Concawe
Environmental Science for European Refining

Refinery Safety and Virtual Reality

Concawe Symposium 18 March 2019

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Agenda

1. Concawe Safety Management Group and European Downstream Oil Industry Safety Performance
2. Focus on human performance
3. Virtual reality in safety training
4. Development of Virtual Reality Refinery Safety Training Tool
5. Effective learning and implementation

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1 Concawe Safety Management Group and European Downstream Oil Industry Safety Performance

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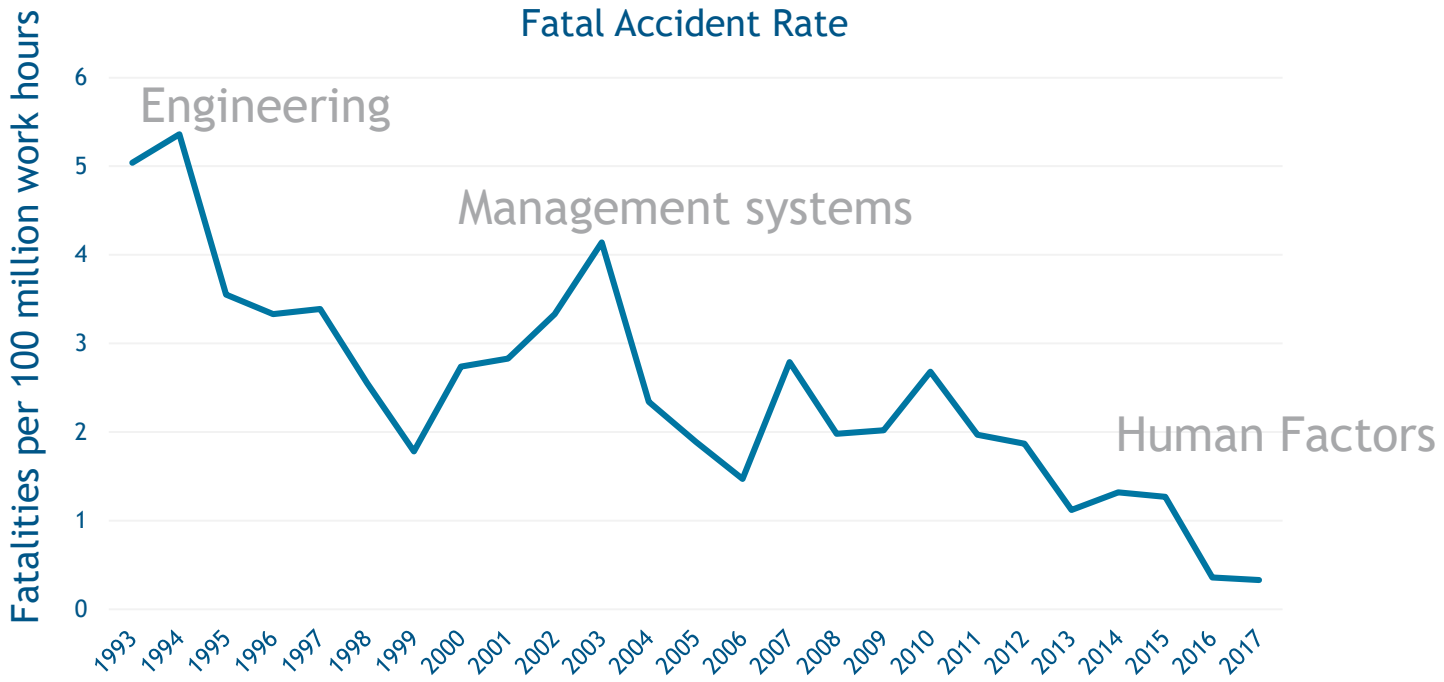
Monitor

Safety Performance improvement



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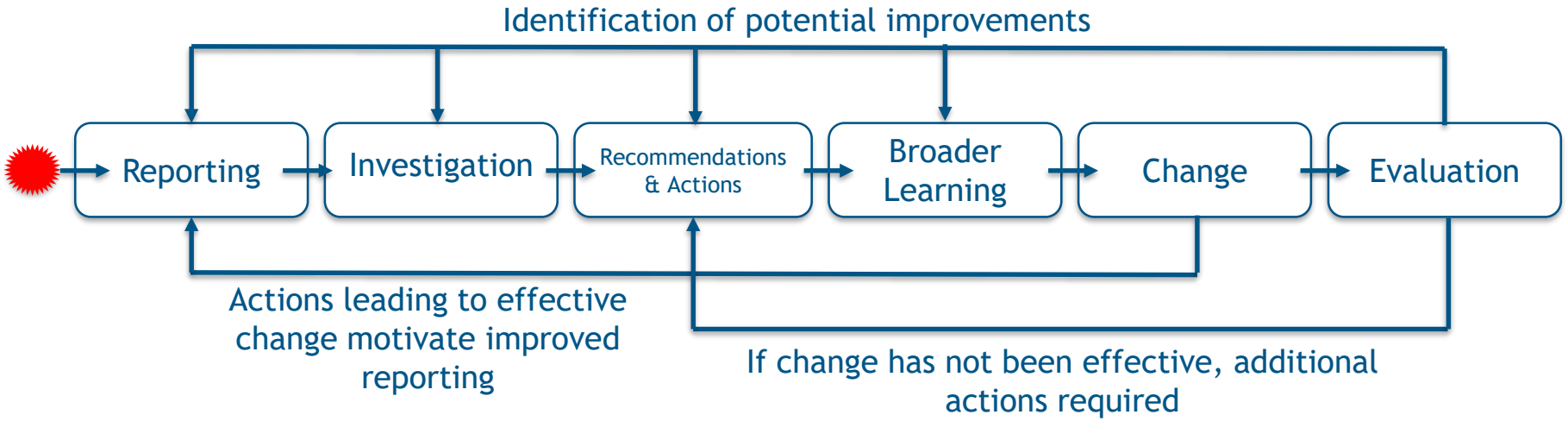
Share and Learn

How do we improve our learning from incidents?



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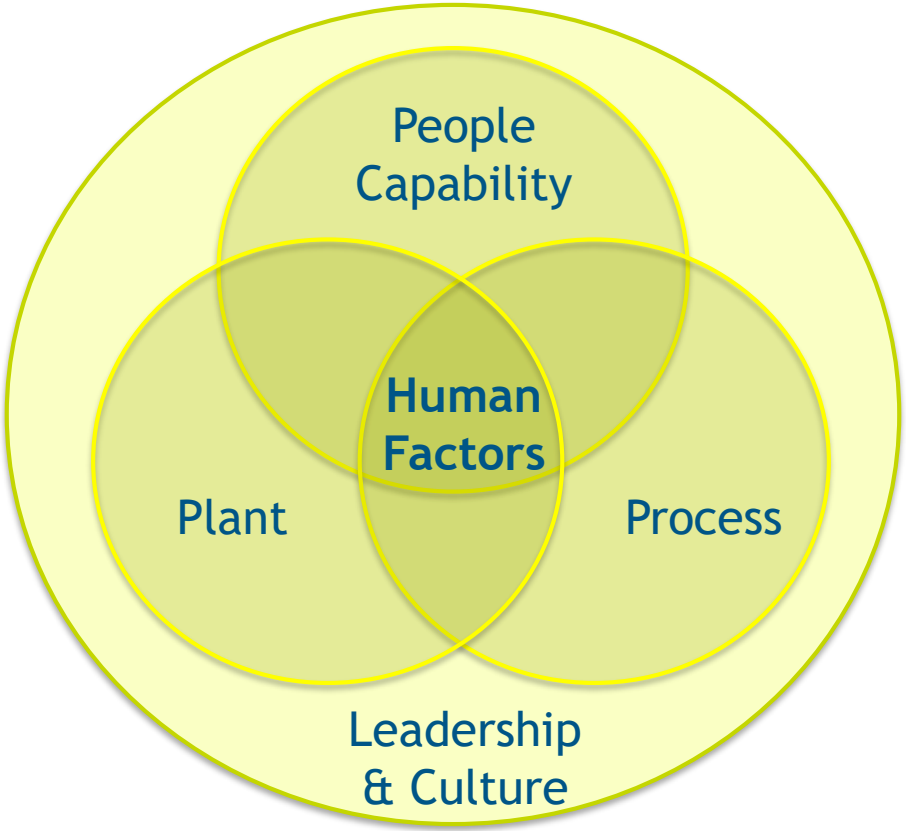
Human Factors



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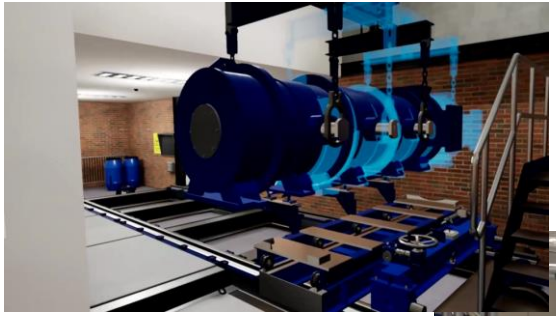
Innovation

Application of emerging technologies to refinery safety training



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2 Focus on human performance

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Human Performance Psychology

BRITISH SHOOTING

RENAULT SPORT FORMULA ONE TEAM

flybe.

ENGLISH INSTITUTE OF SPORT

Ministry of Defence

[dstl]

Neuroscience

Visuomotor Control

Applied Sport Psychology

Cognitive Psychology

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3 Virtual reality in safety training

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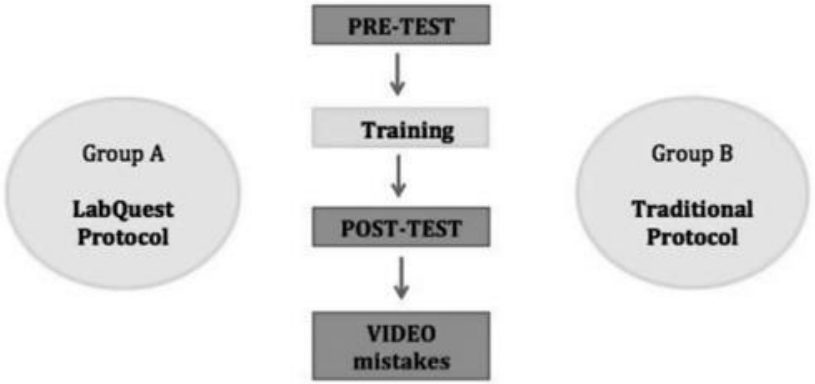
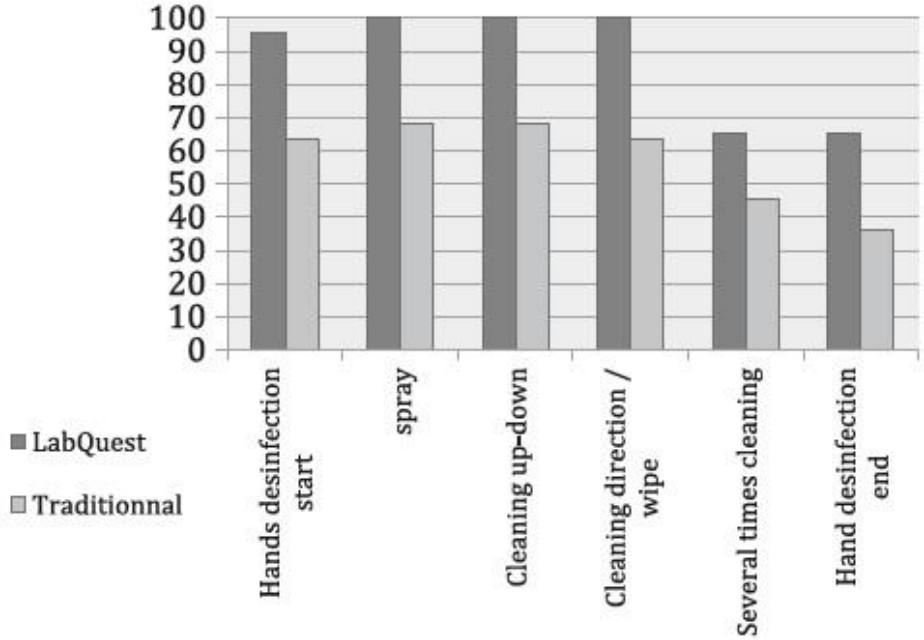
VR training works…





Reference: Denami (2015). Simulation: A Powerful Tool for Training Professional Skills in Cleanrooms DOI 10.1515/pthp-2015-0003

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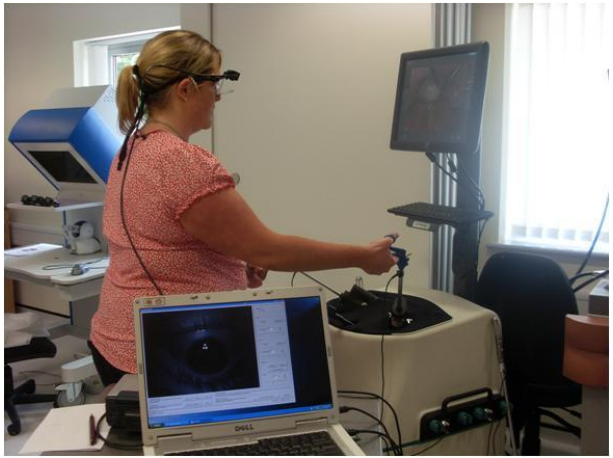
VR training works…

Surg Endosc
DOI 10.1007/s00464-013-3387-4

Assessing visual control during simulated and live operations: gathering evidence for the content validity of simulation using eye movement metrics

Samuel J. Vine · John S. McGrath · Elizabeth Bright · Thomas Dutton · James Clark · Mark R. Wilson



Contents lists available at SciVerse ScienceDirect

International Journal of Surgery

journal homepage: www.theijs.com

Original research

Face validity, construct validity and training benefits of a virtual reality turp simulator

Elizabeth Bright [a,*], Samuel Vine [b], Mark R. Wilson [b], Rich S.W. Masters [c], John S. McGrath [a]

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[b] College of Life and Environmental Sciences, University of Exeter, St Luke's Campus, Heavitree Road, Exeter, Devon EX1 2LU, UK
[c] Institute of Human Performance, University of Hong Kong, Pokfulam, Hong Kong

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4 Development of Virtual Reality Refinery Safety Training Tool

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VR Development Stage 1

Information capture at Total Antwerp

- Interviews with Site Operators
- Recording of eye-tracking data from Site Operators
- Onsite photography, sound and video recordings
- Conversion of existing 3D unit model
- Creation of key 3D assets from photographs

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Eye-Tracking Footage

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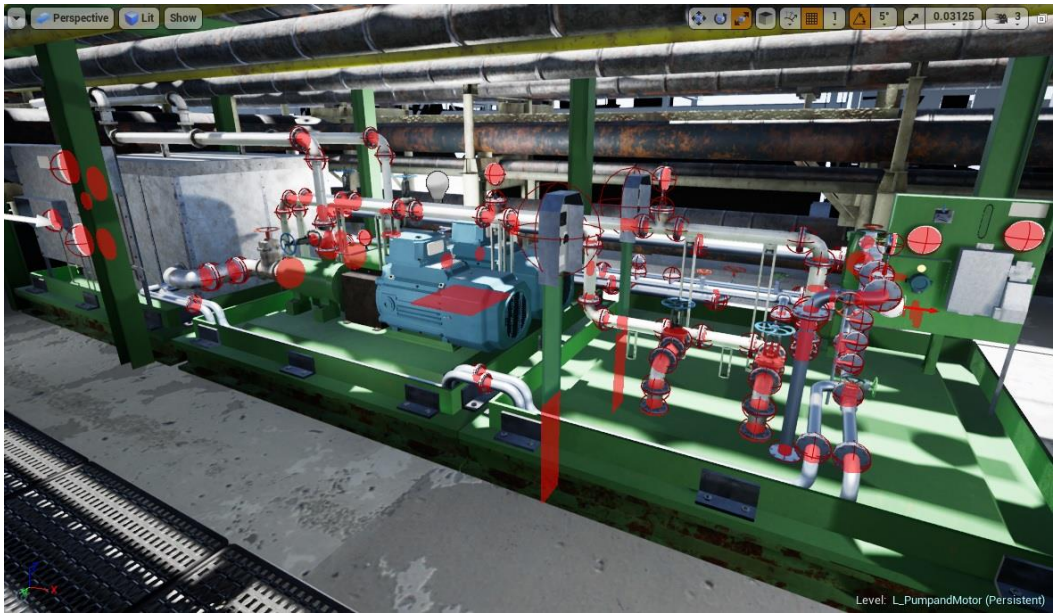
VR Development Stage 2

Identification of Observations and Stimuli Density

- Observation every 2.3 seconds
- 9 Observation types identified
- 12 Error states included in simulation

No	Observation
1	Flange fixed with insufficient bolts (or bolt noticed on ground)
2	Valve leaking (either directly visible or through liquor on ground etc)
3	Grating missing / not fixed (falls from height etc)
4	Minor spill
5	Instrument readings (such as level readings on drums/pressure vessels or illuminated status indicators
6	Lubricating oil condition (through sight glass)
7	Unfixed objects at height / housekeeping
8	Condition of plant (excessive corrosion – through dissimilar metals etc)
9	Procedural adherence - sampling activity



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VR Training Tool Footage

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5 Effective learning and implementation

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Proof-of-concept data

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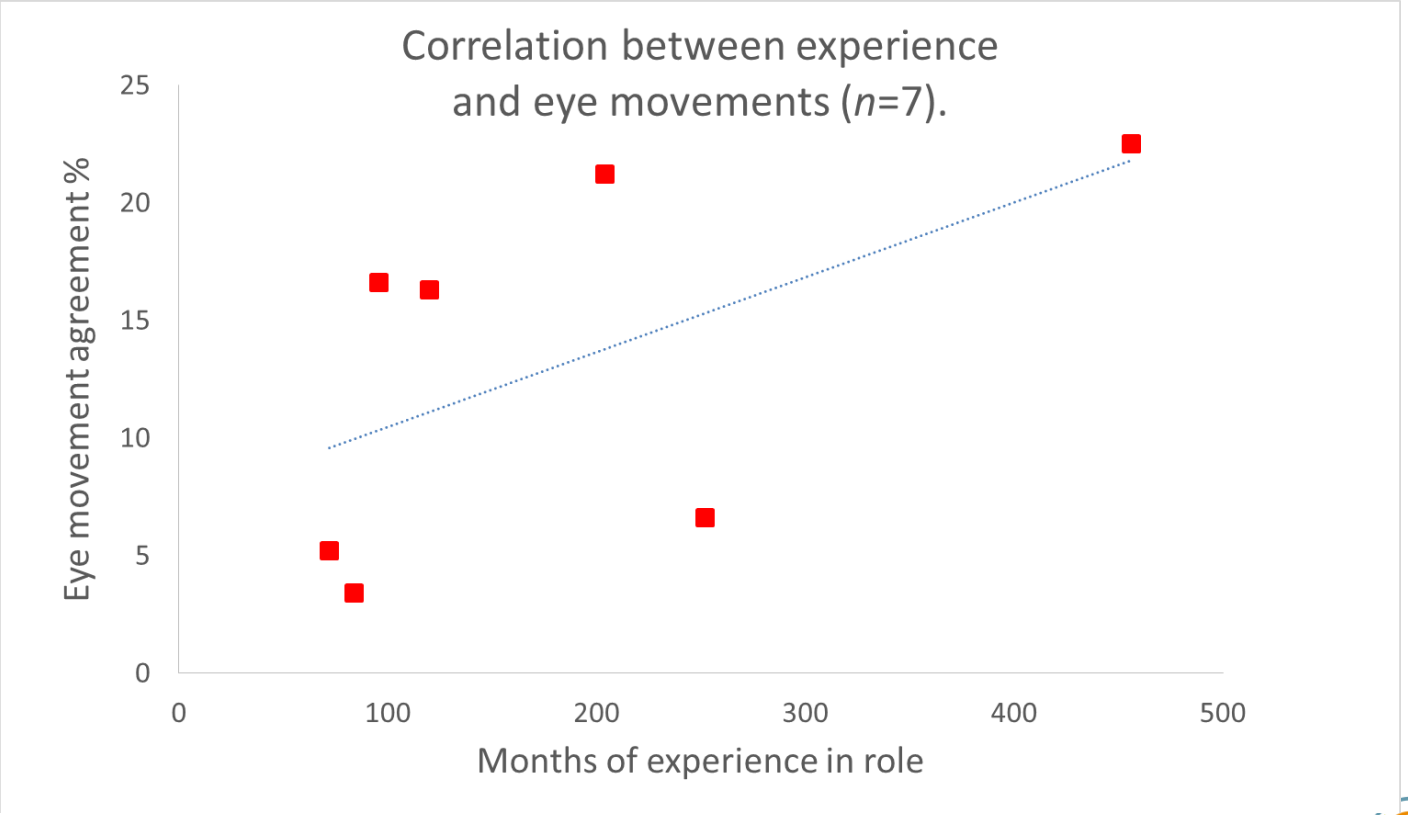
Proof-of-concept data (Eye Tracking)



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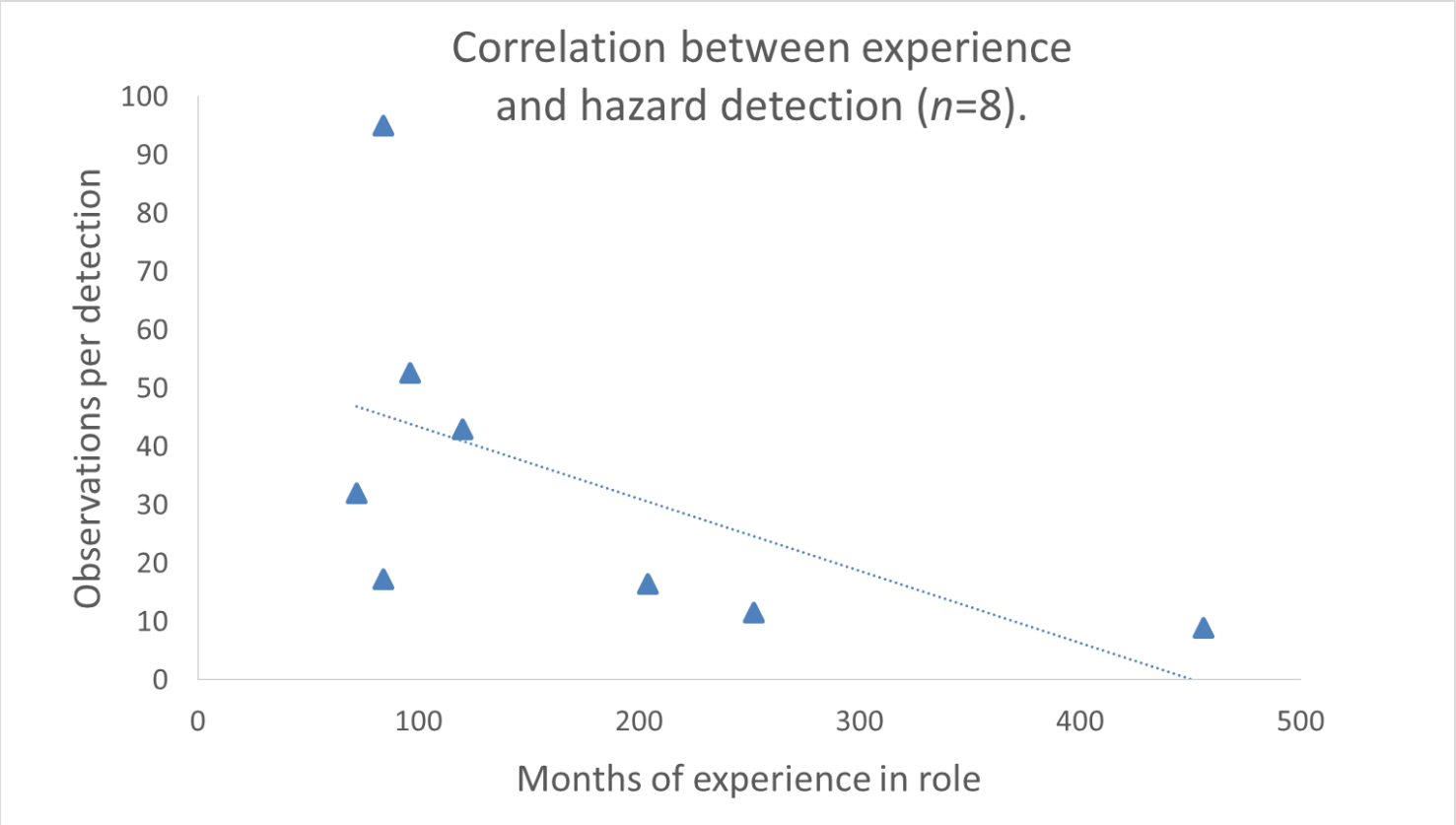
Proof-of-concept data (Pump Area)



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Proof-of-concept data (Compressor Area)

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What next?

Integrate with existing training

- Who, where, when & WHY?

General safety training tool - as per the demonstration today

Bespoke safety training tool

- Problematic tasks; new tasks/plant/processes
- Re-visit previous incidents

Out-reach and education

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Thank You

Concawe acknowledges staff at the Total refinery Antwerp for their close collaboration and dedication in the recording and validation of the virtual refinery safety tool.

All welcome to try out the new tool over the course of the Symposium.

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Thank you for your attention

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