



Applying Human Factors Science

Jim Handyside

Outline

- Human factors science - a sampler
- How to apply human factors knowledge?
 - Idealized design
 - Model used in NIC/Q
 - Future QHN development possibilities?
- Discussion and action planning

Human Factors Science

topic sampler

- Labels and Displays
- Procedures and Task Guidance
- Alertness
- Clinical Alarms
- Device Usability
- Team Communication
- Warnings

Labels and Displays

Labels and Displays

Human Factors Principles

- Design of Message
 - legibility and readability
- Message Transmission
 - environmental factors
- Message Receipt
 - personal and perception factors

Design of message

Legibility

(recognition of letters, numbers and other graphics)

- Font or Typeface - Sans-Serif
- **Use of UPPER or lower case (preferred)**
- Limit **bold** and *italic*
- Size of characters
- Colour combinations

Design of message

Readability

(ease of reading when characters are legible)

- **Conditions of use**

- Glossy paper and curved surfaces

- Use of highlighter, borders, underlining

- Icons, symbols and machine bar codes

Message Transmission

- **Viewing angle and orientation**
- Lighting
 - Ambient
 - Task
 - Displays

Message Receipt

- Bottom up and Top down processing
 - Message context, precedence, expectation
- Brief and concise
- Codes, abbreviations and icons
- **Redundancy**
- Physical separation

Procedures and Task Guidance

Procedures, Safety and Human Factors

⊕ PPPP (policy, procedure, protocol, process)

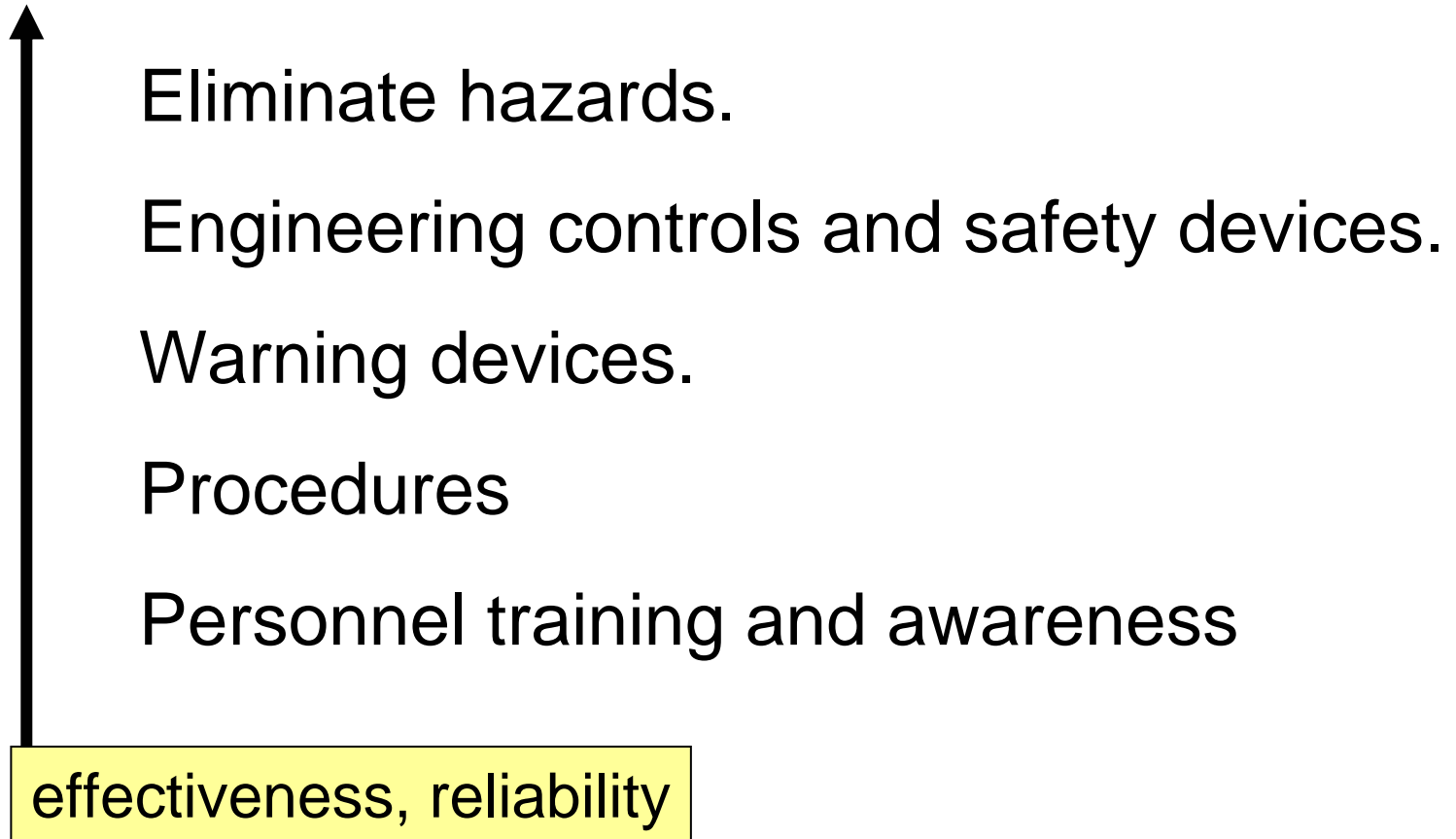
⊕ Human Factors

Design of procedure and documents

Error types and cause factors

Support of procedures when 'in-use'

Safety Precedence Sequence*



* Chemical Process Safety, Radiation Protection, NASA

Slips, Lapses and Omissions

Typical error experience?

 “failure to follow policy or protocol” - contributory factor in 47% of reported incidents

 Omissions account for about 50% of those

Slips - Attentional Failures

Lapse - Memory Failures

Rule-based mistakes

– Misapplication of procedure

Omission Affordance Analysis

- **Affordance** - *Situational factors or characteristics which promote the likelihood of a particular action.*
- **Omission affordance in procedures**
 - *Situational factors or characteristics of a procedural step which promote the likelihood of omitting that step or part of the action involved in that step.*
 - 8 Characteristics
 - Analysis tool provided

Omission Affordances

- Information Load
- Functional Isolation
- Repeated Step
- Necessary Step After Main Goal
- Item Acted On Hidden or not Obvious
- Departure from Standard
- Weak or Ambiguous Signal
- Unexpected Interruption Likely

Reminders, Task Guidance and Other Controls

- Reminders... What makes them work?
- Task guidance
 - checklists, team support
- Using other controls OR changing the procedure.

Criteria for Good Reminders¹¹

Conspicuous – able to catch attention at the critical time.

Contiguous – as close as possible in time and space to the necessary action.

Context – provides information about the *when* and *where* of the item to be remembered.

Content – provides sufficient information about *what* has to be done.

Count – allows a count of the number of actions that need to be done.

Alertness

Alertness

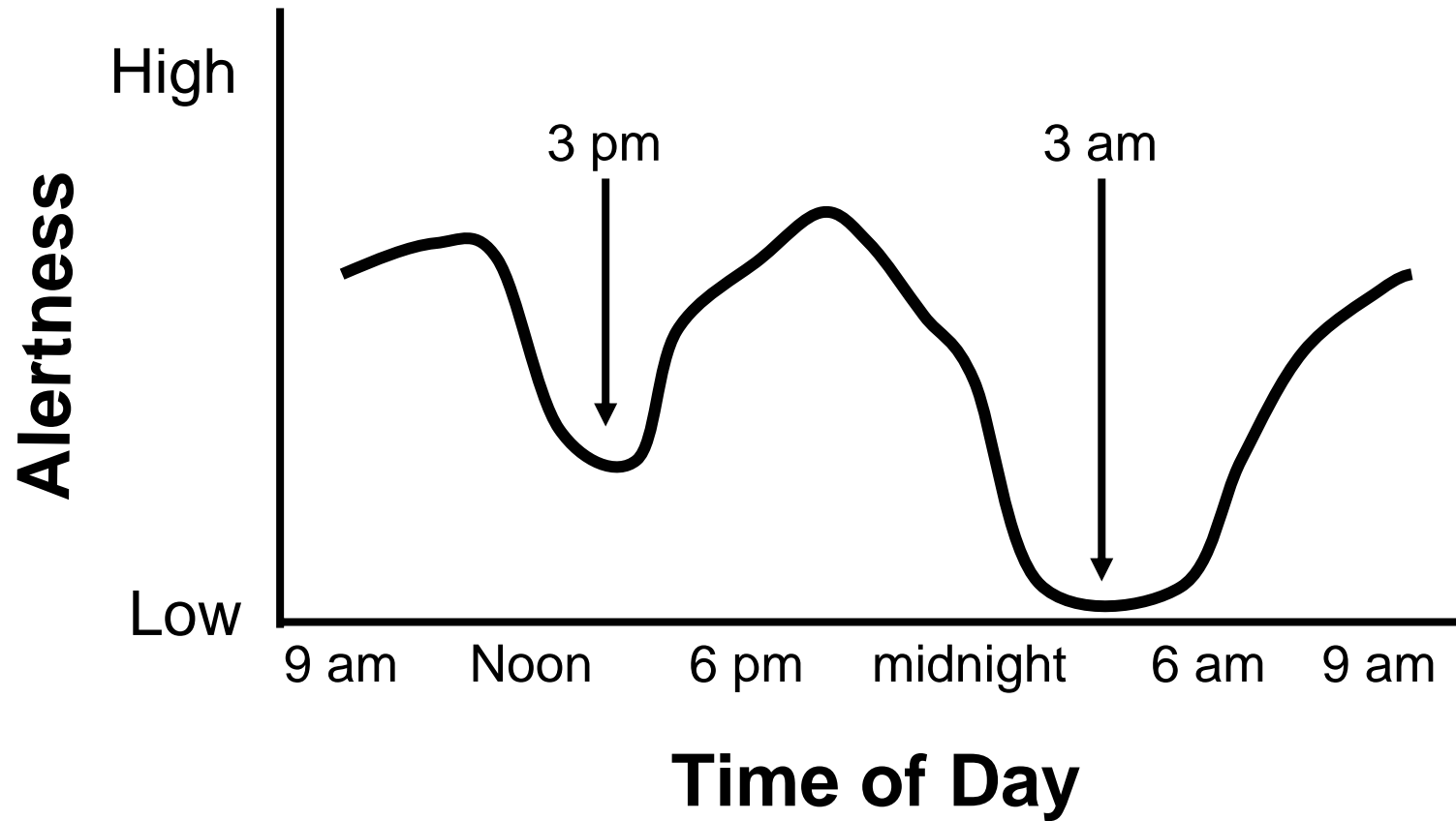
- Alertness and Error: *What influence does alertness have on error potential?*
 - Sleep: Sleep debt and performance.
 - Circadian Factors: Daily cycles in alertness.
 - Hours Worked: Error potential and time on duty.
- Countermeasures: *Preventing and mitigating low levels of alertness.*
 - Shift Design: Optimal shift design to support alertness.
 - Preventive Countermeasures
 - Operational Countermeasures

Alertness and Error

Sleep Loss and Sleep Debt

- Lapsing or blocking on tasks involving vigilance or sustained attention
- Reduced auditory attention
- Increased reaction time
- Slowed performance in cognitive tasks
- Memory problems
- More susceptibility to habituation (more likely to follow habit or established routine)
- Decrement in psychomotor co-ordination
- Decrement in decision making (e.g. fixation on certain aspects of a situation to the neglect of other information)

Circadian Rhythm and Alertness



Hours Worked

- Higher incidence of error and accidents in the last few hours of a 12-hour shift
- Sleep debt accumulates across a series of shifts as does resulting performance decrement

Countermeasures

- Shift design
- Preventive countermeasures
- Operational countermeasures

Countermeasures Shift Design

- Forward rotation:
 - Days to Afternoons to Nights
- Slower rotation
- Permanent assignments

Countermeasures

Preventive Countermeasures

- Adequate sleep
 - time between shifts
 - sleep awareness
 - identification of sleep disorder
- Reduction of sleep debt before a period of anticipated sleep loss
- Prophylactic napping

Countermeasures

Operational Countermeasures

- Strategic napping
 - Less than 45 minutes
 - 10 minute *Power Nap* is effective!
- Stimulants? ... Caffeine!
- Circadian resetting
 - Bright Light - midnight to 5 a.m.
 - Melatonin not effective

How to apply this knowledge?

- Ideally... at the design phase
 - New buildings, new equipment and selection
 - We are all designers... processes, layout, etc.
- Human Factors Checklist Series - NIC/Q
- Potential QHN Developments

Design Phase Application

- Deployment of HF design principles in design of equipment and materials
 - Regulations?
- New construction opportunities
- Usability testing and evaluation when acquiring new equipment and materials

Human Factors Checklist Series

- **NIC/Q Project** (A National Evidence-Based Quality Improvement Collaborative for Neonatology)
 - Vermont Oxford Network
 - Series of topic-based checklists
 - Developed in the context of Neonatal ICU, error experience and potential
 - Poster presentations at semi-annual meetings

Human Factors Checklist

HUMAN FACTORS CHECKLIST

Alarms

Point of Care Ergonomics

Are all alarms audible by care providers at the bedside?^(1, 2)
Alarming devices are positioned to enable alarms to be heard.
Alarm volume is set at 10dB above ambient noise.
Audibility testing is conducted periodically to ensure alarms are audible.
Alarm sound level is adjustable.
Alarms can be heard and responded to even if bedside is unattended.

Grade: ____

Notes:

Is the meaning of the alarms readily apparent?⁽³⁻⁶⁾
The alarming device is easily identified at the bedside.
Alarms have distinct tone or are positioned to enable identification of source device.

Grade: ____

Notes

Point of Care Environment

Are distractions that could interfere with alarm response kept to a minimum?
All auditory interference such as cell phones, conversation and intercoms are minimized.

Grade: ____

Notes:

Individual Human Factors

Are alarms set to reduce the number of alarms to those that are critical?^(7-10, 15)
Equipment is maintained to reduce false alarms.
Settings of alarm levels reduce the number of auditory alarms to those that require corrective or monitoring response.

↓ Model used in other fields

↓ Collaborative development

↓ Five topics so far

📄 Clinical Alarms

📄 Labels and Displays

📄 Alertness

📄 Procedures and Task Guidance

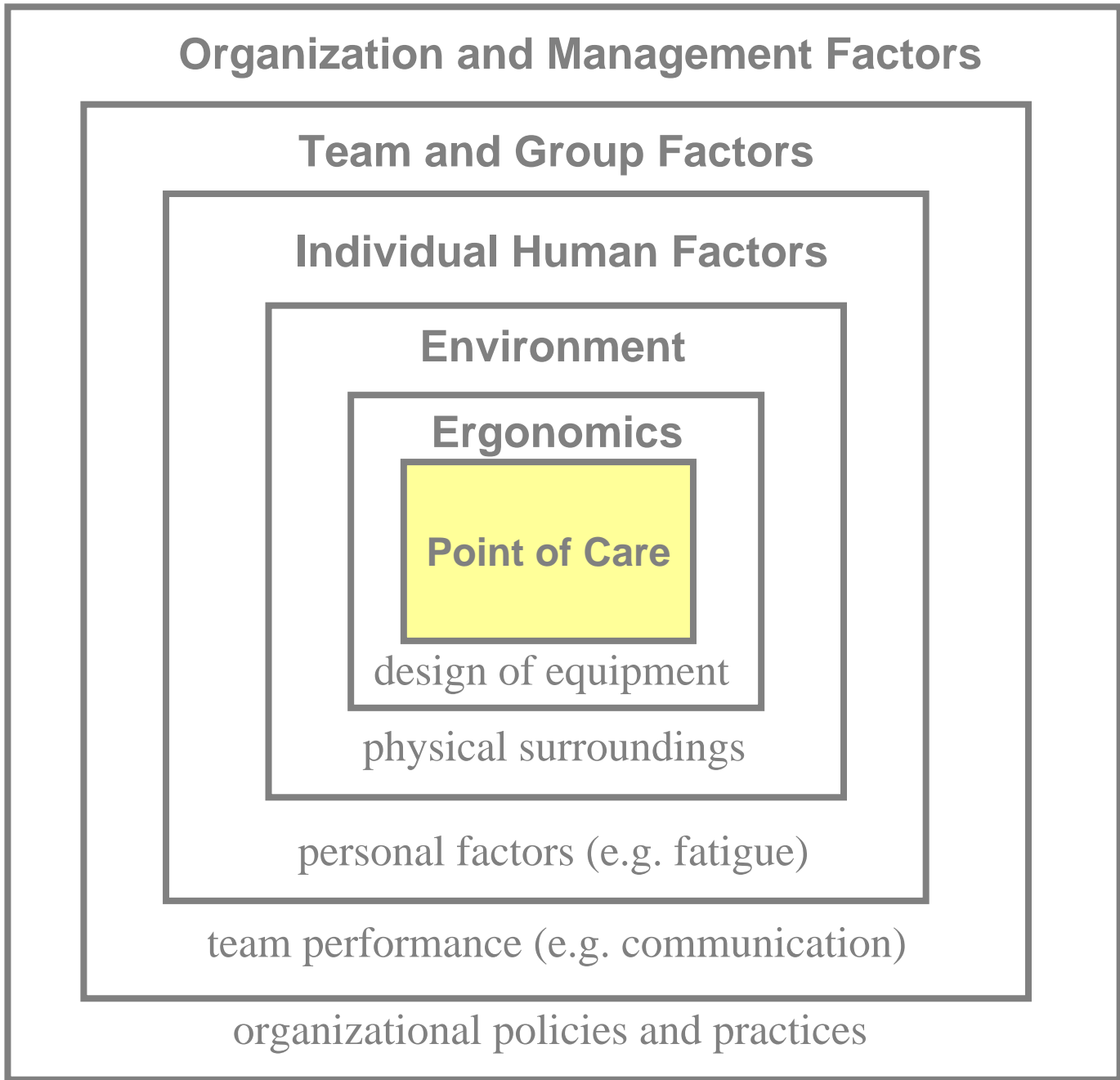
📄 Device Usability

Human Factors Checklist Series

Purpose and Scope

- Purpose:
 - Direct attention to human factors elements
 - Guide for change
 - Improve SYSTEM reliability
 - Educate about Human Factors
 - Build a culture that focuses on systems
- Scope
 - Limited to Human Factors
 - Assumptions (e.g. evidence-based care)

Framework
for the
Human Factors
Checklist
Series



Organization and Management Factors

Team and Group Factors

Individual Human Factors

Environment

Ergonomics

Point of Care

design of equipment

physical surroundings

personal factors (e.g. fatigue)

team performance (e.g. communication)

organizational policies and practices

Application Options

NIC/Q Human Factors Checklist Series

- Review potential hazards using checklist in a proactive manner.
- Management of Change: Use principles and tools as a guide to assist selection of new products or prior to any significant changes in the unit.
- Use principles to support other analysis (e.g. FMEA, RCA, HACCP).

Future Directions

NIC/Q

- Continue issuing new topics
- Revise and refine current topics
- Units to continue with poster session case studies on application
- Compile 'change index' based on changes
 - Link to web-based incident reporting system

Quality Healthcare Network Opportunities

- Follow NIC/Q model? Specialty based checklist series?
- Specialty-based principles and change guide?
- Education sessions?
- Your ideas... discussion

For references and resources contact:

Jim Handyside

Improvisation

improvisation@wwdc.com

www.Hsqi.com