

# Designing operating theatres: An ergonomic approach

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This version of the presentation is for individual viewing. It has copious notes added. It should be viewed in > View > Notes Page, and the slides advanced using the Page Down button.

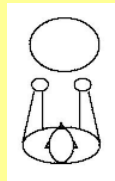
This presentation has grown on several recent occasions, including the ACORN2004 Conference and the Surgical Grand Round at RAH.

I expect it's good for recycling several more times/

# Traditional method

**Engineering approach**  
**technology-**  
**centred**

**Start with the**  
**technology**  
**Fit people**  
**around it**



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The next three slides show contrasting ways of planning. Traditionally the architect likes to lead. Although the intended users are “consulted”, this doesn’t work well because of difficulties discussed later.

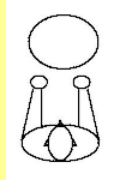
## Two approaches

### Engineering approach

technology-  
centred

Start with the  
technology

Fit people  
around it

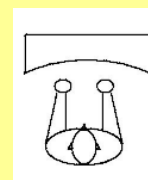


### Ergonomic approach

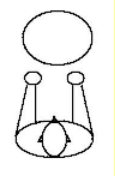
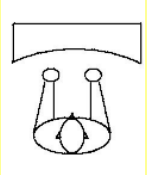
people-  
centred

Start with the  
people

Fit technology  
around them



## Two approaches

<b>Engineering</b> approach	<b>Ergonomic</b> approach
technology-centred	people-centred
Start with the technology Fit people around it	Start with the people Fit technology around them
	

Both use the same technology and the same people

Best – combine the two

# Planning the OR - this talk

**what's involved**

**what's wrong with existing ORs**

**how to do it better – one view**

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The first of these three parts is the shortest.

“What’s wrong” is based on two surveys discussed in detail later.

## What's involved - the challenges

Importance – quality of output, cost,  
productivity, usability, user satisfaction

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An OR (or OT – the terms are used interchangeably) costs several hundred dollars an hour to run. I'd be glad to have some more specific figures if these are available.

The five or so standard ergonomic reasons for intervening are:

1. Accuracy or quality of output
2. Amount of output = productivity
3. Occ Health and Safety
4. Ease of learning and use – avoiding those difficulties which can be avoided.
5. Satisfaction at work for those involved. A lot of this is down to management, leadership, and the workplace culture.

## What's involved - the challenges

Importance – quality of output, cost, productivity, usability, user satisfaction

- changing technology - complexity
- detailed info needs, overload, problems
- individual differences, preferences, ego, dogma
- culture , silo mentality

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Here are the reasons for the formidable problems in planning Ors today.

New technology has come in particularly with microsurgery, laparoscopic surgery, and the imminence of computer and robotic surgery. Already there was formal extra training for the equipment in orthopaedic and cardiothoracic surgery, and all specialties grew in this way.

Some older nurses – and surgeons – found these changes so threatening that they opted out of OR work.

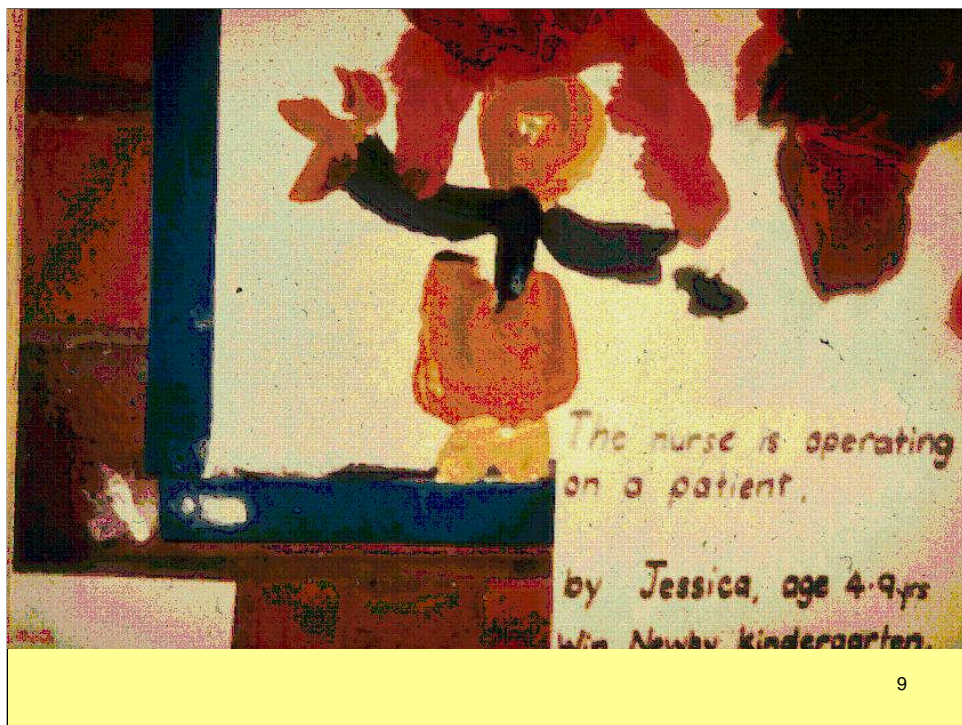


In a mischievous mood I have sometimes asserted that OR work is a team effort, getting the planned enthusiastic response – yes yes yes. However the next statement is a question “But who’s the captain of the team?!” , where people are reluctant to say “the surgeon” and any choice would be contentious.

The answer is “It all depends on the particular issue, whether it is operative, anaesthetic, logistic, timetabling, the electrical system and so on.

Modern management theory discusses topics like “the authority gradient” in the cockpit of the aeroplane. If the co-pilot is too intimidated to mention a possible danger to the pilot captain, disaster may (and has) resulted.

Anyone connected with the functioning of the OR should have input into the design process. Timers have changed since the imperial surgical style.



Here's a drawing by an alert kindergarden student:

"The nurse is operating on a patient".



A cult of self-importance means that some basic jobs just don't get done, particularly some types of cleaning and maintenance.



## The silo mentality

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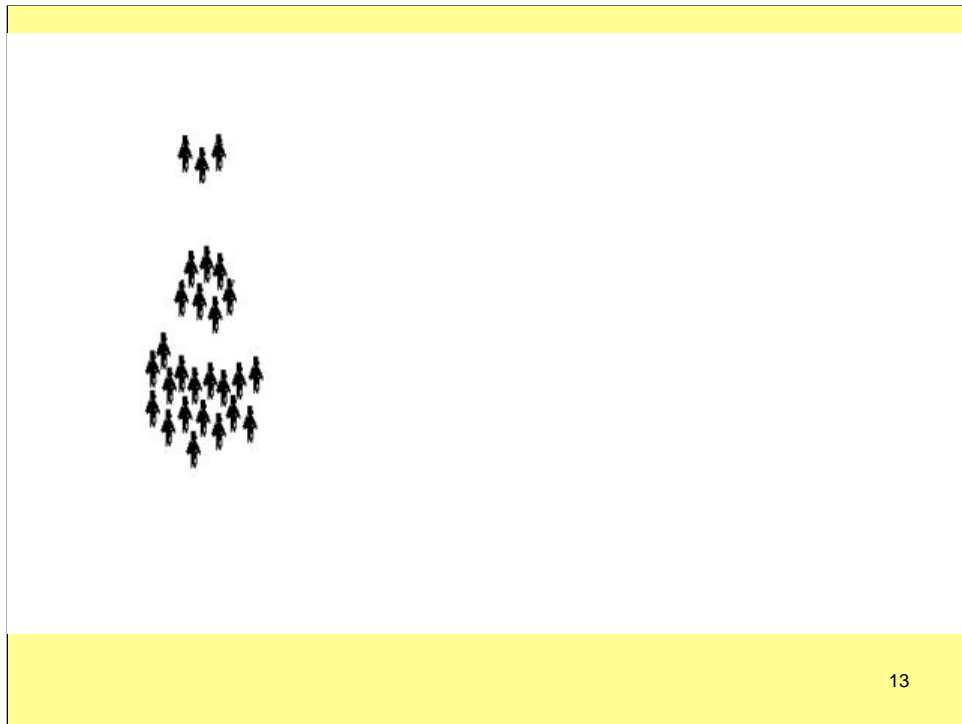
Versions of this are:

Not In My Back Yard - NIMBY

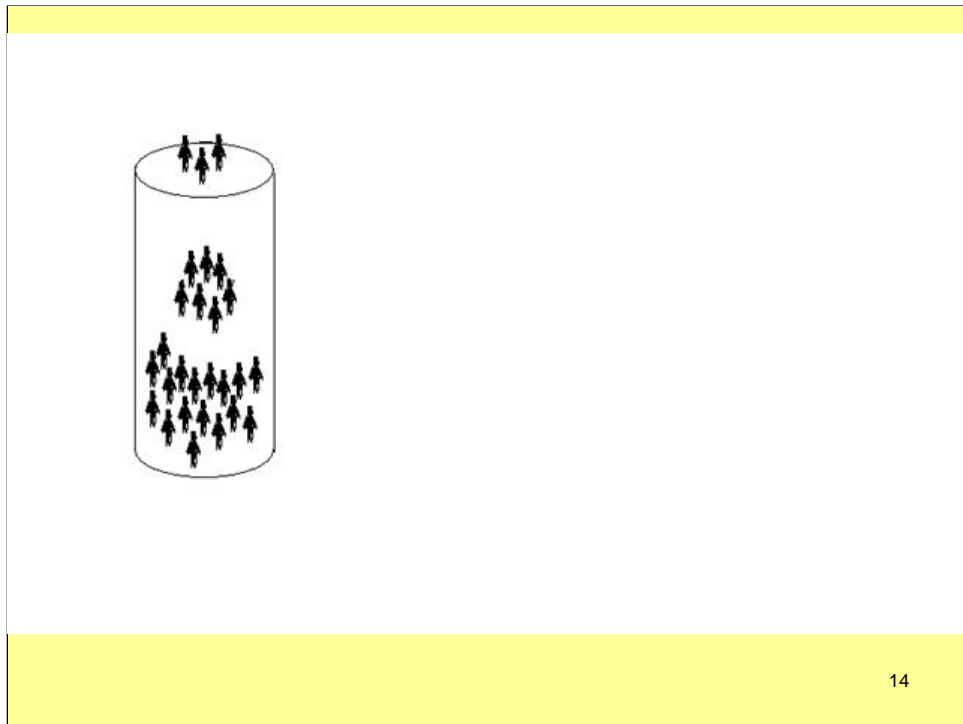
Not Invented Here - NIH

Parochialism

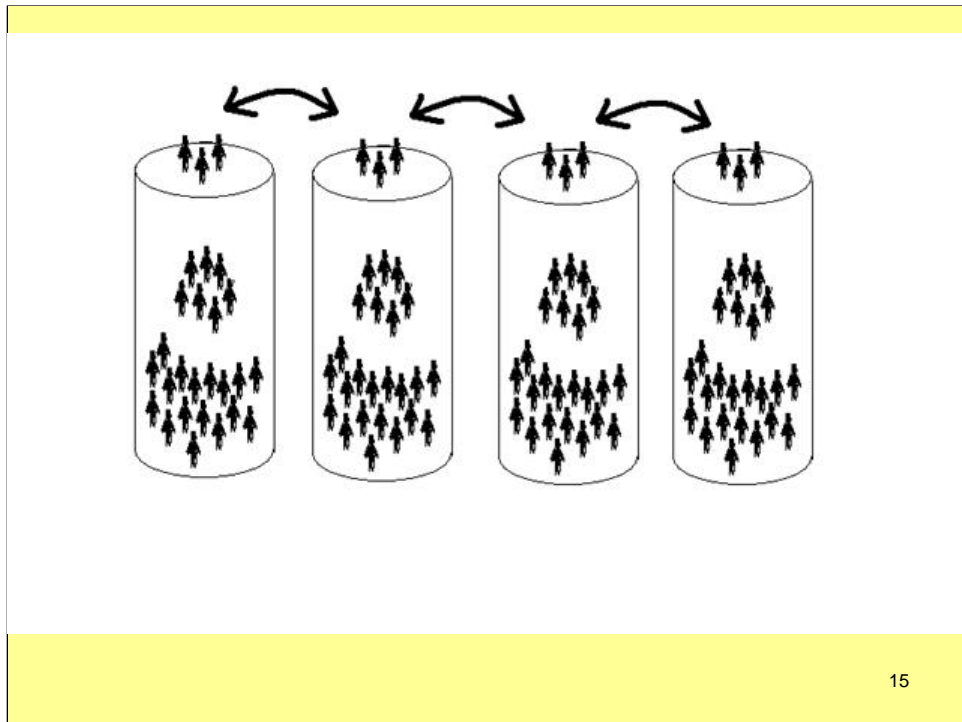
The next few slides illustrate the lack of horizontal communications which is often found in government departments and other bureaucratic institutions.



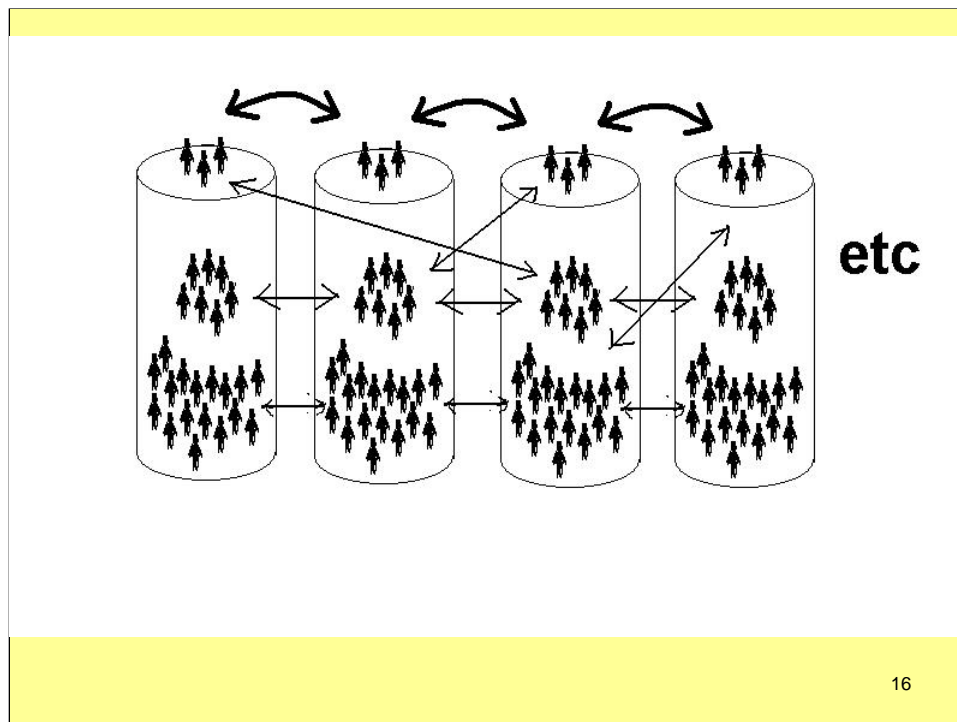
Here are the people in the executive, middle management and the shop floor



... enclosed in a concrete silo



... next to other silos, which only communicate at the top



Where they should communicate at other levels, etc etc etc  
Sir Gus Nossal's answer at Walter and Eliza Hall – one coffee room for five floors.

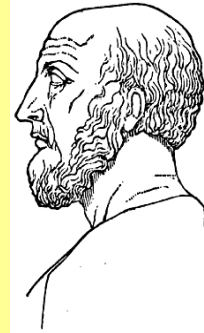
## OR planning - what to consider

- projected workload
- possible site and size
- links
- staff
- fittings, equipment
- management, culture
- change
- politics

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## An early view by Hippocrates:

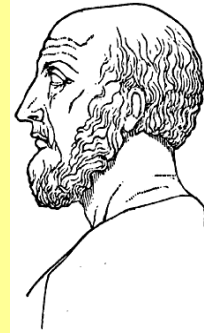
**The operator should sit comfortably, in a good light, and steady the elbows on the knees**



## An early view by Hippocrates:

The operator should sit comfortably,  
in a good light, and steady  
the elbows on the knees

**“Those about the patient must  
present the part to be operated  
upon as may seem proper,  
steady, in silence, and listening  
to the commands of the  
operator.”**



# What's wrong with ORs today

two recent surveys

40 surgeons    349 responses

42 nurses      150 responses

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A lot! – as for hospital and building design in general

## What surgeons want in operating rooms

M. Patkin

*Departments of Surgery, University of Adelaide and Flinders University, South Australia, Australia*

### Summary



The wishes of surgeons for their operating rooms (ORs) are similar in principle to those of other workers for their work place – to be able to do their work accurately, productively, safely, and with satisfaction. To determine these wishes 40 Australian surgeons were asked what changes they would like in their operating rooms. From their responses there were 349 separate comments defined. Each comment was labeled with a keyword which was used to sort them into categories using a spreadsheet. Within each category labels were modified as appropriate and sorting was repeated several times until the groupings appeared stable. Feedback was sought from participants after circulating the collated results by email. Not surprisingly, there were problems in many areas – equipment, lighting and OR planning. Altogether there were 36 different categories of comment, with half of them having six or fewer respondents. The analysis clarified the problems of surgeons, and yielded some that were not

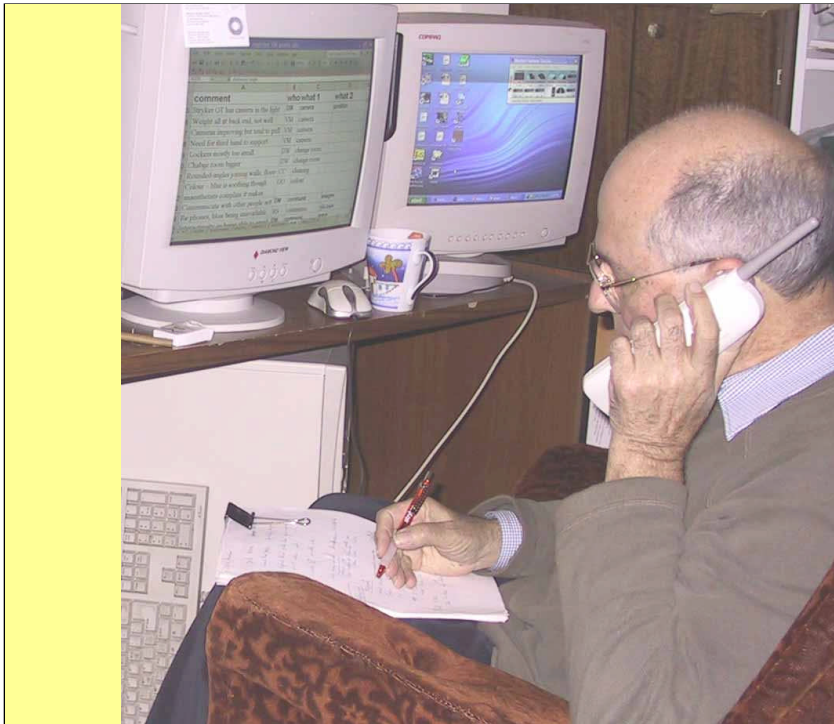
## The survey of surgeons - how

- **telephone**
- **40 surgeons (Adelaide 34, Sydney 6)**
- **349 comments**
- **keyword**
- **sorted, 36 categories, spreadsheet**

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Flowchart??

Paperwork is an occupational hazard for GPs. One GP counted a barrage of 1574 individual communications monthly.<sup>1</sup> In cold cash terms, the Productivity Commission found that GPs' administrative



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Microsoft Excel - Master register OR prefs .xls

File Edit View Insert Format Tools Data Window Help

Type a question for help

150% 10 B

A370 diathermy tangle

	A	B	C	D
1	comment	who	what 1	what 2
35	Stryker OT has camera in the light	DM	camera	position
36	Weight all at back end, not well	VM	camera	
37	Cameras improving but tend to pull	VM	camera	
38	Need for third hand to support	VM	camera	
39	Lockers mostly too small	DW	change room	
40	Chabge room bigger	DW	change room	
41	Rounded-angles joining walls, floor-	CC	cleaning	
42	Colour – blue is soothing though	GO	colour	
43	anaesthetists complain it makes			
44	Communicate with other people not	DM	communic	images
45	Re phones, likes being unavailable	RS	communic	phones
45	Interactive eg being able to email	DM	communic	xrays

Ready

## What surgeons wanted

Category	No.	Category	No.
Equipment	50	Tables	17
Lighting	32	Planning, design	16
Cables and tubing	25	Surgeons	13
Computers, video, communications, cameras	24	Sterile zones	12
Staff	20	Management	11
Foot pedals	19	Monitors	11

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## A few details

equipment	not replaced, too bulky, complex, connections, bioengineer, standards, assembly, camera heavy autoclavable
lighting	hard to position
cables, tubing	
computers etc	
staff	same nurse, technicians position pts, trained
pedals	locating, operating
tables	low enough
design	anaesthetic bays, doors
surgeons	
sterile zones	
management	
monitors	

# Survey of OR nurses

## **ACORN 2004**

Attendees asked to list complaints

Collected at exit

Same methodology as before

## Results of nurses survey

Equipment	30	xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
Storage	20	xxxxxxxxxxxxxxxxxxxxxx
Cords, tubes	17	xxxxxxxxxxxxxxxxxxxx
Design / traf	14	xxxxxxxxxxxxxx
Management	10	xxxxxxxxxx
Staff	9	xxxxxxxxxx
Manual h	8	xxxxxxxxxx
Size	7	xxxxxxx
Cost	7	xxxxxxx
Doors	6	xxxxxx
Computers	5	xxxxx
Surgeons	5	xxxxx
Teaching	4	xxxx
Architect	2	xx
Single issue	6	xxxxxx
	150	

# Planning

problems to be recognised – political !

the planning group

architectural plans

choosing fittings and equipment

## What causes these problems?

- architects untrained, unaware
- lack of guidelines, info other than personal experience & hearsay
- communication
- common sense & opinions not enough
- ergonomics neglected
- committee processes
- stakeholders

traditional architects' plans

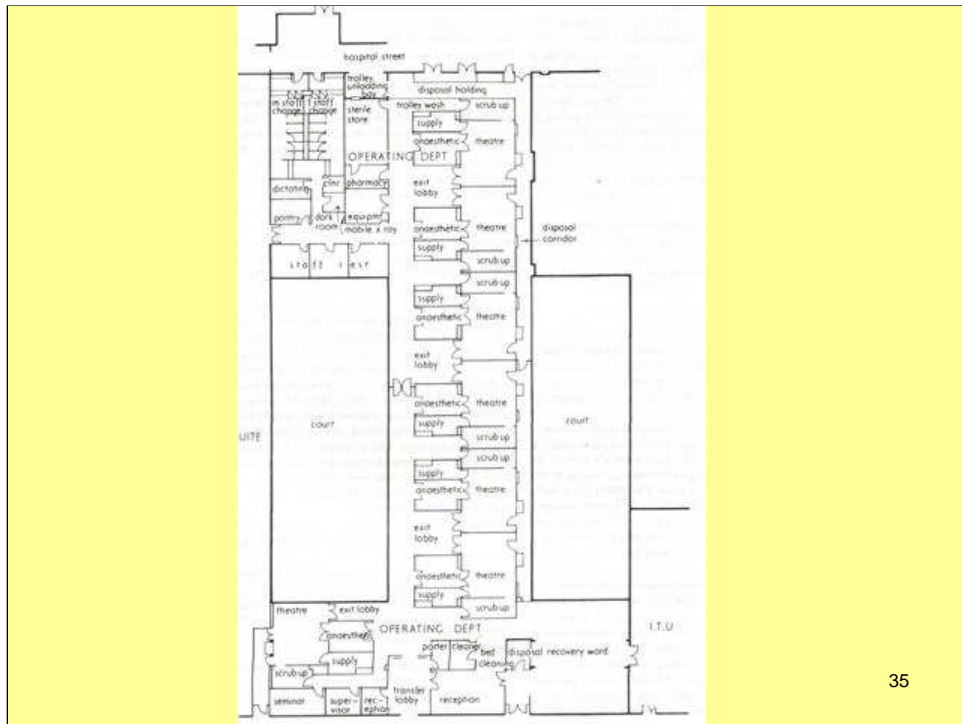
32



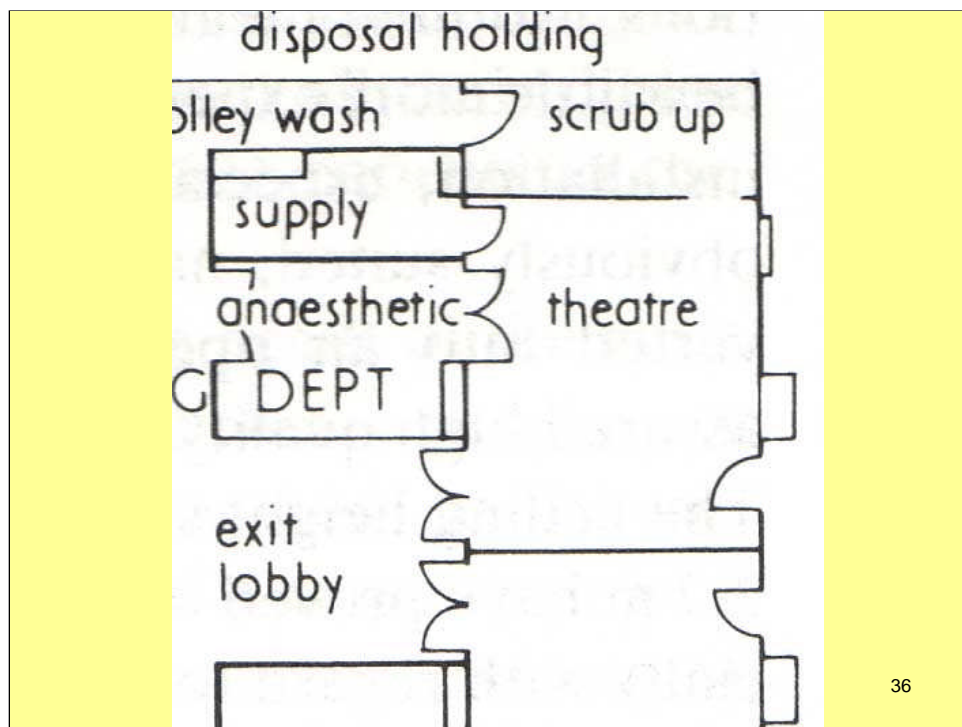
EDITED BY PATRICIA TUTT AND DAVID ADLER

# NEW METRIC HANDBOOK PLANNING AND DESIGN DATA

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35



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## The problems of communication

- workplace culture, lack of feedback, silo mentality
- blinkers, ego / thoughtlessness
- lack of tools

## info sources

- books [Barr Smith, British Library, LOC, special libraries e.g. Hosplan]
- journals, reports etc
- internet mailing lists, Medline, Google
- other sources – ECRI
- previous OR building projects

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Building an OR is like getting married. In a well regulated life you only do it once or twice so you never really get good practice at it, and the advice of others is generally going to be at least a little suspect, self justification.

There are lots of marriage manuals and counselling services but not for building ORs

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- previous OR building projects

None really seem to give you the key information

39

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There are lots of marriage manuals and counselling services but not for building ORs

## The planning group

- members are representative, knowledgeable
- secretary
- email communication between members
- info resources

Stakeholder	Agenda
hosp admin	simple, cheap solution
doctors, nurses	usable, quality, size, staff
non-clinical staff	usable
unions	wages, conditions, OHS
SA govt	votes
patients	prompt kind safe Rx

## Choosing equipment

- decide specs - task, info (mfrs AND others)
- consult users, users elsewhere
- note earlier mistakes

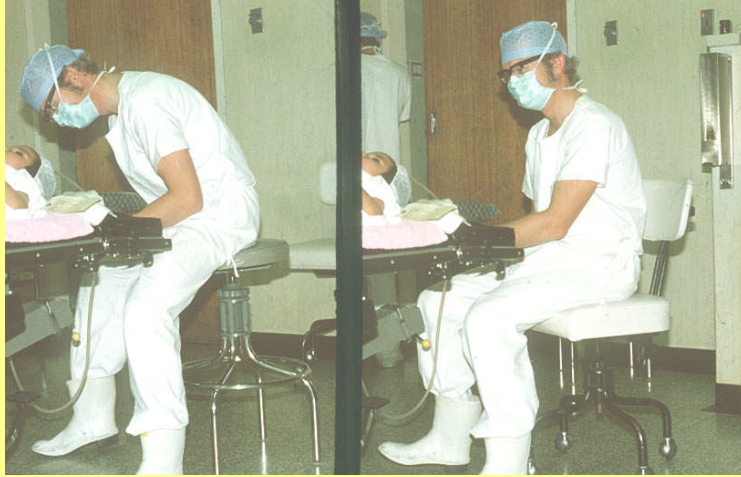
# MIMS directory

## Examples of bad ergonomics

- plaster cutters
- chicken-wing posture from OR table height
- operating stools
- early Zeiss operating microscope



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## The Denyer operating table

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## The Stille operating table

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Pair of scissors given to me

## Better ways of planning


1. task analysis – checklists for areas, people, equipment
2. communication - picking the right tools

## Operating room design for minimally invasive surgery


M. Patkin

*Department of Surgery, Flinders University, South Australia*

### Summary

 Adapting the modern operating room (OR) for minimally invasive surgery (MIS) is a challenge that begins with the more general problem of designing the OR. Apart from the scarcity of practical publications and details in this area, the highly technical nature of many of the issues, and the difficulty of communicating them, often result in mistakes being made in planning at a very simple level. Three specific ways of improving communication in planning are: using a checklist, sharing a planning handbook among the intended users, and modifying architects' drawings to 1:10 scale floor plans with movable cut-outs to represent equipment and staff.

### Keywords

 operating room design, planning, minimally invasive surgery

## A checklist for components of operating room suites

M. Patkin

*Departments of Surgery, University of Adelaide and Flinders University, South Australia, Australia*

### Summary



Planning an operating room (OR) is a complex process, and it is common to find that essential items are overlooked. A checklist may be one measure for preventing this. An example of this is presented.

### Introduction

Planning a new operating room (OR) is an uncommon experience for most doctors and other hospital staff, and for architects unless they specialise in this area. A study of the wishes of surgeons for OR design [1] supports this proposition. As a result it is likely that essential parts of a new OR will be overlooked unless

references listed, others may be found online at the British Library ([www.bl.uk/](http://www.bl.uk/)) and the Library of Congress ([www.loc.gov/](http://www.loc.gov/)).

### General requirements for all areas:

- Usability – fulfilment of basic ergonomic criteria

## Checklist - areas

- Reception
  - Office
  - Change room, toilet
  - Anaesthetic room
  - OR
  - Recovery
- etc etc

## checklist - areas

General req	Sterilizing
Reception	Storage
Corridors	Change room
Anaesthetic	Lounge
Scrub room	Office
Operating room	Related areas
Recovery	Other
Set-up	Problems
Clean-up	

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## e.g. scrub area

access	trolley - gowns, gloves
lighting	clearance
taps	mirror
timer	trash bin
sinks	
soap	

## Checklist - people

- Surgeon / physician / endoscopist / other
- Assistant (s)
- Anaesthetist (s)
- OR nurse (s)
- Technician (s) Imaging, other
- Technical assistant (s)
- Other

## Checklist - equipment

General	- lights table instruments platform
Surgeon / physician / endoscopist / other	- As appropriate
Assistant (s)	-- stool
Anaesthetist (s)	-- anaesthesia eqpt q.v.
OR nurse (s)	-- trolleys
Technician (s)	-- imaging
Imaging, other	
Technical assistant (s)	---
Other	---

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## making plans easier to understand

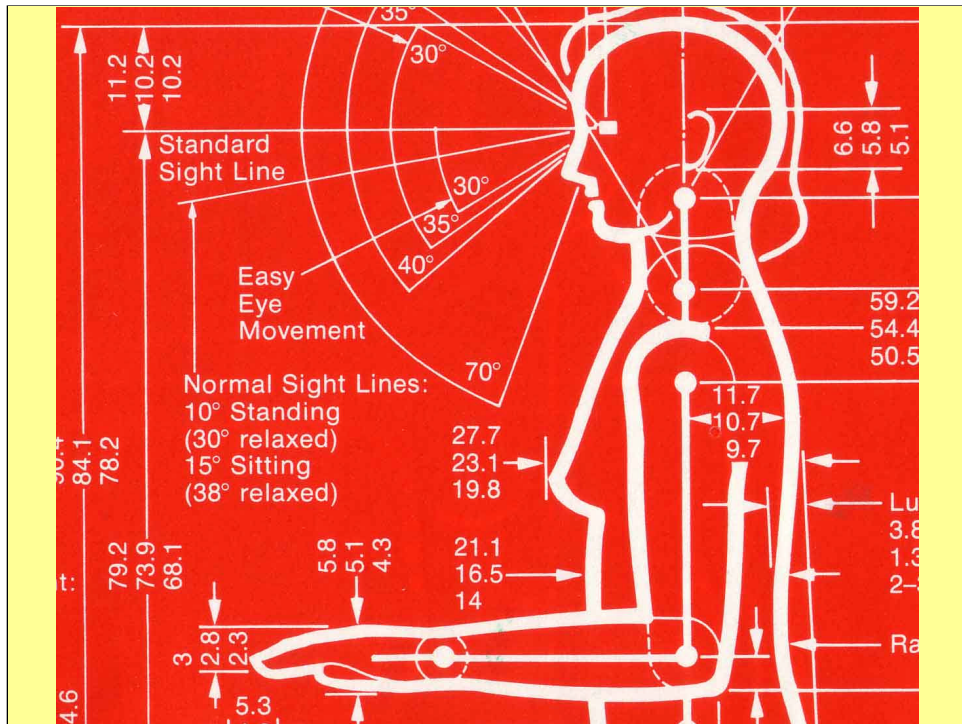
larger scale 1:10 [for detail]

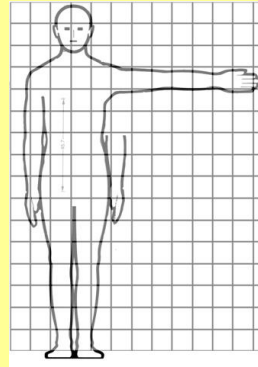
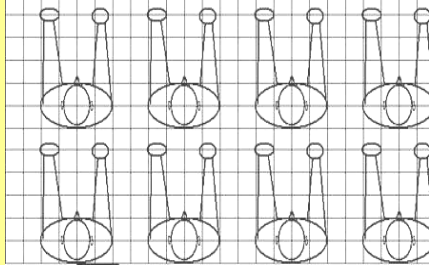
less cluttered

anthropometry

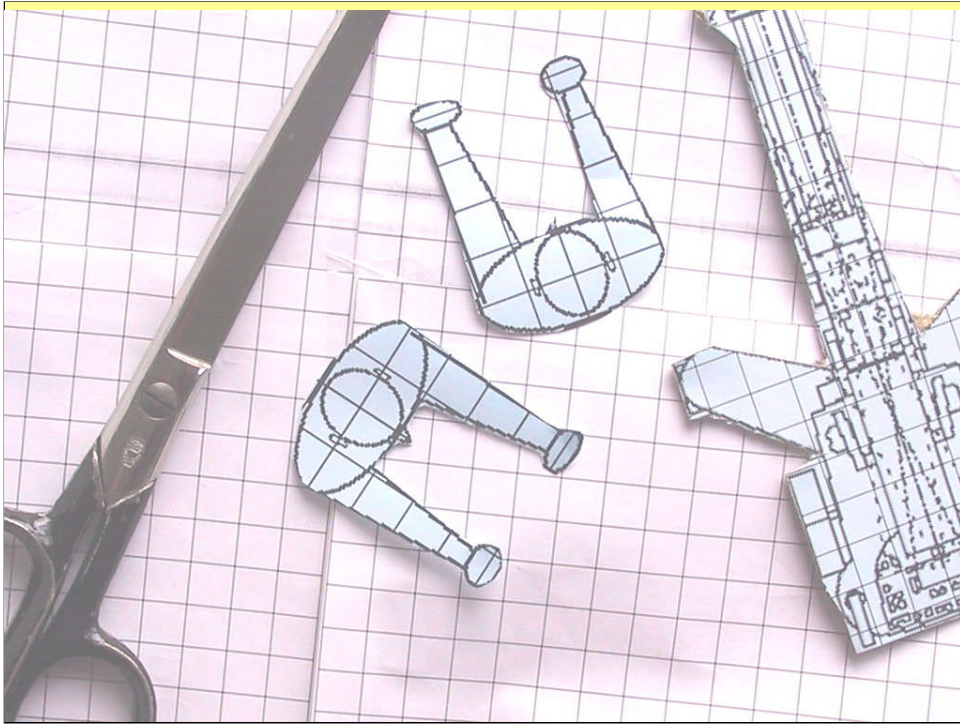
movable cut-outs of equipment, people

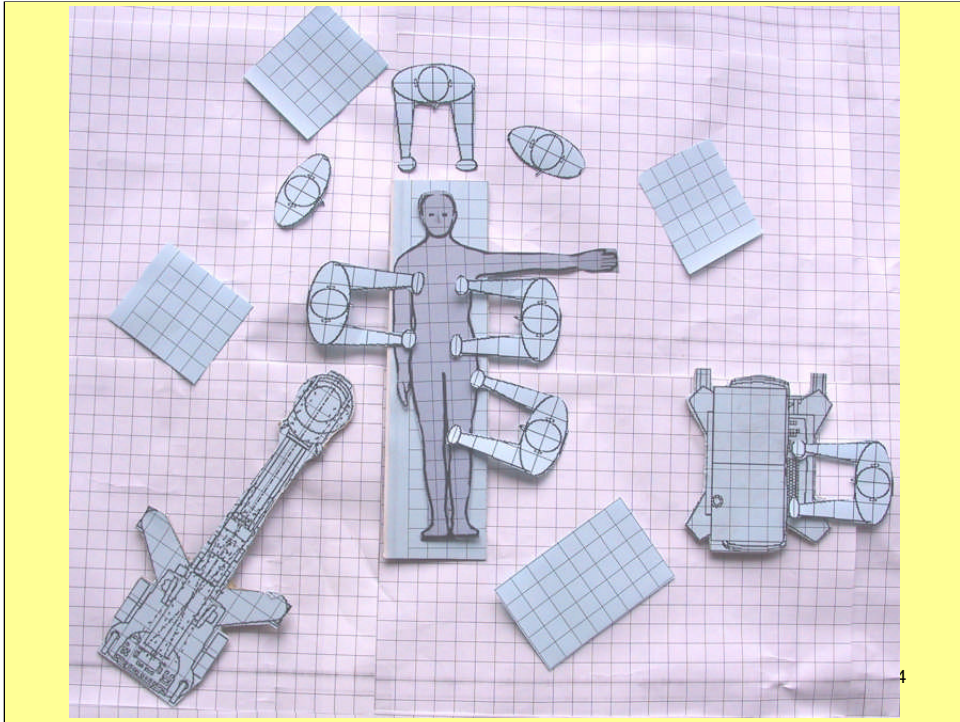




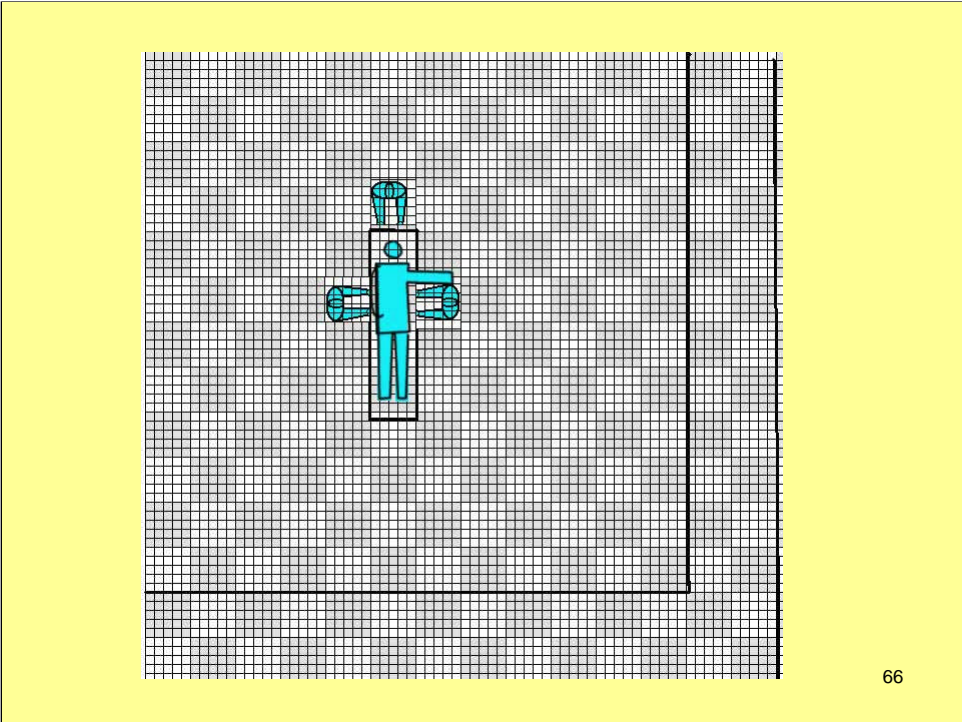








OR size –  $6\text{m}^2$  or  $7\text{m}^2$  ?



## What about aesthetics?

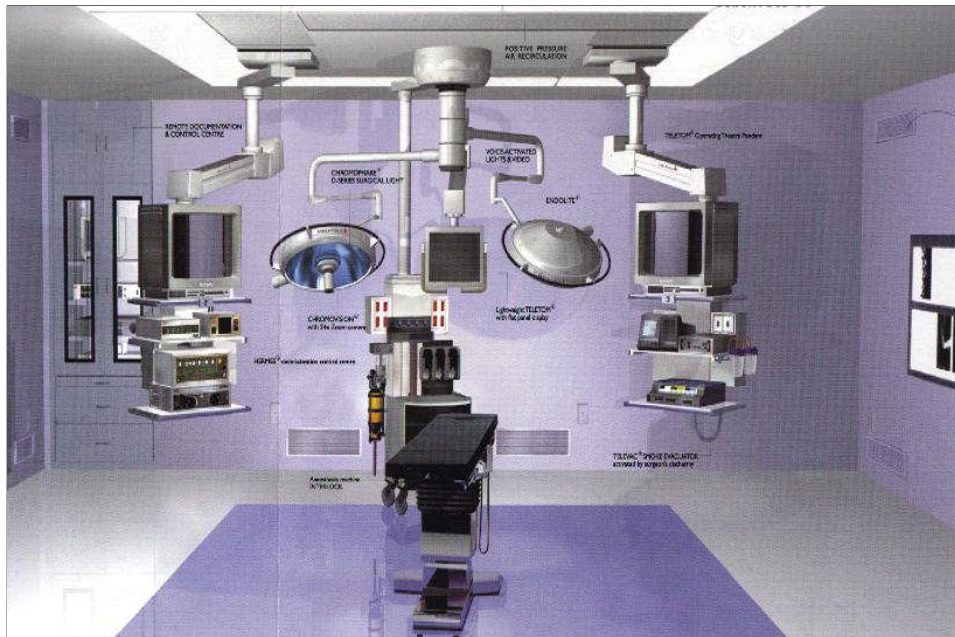
+/- subjective  
not primary, but ....

colours  
acoustics  
view ? outside corridor  
furnishings

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What is beauty?

OR of the future



Karl Storz - OR of the future

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Lap sub-total hysterectomy, Hubertus Hosp. Berlin

## An agenda

- what is the best planning process ?
- a culture of communication
- define OR functions, dependencies
- checklists, update
- better 1:10 scale plans
- publish papers

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