

Introduction to Human Factors

Trinity College Dublin

Outline

- Start from experience
- Production game: assembly a car study the functional analysis of assembling a car and risk assess the process Do it...
- Introduce HOF and SCOPE..reassess the process
- Example (either Formosa, Uberlingen midaircollision)
- Current way of assessing HOF in Risk Assessment issues and challenges. .
- Risk assessment done as a paper exercise is not good enough...not everything is predictable at design..and risk as to be managed as part of day to day operations.



Start from experience

“A few observations and much reasoning lead to error;
many observations and a little reasoning to truth” Alexis Carrel

What is Human Factors?

What is Human Factors?

- Anything that affects human performance (European Human Factors Advisory Group EASA (2008)
.....
- But it should also reflect on how human performance affects an overall system performance..the so called socio-technical system

Application Areas

- **'Ex-post' Analysis**

- Accidents analysis and Human Error

- **'Ex-ante' Analysis**

- Human Performance predictions

- **HF and Ergonomics in Design**

- Apply what is known about human performance capacity and limitations to inform design (physical, cognitive ergonomics to design workplace environments, interfaces, automation, procedures).

- **Training**

- Technical and "Non-technical skills"

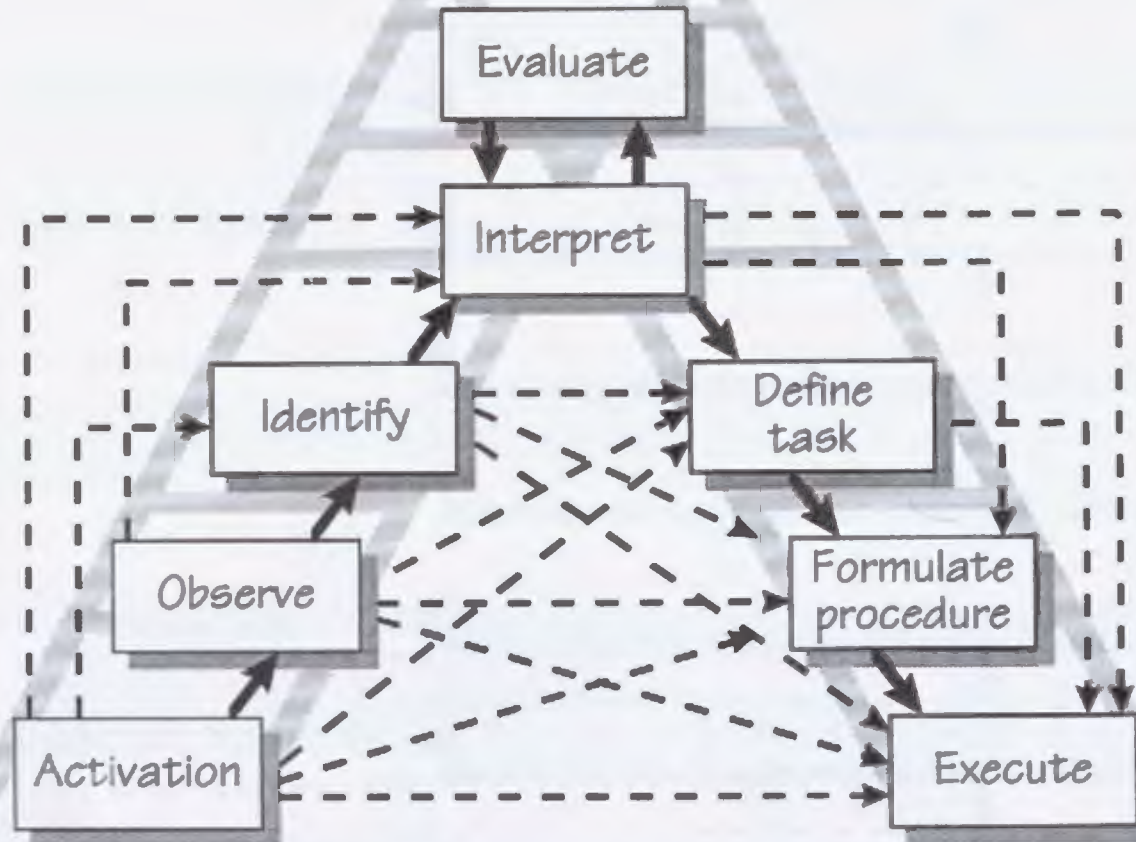
Why are Human Factors important?

- Up to 80% of accidents in safety critical industries have human error as a cause
- Understanding why humans make mistakes allows us to design a system which minimises the opportunity for errors
- New systems and new technology can create new mechanisms for human error

How to model Human Factors ?

- Traditional HRA approaches use a simple classification scheme but have only weak links to a model of cognition (For First generation the human is just a component of the system, only less predictable and only the task he/she performs is under scope of analysis“).
- Information processing approaches can produce detail explanations in terms of mental processes, but are weak in accounting for causes that have their origin in the working environment; (Hollnagel E. and Marsden A 1996).

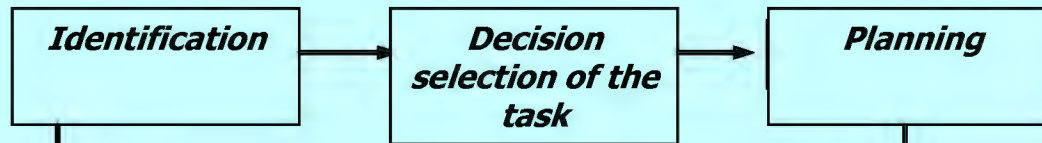
HF models: An Information processing Approach: the step ladder model



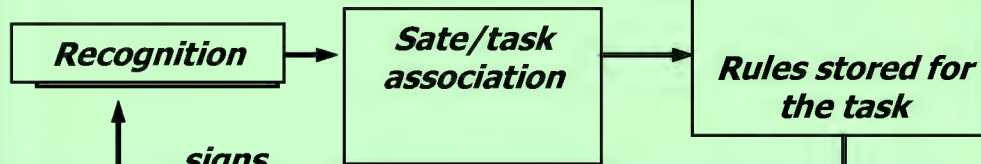
Rasmussen, J. (1986), "Information Processing and Human-machine Interaction: An Approach to Cognitive Engineering. North-Holland: New York

(Skill-Rule-Knowledge SRK)

Knowledge-based Level



Rule-based Level



Skill-based Level



Sensorial input

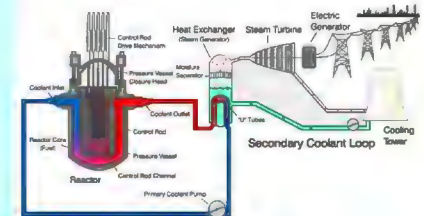
signs

signs

signs

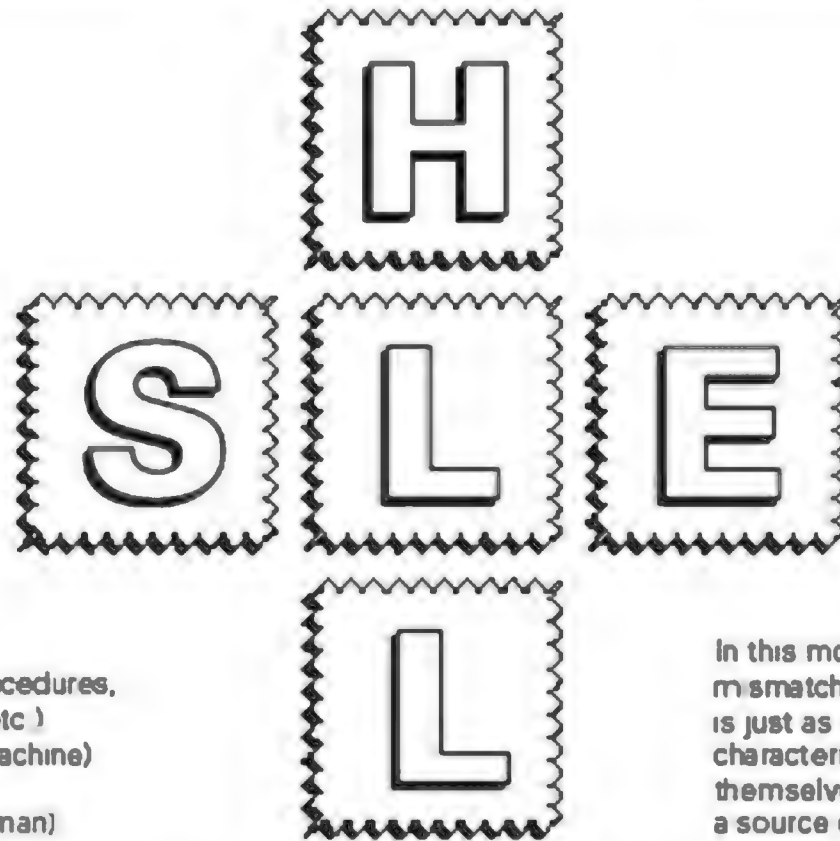
signs

Actions



(Rasmussen et al, 1981)

HF Models – SHELL not only the individual but also the system



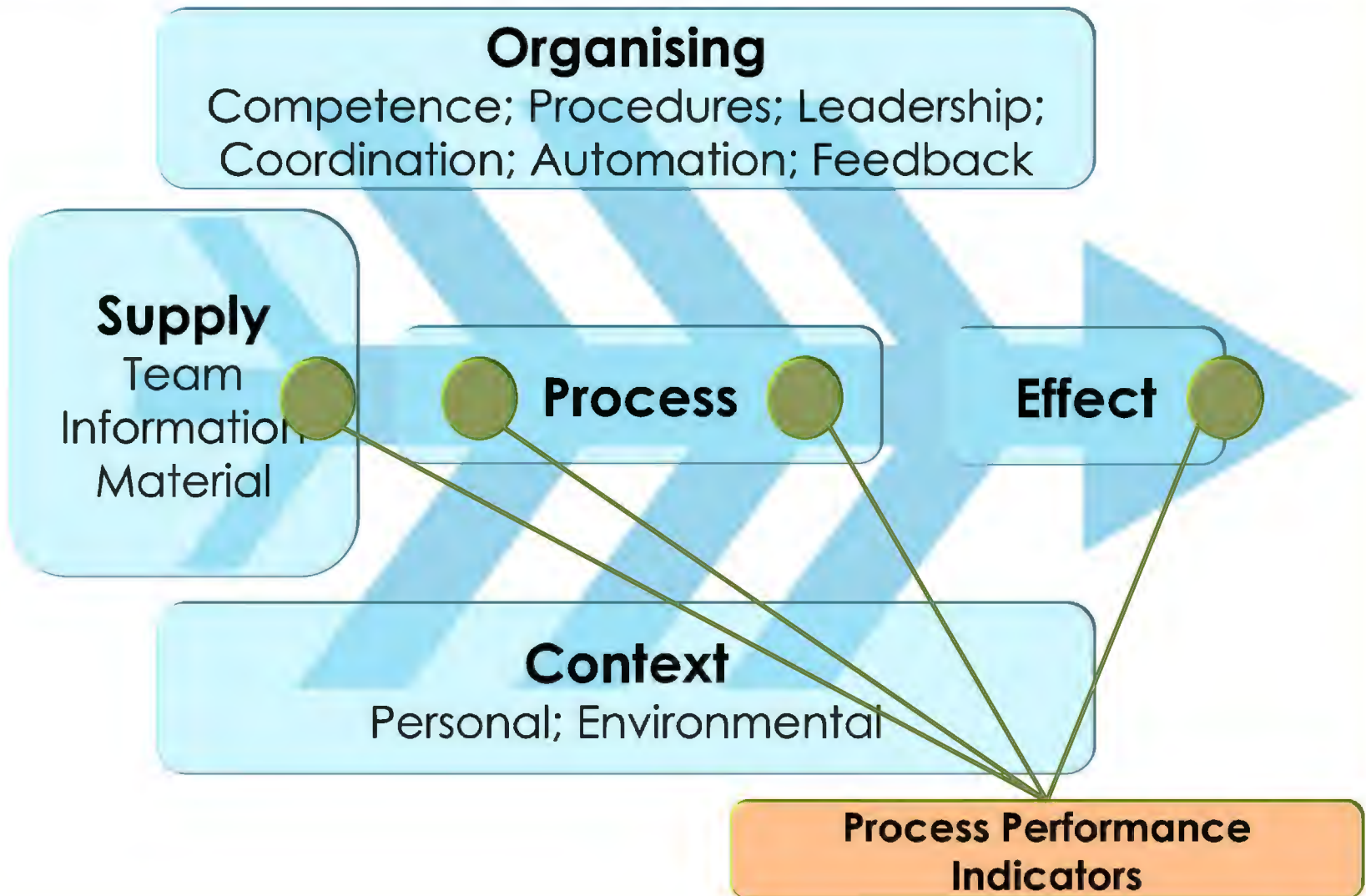
S = Software (procedures, symbology, etc)
H = Hardware (machine)
E = Environment
L = Liveware (human)

In this model the match or mismatch of the blocks (interface) is just as important as the characteristics of the blocks themselves. A mismatch can be a source of human error.

HF Models - SHELL

- **Hardware** Various equipments, tools, aircraft, workspace, buildings and other physical resources without human elements constitute the Hardware.
- **Software** the Software comprehends all non-physical resources, which are for organically operation, like organizational policies/rules, procedures, manuals etc..
- **Environment** The Environment includes not only the factors which influence where people are working such as climate, temperature, vibration and noise, but also socio-political and economic factors.
- **Liveware** The Liveware includes factors like teamwork, communication, leadership and norms.
- **Central Liveware** The Liveware, which is in the centre of the SHELL Model, can be defined as human elements such as knowledge, attitudes, cultures and stress.

SCOPE – Process & Performance Analysis



Exercise: applied functional analysis for Man machine system

can we redo the functional analysis we have already done
(functional analysis and simple FMEA) using SCOPE as a framework?