P01

The Most Critical Component

E365 – Aviation Human Factors

SCHOOL OF ENGINEERING

Definition of Human Factors

- ICAO Human Factors Digest No. 1:

Human Factors is about the optimization of the relationship between people and their activities,

- "people" – male and female
- "activities" – communication between individuals; behaviour of individuals and groups

by the systematic application of human sciences,

- structure and nature of human beings
- their capabilities and limitations
- their behaviours both singly and in groups

integrated within the framework of systems engineering.

- attempts to understand the goals and methods as well as the difficulties and constraints under which people working in interrelated areas of engineering must make decisions

Definition of Human Factors

- FAA Order 9550.8 Human Factors Policy:
  - A multidisciplinary effort to generate and compile information about human capabilities and limitations and apply that information to equipment, systems, facilities, procedures, jobs, environments, training, staffing and personnel management for safe, comfortable, effective human performance.
- United Kingdom Health and Safety Executive:
  - Human Factors refer to environmental, organizational and job factors, and human and individual characteristics which influence behaviour at work in a way which can affect health and safety.
- Human Factors is about
  - people in their living and working situations;
  - their relationships with machines, with procedures, with the environment around them and with other people.

Why Aviation Human Factors?

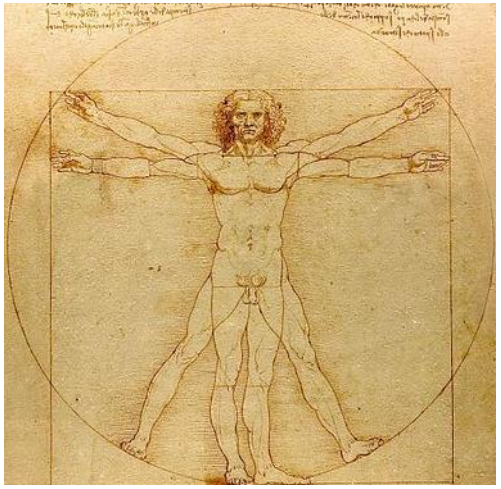
Efficiency

Safety

Well-being of crew members

The Most Critical Component

Performance



Limitations

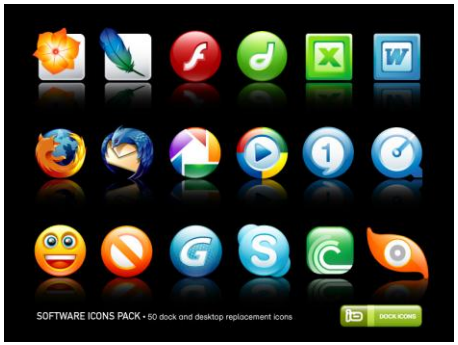
- Human characteristics
  - Information processing
  - Physical size and shape
  - Physical needs
  - Input characteristics
  - Output characteristics
  - Environmental tolerances
- Knowledge sources
  - Anthropometry
  - Biology
  - Biomechanics
  - Physiology
  - Psychology

SHEL Model

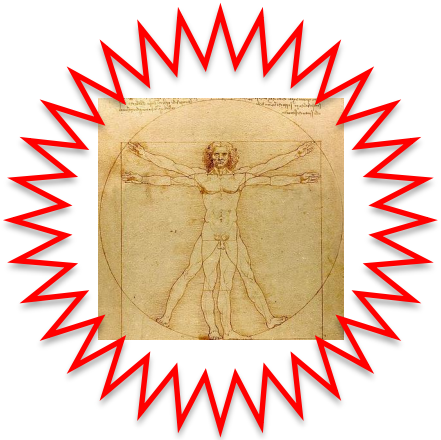
A mismatch at any of the four interfaces can be a source of human errors

Hardware

L-H



L-S



L-E

Software

L-L

Environment

Liveware

Liveware-Software (L-S)

- Software
  - Non-physical items
  - Requires mental interactions
- Examples of software
  - Regulations, standard operating procedures (SOPs), computer software, information accuracy, format and presentation, vocabulary, clarity
- Examples of mismatch
  - Insufficient/inappropriate procedures
  - Confusing or ambiguous symbols and checklists

Liveware-Hardware (L-H)

- Hardware
  - Physical items
  - Requires mechanical interactions
- Examples of hardware
  - Aircraft, machines, furniture, tools, display monitors
- Examples of mismatch
  - Poorly designed equipment
  - Badly located or coded instruments and control devices

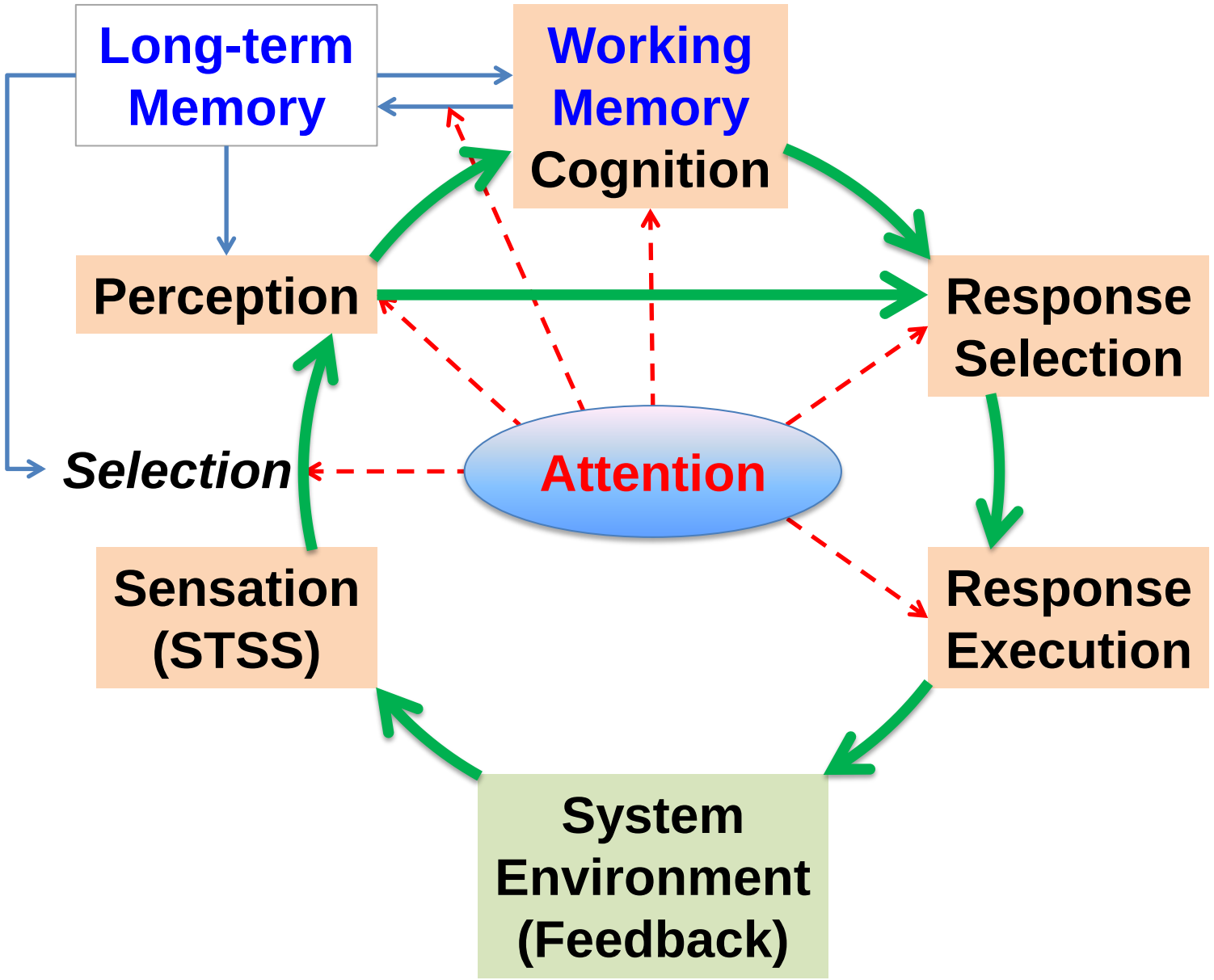
Liveware-Environment (L-E)

- Environment
  - Conditions of the workplace
- Examples of environmental conditions
  - Temperature, ambient light, noise, vibration, air quality, transmeridian travel, political climate, economical climate
- Examples of mismatch
  - Visual illusions during aircraft approach/landing at nighttime
  - Irregular work-sleep patterns

Liveware-Liveware (L-L)

- Liveware
  - Other persons in the workplace
  - Requires social interactions
- Examples of liveware
  - Flight crews, air traffic controllers, aircraft maintenance engineers, corporate culture, corporate climate and company operating pressures
- Examples of mismatch
  - Miscommunications
  - Imbalanced authority relationships

Human Information Processing



Human Information Processing

- Attention is the concentration of mental effort on sensory or mental events
  - A limited resource
- Sensory systems detect and gather raw data of the surroundings and relay them to the brain.
  - Short-term sensory store (STSS) that resides within the brain is a temporary mechanism for prolonging the representation of the raw data
- Perception gives meaning to the raw sensory data.
  - Automatically and rapidly
- Cognition involves conscious activities which transform or retain information
  - Require greater time, mental effort, attention than perception
  - E.g. rehearsal, reasoning, image transformation

Human Information Processing

- Response selection is the decision making process after having an understanding of a situation, achieved through perception and augmented by cognitive
- Response execution requires the coordination of the muscles for controlled motion, to assure that the selected response is correctly achieved
- Feedback implies that
  - The flow of information can be initiated at any point
  - The flow of information is continuous
- Memory can be considered to be the storage and retention of information, experiences and knowledge, as well as the ability to retrieve this information.
  - Working memory is temporary, limited, attention-demanding
  - Long-term memory is permanent, unlimited

Learning Objectives

- Definition of Human Factors
- Need for Human Factors in the aviation industry
- Disciplines of Human Factors knowledge
- SHEL Model
- Human information processing