Ergonomics Everywhere

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What is ergonomics?
What is ergonomics?
Ergonomics/human factors is about more than chairs....
The origins of ergonomics

“Fitting the task to the person”
Studying performance in controlled conditions

Taking a systems perspective

Studying performance in context

Informing theory

Eliciting information

So what do I do?
Contexts of work
Patient Safety: a pressing issue

Scots centre of excellence for cancer treatment ordered to improve after concerns over patient safety

Study suggests there is confusion over monitoring patient safety in primary care

Junior doctors' contract could 'compromise patient safety', says Ex-Tory health minister Dan Poulter

Patient safety warning at Princess Royal Hospital
Patient safety in the Operating Theatre

What we can learn from fatal mistakes in surgery

By Dr Kevin Fong
Presenter, How to Avoid Mistakes in Surgery

21 March 2013 | Health

In 2005 Elaine Bromiley, a 37-year-old woman attending hospital for what was supposed to be a routine operation on her nasal air passages, suffered catastrophic brain damage after unexpected complications occurred at the start of the procedure.

An emergency had arisen shortly after the anaesthetic drugs had been injected. Elaine's airway - the path from her mouth to her lungs through which air normally flows - had become obstructed. It was a rare event, of the type that occurs in fewer...
The role of design

Taken from Toft Report:
Considering design within a systems perspective

Intelligent redesign resulting from a recurring severe adverse event

Vincristine: Wayne Jowett

Wayne Jowett was in remission from acute leukaemia, undergoing the final stages of his treatment..... A variety of solutions have been proposed, including restrictions around seniority and training, separation of the intrathecally and intravenous drugs in time and space and technical solutions. Separate ‘lock and key’ systems for intravenous and intrathecal systems to prevent cross-use have long been viewed as the solution but have proved hard to achieve. More recently, the supply of vincristine in a ‘mini-bag’ of saline has been used. The volume of saline is such that no doctor or nurse would consider nor could inject the drug into the spinal space. However, owing to the volume of fluid, the mini-bags are not safe in the paediatric setting and so only represent a partial solution. These solutions represent key examples of redesigning technology to make care safer.

Designing for user interaction

“reducing, as far as possible, the risk of use error due to the ergonomic features of the device and the environment in which the device is intended to be used (design for patient safety) and consideration of the technical knowledge, experience, education and training and where applicable the medical and physical conditions of intended users (design for lay, professional, disabled or other users).” 93/42/EEC Amended by 2007/47/EC
Taking a holistic view of patient safety....

‘...water births, ..... we have to do it regardless of what it might, of how we might feel about it and what the position might do to us’

Professor Sue Hignett
S.M.Hignett@lboro.ac.uk
The birthing pool was redesigned to incorporate:

- shaped edges to give an armchair style support for the mother
- integral seat for delivery and perineal examination
- concave side to provide knee room for the sitting midwife
Birthing pool

£10million fund for hospitals to buy more birthing pools and chairs for new mums (and at last there'll be somewhere for new dads to sleep, too)

- 40 hospitals in areas with highest birth rates to share cash
- Trusts need to expand and improve facilities to cope with demand

By MATT CHORLEY, MAILONLINE POLITICAL EDITOR

PUBLISHED: 09:17, 7 January 2014 | UPDATED: 10:46, 7 January 2014

Professor Sue Hignett
S.M.Hignett@lboro.ac.uk

Loughborough University
The proliferation of information

“It is estimated that the doubling time of medical knowledge in 1950 was 50 years; in 1980, 7 years; and in 2010, 3.5 years. In 2020 it is projected to be 0.2 years—just 73 days. Students who began medical school in the autumn of 2010 will experience approximately three doublings in knowledge by the time they complete the minimum length of training (7 years) needed to practice medicine. Students who graduate in 2020 will experience four doublings in knowledge. What was learned in the first 3 years of medical school will be just 6% of what is known at the end of the decade from 2010 to 2020.”

Considering the whole system

Nottingham City Hospital
5 Floors
~36 Wards
~1100 Beds
~360,000sqm
~1.5km x 1km
10,000 doors
5 doctors OoH

Only 25% of the hospital year falls between 9am and 5pm Monday to Friday. During the remaining 75%, known as ‘Out of Hours’ (OOH), a skeleton staff of junior doctors, support workers, and nurses must provide safe and timely care in hospital.

Staff receive minimal training to deal with the non-technical challenges of OOH working.
Traditional ‘pager’ System

New approach
Data to support for Intelligent Healthcare Delivery

• Understanding out of hours work

• Designing layouts of clinical environments

• Planning staffing to meet demand
Contexts of work
Wish you were here!
QUEUE AHEAD
40 MIN DELAY
## Fastest by public transport

<table>
<thead>
<tr>
<th>Departs</th>
<th>Arrives</th>
<th>Duration</th>
<th>Mode/Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:04</td>
<td>12:15</td>
<td>1 hr 11 mins</td>
<td>Walk to Surbiton</td>
</tr>
<tr>
<td>11:22</td>
<td>12:24</td>
<td>1 hr 2 mins</td>
<td>Walk to Langley Avenue (KT6)</td>
</tr>
<tr>
<td>11:24</td>
<td>12:33</td>
<td>1 hr 9 mins</td>
<td>Walk to Surbiton</td>
</tr>
</tbody>
</table>

### Notes:
- **Status alert for route 465**: Severe Delays
- **Victoria line**

### Additional Information:
- **Victoria line to King's Cross St.Pancras Underground Station**
- **Bakerloo line to Oxford Circus Underground Station**
Understanding the work of railway signallers


“Low automation”

“High automation”
03 June 2014 Designing interaction between people, technology and systems

### Figure 1: Mean IWS over Time

**Passive Monitoring**
- Mean IWS: \( r = -0.526 \)

**Active Monitoring**
- Mean IWS: \( r = 0.444 \)

**Intervention**
- Mean IWS: \( r = 0.342 \)

**X-axis**: Time (in minutes) from 2 to 30 minutes
**Y-axis**: Mean IWS (0 to 7)

**Bars**: Confidence intervals for each time point.
Different signallers’ data demonstrated different relationship strengths.
Air Traffic Controller Behavioural markers and the ‘Precipice of Performance’
Asking experts about observable behaviours

1. Begin losing awareness around edges
2. Period of planning ahead decreases
3. Method of scanning degrades
4. Miss things
5. Don’t know who is calling

1. Unexpected clearances
2. Small mistakes
3. Can see the aircraft but don’t know what to do
4. Fall behind the traffic
5. Don’t have a plan

Prevention: change strategy prior to traffic increase

Recovery: change control strategy

Recovery: change control strategy, CC reducing traffic

Recovery only likely with guidance and reduction in traffic

1. Asking for confirmation
2. Unsafe clearance
3. Unexpected decisions
4. Jumping from one aircraft to another
5. Cannot see a solution
6. Panic
7. ‘Blacked out’/ silent

Designing information representations

Capturing responses to current sign content

Participation in design of new concepts

Which message would be most likely to make you slow down?

![Graph showing message ranking]

Least likely

Most likely

Accident slow down
Incident slow down
Congestion slow down
Queue ahead
Queue caution
Congestion caution
Queue after jct
Long delays after jct
Congestion after jct
Delays after jct

Ergonomics and Human Factors in partnership with Health and Safety

• Beyond human error, to resilience (Safety I to Safety II)
• Following up incidents with action
• Data driven decision making
• Considering the whole system and its stakeholders
Some challenges for the future

• E/HF as a distinct discipline
  “Chartered status has conferred recognition, at the highest level, of the uniqueness and value of our scientific discipline”

• Embracing technology, and the change it brings

• Getting the most from our varied research approaches
“What the world needs is ergonomics, not ergonomists”

Hywell Murrell ~1950s


“E/HF may not always be about delivering the right solution(s), but it is always about delivering the right approach”

Sharples & Buckle (2015)

Thank you
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