Human Behaviour and Reliability at Work

Herefordshire Health and Safety Group
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Objectives:

- Understanding psychological and sociological factors which may give rise to specific patterns of safe and unsafe behaviour in the working environment
- Understanding the perception of risk and its role in the workplace
- Understanding the classification of human failure
- Understanding methods of improving individual human reliability in the workplace
- Understanding how organisational factors could contribute to improving human reliability
- Understanding how job factors could contribute to improving human reliability
- Outline the principles of behavioural change programmes designed to improve safe behaviour in the workplace

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Human psychology, sociology and behaviour

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MEANING OF THE TERMS: PSYCHOLOGY AND SOCIOLOGY

Definition:
Psychology is the scientific study of human mind and behaviour: how we think, feel, act and interact individually and in groups.

Psychology is concerned with all aspects of behaviour and with the thoughts, feelings and motivations underlying that behaviour.
British Psychological Society

The study of psychology includes:
perception, cognition, attention, emotion, intelligence, phenomenology, motivation, brain functioning, memory, information processing, personality, behaviourism, social psychology, etc.

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MEANING OF THE TERMS: PSYCHOLOGY AND SOCIOLOGY

Sociology is the study of how society is organised and how we experience life.
British Sociological Association.

The study of sociology includes how the following relate to social interactions:
Conflict Criminology Culture Development Deviance Demography Education Economic Environmental Family Gender Health Industrial Inequality Knowledge Law Literature Medical Military Organizational Political Race and ethnicity Religion Rural Science Social change Social movements Social psychology Stratification Technology Urban

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THE INFLUENCE ON HUMAN BEHAVIOUR OF PERSONALITY, ATTITUDE, APTITUDE AND MOTIVATION

Personality

Imaginative	Abstractedness	Practical
Worried	Apprehension	Confident
Forceful	Dominance	Submissive
Calm	Emotional stability	Highly strung
Spontaneous	Liveliness	Restrained
Flexible	Openness to change	ttached to familiar
Controlled	Perfectionism	Undisciplined
Discreet	Privacy	Open
Abstract	Reasoning	Concrete
Conforming	Rule consciousness	Non-conforming
Self-sufficient	Self-reliance	Dependent

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Attitude

AFFECTIVE	BEHAVIOURAL/ CONATIVE	COGNITIVE
"I am scared of spiders"	"I will avoid spiders and scream if I see one"	"I believe spiders are dangerous"
EMOTION	**INSTINCT**	**INTELLIGENCE**

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THE INFLUENCE ON HUMAN BEHAVIOUR OF PERSONALITY, ATTITUDE, APTITUDE AND MOTIVATION

Aptitude

An aptitude is a component of a competency to do a certain kind of work at a certain level, which can also be considered "talent". Aptitudes may be physical or mental. Aptitude is not developed knowledge, understanding, learned or acquired abilities (skills) or attitude. The innate nature of aptitude is in contrast to achievement, which represents knowledge or ability that is gained through learning

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THE INFLUENCE ON HUMAN BEHAVIOUR OF PERSONALITY, ATTITUDE, APTITUDE AND MOTIVATION

Motivation

Motivation is defined as the process that initiates, guides, and maintains goal-oriented behaviours. Motivation is what causes us to act, whether it is getting a glass of water to reduce thirst or reading a book to gain knowledge.

It involves the biological, emotional, social, and cognitive forces that activate behaviour.

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KEY THEORIES OF HUMAN MOTIVATION

Elton Mayo – Human Relations

Mayo concluded that workers are best motivated by:

- Better communication between managers and workers
- Greater manager involvement in employees working lives
- Working in groups or teams

Key motivator – Social needs
Financial rewards – low importance

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KEY THEORIES OF HUMAN MOTIVATION

Victor Vroom – Expectancy Theory

Expectancy

- Proper skills and knowledge
- Facilitating environment
- Provide encouragement

MOTIVATION

=

EXPECTANCY

x

INSTRUMENTALITY

x

VALENCY (VALUE)

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KEY THEORIES OF HUMAN MOTIVATION

Victor Vroom – Expectancy Theory

Instrumentality

- Reward performance
- Prior information about rewards
- Eliminate non-performance

MOTIVATION

=

EXPECTANCY

x

INSTRUMENTALITY

x

VALENCY (VALUE)

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KEY THEORIES OF HUMAN MOTIVATION

Victor Vroom – Expectancy Theory

Valence

- Desirable rewards
- Fairness of rewards
- Employees' choice

MOTIVATION

=

EXPECTANCY

x

INSTRUMENTALITY

x

VALENCE (VALUE)

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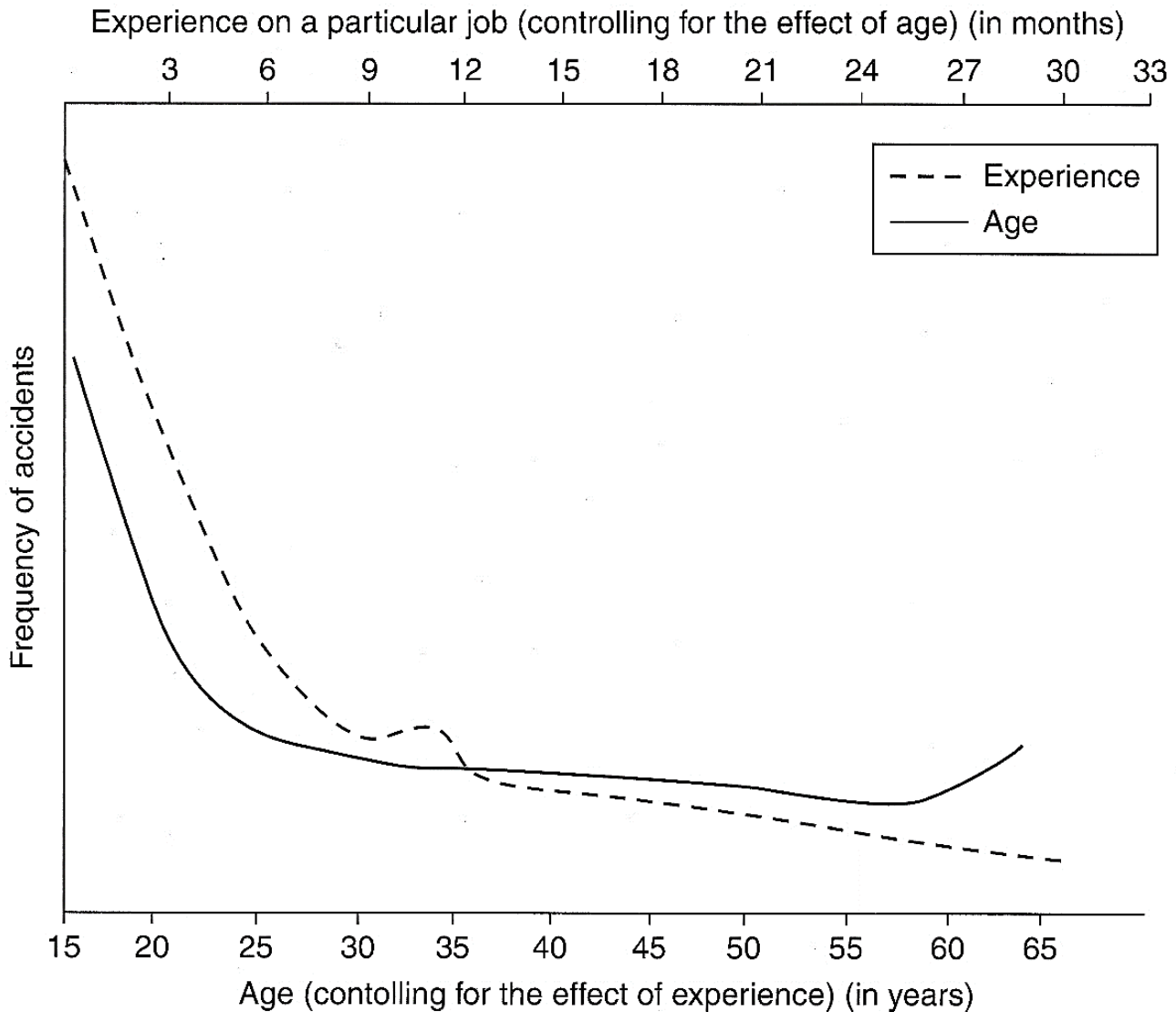
EFFECTS ON BEHAVIOUR AT WORK

Experience



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EFFECTS ON BEHAVIOUR AT WORK

Social and cultural background

Class
Ethnicity
Country of origin
Family influences
Primary and secondary socialisation
Hobbies and interests

Education

Training

Knowledge

Skills

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Perception of risk

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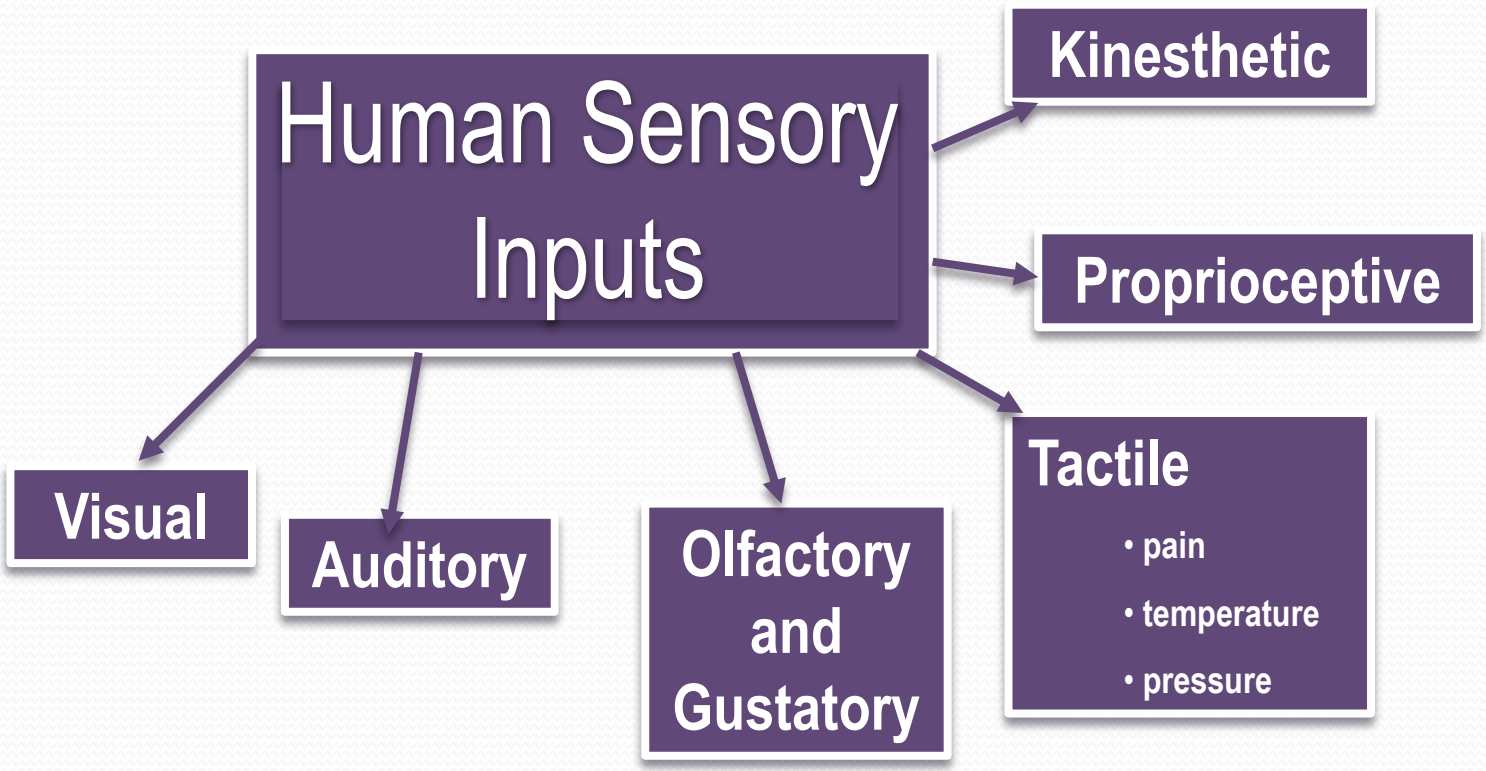
HUMAN SENSORY RECEPTORS



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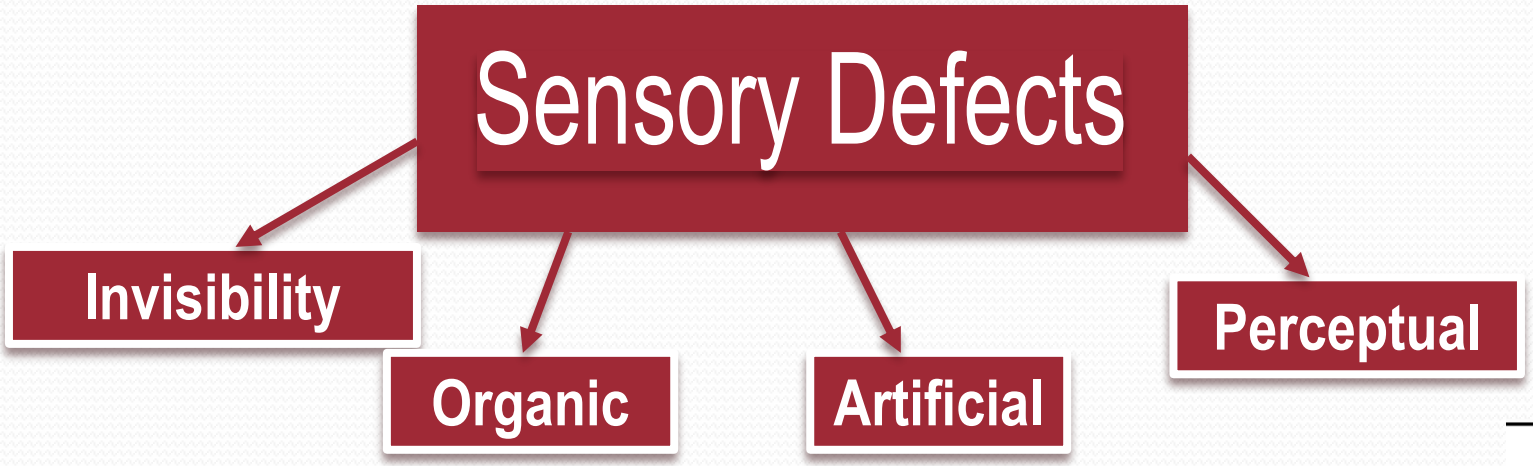
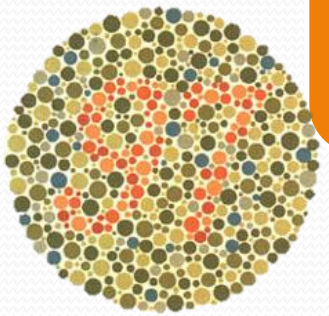
HUMAN SENSORY RECEPTORS



Sensory screening techniques



- Snellen's test
- Ichihara's test
- Baseline audiometry

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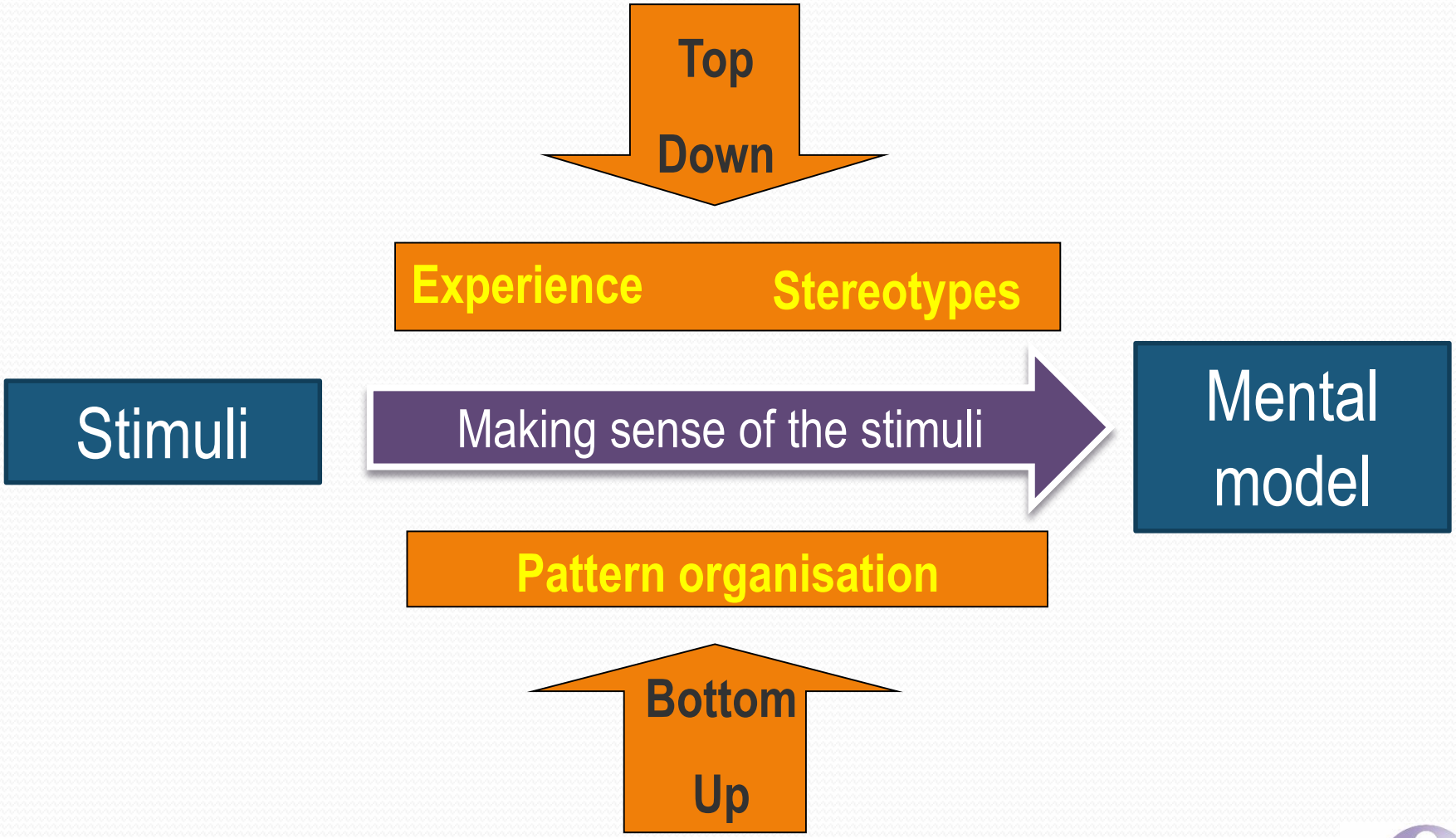
PERCEPTUAL PROCESS



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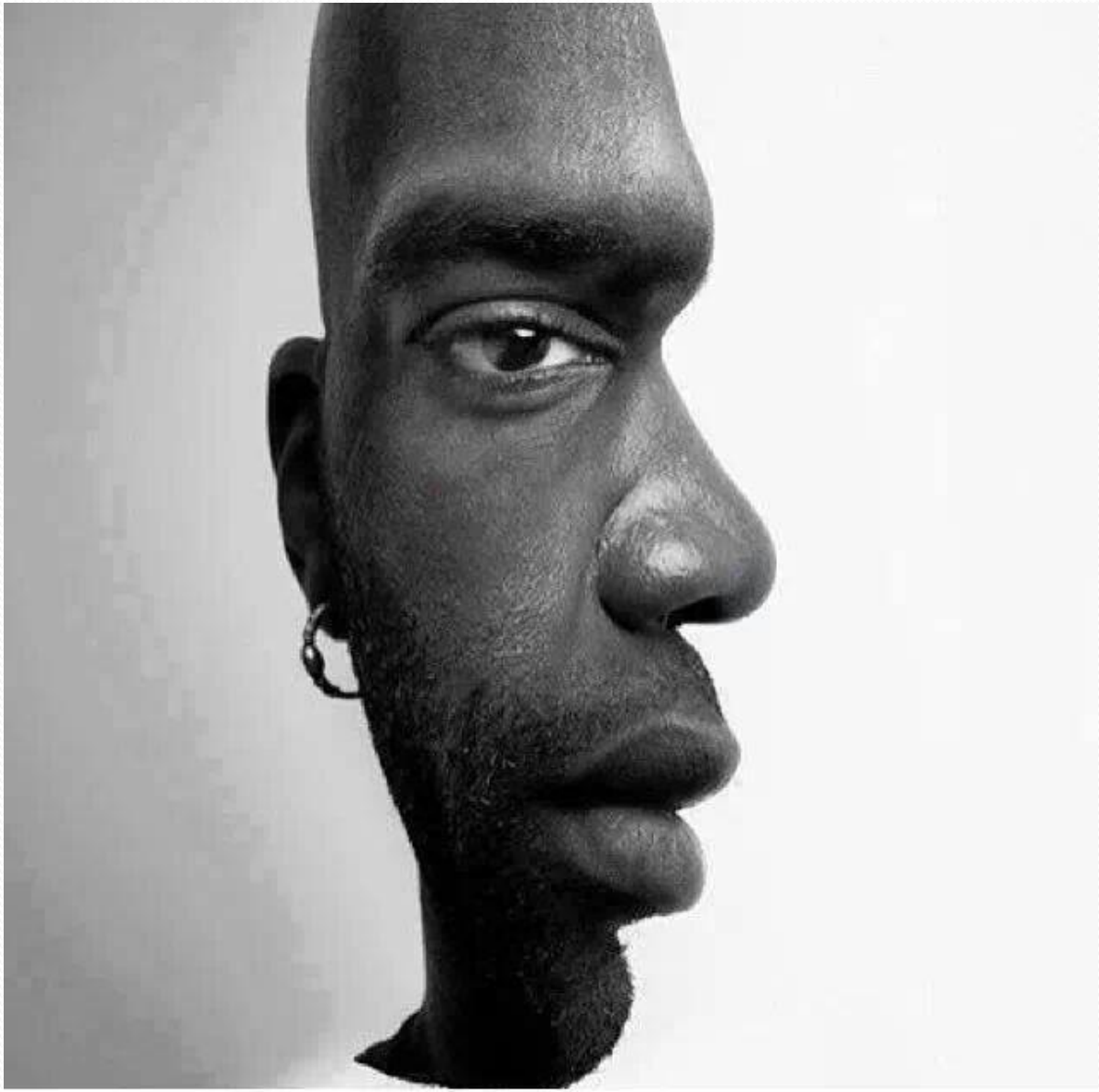
PERCEPTUAL PROCESS



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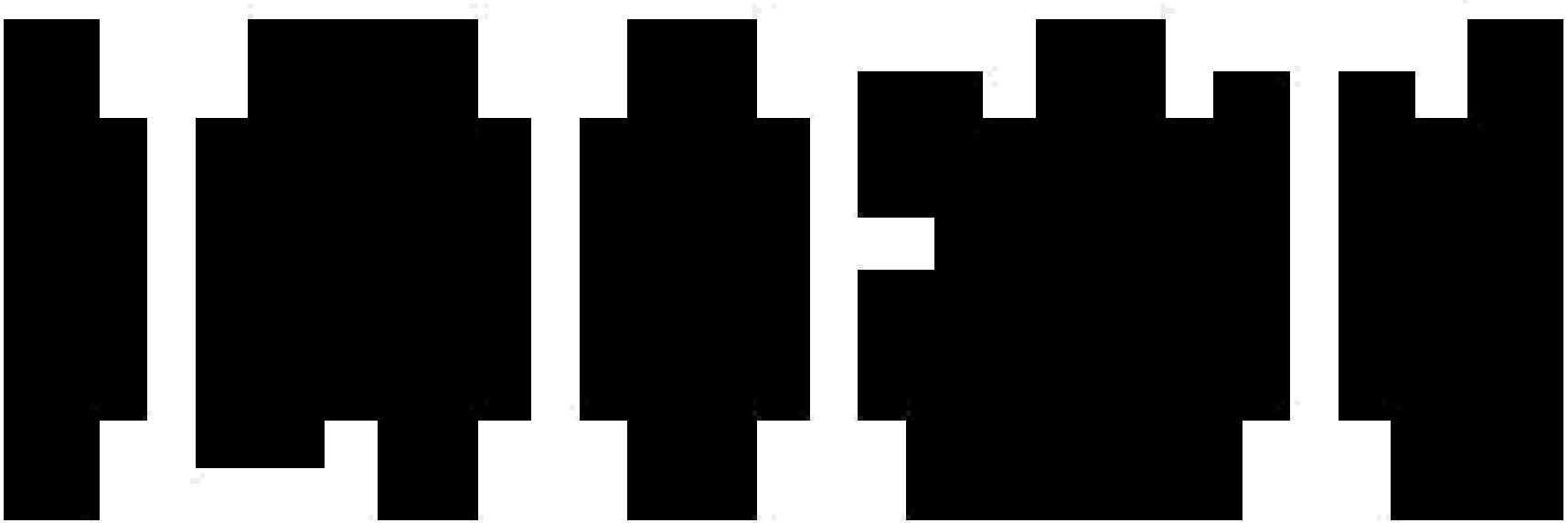

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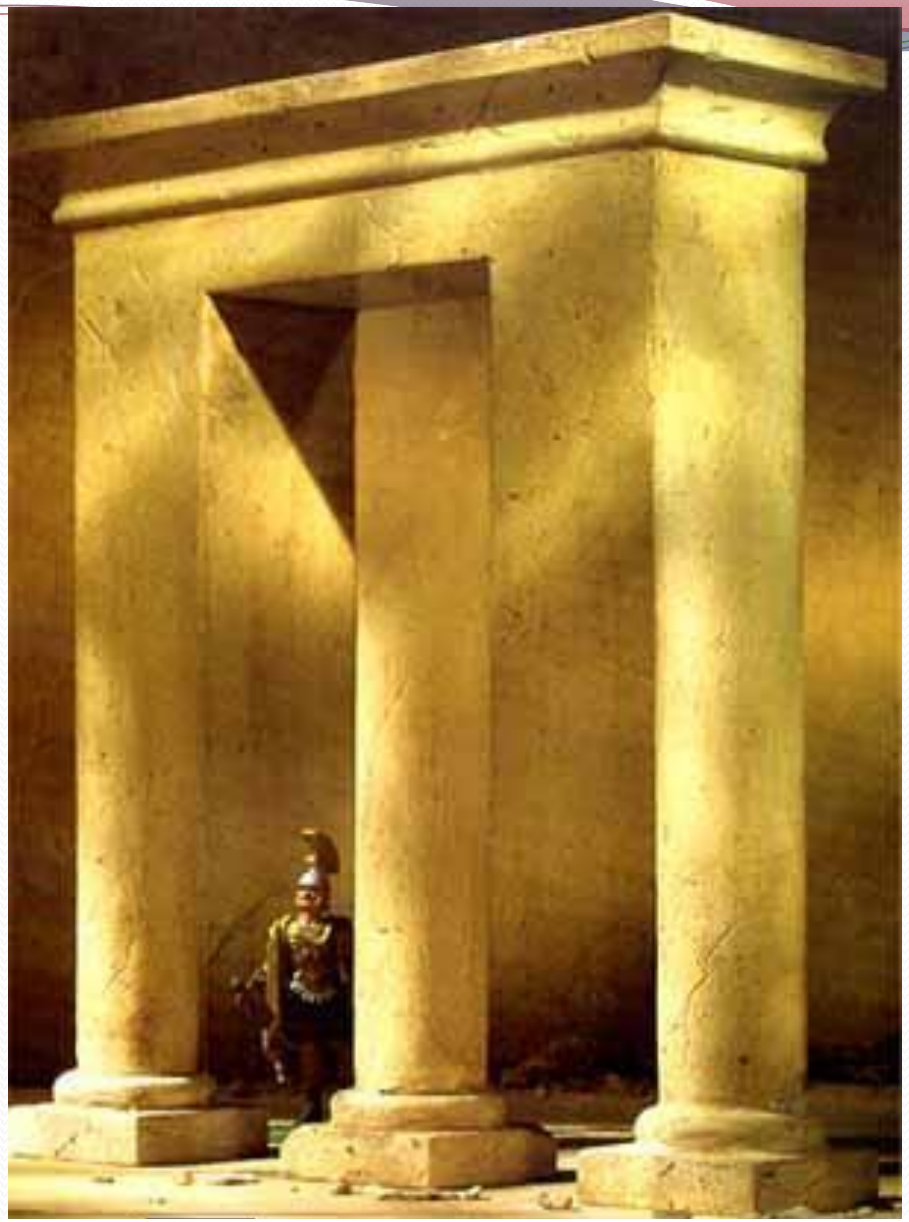

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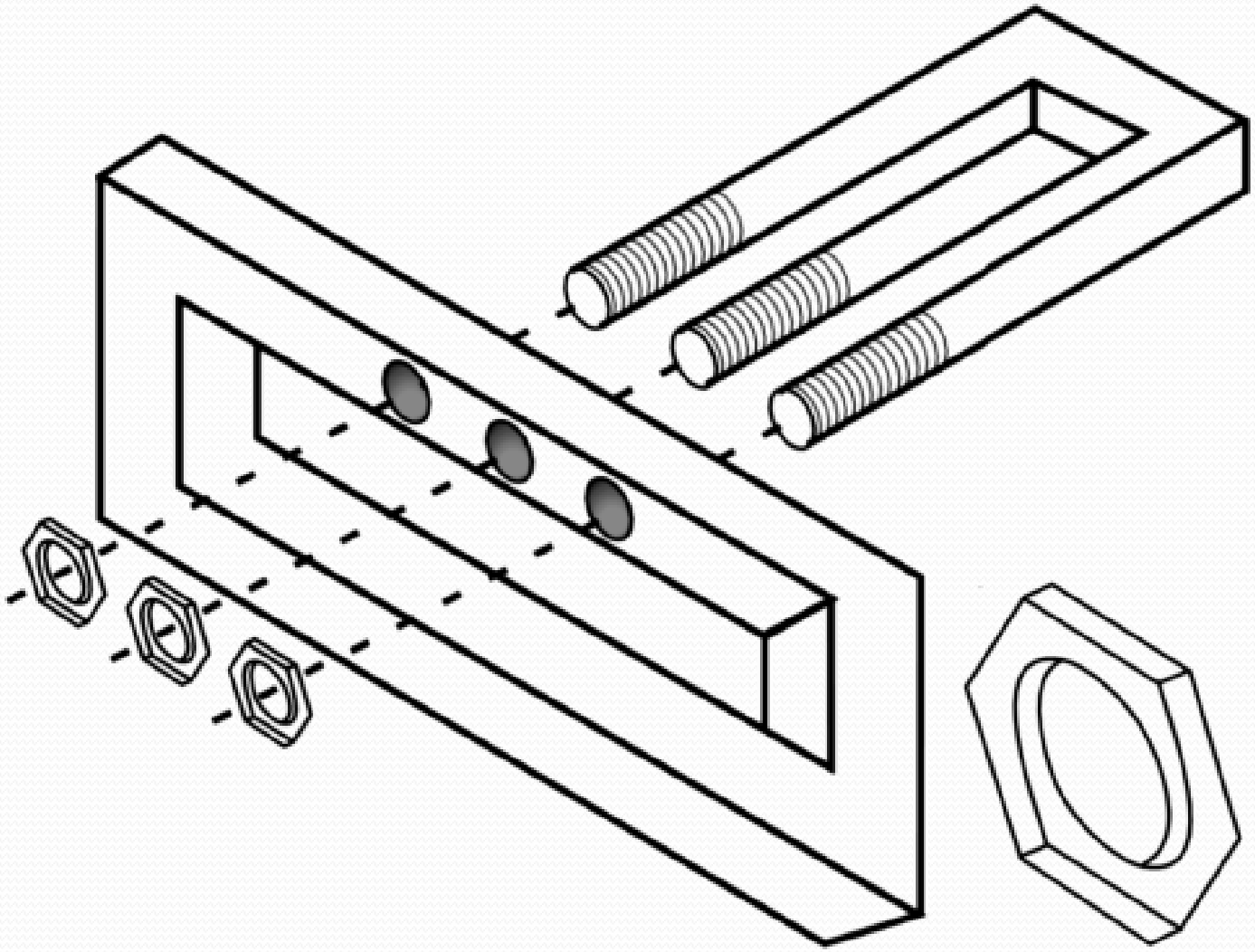

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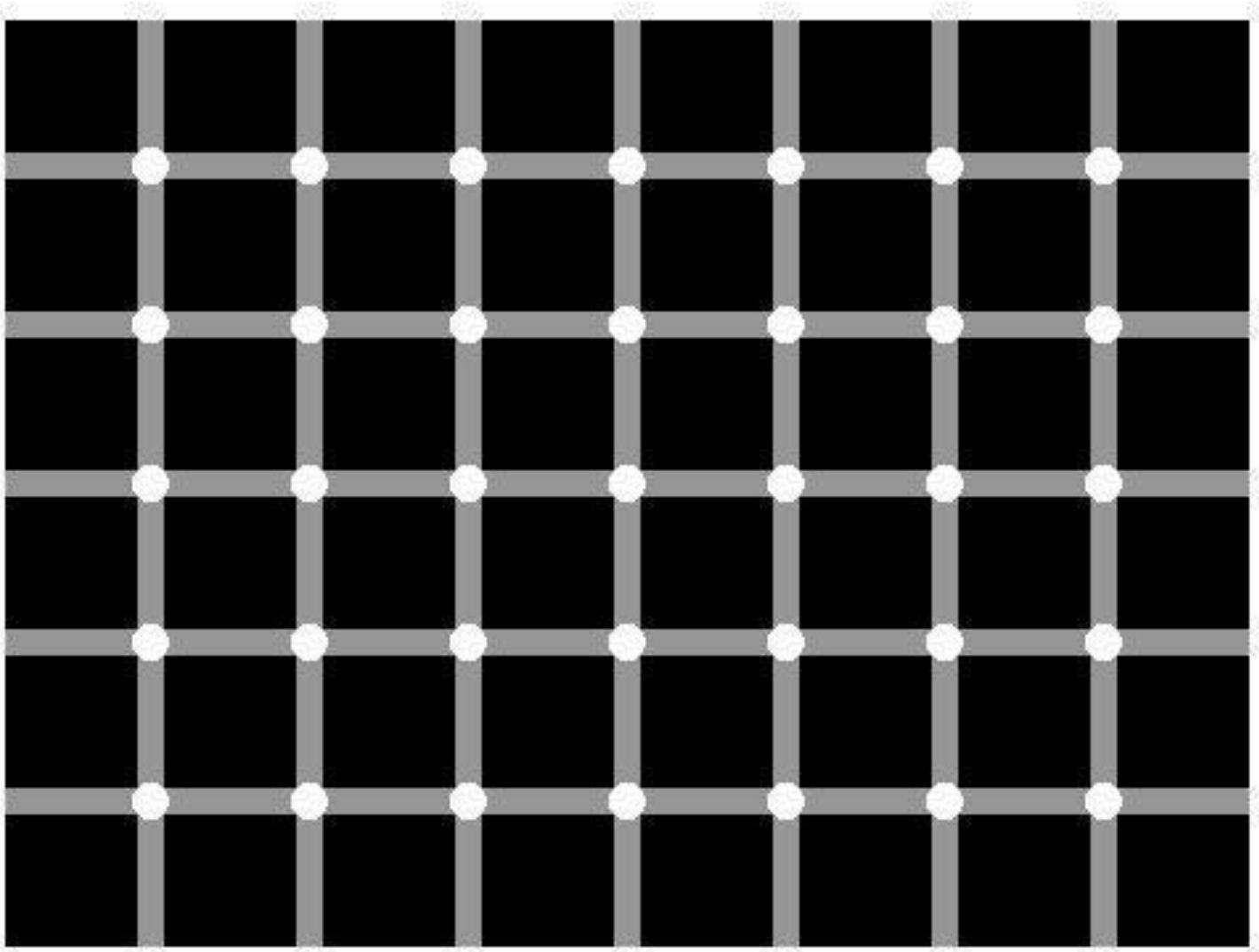

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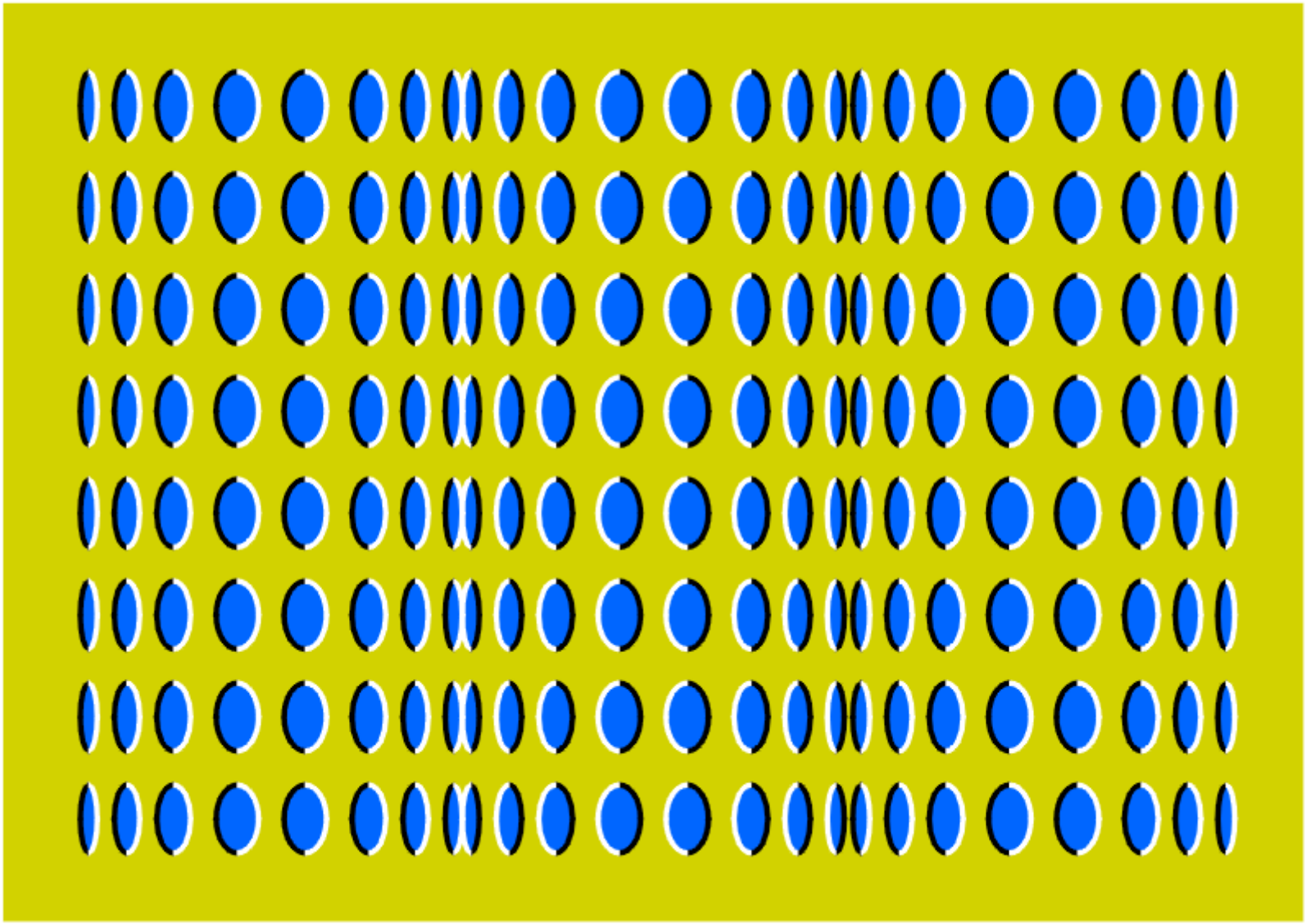

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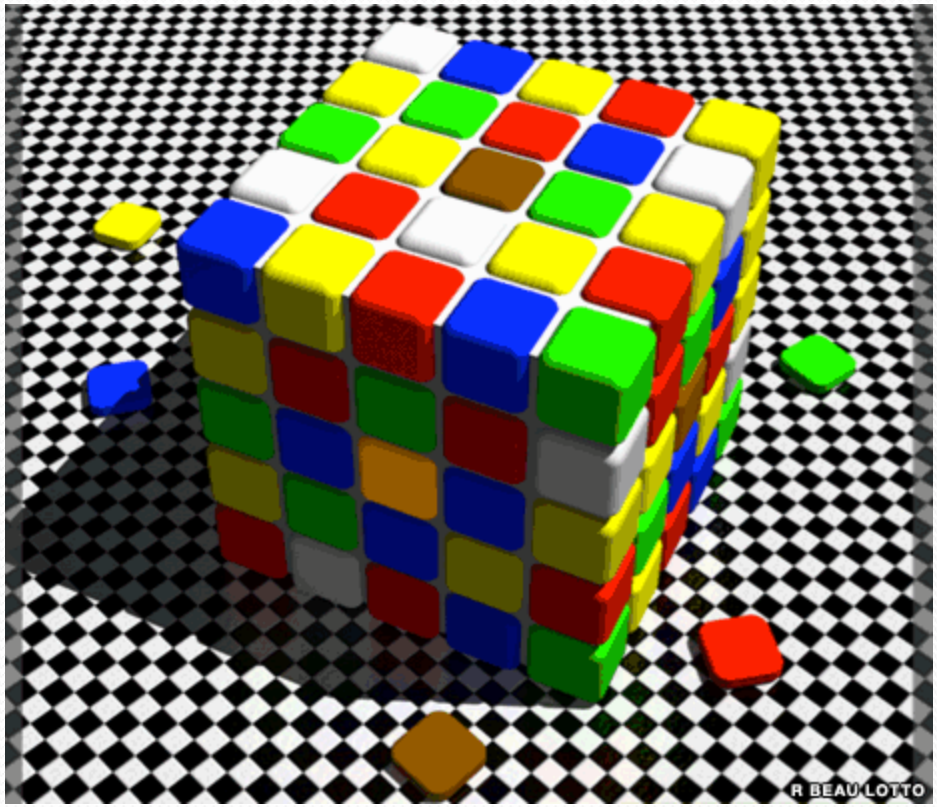

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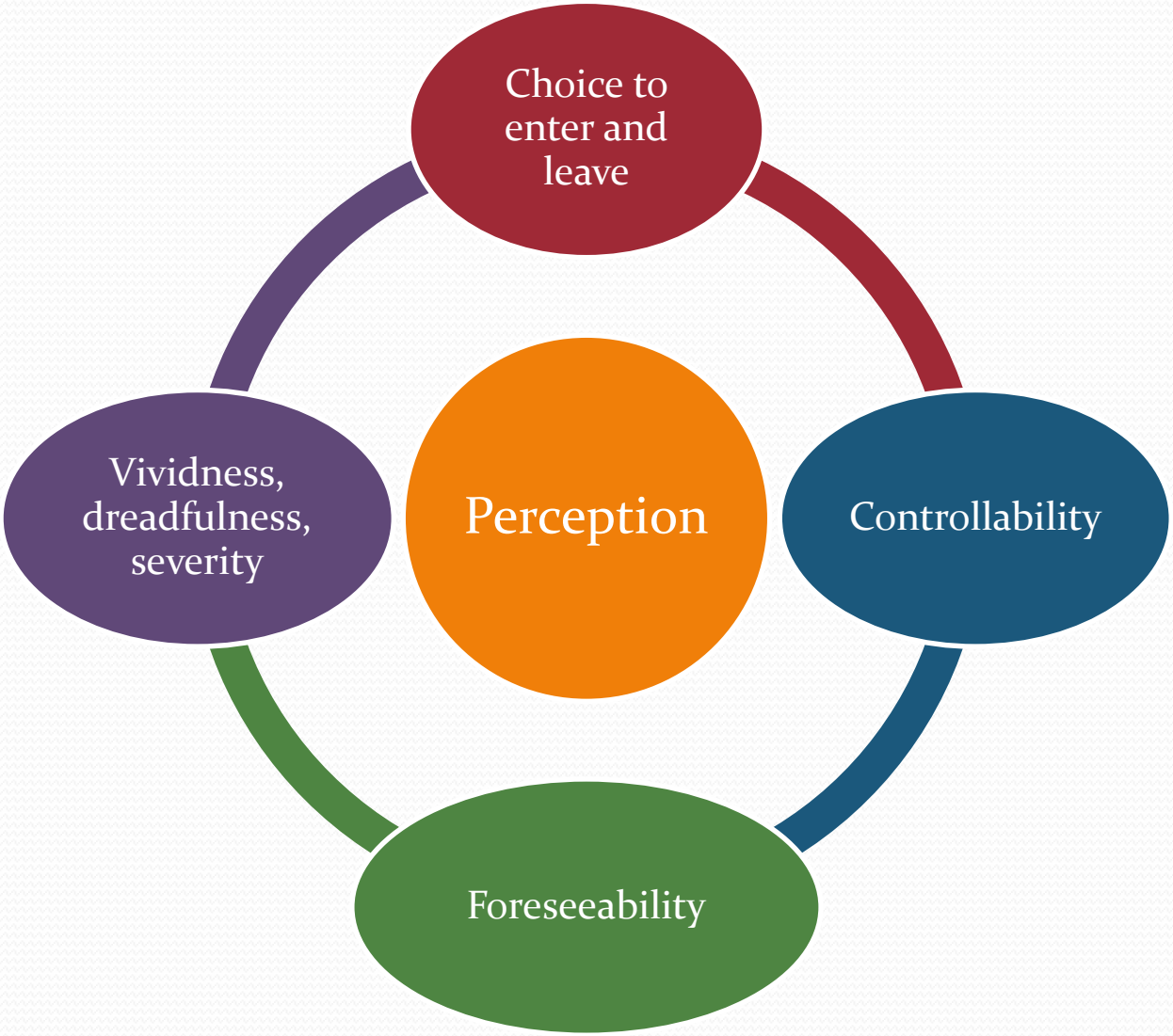
PERCEPTION OF DANGER



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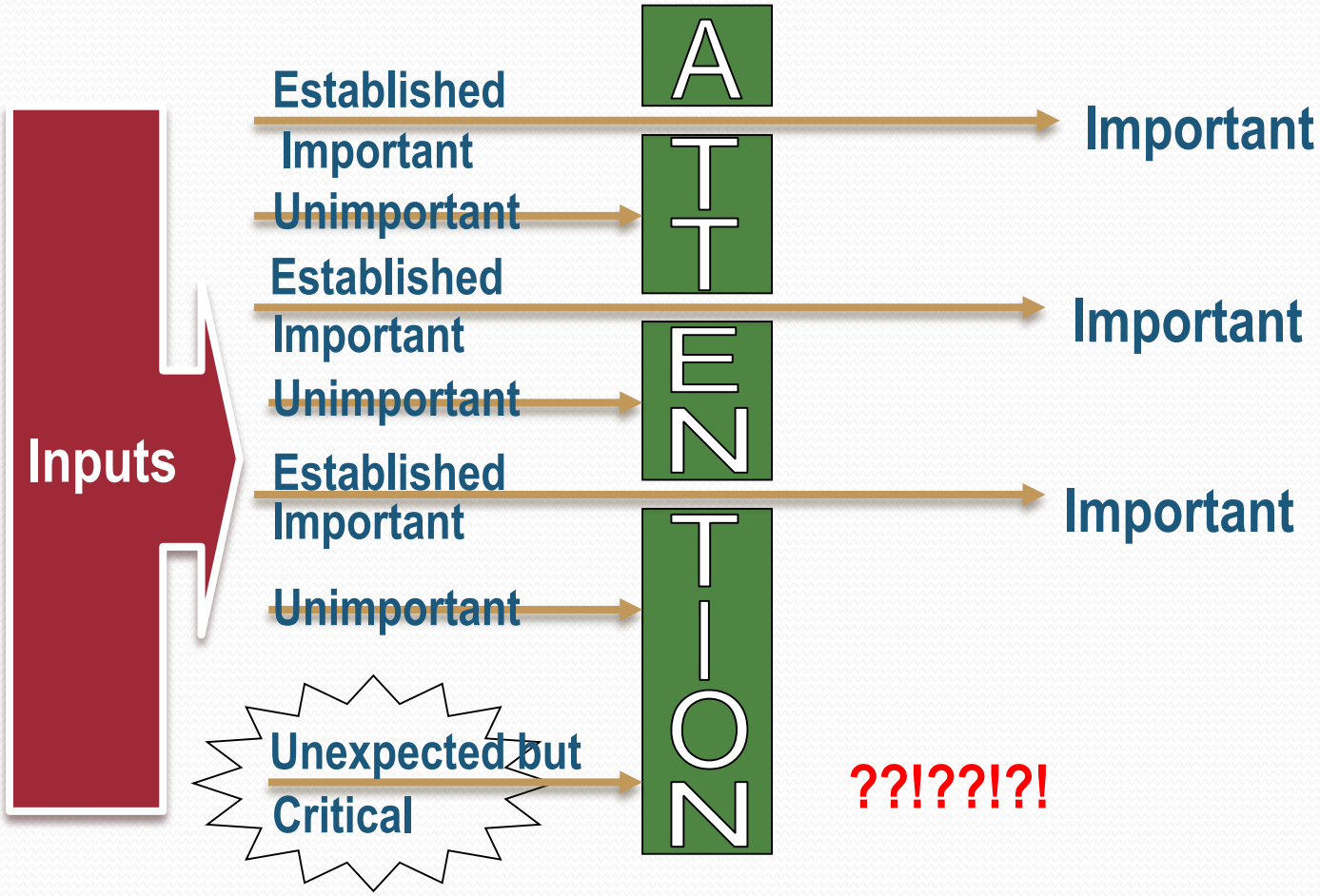
PERCEPTUAL SET



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PERCEPTUAL DISTORTION

Cognitive biases derive from:

- Information-processing shortcuts (heuristics)
- Mental noise
- The mind's limited information processing capacity
- Emotional and moral motivations
- Social influence

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ERRORS IN PERCEPTION CAUSED BY STRESSORS

Stressors

- Workload
- Fatigue
- Drugs/alcohol
- Lighting
- Temperature
- Noise
- Distractions

Affect

- Memory
- Vigilance
- Sustained attention
- Perceptual-motor function

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FILTERING AND SELECTIVITY

Attention	• Habituation • Limited attentional resource
Novelty and Consistency	• Competing drives • Balance is best fit
Social and Cultural	• Gender, culture, ethnicity, age, sexuality, peer groups, upbringing, environment and education

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Human failure classification

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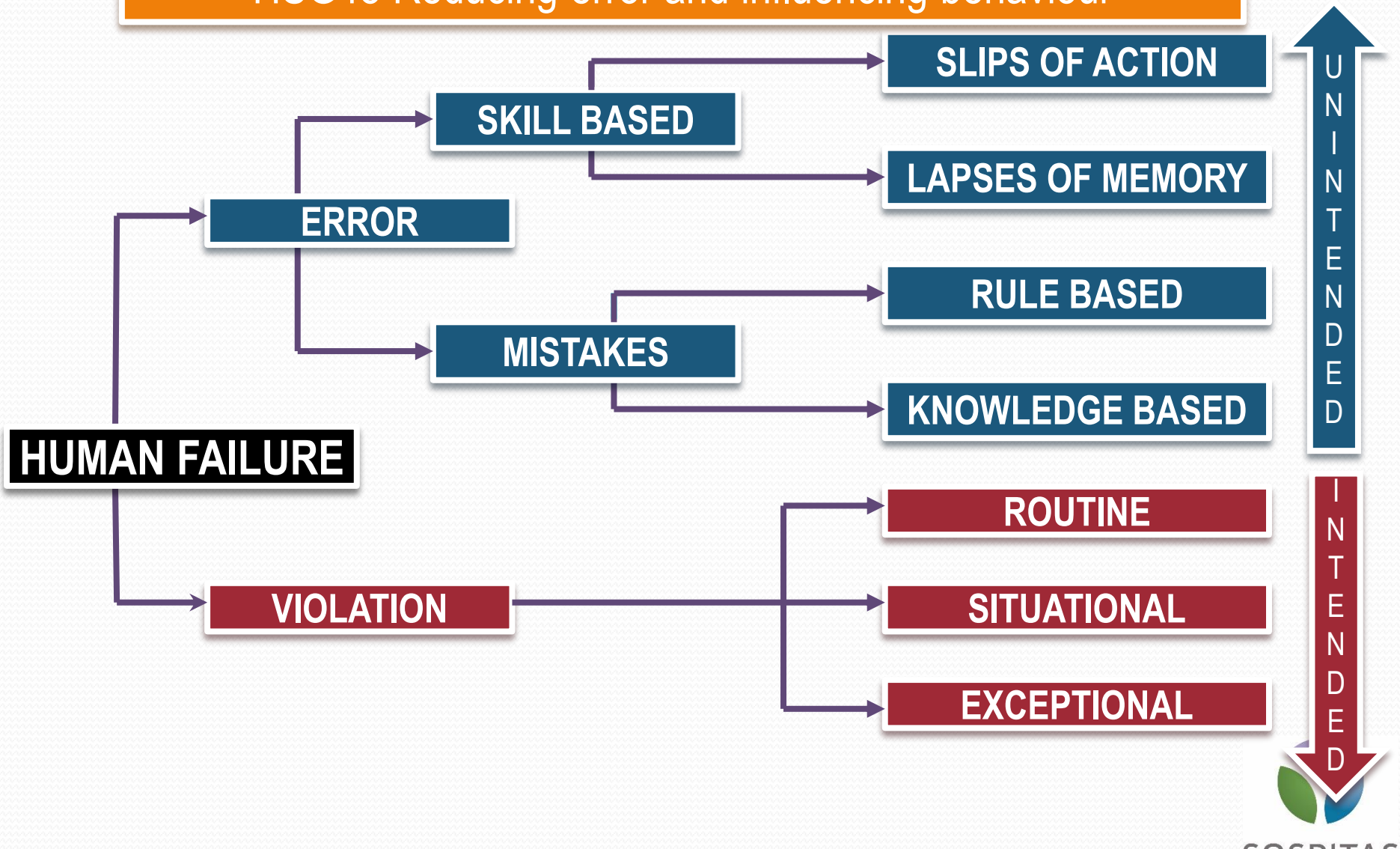
HSG48 – HUMAN FAILURE CLASSIFICATION

HSG48 Reducing error and influencing behaviour



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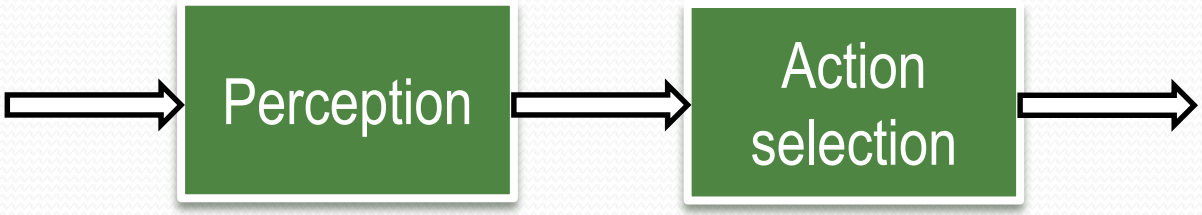
COGNITIVE PROCESSING

On-line processing



Off-line processing

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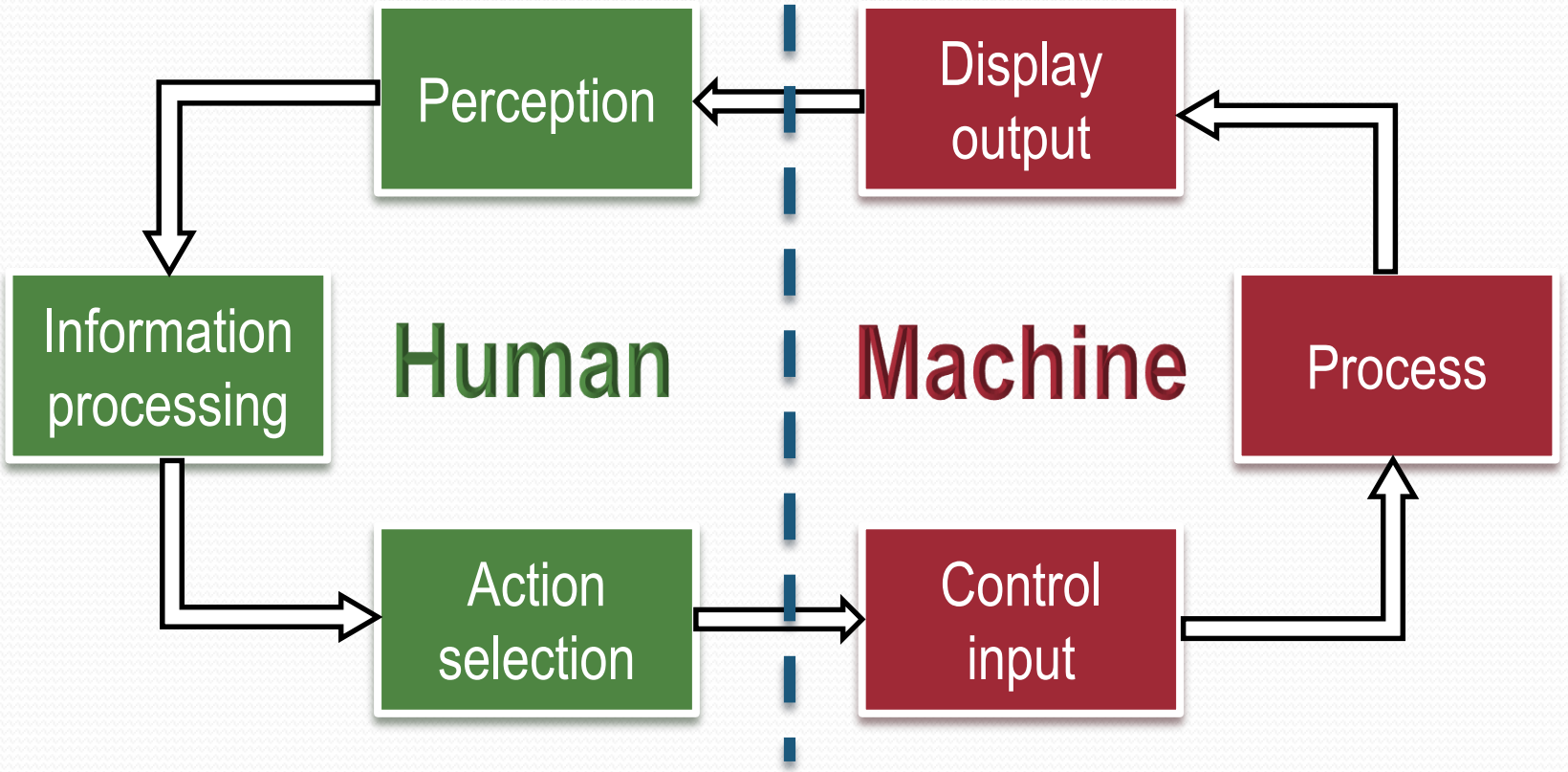
COGNITIVE PROCESSING

Types of behaviour leading to errors - Rasmussen



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COGNITIVE PROCESSING

Types of behaviour leading to errors - Rasmussen

Skill-based behaviour

- Autonomous actions
- Highly practiced routines
- Leads to slips of action and lapses of memory

Rule-based behaviour

- Known rules are applied to situation
- Cognitive-rich process
- Leads to mistakes

Knowledge-based behaviour

- Unfamiliar processes
- Trial and error
- Leads to mistakes

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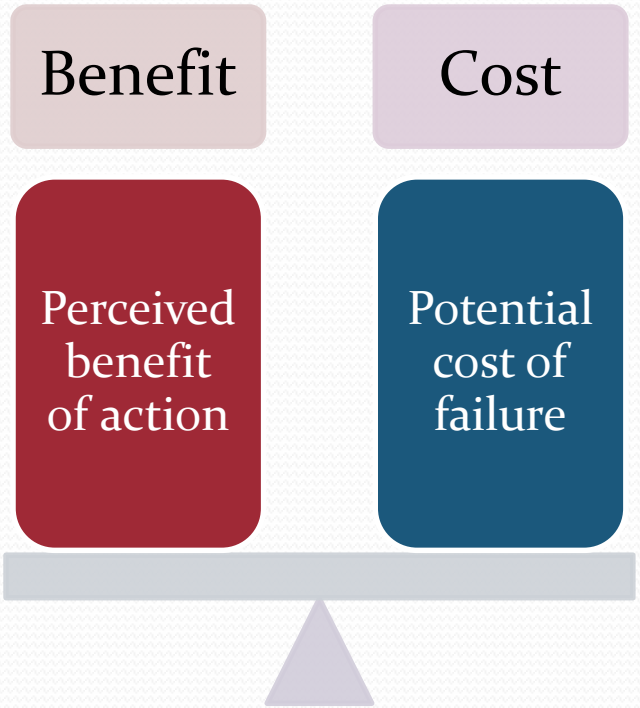
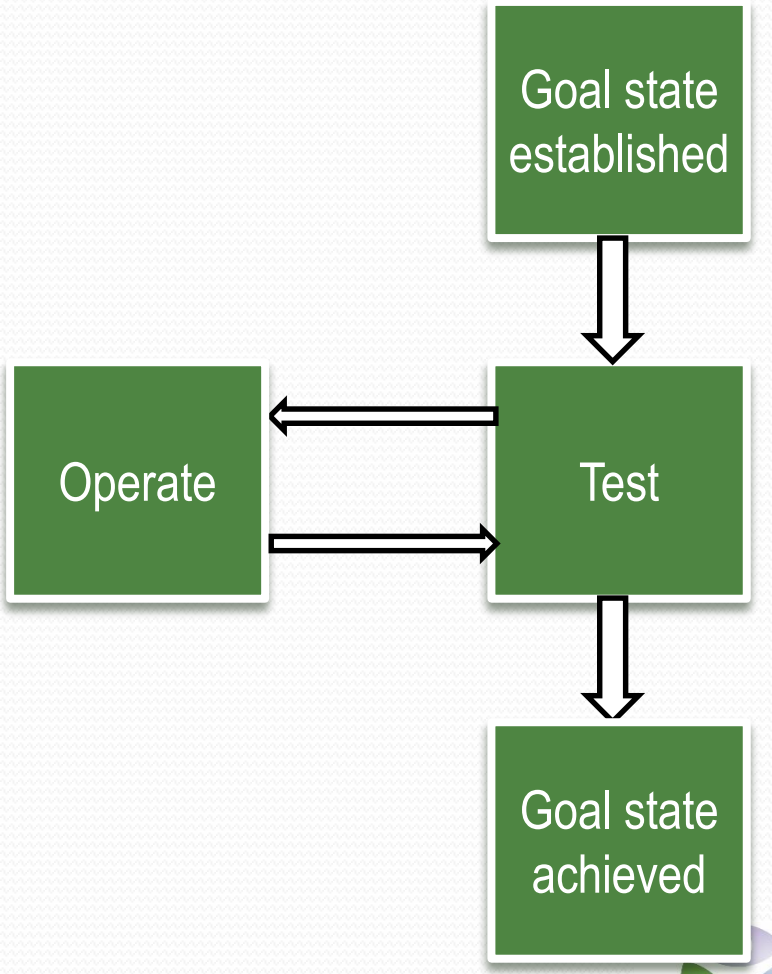
COGNITIVE PROCESSING

INDIVIDUAL DECISION MAKING & PROBLEM SOLVING PROCESSES





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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Kegworth 8th January 1989

Knowledge based error - Smoke in the cabin indicates that the engine from which bleed air (used for heating, pressure, etc.) is taken will have smoke in it. Flight crew assumed bleed air was taken from the right engine. This is true of the Boeing 737 but not the new 737-400, which drew bleed air from both.

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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Kegworth 8th January 1989

Perception failure - The vibration sensors were tiny and had a new digital display style

Routine violation – in pilot's experience vibration gauges were notoriously unreliable and so ignored. This was not the case with the redesigned 737-400

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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Kegworth 8th January 1989

Lack of feedback - The cabin crew and passengers could see the left engine was on fire, but did not inform the pilot, even when the pilot announced he was shutting down the right engine.

Lapse of memory – After shutting down the right engine the pilot began checking all meters and reviewing decisions but stopped after being interrupted by a transmission from the airport asking him to descend to 12,000 ft.

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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Herald of Free Enterprise 6th March 1987

Routine violation – the Herald made way with the bow doors open…

Rule-based mistake – due to a culture of negative reporting the Master of the Bridge assumed that the doors were closed unless told to the contrary

Cultural influences – Assistant Bosun asleep in his cabin; closing the doors was his job. Bosun sees that doors still open but does not close them as “not his job”.

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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Herald of Free Enterprise 6th March 1987

Lack of accurate feedback – despite repeated requests for an indicator light indicating open/closed status of bow doors these were not fitted

Cultural influences – Chief Officer who's job it was to ensure door closure was put under documented management pressure to work more hastily

Cultural influences – Senior management openly ridiculed Master's requests for an indicator light

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CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Piper Alpha 6th July 1988

Routine violation – the permit to work system was regularly breached. This was noticed but never enforced by management

Cultural influences – management propagated a perception of product revenue over safety

Exceptional violation – the workers who survived breached the evacuation procedures and jumped into the North Sea – those who mustered at the top of the accommodation block perished

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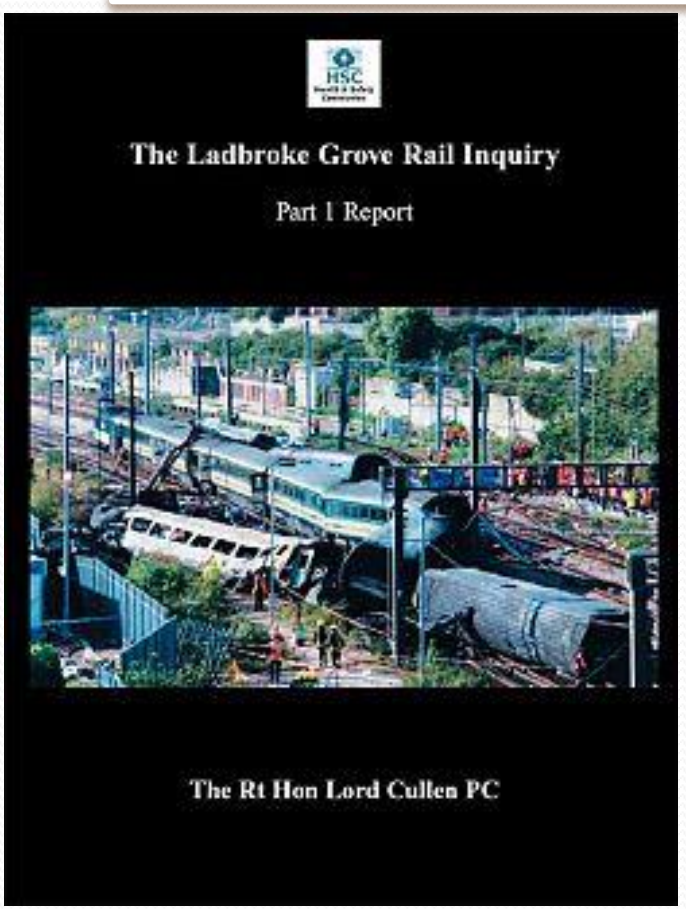
CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Ladbrook Grove 5th October 1999



Michael Hodder is judged to have believed that he had a 'proceed' aspect at the signal he passed at danger:

- Bright sunlight was falling on the signal
- The duration for recognition was brief
- The unusual signal configuration may have contributed to his misperception
- He had not been made aware that SN109 was a multi-SPAD site

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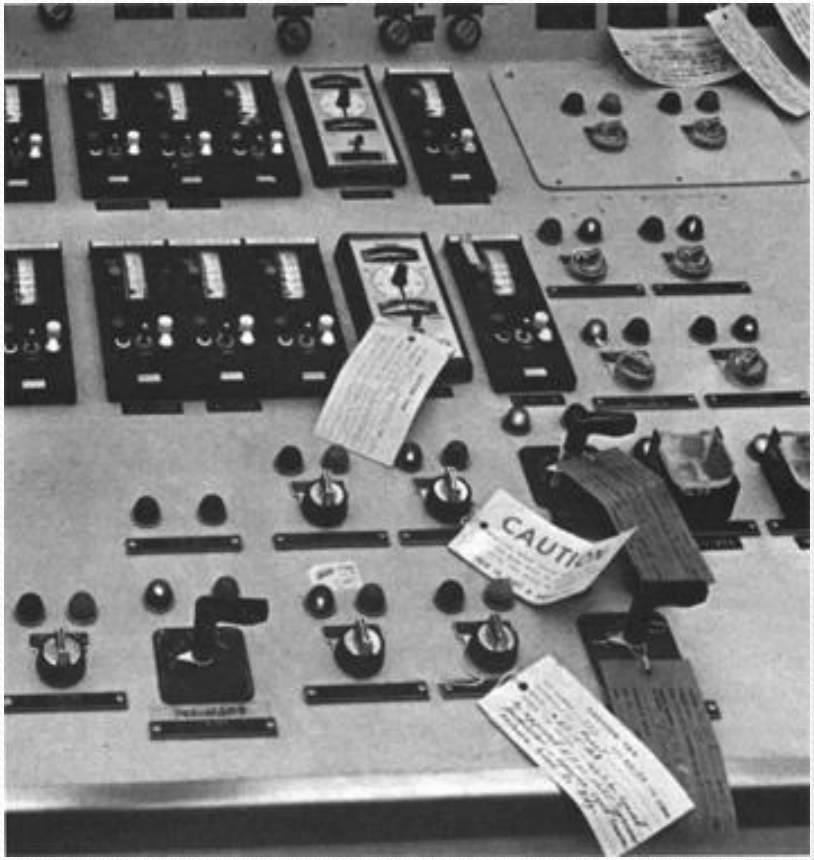
CONTRIBUTION OF HUMAN FAILURE TO SERIOUS INCIDENTS

Three Mile Island 28th March 1979



- Incident occurred at 4am on third night of rotating shift pattern – circadian rhythms misaligned; sleep deficit
- Control panel 'lit up like a Christmas Tree' inducing operator confusion
- Training covered normal operation – crisis simulations were not provided
- Operating procedures were poorly written and easy to misinterpret
- Organisational failure to learn from previous similar incidents
- Fundamental deficiencies in the design of the control room.

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Improving individual human reliability in the workplace

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MOTIVATION AND REINFORCEMENT

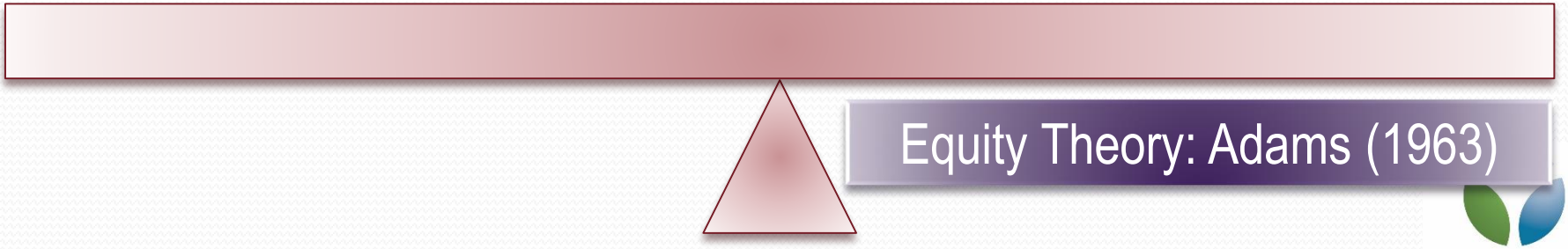
Inputs

People become demotivated, reduce input and/or seek change/improvement whenever they feel their inputs are not being fairly rewarded. Fairness is based on perceived market norms.

Outputs

What I put into my job:
time, effort, ability, loyalty, tolerance, flexibility, integrity, commitment, reliability, heart and soul, personal sacrifice, etc

What I get from my job:
pay, bonus, perks, benefits, security, recognition, interest, development, reputation, praise, responsibility, enjoyment, etc



Equity Theory: Adams (1963)

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MOTIVATION AND REINFORCEMENT

Consequences that increase behaviour

Positive reinforcement	Negative reinforcement
Receive something that you want	Avoid something you do not want

Operant Conditioning: Skinner (1948)

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MOTIVATION AND REINFORCEMENT

Consequences that decrease behaviour

Punishment	Punishment
Receive something you do not want	Lose something you have or want

Operant Conditioning: Skinner (1948)

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MOTIVATION AND REINFORCEMENT

Appraisal Schemes

ADVANTAGES:

- Providing feedback minimises perceptions of uncertainty in employees and contributes to organisational communication overall
- Enhancement of employee focus through promoting trust in the organisation and therefore reducing unwanted distractions
- Goal setting in alignment with organisational objectives and so effort is directed in a mutually beneficial way
- Performance improvement – “what gets measured gets done”
- Determination of training needs and career goals so facilitating individual personal improvement

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MOTIVATION AND REINFORCEMENT

Appraisal Schemes

DISADVANTAGES:

- Appraiser's evaluations based on employee 'likeability' and other personal prejudices
- Negative perceptions that the appraisal is merely a tick-box exercise
- Appraiser may rate employees more favourably in order to please the employees and avoid conflict
- The improper application of appraisals may lead to legal action against the organisation
- Performance goals may be overly challenging or over emphasised

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SELECTION OF INDIVIDUALS

The recruitment process

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Organisational factors

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THE INFLUENCE OF FORMAL AND INFORMAL GROUPS

Reference groups can be positive or negative depending on whether the individual wishes to associate with them

Normative

- Individual accepts the general values of the group
- Adopts the social norms as basis of behaviour

Comparative

- Individual compares themselves with group members
- Imitation of group member behaviour

Status

- Individual seeks acceptance by group members
- Aspires to membership

Glendon *et al* (2006)

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ORGANISATIONAL COMMUNICATION MECHANISMS

Considerations when developing communication systems

- **Recognise the needs of the information sender:**
  - enable the sender to select who, what, when and how best to communicate.
- **Recognise the needs of the information receiver:**
  - enable the recipient to receive the message, establish and evaluate its meaning; and
  - continue the dialogue as appropriate and provide feedback to the sender.

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PROCEDURES FOR RESOLVING CONFLICT

- Train managers to handle difficult conversations with employees
- Encourage open expression of opinions
- Recognise the importance of feelings
- Listen to what people have to say
- Focus on interests not positions and personalities
- Have clear discipline, grievance and dispute procedures for dealing with conflict
- Write mediation into your contracts of employment and/or individual disciplinary and grievance procedures
- Consider outside help where necessary, for example, using a third party by way of mediation

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PROCEDURES FOR INTRODUCING CHANGE

Gradualism

1. Justification

- Best course of action
- Necessity
- Statutory obligation

2. Define need and technical basis

- Justification
- Generate objectives

Consultation

3. Engage leaders

- Personality
- Attitude
- Ability

Feedback

4. Communicate mechanism and roles

- Managers/workforce
- Conflict resolution
- "Buy in"

5. Identify training needs

- TNA
- Devise training
- Deliver and appraise

Transparency

6. Monitor progress

- Review success/failure
- Iterative process

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Job factors

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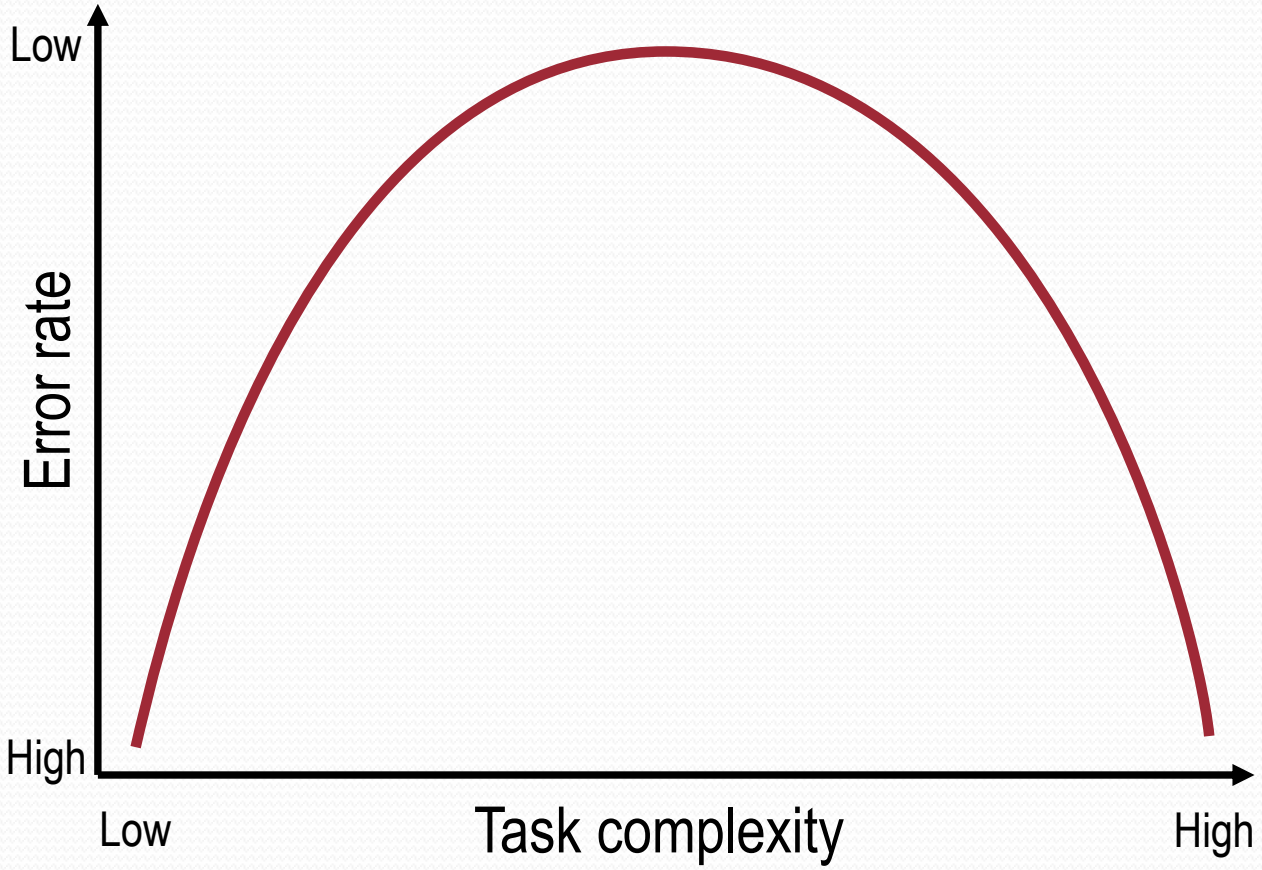
JOB FACTORS AND THE PROBABILITY OF HUMAN ERROR

Task Complexity



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JOB FACTORS AND THE PROBABILITY OF HUMAN ERROR

Patterns of employment

Higher probability of human failure:	
Temporary workers	Lack motivation and commitment; reliance on integrity of agency selection criteria;
Subcontracting	Lack motivation and commitment; lack of direct management control
Teleworking	Reliant on self-supervision
Career breaks	Skill-set subject to slipping; interim process changes
Overtime	Increased fatigue thus vigilance; increased health problems
Job sharing	Poor communication leads to ineffective handover procedure
Shiftwork	Disruption of circadian rhythms; lack of sleep; increased fatigue; recovery time too short

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JOB FACTORS AND THE PROBABILITY OF HUMAN ERROR

Patterns of employment

Lower probability of human failure:	
Flexible working	• Reduction of ill-health • Reduction of stress • Increase in morale • Increase in commitment • Increased motivation

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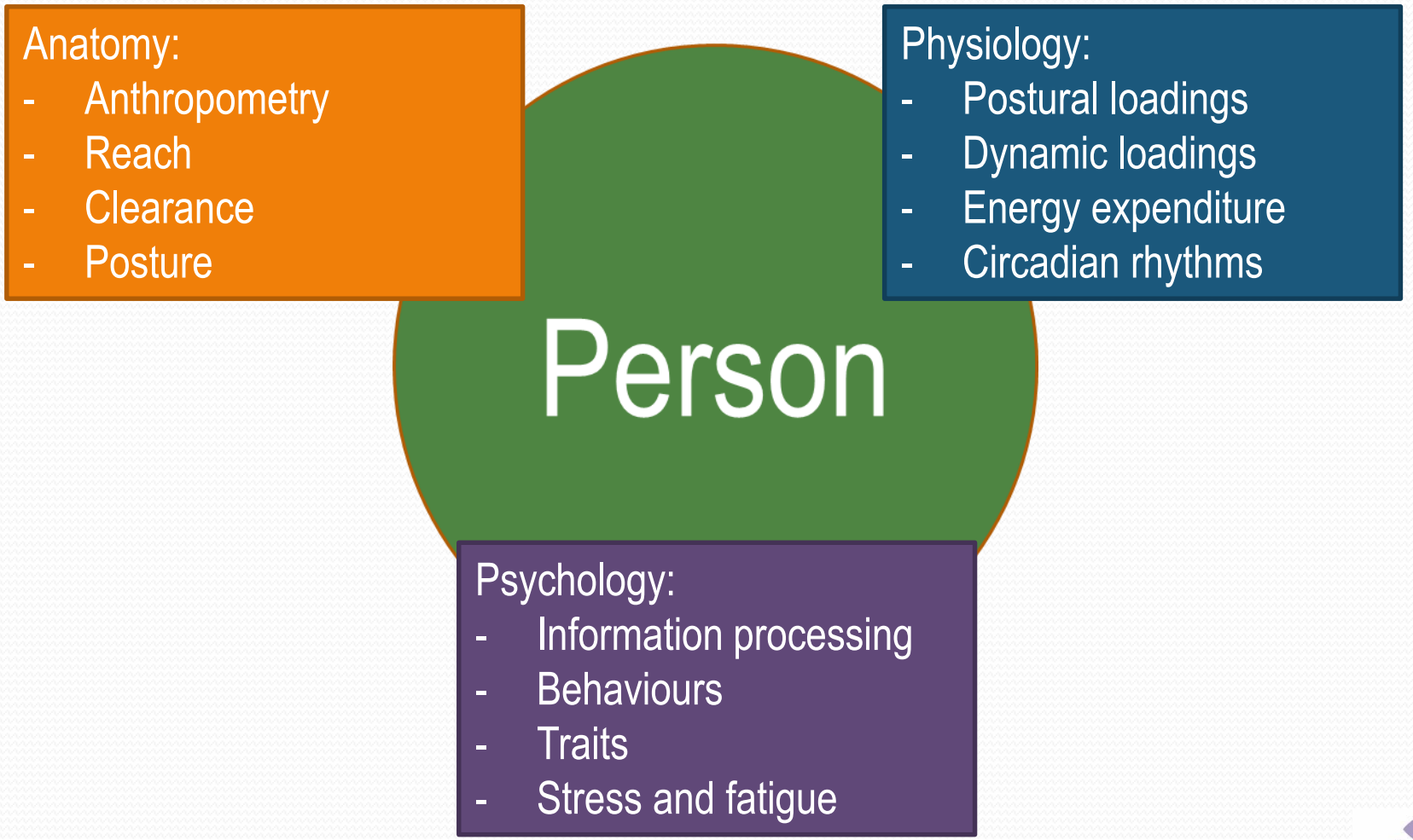
THE ROLE OF ERGONOMICS IN JOB DESIGN

The employee and the workstation as a system



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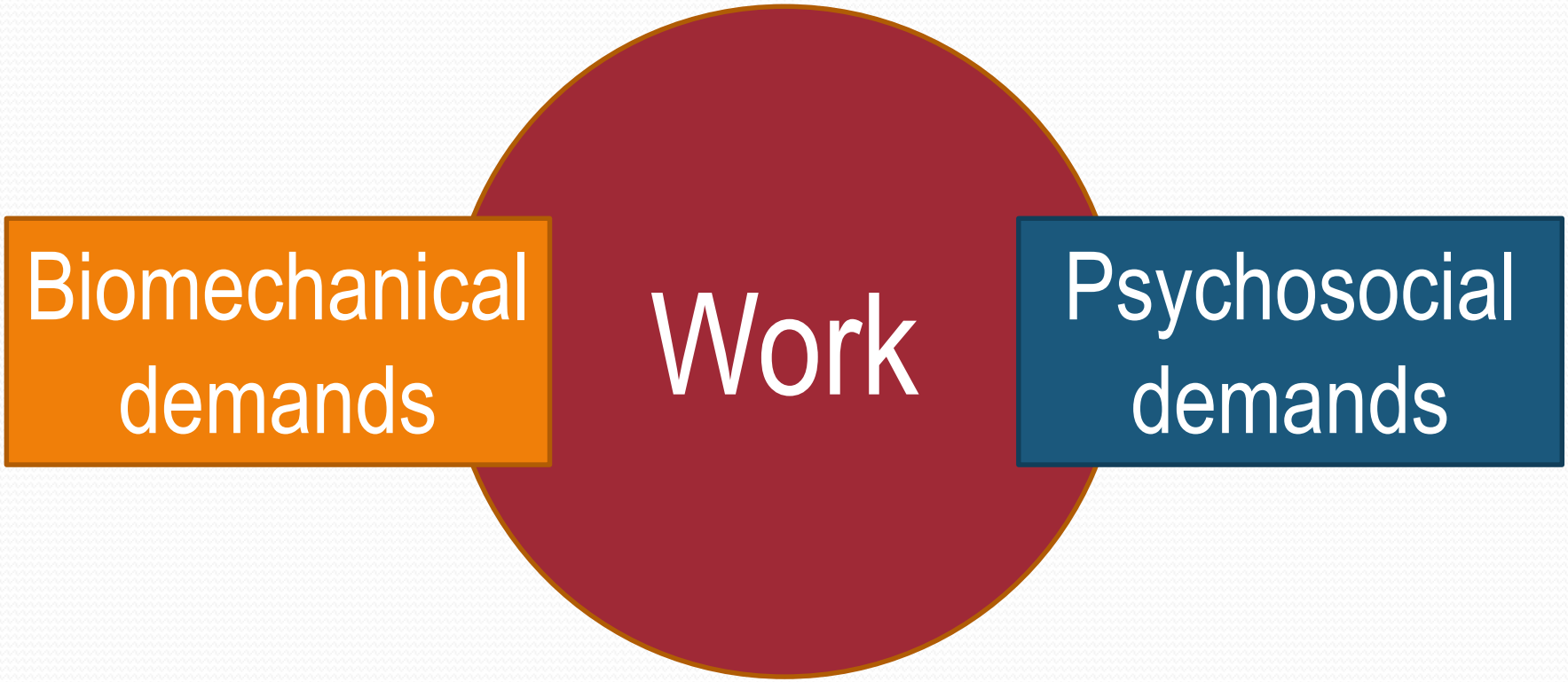

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THE ROLE OF ERGONOMICS IN JOB DESIGN

The employee and the workstation as a system

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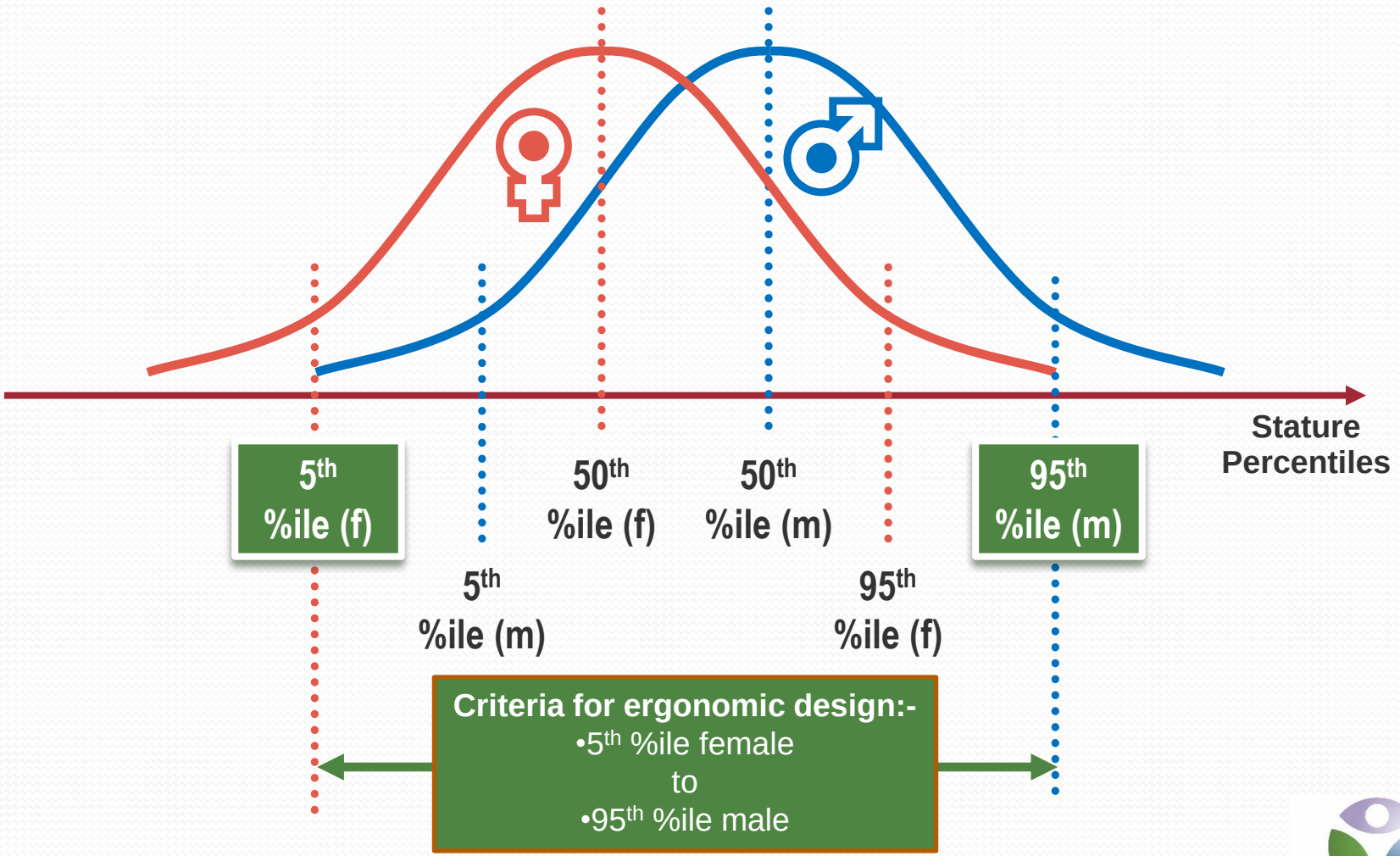
THE ROLE OF ERGONOMICS IN JOB DESIGN

Elementary anthropometry



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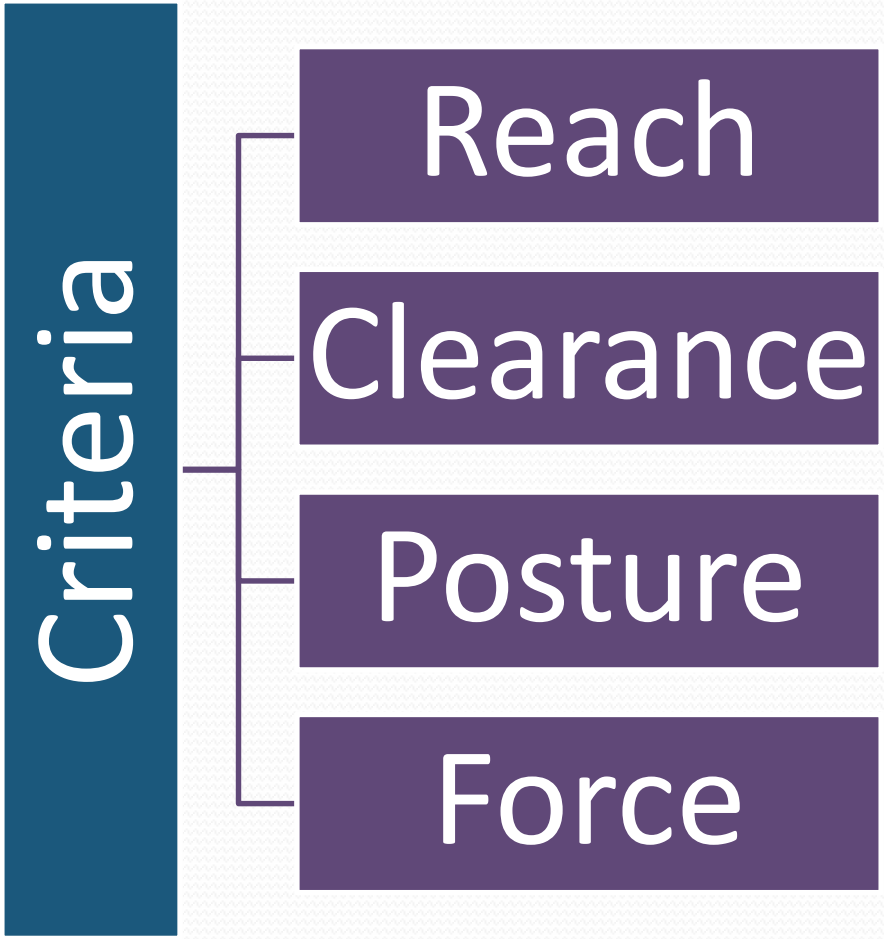
THE ROLE OF ERGONOMICS IN JOB DESIGN

Elementary anthropometry – the limiting user



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THE ROLE OF ERGONOMICS IN JOB DESIGN

Poorly designed workstations

Increase probability of human errors or inefficiency resulting in high system failure rates, poor maintenance, low productivity, and high accident rates

Increase probability of dangerous accidents due to a poorly designed and managed organisation unable to respond appropriately to emergency situations

Degrade the operators' and maintainers' performances and increase stress levels and cause personnel discomfort, injury, or death

Result in a lack of employee motivation or loyalty, and high employee turnover

Result in high absenteeism, worker complaints, and a higher rate of worker compensation or personal damage claims

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ERGONOMIC CONTROL SYSTEM DESIGN

Factors to be included in design

Displays
Information clear and accurate
Reliability
Visibility
Appropriate size
Legibility
Matches stereotype
Suitably differentiated and coded
Prioritisation and positioning

Controls
Accessibility
Easy to operate
Protect from unplanned activation
Compatibility with displays
Sensory feedback
Matches stereotype
Suitably differentiated and coded
Size relative to force needed

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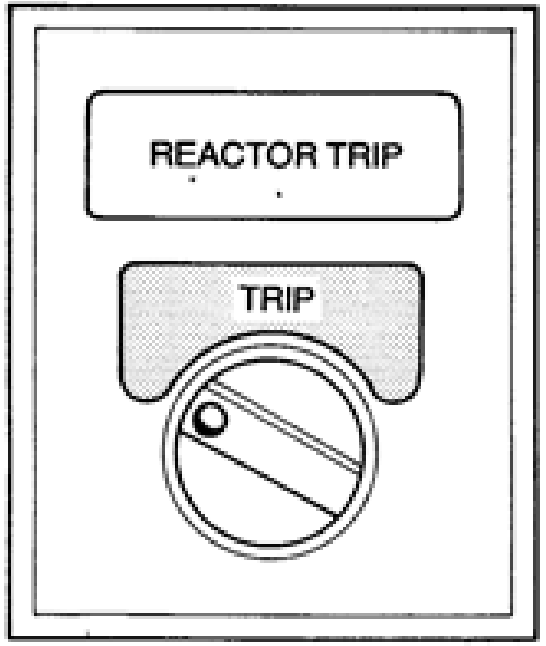
ERGONOMIC CONTROL SYSTEM DESIGN

Three Mile Island Control System



Lack of consistency – coding

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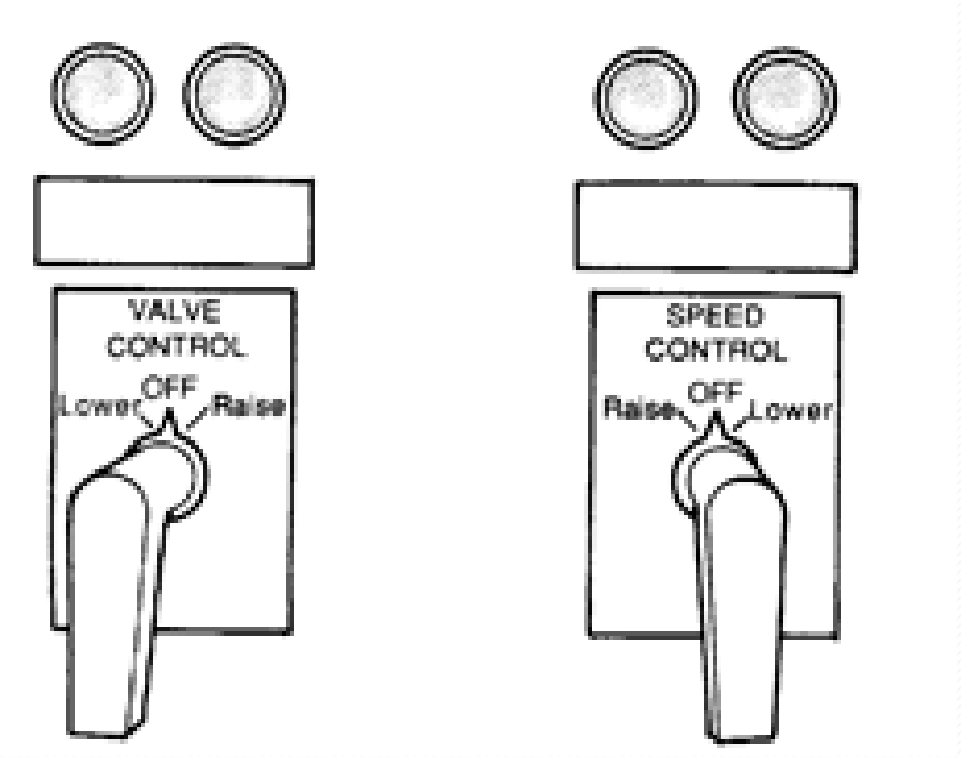
ERGONOMIC CONTROL SYSTEM DESIGN

Three Mile Island Control System



Failure to match stereotype – mirrored operation

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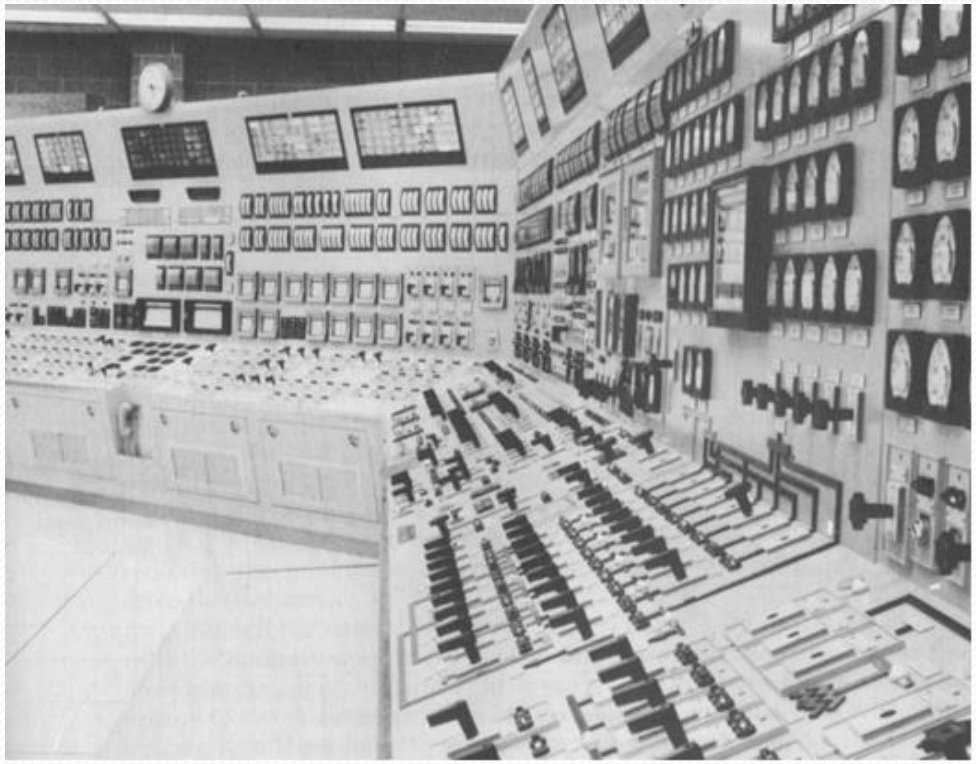
ERGONOMIC CONTROL SYSTEM DESIGN

Three Mile Island Control System



Response confusion – different functions inadequately differentiated

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ERGONOMIC CONTROL SYSTEM DESIGN

Cockpit of Boeing 737

15. The change from hybrid electro-mechanical instruments to LED displays for engine indications has reduced conspicuity, particularly in respect of the engine vibration indicators. No additional vibration alerting system was fitted that could have highlighted to the pilots which of the two engines was vibrating excessively.

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Behavioural change programmes

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BEHAVIOURAL CHANGE PROGRAMMES

Principles

- Engaging, motivating, assisting, reinforcing, and sustaining safe behaviours
- Systematic examination of motivation underlying behaviours
- An ongoing effort is required
- Focus should be leading indicators not length of time without injury
- A tool that will enhance the effect of already existing practices

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BEHAVIOURAL CHANGE PROGRAMMES

Organisational conditions needed for success

- A strong management commitment towards improving behavioural safety
- Respectful, trusting, open communication between management and employee groups
- An open, feedback-rich culture among employees
- A commitment to improving the profile of health and safety
- A commitment to improving increased employee engagement in safety
- An emphasis on safe and unsafe behaviour
- A strong, consistent, timely reaction to the discovery of unsafe acts
- Transparent and fair leadership
- Awareness amongst all staff of the relevance of human factors

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BEHAVIOURAL CHANGE PROGRAMMES

Typical contents of a behavioural safety programme

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BEHAVIOURAL CHANGE PROGRAMMES

Typical contents of a behavioural safety programme

Antecedents	Behaviour	Consequences
Causal event (trigger) preceding the behaviour	Observable thing that someone does or doesn't do	Outcome of the behaviour for the individual

that influences the likelihood that the behaviour will be repeated

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BEHAVIOURAL CHANGE PROGRAMMES

Typical contents of a behavioural safety programme

Consequences that increase behaviour

Positive reinforcement	Negative reinforcement
Receive something that you want	Avoid something you do not want

Consequences that decrease behaviour

Punishment	Punishment
Receive something you do not want	Lose something you have or want

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BEHAVIOURAL CHANGE PROGRAMMES

Typical contents of a behavioural safety programme

	Timing	Likelihood	Significance
Strong consequences	Soon	Certain	Important
Weak consequences	Distant	Uncertain	Unimportant

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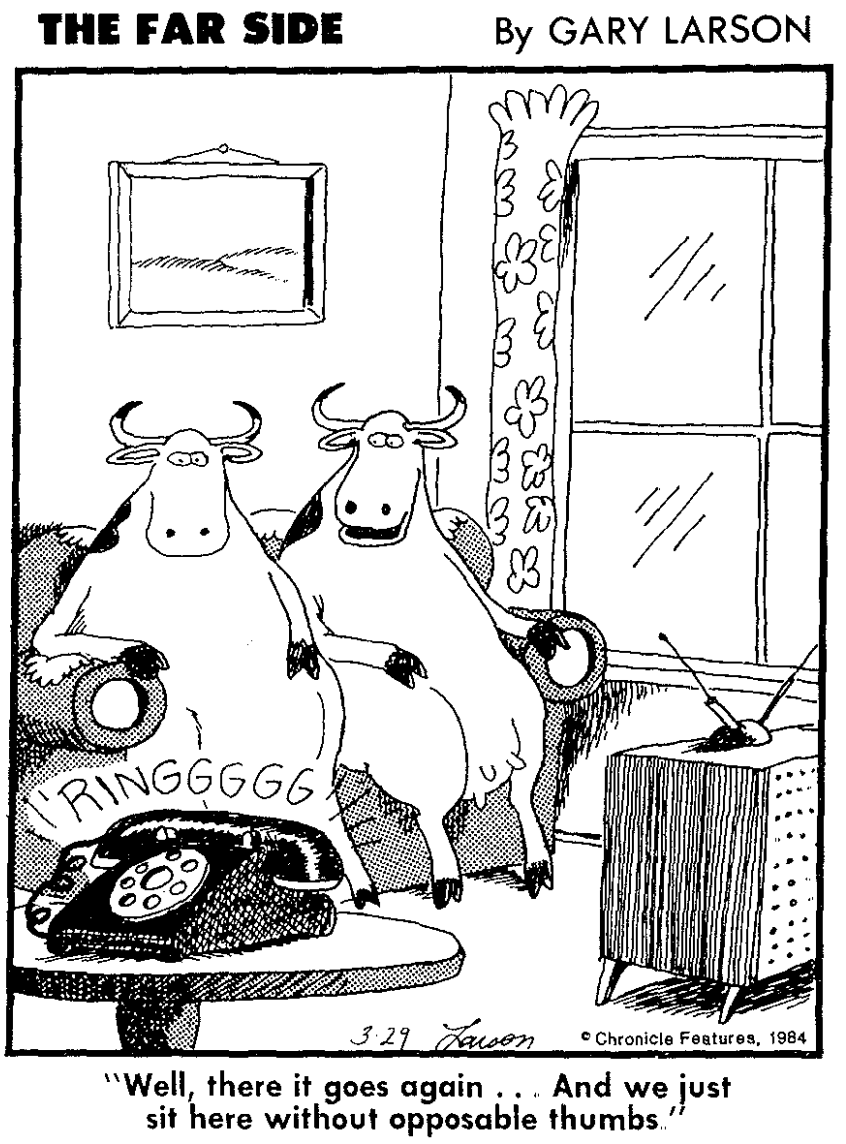

Any final Questions?

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Human Behaviour and Reliability at Work

Herefordshire Health and Safety Group
21st November 2018

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