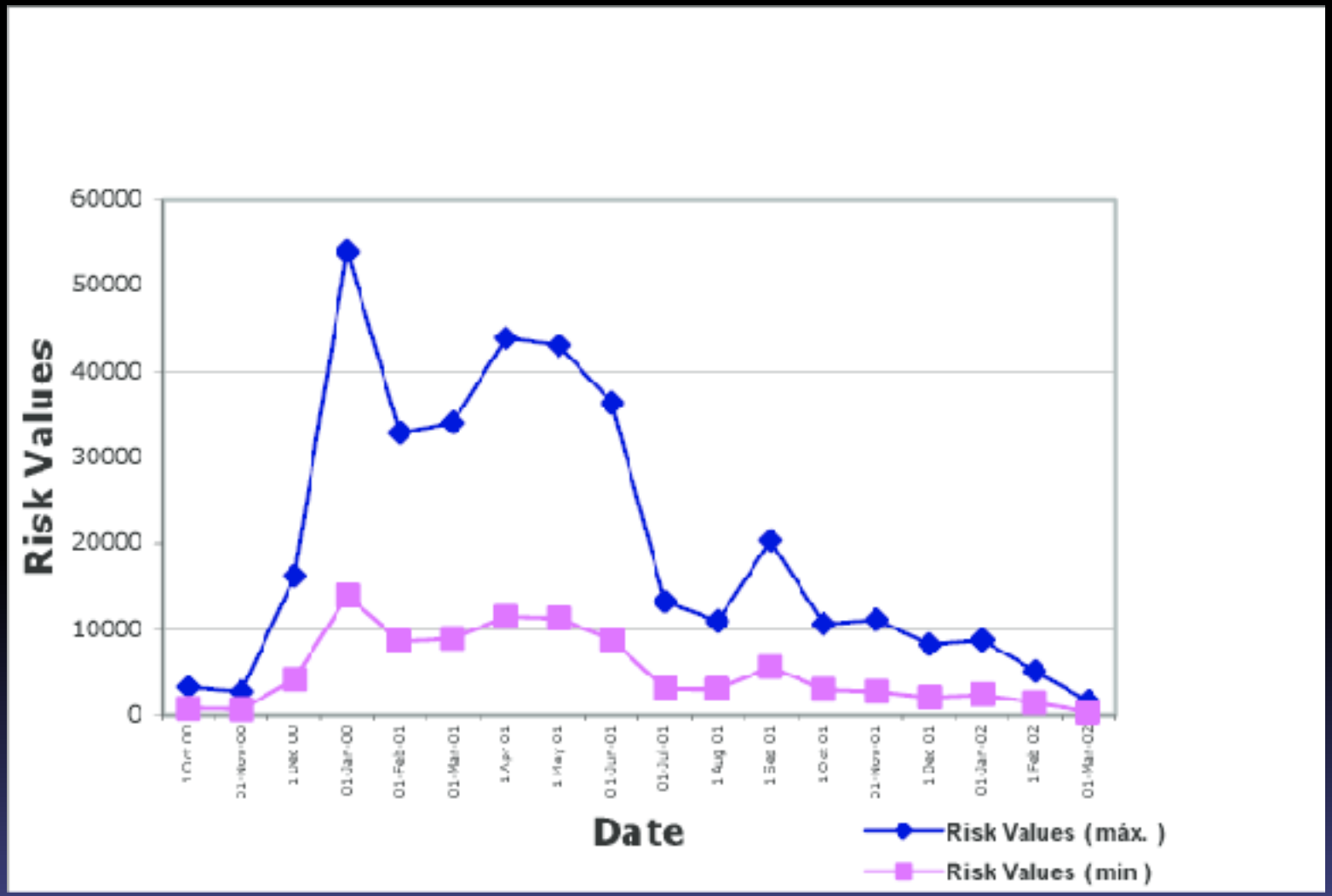
2.Ubiquity

- Usual - address ALL risks
- Limited human resources
- Probability
- Gravity
- Exposure
- Decision what is relevant

2.Process

- Plan construction tasks
- Associate to each task related risks
- Probability
- Gravity (Seriousness)
- Exposure
- Order each risk (P, G, E)
- Minimum and maximum indicators

2.Plan and choice



Caption

3.Simulation

- Virtual reality
  - Visual representation (BIM)
  - Simulated tasks
- Augmented reality
  - Training
  - Anticipate
- Immersive reality
  - Cave
  - Glasses

3.CSETIR

Construction Safety Education and Training with Immersive Reality

Identified serious risky scenarios

Training modules

Construction company and ISHCCO

http://csetir.civil.auth.gr/

Co-funded by the Erasmus+ Programme of the European Union

Thank you!

avsoeiro@fe.up.pt