MIE 240: Human-centred system design

Applying design guidelines

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Learning Objectives

- Review design guidelines for attention, working memory, long-term memory, & decision-making
- Discuss examples of design shortcomings and areas of improvement

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Skill in Decision Making	Less Proficient (Novice)		Very Proficient (Expert)
Reasoning Level	Knowledge-based	Rule-based	Skill-based
Decision Type	Analytic		Intuitive
Decision System	System 2		System 1
School of Decision Research	Heuristic and Biases "What's wrong"		Naturalistic Decision Making "What's right"
Adaptive Decision Making	Less		More

Increasing Experience

Last Lecture

- Decision-making
  - Characteristics
  - Normative and descriptive decision making
  - Heuristics and biases
- Introduced knowledge, rule, skill model
- Discussed design guidelines for decision-making

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Design implications

Selective attention

1. Optimize bottom-up processing
2. Support automaticity and unitization
3. Optimize top-down processing
4. Maximize discriminating features

Working Memory

1. Minimize working memory load
2. Provide visual echoes
3. Provide placeholders for sequential tasks
4. Exploit chunking
5. Minimize confusability
6. Avoid unnecessary zeros
7. Ensure congruence of instructions
8. Avoid negation

Phonetic alphabet

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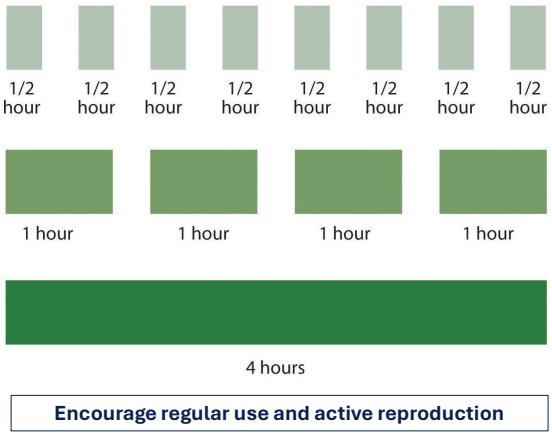
Design Implications

Long-term memory

1. Encourage regular use
2. Encourage active reproduction
3. Use memory aids - place “Knowledge in the world”
4. Support correct mental models
5. Standardization

Decision-making

1. Task redesign
2. Choice architecture
3. Proceduralization
4. Training decision-making
5. Use displays
6. Automation and decision support tools



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Examples

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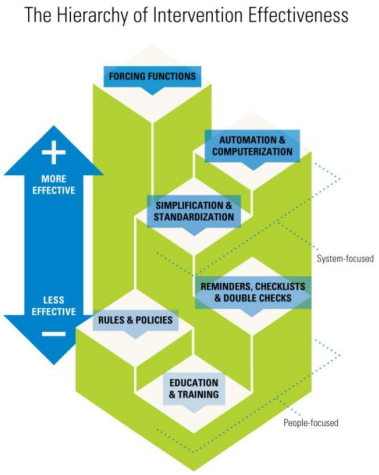
Keep in mind

Design implications
- Selective attention
- Working memory
- Long-term memory
- Decision-making



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Dosing instructions

A

Start / Stop / Current Status	Medication
20/02/21 1030 06/03/21 1029 Active	Rx R000004815 **HYDROmorphone (10 mg/mL) 1,000 MG in 100 ML CASSETTE**

Dose Instructions
Continuous Rate

Start / Stop / Current Status	Medication
20/02/21 1030 06/03/21 1029 Active	Rx R000004816 **HYDROmorphone (10 mg/mL) 1,000 MG in 100 ML CASSETTE**

Dose Instructions
Demand Dose/Breakthrough Dose

B

Start / Stop / Current Status	Medication
03/12/20 1020 13/12/20 1044 Active	Rx R000004588 **HYDROmorphone (10 mg/mL) 1,000 MG in 100 ML CASSETTE**

Dose Instructions
Concentration: 10 mg/mL
Continuous Rate: 4 mg/Hour

Linked Orders

03/12/20 1015 17/12/20 1014 Active	Rx R000004587 **HYDROmorphone (10 mg/mL) 1,000 MG in 100 ML CASSETTE**

Dose Instructions
Breakthrough Dose: 2 mg/30 minutes AS NEEDED
Doses Per Hour : 2 / hr

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Weight-based dosing

Dosing chart

	Acetaminophen (such as Tylenol)			Ibuprofen (such as Motrin or Advil)			Diphenhydramine (such as Benadryl)	
Can be given:	every 4-6 hrs			every 6-8 hrs			every 6-8 hrs	
Concentration:	Infant Dropper	Infant's and Children's	Chewable Tablets	Concentrate	Liquid	Chewable Tablets	Liquid	Meltaway Tablets
	0.8mL= 80mg	5mL (1tsp)= 160mg	1 tablet= 80mg	1.25mL= 50mg	5mL (1tsp)= 100mg	1 tablet= 50mg	1tsp= 12.5mg	1 tablet = 12.5mg
Age:	2 Months or Older			6 Months or Older			6 Months or Older	
WEIGHT								
12-15 lbs	1 dropper (0.8 mL)	1/2 tsp (2.5 mL)		1.25 mL	2.5 mL		1/2 tsp	
15-19 lbs	1.25 droppers (1 mL)	(3 mL)		1.5 mL	3 mL		1/2 tsp	
19-24 lbs	1.5 droppers (1.2 mL)	3/4 tsp (4 mL)		2 mL	4 mL		3/4 tsp	
24-32 lbs	2 droppers (1.6 mL)	1 tsp (5 mL)	2 tablets	2.5 mL	5 mL	2 tablets	1 tsp	1 tablet
30-40 lbs	2.5 droppers (2 mL)	1 1/4 tsp (6 mL)	2.5 tablets	3.5 mL	1 1/2 tsp (7.5 mL)	3 tablets	1 1/4 tsp	1 1/4 tablets
38-48 lbs	3 droppers	1 1/2 tsp (7.5 mL)	3 tablets	4.25 mL	1 3/4 tsp (8.75 mL)	3 1/2 tablets	1 1/2 tsp	1 1/2 tablets
46-56 lbs	3.5 droppers	1 3/4 tsp (9 mL)	3.5 tablets	5 mL	2 tsp (10 mL)	4 tablets	2 tsp	2 tablets
54-64 lbs	4 droppers	2 tsp (10 mL)	4 tablets	6.25 mL	2 1/2 tsp (12.5 mL)	5 tablets	2 1/2 tsp	2 1/2 tablets

Many drugs (especially in children) are dosed according to body weight (mg/kg). These calculations are carried in 3-step conversions. The first step is to convert the body weight from pounds (lbs) to kg. The second step is to convert kg to mg (the total mg dose calculated based on body weight). Finally, the mg dose is converted to the number of tablets.

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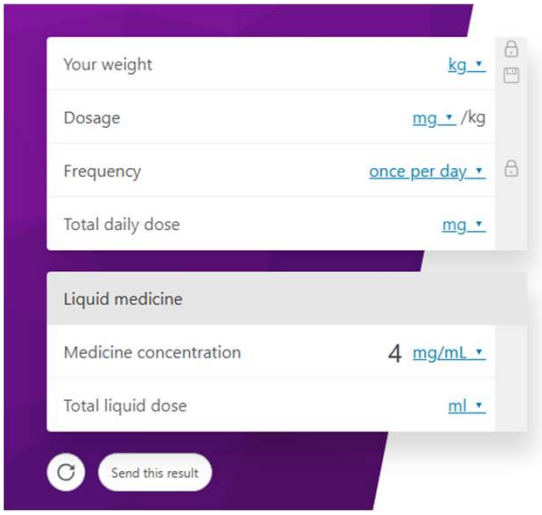
Weight-based dosing



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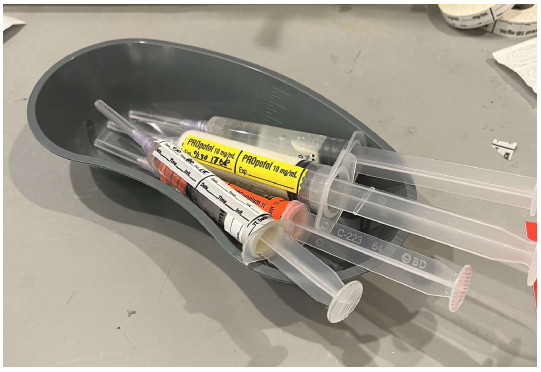
Medication preparation



Medications stored in a kidney basin

Medication storage tray

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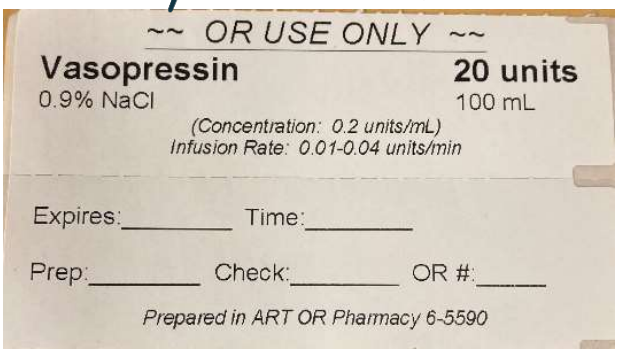
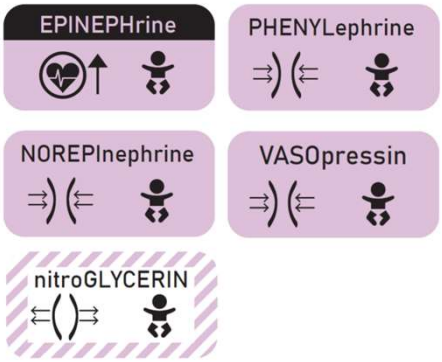
Anesthesia labels

Challenge with selective attention in the OR



Standard pharmacy labels



Icon-based labels

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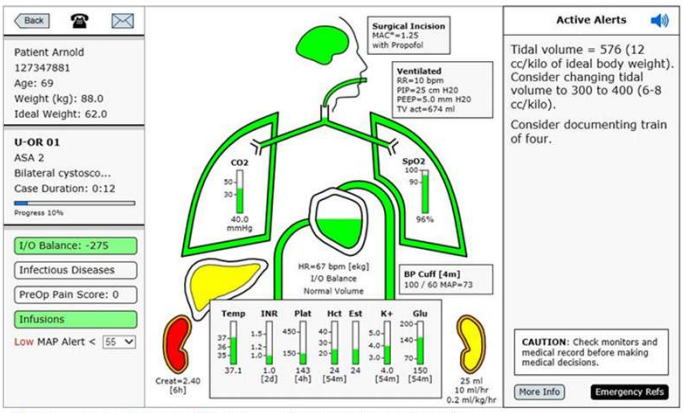
Anesthesia monitoring

Standard anesthesia machine



Proposed anesthesia machine design

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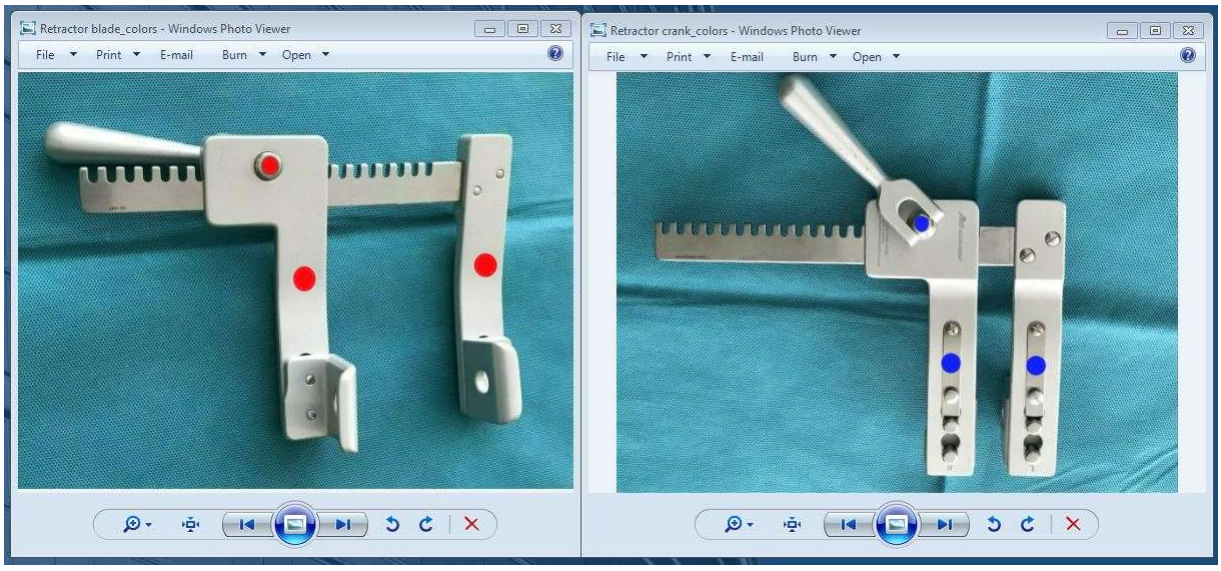
Supporting assembly of chest retractors



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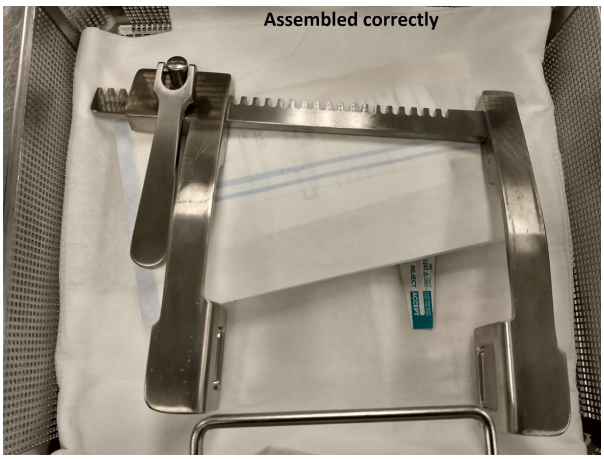
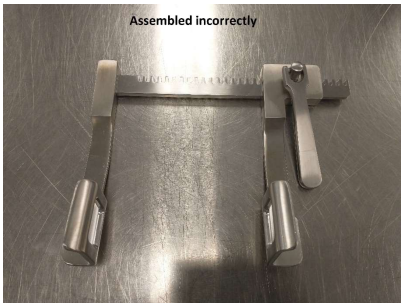
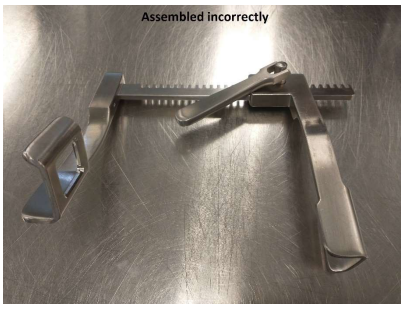
Supporting assembly of chest retractors







Pictures of incorrect and correct assembly place in retractor book and at workstation

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Supporting assembly of chest retractors

Assembly video included instrument management system

- Implemented hard stop in instrument management system (could not complete tray without supervisor approval)
- Supervisor verifies retractor assembled correctly

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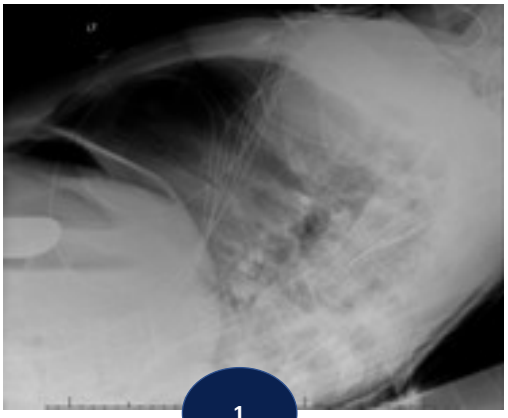
Radiology: reducing retained foreign objects



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Is a retained foreign object present?

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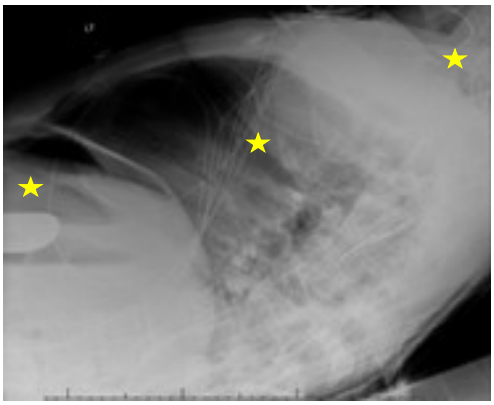
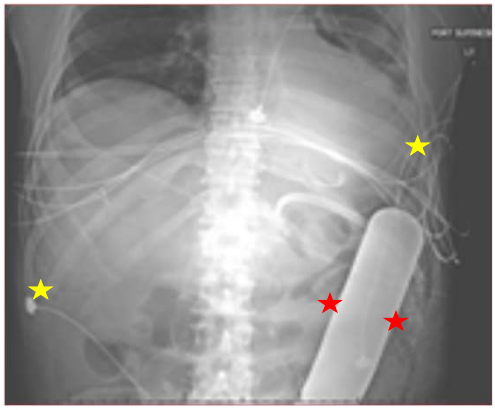
Radiology: reducing retained foreign objects



☆ Possible abnormality



☆ Possible abnormality ★ Abnormality detected

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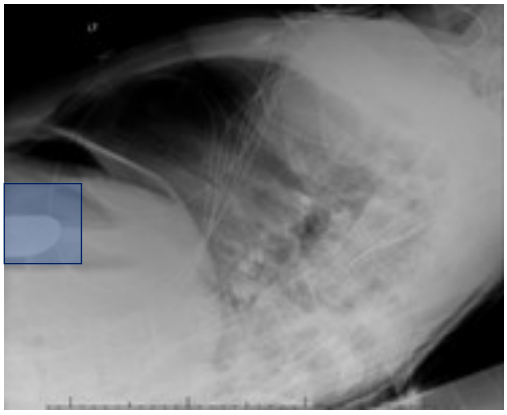
Radiology: reducing retained foreign objects



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Next lecture (Tues. Jan 28)

Topic: Displays
Review: Ch 8.1 – 8.5, 8.7-8.9
Review questions: 8.1, 8.3, 8.6-8.18
Upcoming assignments: Case study: Act of God (due Jan 30th at 11:59pm)

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