Geometric Interpretation of Risk and Prevention, with the BIM Implementation of the "Level of Preventive Action" Risk Assessment Method

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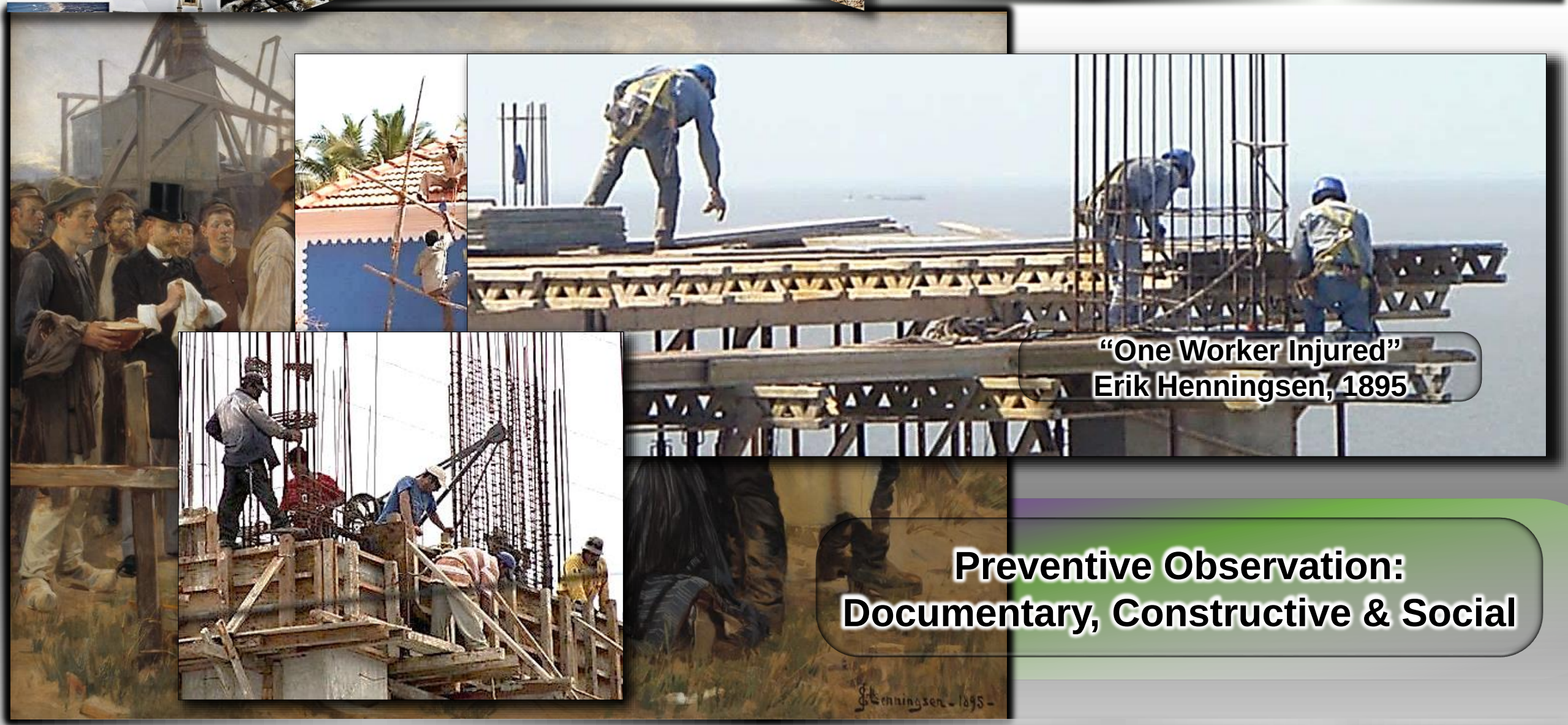
Focus on Humans in a TECHNOLOGICAL World

"One Worker Injured"
Erik Henningsen, 1895



Preventive Observation: Documentary, Constructive & Social

1.- Parameters of Observation

Risk Definition
Level of Preventive Action
Parameterisation of the method

2.- Methodology

Case Study

3.- Results

Risk Geometric Interpretation

Conclusions

Risk Definition

Probability

Consequences

Exposure Degree

$$R = P \cdot C \cdot \frac{E}{Cd}$$

Correction Degree (William T. Fine - 1975)

Risk Definition

Probability

Consequences

Exposure Degree

$$L_{pac} = P \cdot C \cdot \left(\frac{R_r \cdot B_r \cdot E}{E_c \cdot P_i \cdot L_s} \right)$$

Level of Preventive Action

Correction Degree

Probability

Consequences

Relative Risk

Border Risk

$$L_{pac} = P \cdot C \cdot \left(\frac{R_r \cdot B_r \cdot E}{E_c \cdot P_i \cdot L_s} \right)$$

Exposure

Economic Capacity

Participatory Interest

Level of Satisfaction

Level of Preventive Action

Environments

Initial

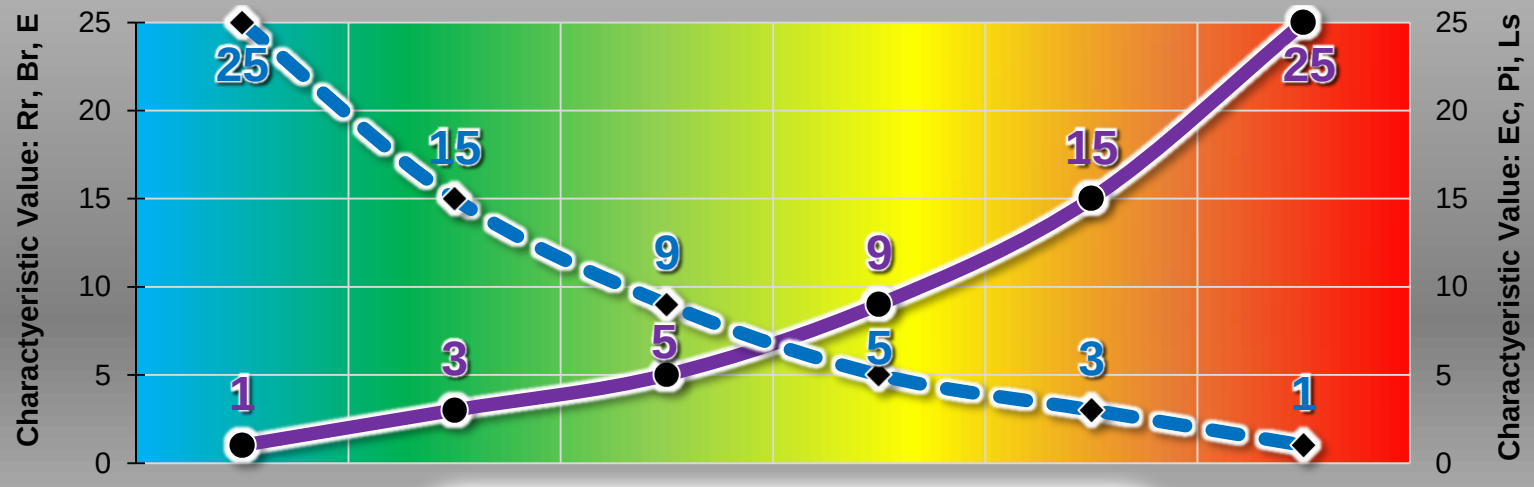
Documentary

Constructive

Social

- Probability
- Consequences
- Relative Risk
- Border Risk
- Exposure
- Economic Capacity
- Participatory Interest
- Level of Satisfaction

$$L_{pac} = P \cdot C \cdot \left(\frac{R_r \cdot B_r \cdot E}{E_c \cdot P_i \cdot L_s} \right)$$



Characteristic Value

BIM Parameterisation of the Lpac parameters

Probability

Consequences

Occupational Health and Safety Plan
Evaluation is Transferred Manually

Relative Risk

Border Risk

Previously Incorporated in BIM
Technical Criteria

Exposure

Economic Capacity

Participatory Interest

Level of Satisfaction

Body Sensor for Geolocation

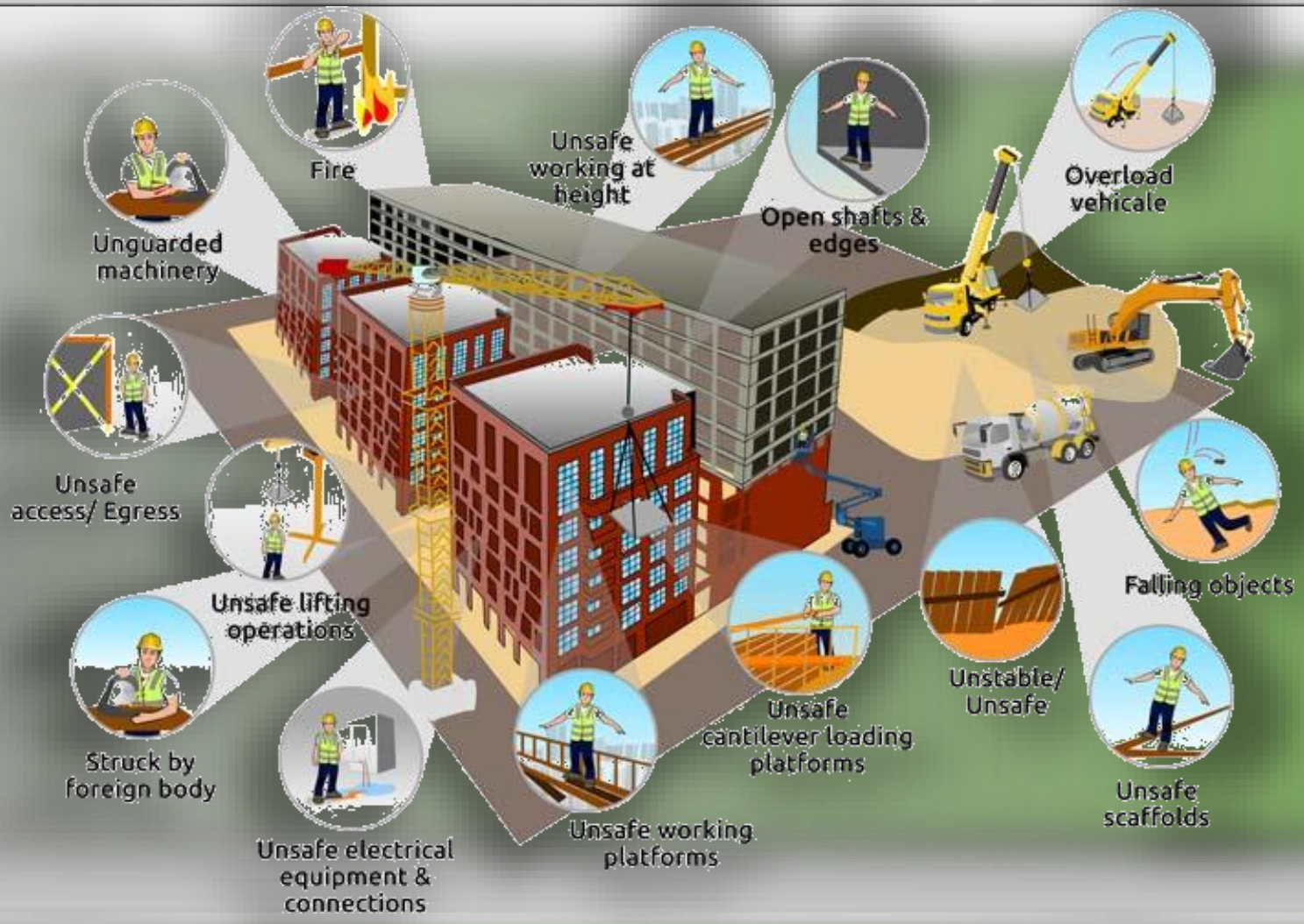
Worker Communicator & Tool Device

Audio - Microphone Devices

Body Sensors (Intelligent Clothing)

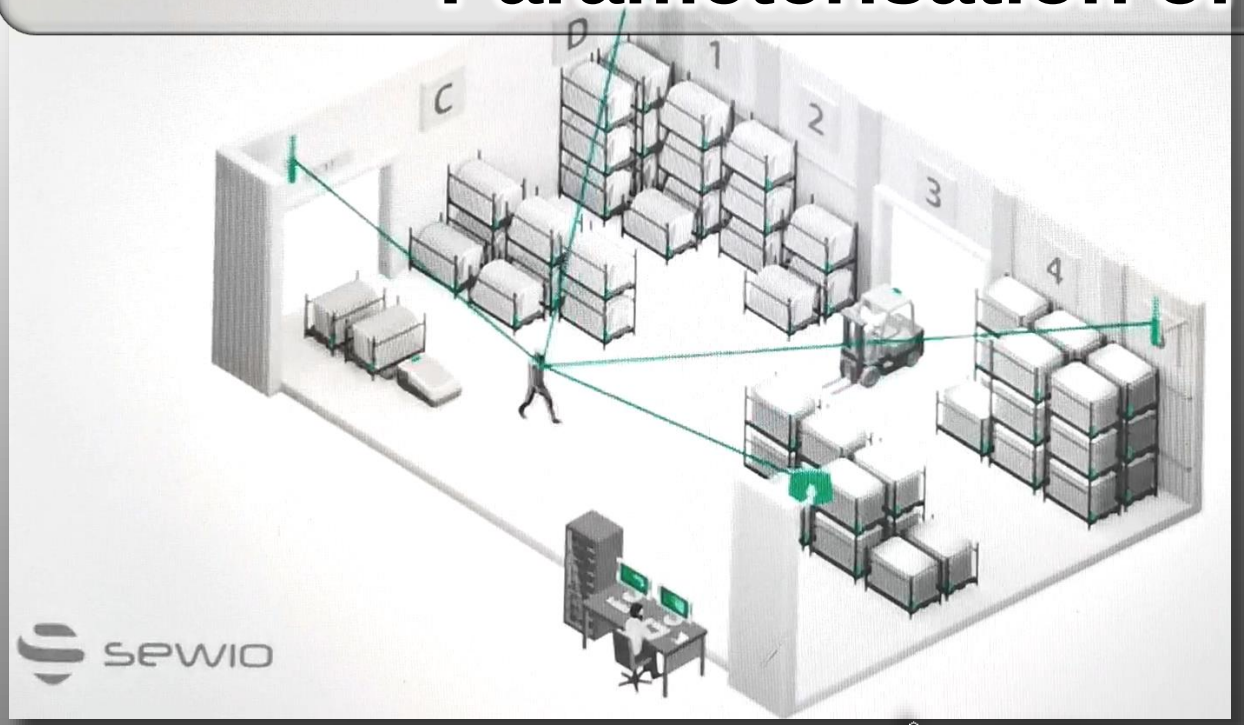
Linguistic Variables of Communication (Machine-Man)

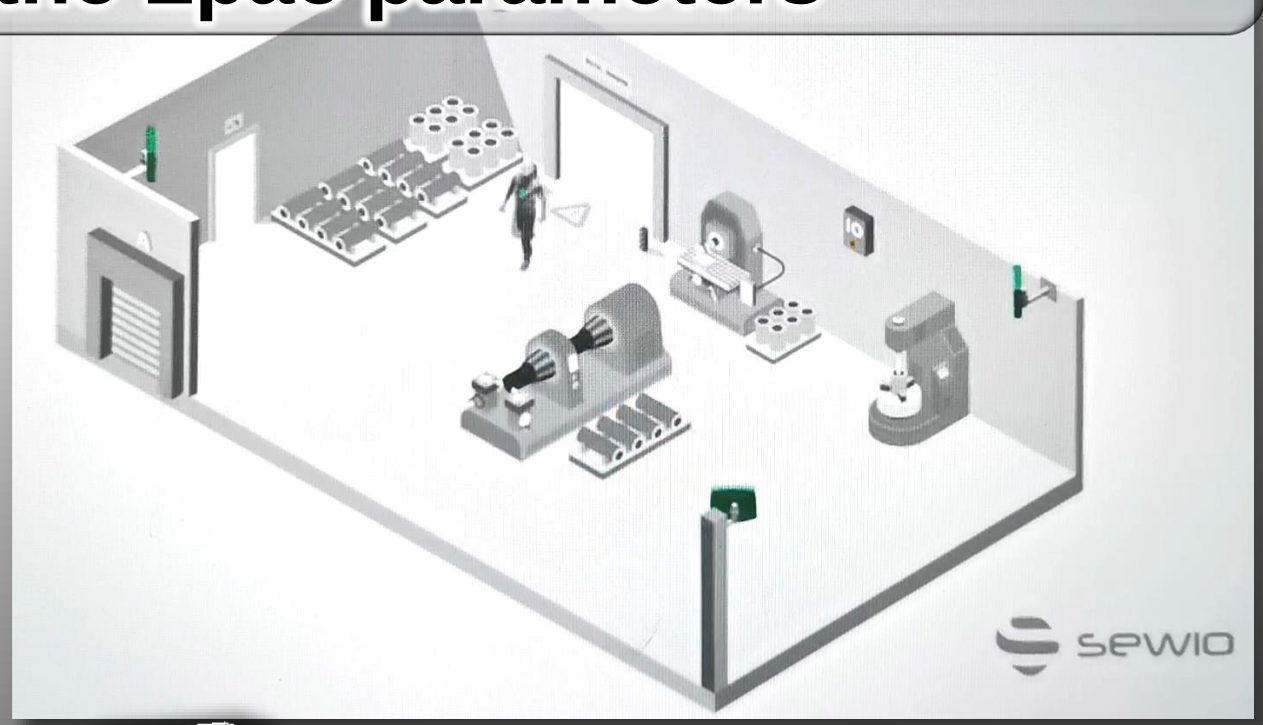
Parameterisation of the Lpac parameters



Tool
Devices
RTLS

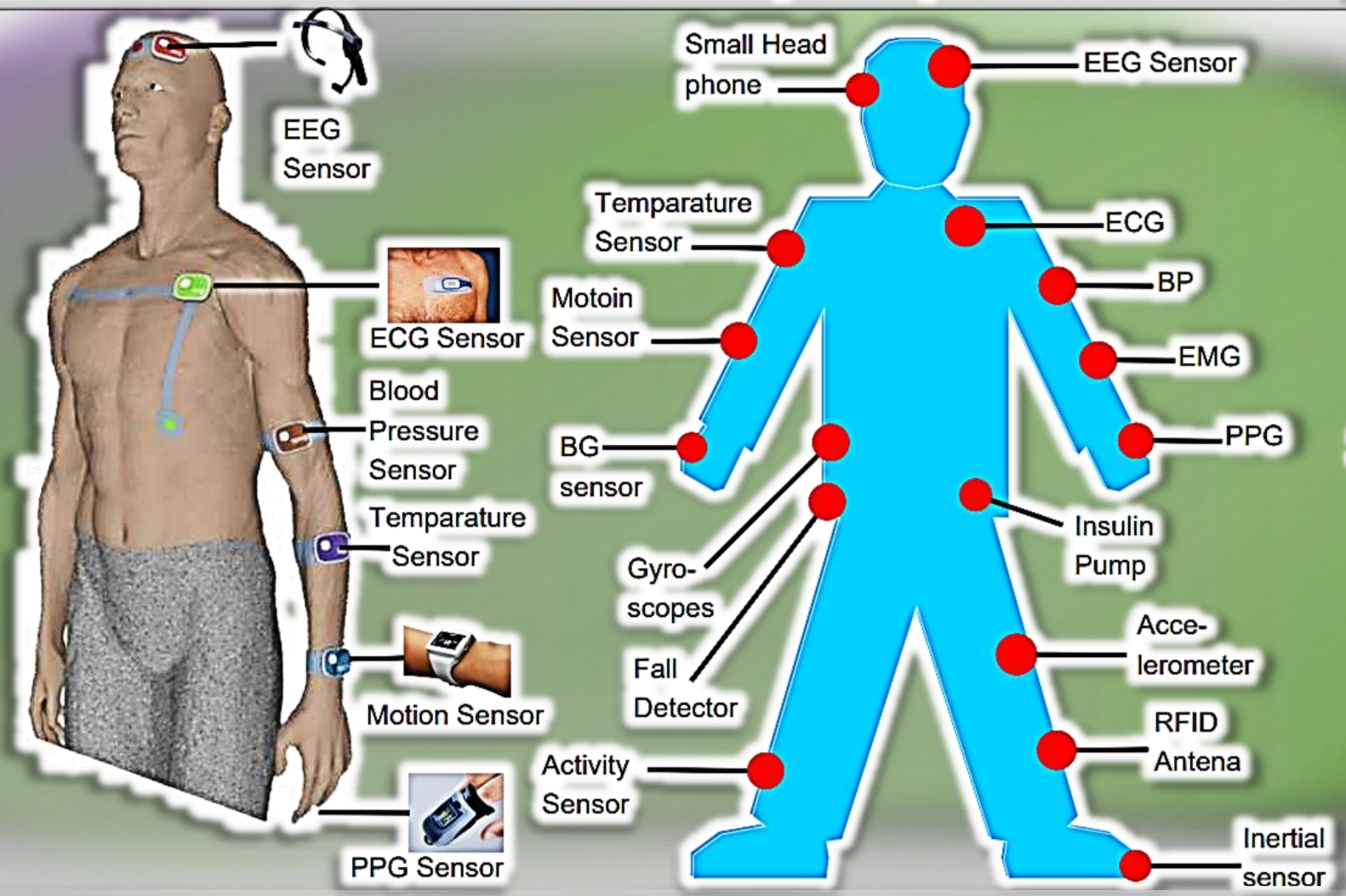
Parameterisation of the Lpac parameters



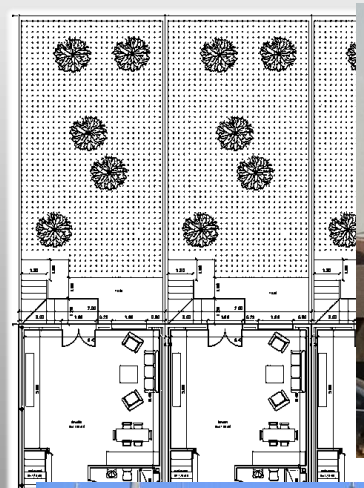


Sensor Geolocation
RTLS

Parameterisation of the Lpac parameters



Case Study – Graphical & Working Information



Brick Wall on the First Floor

Characteristic Value

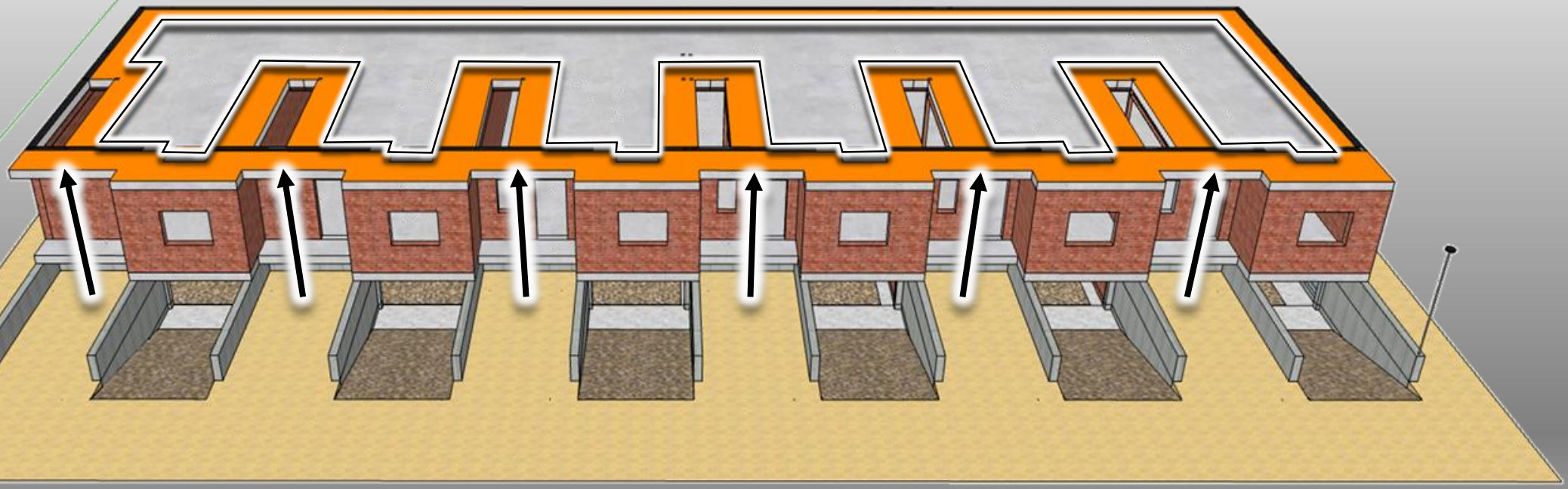
Relative Risk – Geometrical & Physical Conditions

Rr	9
Br	
E	
Ec	
Pi	
Ls	

Characteristic Value

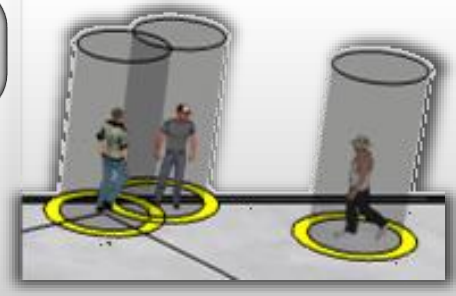
Border Risk – the Height & the Distance

Rr	
Br	15
E	
Ec	
Pi	
Ls	



Characteristic Value

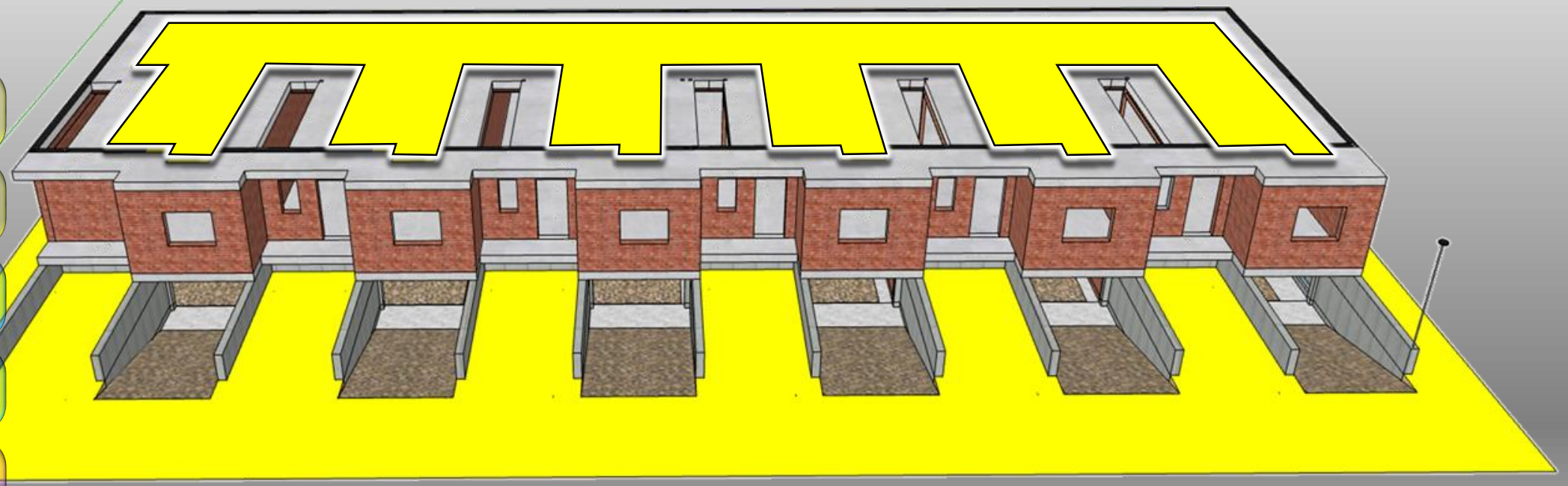
Exposure Degree - frequency to the hazard



Rr	
Br	
E	9
Ec	
Pi	
Ls	

Characteristic Value

Economic Capacity - Organisation and Disposition



Rr

Br

E

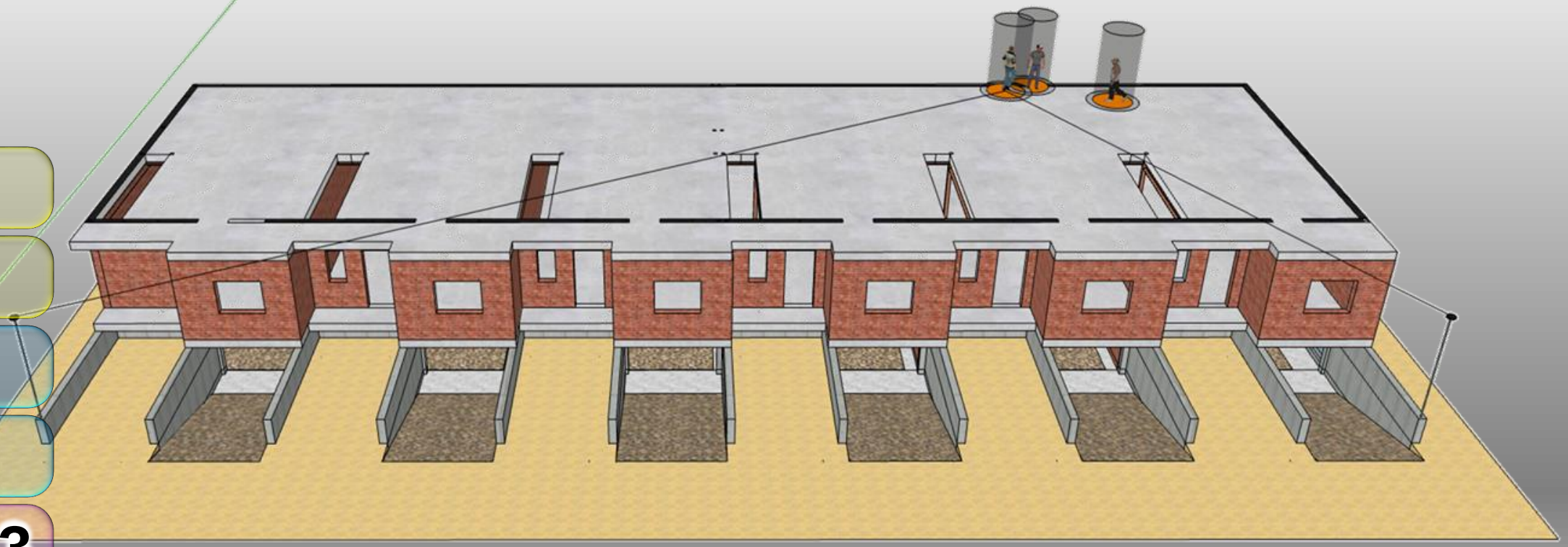
Ec 5

Pi

Ls

Characteristic Value

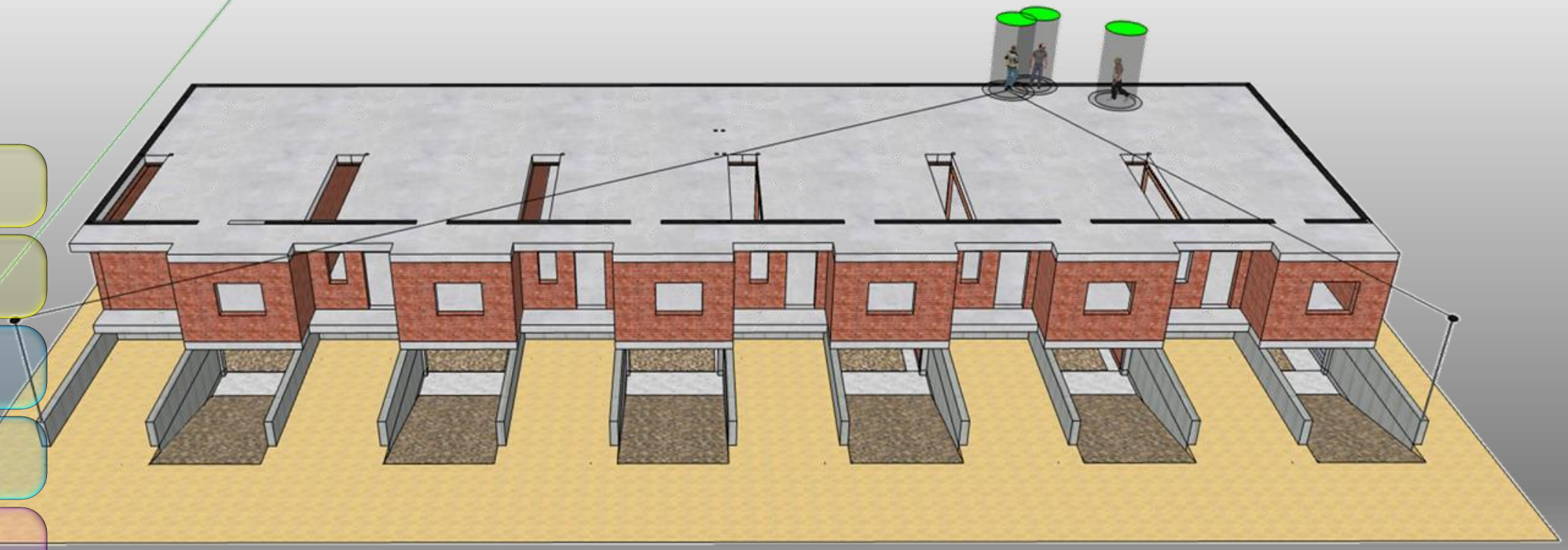
Participatory Interest – Prevention Information & Training



Rr	
Br	
E	
Ec	
Pi	3
Ls	

Characteristic Value

Level of Satisfaction - State of Mind and the Safety Perception



Rr	
Br	
E	
Ec	
Pi	
Ls	9

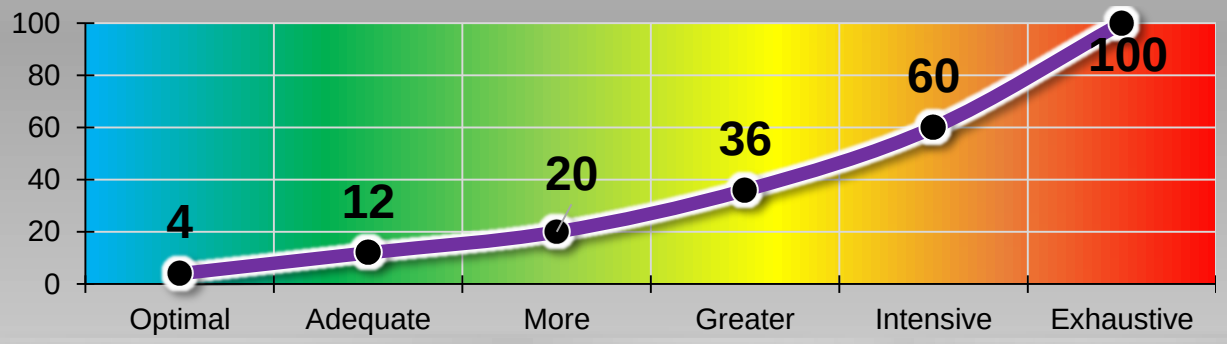
Characteristic Value

Characteristic Values

Rr	9
Br	15
E	9
Ec	5
Pi	3
Ls	9

Characteristic Value (*Cv*)					
Rr	*Br*	*E*	*Ec*	*Pi*	*Ls*
9	15	9	5	3	9

Assessed Disciplines	Assessed Risks	Initial Risk	Incidence on Risk						*Apac*	*Lpac (%) Risks*	*Lpac (%) Disciplines*	*Lpac (%) Total*
Occupational Safety	Different Level	25	9	18	7	3	2	7	27.00	675.00	414.80	177.29
	Same Level	15	9	12	9	3	2	7	23.14	347.14		
	Handling Loads	25	9	12	9	3	2	7	23.14	578.57		
	Entrapment	5	7	13	9	5	2	7	11.70	58.50		
Industrial Hygiene	Thermal	5	11	15	11	4	2	8	28.36	141.80	138.96	
	Lighting	5	11	18	11	5	2	8	27.23	136.13		
Ergonomic	Displacement	15	9	12	11	5	2	9	13.20	198.00	126.00	
	Loads	5	9	12	9	5	2	9	10.80	54.00		
Psychosocial	Relationships	5	9	12	9	7	3	9	5.14	25.71	29.39	
	Organization	5	9	12	9	7	3	7	6.61	33.06		



Lpac of Risks – Preventive Action Controls

Risks	
Different Level	Exhaustive
Same Level	Exhaustive
Handling Loads	Exhaustive
Entrapment	Intensive
Thermal	Exhaustive
Lighting	Exhaustive
Displacement	Exhaustive
Loads	Intensive
Relationships	More
Organization	More

Lpac of Disciplines – Preventive Action Controls

Risks	
Different Level	Exhaustive
Same Level	Exhaustive
Handling Loads	Exhaustive
Entrapment	Intensive
Thermal	Exhaustive
Lighting	Exhaustive
Displacement	Exhaustive
Loads	Intensive
Relationships	More
Organization	More

Disciplines	
Occupational Safety	Exhaustive
Industrial Hygiene	Exhaustive
Ergonomic	Exhaustive
Psychosocial	More

Total of Lpac– Preventive Action Controls

Risks	
Different Level	Exhaustive
Same Level	Exhaustive
Handling Loads	Exhaustive
Entrapment	Intensive
Thermal	Exhaustive
Lighting	Exhaustive
Displacement	Exhaustive
Loads	Intensive
Relationships	More
Organization	More

Disciplines	
Occupational Safety	Exhaustive
Industrial Hygiene	Exhaustive
Ergonomic	Exhaustive
Psychosocial	More

Total of Lpac	
Level of Preventive Action	Exhaustive

Conclusions

Lpac - risk can be interpreted geometrically

Results – linguistic, quantitative, visual, and dynamic

Body Sensors - receiving communication in real-time

Monitoring - technology and human behaviour are unified

Lpac - the risk situation improves to optimal prevention conditions

Lpac - Linguistic Variables of Communication (Machine-Man)

THANK YOU

Hernán J. Aldana Marcos (Neuroscientist)

"Neuroscience will become a good communication tool"