

# Presenting about Operations Research – 10 Tips for OR Talks

SA475B Operations Research for the Military, Business and Society

## 0. Credits and disclaimers

- These are some collected “dos and don’ts” through observation and experience
- This talk was heavily inspired by articles written by Matt Might<sup>1</sup> and Jeff Kline<sup>2</sup>
- There are **many** ways of giving a good talk

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<sup>1</sup><http://matt.might.net/articles/academic-presentation-tips/>

<sup>2</sup>Owl speaks lion, *ORMS Today*, August 2016

## 1. Know your audience

- Find out who you're speaking to, and **aim appropriately**
- A presentation to a senior executive with no OR background is different from a talk to a room of OR academics
- Take your time with introductory material, even if it feels awkward or insulting (it's not)
- It's easy to gloss over concepts and details that took us months or years to learn

# 1. Know your audience

- No matter who your audience is, **keep it professional**
- Every talk is an opportunity for you to put your best foot forward
- Be mindful that there might be different backgrounds in your audience

## 2. Practice, practice, practice

- Practice is the key to a natural delivery
- Rehearse the presentation, don't memorize the talk
  - e.g. transitions between topics, intentional pauses
- Concentrate on your opening
  - First impressions are important
  - Good opening = comfort early on

## 2. Practice, practice, practice

- After rehearsing, ask yourself:
  - Was there a topic I spent too much time on?
  - Was there a topic I could have done without?
  - Did I explain each topic clearly and concisely?

⇒ Expand, cut, or refine as necessary

### 3. A talk is about the big ideas

- Your talk should present the same ideas in your report, but **on its own terms**
- The ideal way to present an idea for a talk may be very different from how you've written your report
- Your talk should concentrate on the **big ideas**

## 4. The 40/30/30 rule

- First 40% of your talk:
  - Introduce and motivate your problem
  - Why is this problem important?
- Second 30% of your talk:
  - Give an overview of your data, models, and results
  - What is novel about your approach?
  - Why are your results interesting, important, etc.?
- Last 30% of your talk (or for Q+A):
  - For the experts: mathematical and computational details, etc.
  - Blow the audience away with your technical prowess

## 5. Slides should not overwhelm the viewer

- Too much information on a slide  $\Rightarrow$  brain shuts off
- Present information **piecemeal**  
e.g. bullet-by-bullet, node-by-node, equation-by-equation
- Highlight important parts  
(but use sparingly)
- Spread information among multiple slides if necessary
- **Do not** cut and paste from your paper

# Don't do this

## Theorem

Computing the least core value of scheduling games is NP-hard.

## Proof.

By the previous theorem, the least core value of scheduling games is

$$z^* = \frac{1}{2} \max_{\substack{S \subseteq N \\ S \neq \emptyset, N}} \{v(N) - v(S) - v(N \setminus S)\} = \frac{1}{2} v(N) - \frac{1}{2} \min_{\substack{S \subseteq N \\ S \neq \emptyset, N}} \{v(S) + v(N \setminus S)\}.$$

Note that the minimization problem above is equivalent to the problem of minimizing the sum of weighted completion times of jobs in  $N$ , with weight  $w_j$  and processing time  $p_j$  for each job  $j \in N$ , on two identical parallel machines. Sahni (1976) showed that this two-machine problem is NP-hard, even when  $w_j = p_j$  for all jobs  $j \in N$ .  $\square$

## Do this

### Theorem

Computing the least core value of scheduling games is NP-hard.

### Proof.

$$\begin{aligned} z^* &= \frac{1}{2} \max_{\substack{S \subseteq N \\ S \neq \emptyset, N}} \{v(N) - v(S) - v(N \setminus S)\} \\ &= \frac{1}{2} v(N) - \underbrace{\frac{1}{2} \min_{\substack{S \subseteq N \\ S \neq \emptyset, N}} \{v(S) + v(N \setminus S)\}}_{P2 \parallel \sum w_j C_j} \end{aligned}$$

⇒ Problem is equivalent to  $P2 \parallel \sum w_j C_j$ , which is NP-complete. [Sahni (1976)]

□

## 6. A picture is worth a 1000 words

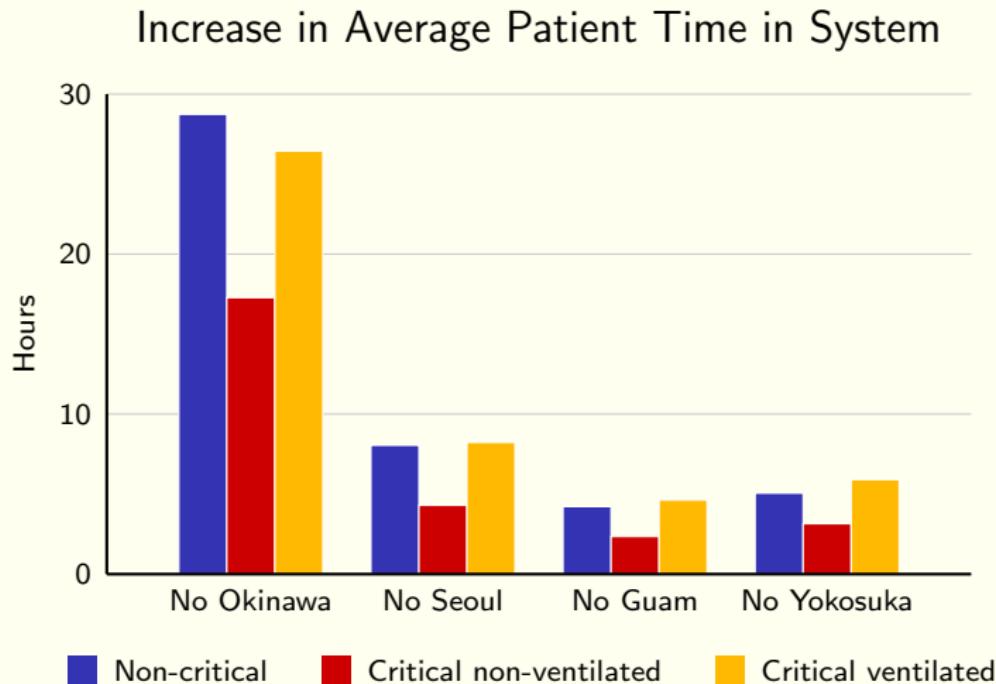
- Images and animations can convey or illustrate an idea better than text
- If you can use an image instead of text, do it
  - This takes thought and time
- Avoid unnecessary details on images

## Avoid this

### Average Patient Time in System

	Non-critical	Critical non-ventilated	Critical ventilated
Base	54.15	27.93	42.46
No Okinawa	82.89	45.21	68.90
No Seoul	62.20	32.23	50.69
No Guam	58.37	30.28	47.09
No Yokosuka	59.21	31.08	48.97

# Try this instead



## 7. Use math carefully

- Math as a language is expressive and precise
- Talks are hand-wavy and should focus on **intuition**
- Reading lots of math disengages the reader from the speaker
- Be careful with how you use math
- Avoid unnecessary details
- Consider changing notation to make it easier to grasp

# This is not a good way to present math

minimize  $C_{\max}$

subject to  $C_{\max} \geq C_{mn}$

$$C_{00} \geq \sum_{j \in \mathcal{J}} \sum_{s \in \mathcal{S}} p_{0js} x_{0j0s}$$

$$C_{ik} \geq C_{i-1,k} + \sum_{j \in \mathcal{J}} \sum_{s \in \mathcal{S}} p_{ijs} x_{ijks} \quad i = 1, \dots, m; k \in \mathcal{J},$$

$$C_{ik} \geq C_{i,k-1} + \sum_{j \in \mathcal{J}} \sum_{s \in \mathcal{S}} p_{ijs} x_{ijks} \quad i \in \mathcal{M}; k = 1, \dots, n-1,$$

$$S_{ij} - S_{hk} \leq M u_{hkij} - 1 \quad i, h \in \mathcal{M}; j, k \in \mathcal{J},$$

$$S_{hk} - S_{ij} + \sum_{l \in \mathcal{J}} \sum_{s \in \mathcal{S}} p_{hls} x_{hlks} \leq M v_{hkij} \quad i, h \in \mathcal{M}; j, k \in \mathcal{J},$$

$$C_{ij} = S_{ij} + \sum_{r \in \mathcal{J}} \sum_{s \in \mathcal{S}} x_{irjs} p_{irs} \quad i \in \mathcal{M}; j \in \mathcal{J},$$

$$u_{hkij} + v_{hkij} = 1 + y_{hkij} \quad i, h \in \mathcal{M}; j, k \in \mathcal{J},$$

$$x_{hlks} + y_{hkij} \leq 1 + z_{hlksij} \quad i, h \in \mathcal{M}; j, k, l \in \mathcal{J}; s \in \mathcal{S},$$

$$\sum_{k \in \mathcal{J}} \sum_{s \in \mathcal{S}} x_{ijks} = 1 \quad i \in \mathcal{M}; j \in \mathcal{J},$$

$$\sum_{j \in \mathcal{J}} \sum_{s \in \mathcal{S}} x_{ijks} = 1 \quad i \in \mathcal{M}; k \in \mathcal{J},$$

$$\sum_{s \in \mathcal{S}} x_{ijks} = \sum_{s \in \mathcal{S}} x_{hjks} \quad i, h \in \mathcal{M}; j, k \in \mathcal{J},$$

$$\sum_{r \in \mathcal{J}} \sum_{s \in \mathcal{S}} q_{irs} x_{irjs} + \sum_{h \in \mathcal{M}, h \neq i} \sum_{l \in \mathcal{J}} \sum_{k \in \mathcal{K}} \sum_{s \in \mathcal{S}} q_{hls} z_{hlksij} \leq Q_{\max} \quad i \in \mathcal{M}; j \in \mathcal{J},$$

$$x_{ijks}, u_{hkij}, v_{hkij}, y_{hkij}, z_{hlksij} \in \{0, 1\} \quad i, h \in \mathcal{M}; j, l, k \in \mathcal{J}; s \in \mathcal{S}.$$

# This is a better way to present math

- Overall mathematical program

minimize  $C_{\max}$

subject to permutation flow shop constraints

concurrent job constraints

peak power consumption  $\leq Q_{\max}$

variable-type constraints (nonnegativity, binary)

Subsequent slides: one slide per constraint type

## 8. Style matters

- Your talk is primarily about what you say, but...
- Your slides should be visually appealing
  - Clean fonts
  - Lack of gratuitous adornments
  - Balance of whitespace
  - Imagery and animations that enhance your message
- Learn to use your presentation software well

## 9. Questions are not random

- **Anticipate** questions your audience might ask
- Some answers belong in your talk
- Some don't, but you can reserve a separate slide
- For unanticipated questions, buy time by reformulating the question in your own words
- If an exchange becomes long or hostile, thank the questioner and suggest taking the discussion offline

## 10. Speak slowly and use your body

- You are probably talking too fast
  - Rule of thumb: **at least** 1 minute per slide
- Be aware of your **body language**
  - Stand up straight
  - Gesture with your whole body

## 10. Speak slowly and use your body

- Look at your projected slides, look at your audience, don't look at the computer
- Step away from the podium, walk around
- Invest in a good presentation remote

## To summarize...

1. Know your audience
2. Practice, practice, practice
3. A talk is about the big ideas
4. The 40/30/30 rule
5. Slides should not overwhelm the viewer
6. A picture is worth a 1000 words
7. Use math sparingly
8. Style matters
9. Questions are not random
10. Speak slowly and use your body