Human or machine?

The advantages and disadvantages of automation

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Introduction: position of warehouses

Logistics costs as percentage of sales:

- 1987: 12%
- 2003: 6%

Market share of The Netherlands (2004):

- 22% of the European road transportation
- 50% of all American and Asian EDCs

Top 5 locations of DCs in Europe:

1. Belgium
2. France
3. The Netherlands
4. Czeck Republic
5. Poland

(Cushman&Wakefield Healey&Baker, 2006)

Proportion of logistics costs for warehousing:

- 37% in 1995
- 25% in 2005

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Introduction: trends and goals

- Trends
  - More product variety
  - Fewer products per order
  - Faster response
  - Higher accuracy

- What is the biggest piece of the operating expenses in a typical warehouse?

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Key questions

- Human or machine?
  - How much do you invest in equipment?
  - And how much will you spend on wages?
- Human or computer?
  - What is the current functionality of your WMS?
  - Which decisions must be made by your warehouse workers?
  - Can you improve efficiency by expanding your WMS?

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Human or machine?

Are you going to the product?

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Human or machine?

Or is the product coming to you?

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Human or machine?

Or a little bit of both?

Human or machine?

Financial considerations

- As for any investment you need to determine:
  - whether to make an investment
  - which investment option to take
  - expected (financial) outcomes

- Automation is not a goal by itself. It must support your corporate goals.

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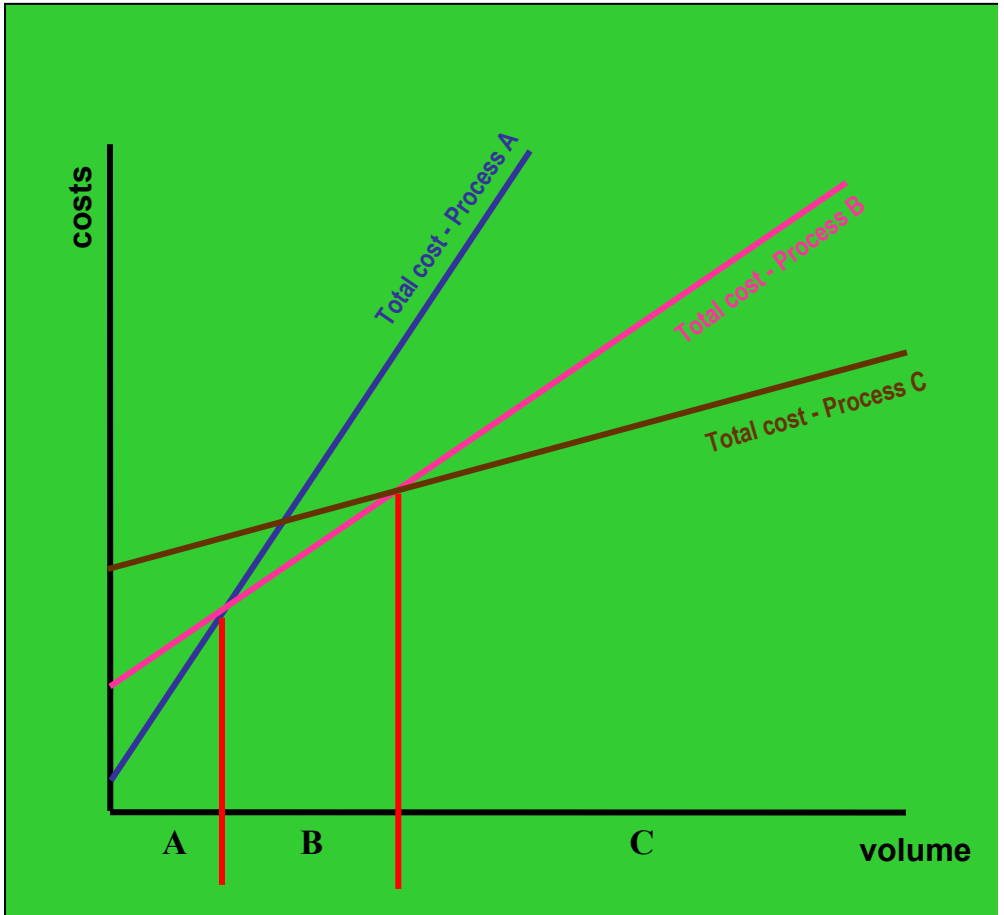
Human or machine?

Financial considerations

- Initial considerations
  - Costs
  - Savings
- Common financial tools
  - Payback period
  - Return on investment
  - Net present value
- Break-even analysis



Human or machine?

Other objectives

- Accuracy
- Throughput requirements
- Storage density
- Employee welfare
- Compatibility with the existing operation
- …..

- Although intangible benefits are difficult to quantify, there is no reason to value them at zero, . . ., zero is, after all, no less arbitrary than any other number."

  Robert Kaplan

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Human or machine?

Important applications of automation

- Will technology eliminate the presence of people in the warehouse?

- Replace humans for
  - Heavy lifting,
  - Non-value-added movement of goods,
  - Repetitious jobs
  - Dangerous jobs,
  - Limited-access areas of the warehouse.

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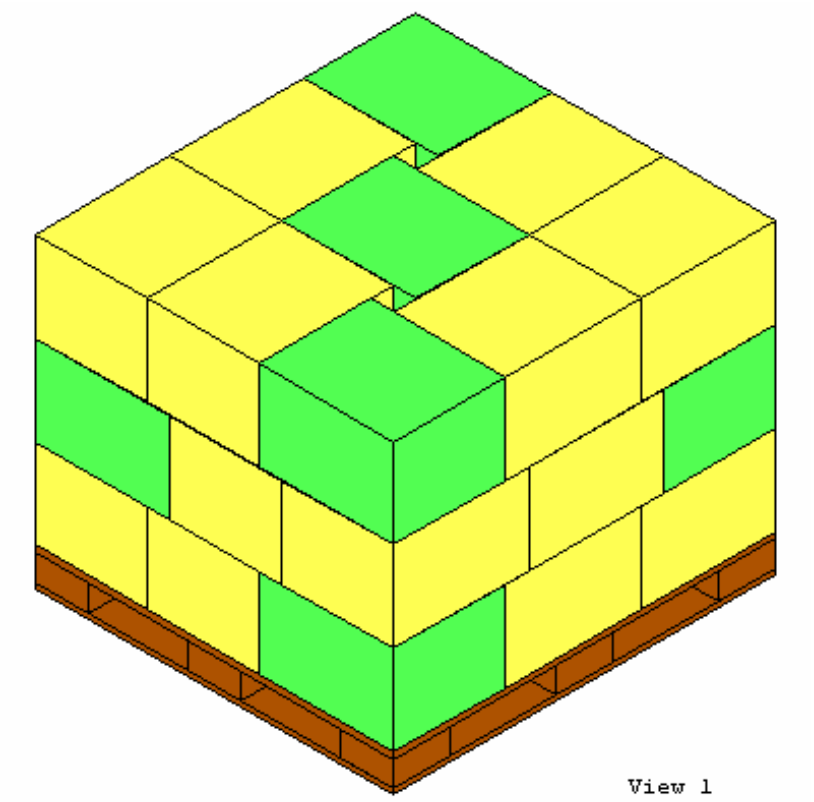
Human or machine?

Who can do this best?

- The flexibility and decision-making capabilities of a human are difficult to replace.

- For example pallet loading.
- Difficult:
  - Calculate a good positioning of boxes on pallet.
  - Handle boxes of different sizes.



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Human or machine?

Where can you save by automating?

1. Communication of locations to be visited (7% of time)
   - communication by RF terminal
   - Voice picking
2. Walking of order picker to collect items (50% of time)
   - Part-to-picker systems
3. Transportation of items to other areas (7%)
   - Automated transport systems (e.g. conveyors)
4. Orientation to find the right location (7%)
   - Pick-to-light systems
5. Avoiding errors (3%)
   - Scanning systems

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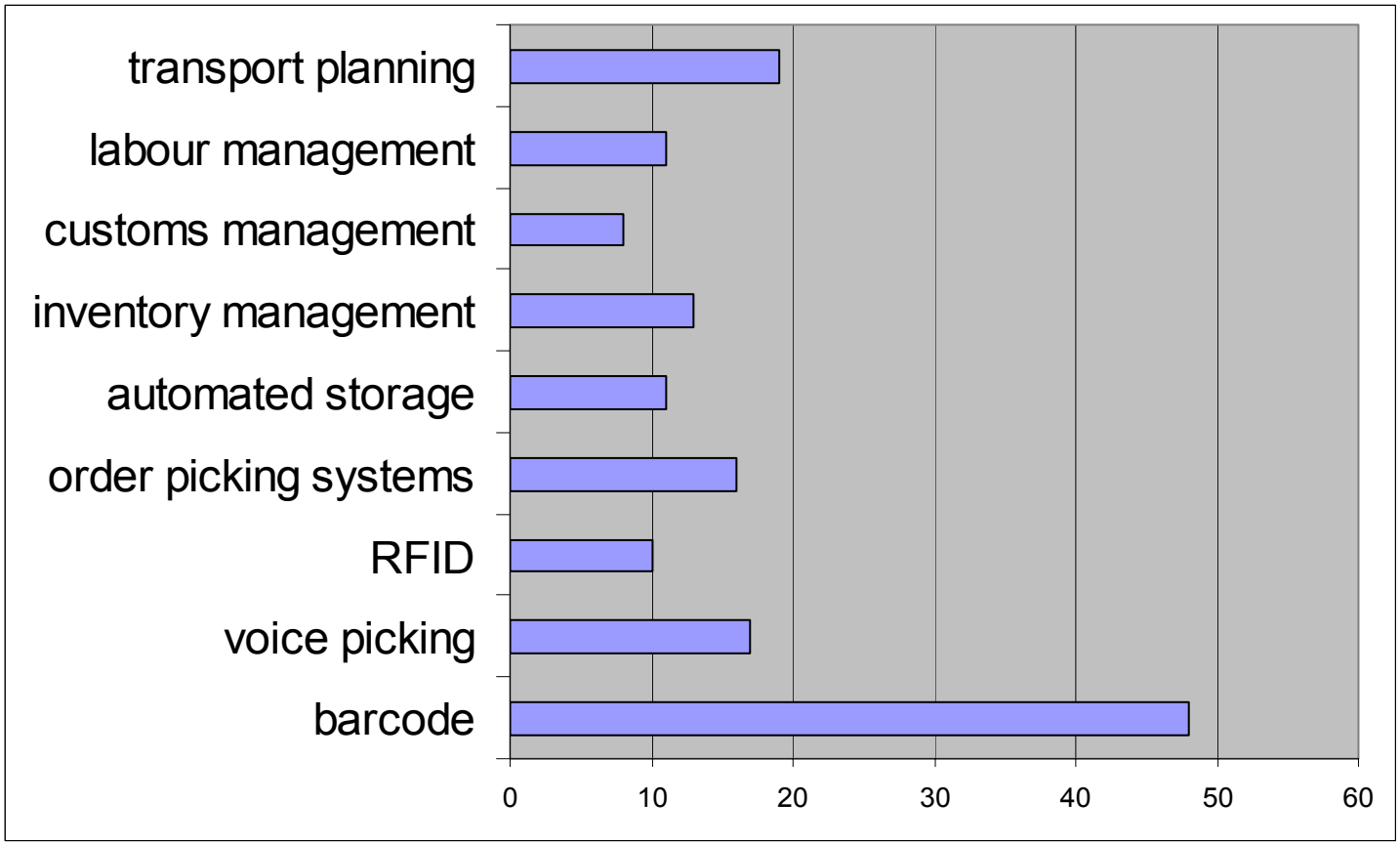
Human or machine?

Future plans of companies



Source: logistiek.nl, 2008

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Human or machine?

Consequences of the choices

- Do you need less-skilled workers after automating?
  - Computers can do the “thinking”.
  - Simple jobs remain such as picking orders or making boxes.

- BUT….

- The simple jobs will be minimized by the very technology that makes them simple.
- New jobs emerge.

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Human or machine?

Consequences of the choices

- More technology means
  - A mixture of job skills is required.
  - Required level of expertise and technical skills will increase.
  - Especially computer skill requirements will grow.
  - Quality and education of the primary workforce must improve.
  - Temporary workers will no longer be as effective.

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Human or machine?

Make a fair comparison

- It is difficult to compare automated and manual systems.
- Automation may sometimes seem to be more efficient, but what are you comparing it to?
- To consider automation properly, you need a well-organized manual process as a benchmark, not a badly organized one.
- Optimizing manual processes typically implies using more advanced software.
- What can your WMS do?

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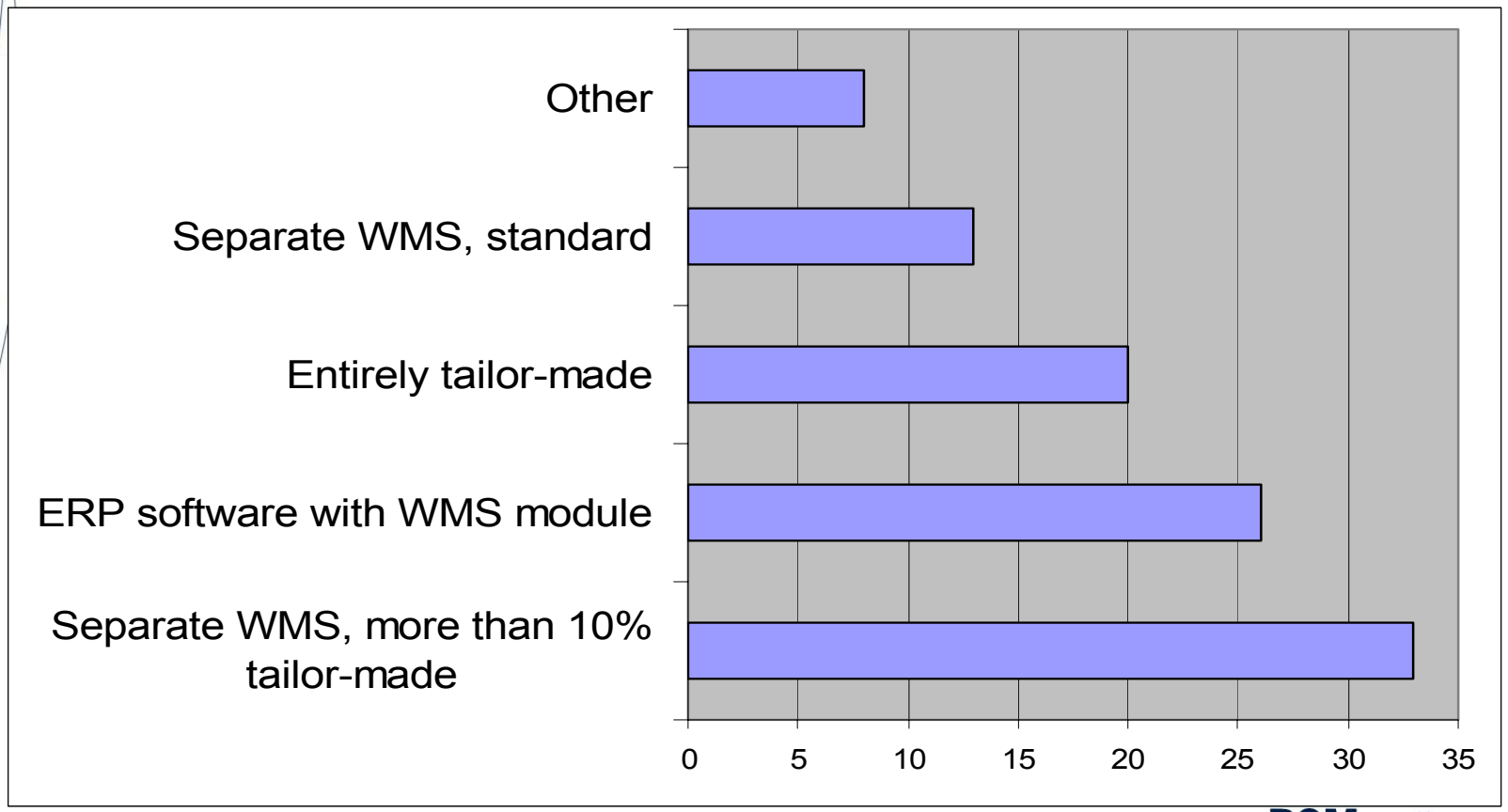
Human or computer?

- What is the current functionality of your WMS?



What companies are using.

Source: logistiek.nl, 2008

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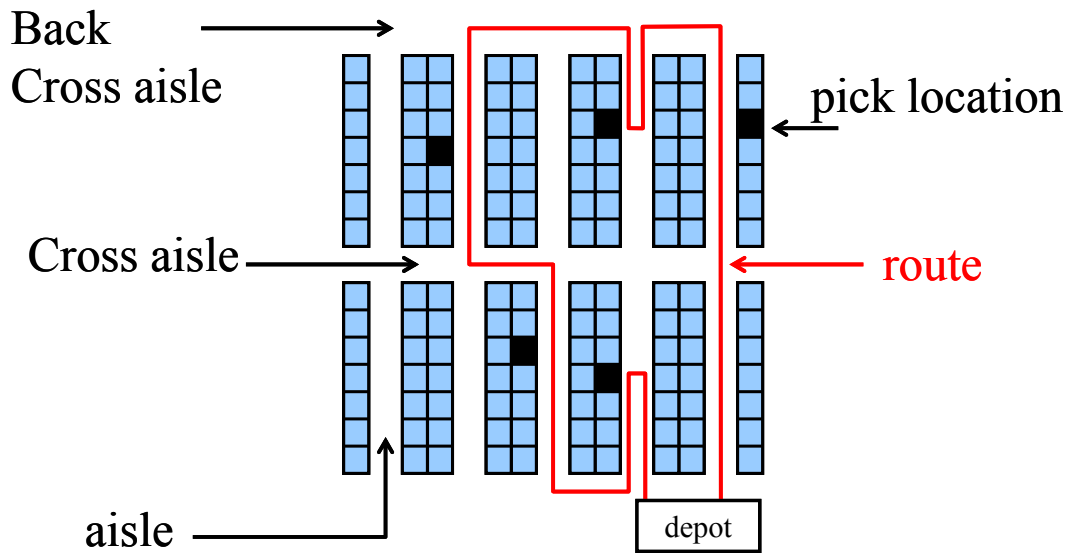
Human or computer?

Improving manual work

- Several methods are known that can improve efficiency, but they are rarely available commercially.
- Do you leave it up to the warehouse worker?
- Or do you buy extra (custom) software for your WMS?



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Human or computer?

Improving control

- Storage assignment:
  - Assign incoming loads to storage locations.
  - ABC storage is often used.
- Zoning
  - The order picking area is divided into zones.
  - Each picker picks the part of the order that is in his zone.
- Batching
  - Combine several customer orders into one pick order
- Routing
  - Determine the sequence in which products are retrieved from storage

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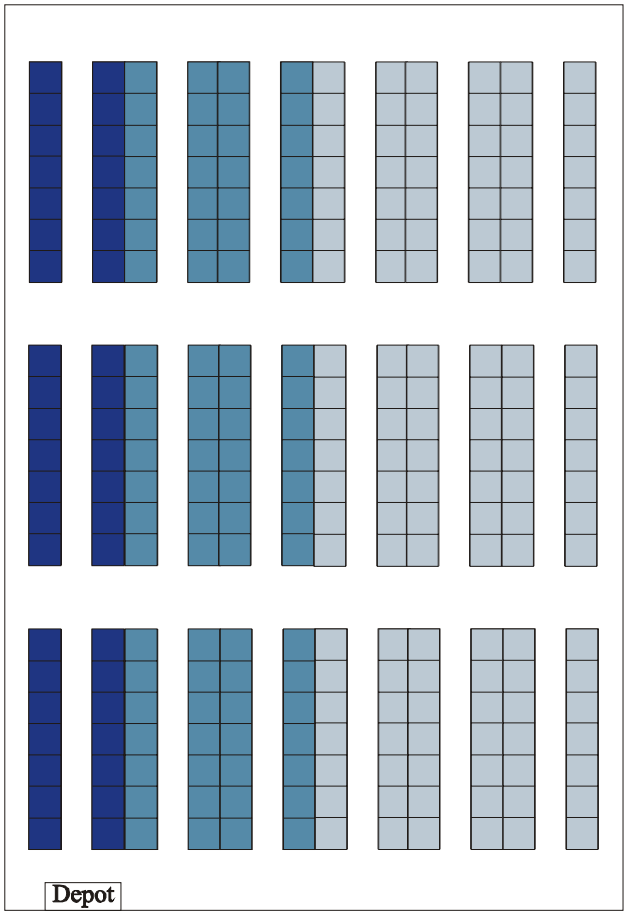
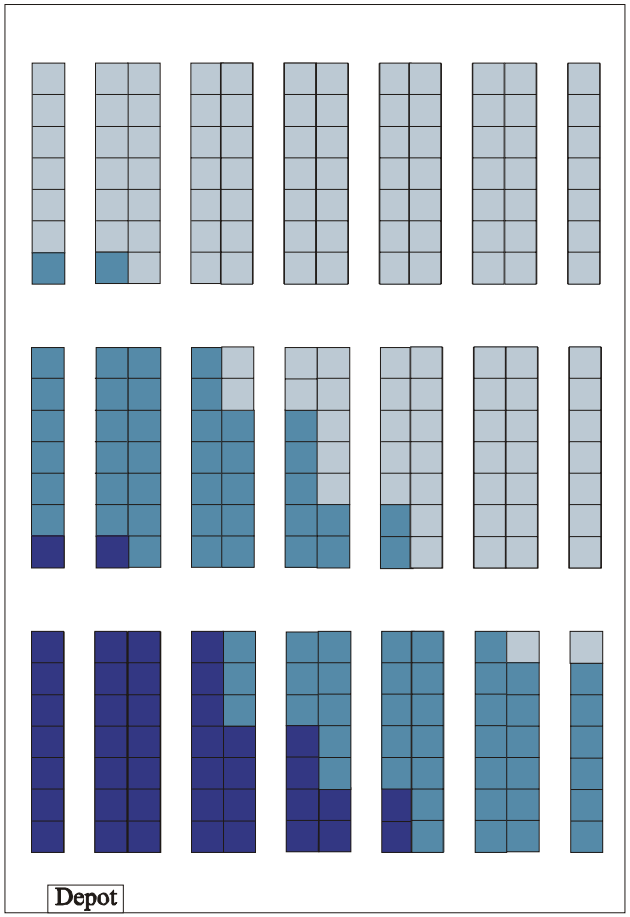
Human or computer?

Improving storage



Within-aisle storage



Nearest-location storage

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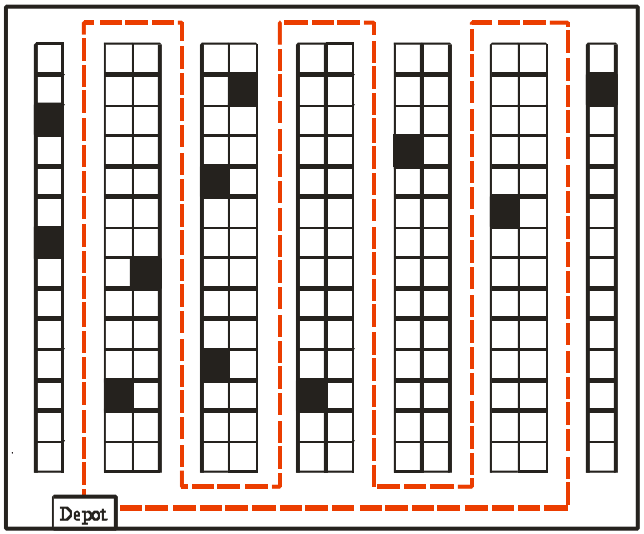
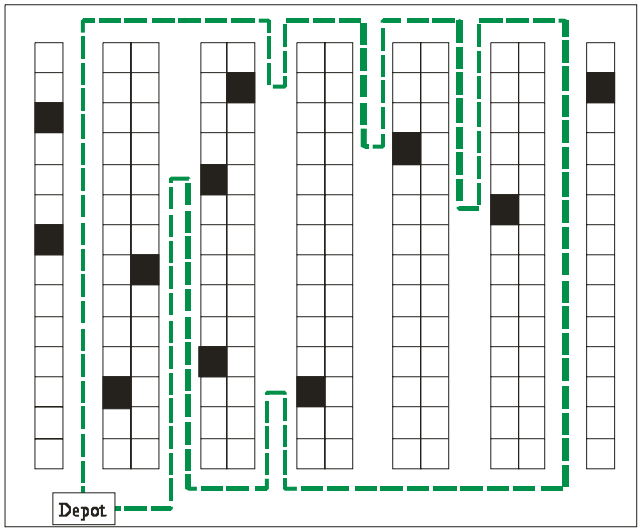
Human or computer?

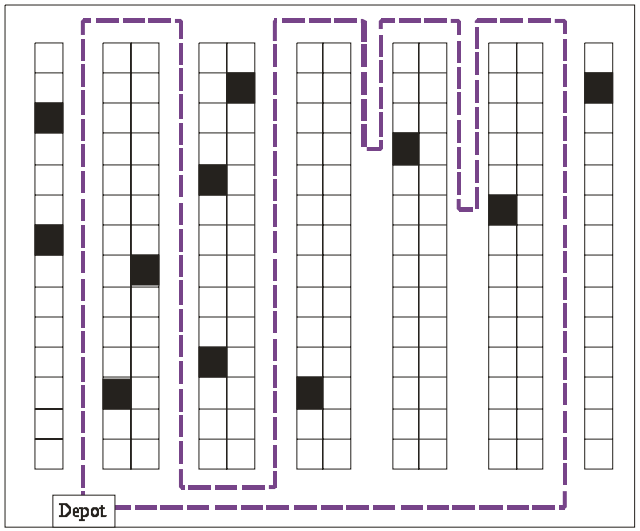
Improving routing



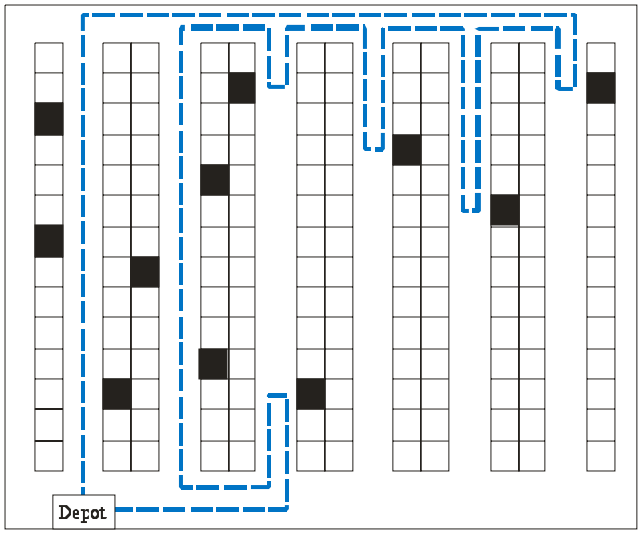
S-shape



Largest Gap



Combined



Optimal

Is a machine efficient?

- AS/RS
  - Automated Storage and Retrieval System
  - Fully automated
- No humans interfering in the process.
- But ...

Is a machine efficient?

- If the WMS is not very smart, your workers can partly compensate for that.
- An automated system will blindly follow the instruction from the WMS.
- If the WMS is not very smart, then your automated system will not perform well.

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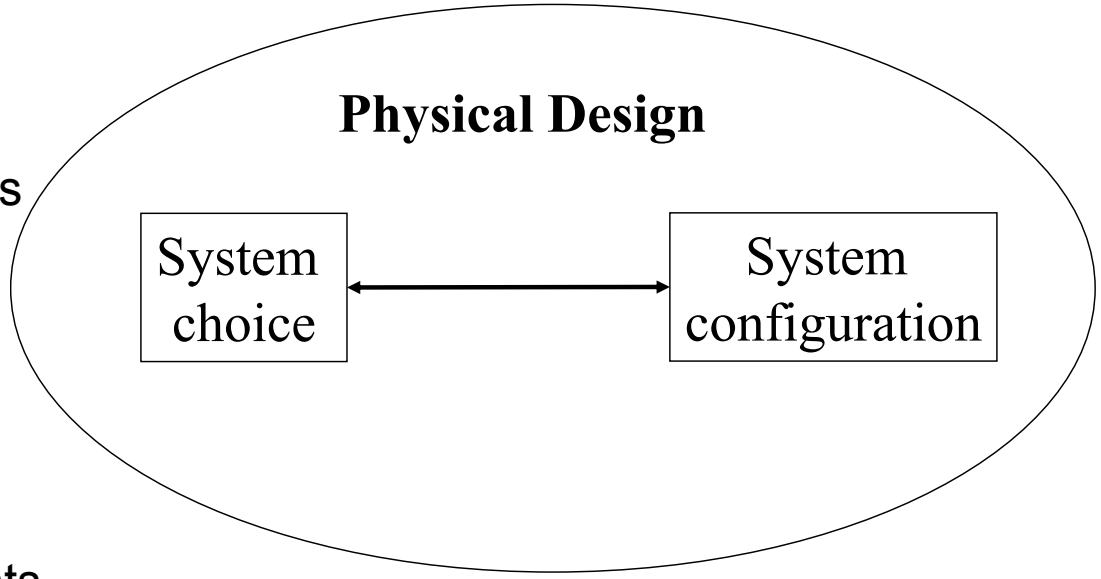
Is a machine efficient?

Physical design aspects

- Optimizing an AS/RS
  - Number of aisles
  - Height of the storage racks
  - Length of the aisles
  - Equally sized or modular storage locations
  - Number and location I/O-points
  - Buffer capacity at I/O-points
  - Number of cranes per aisle
  - Number of order pickers per aisle (if any)



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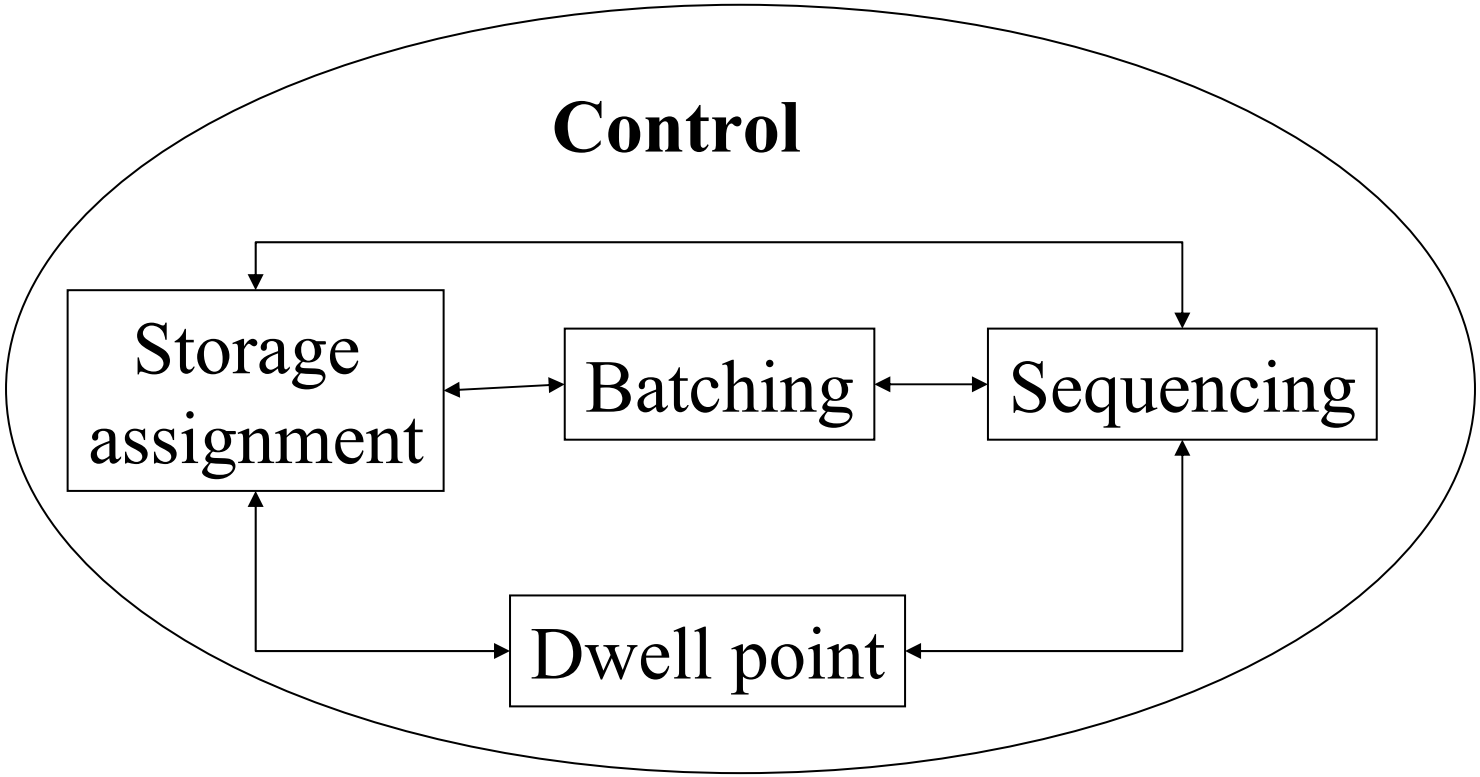
Is a machine efficient?

Improving AS/RS control



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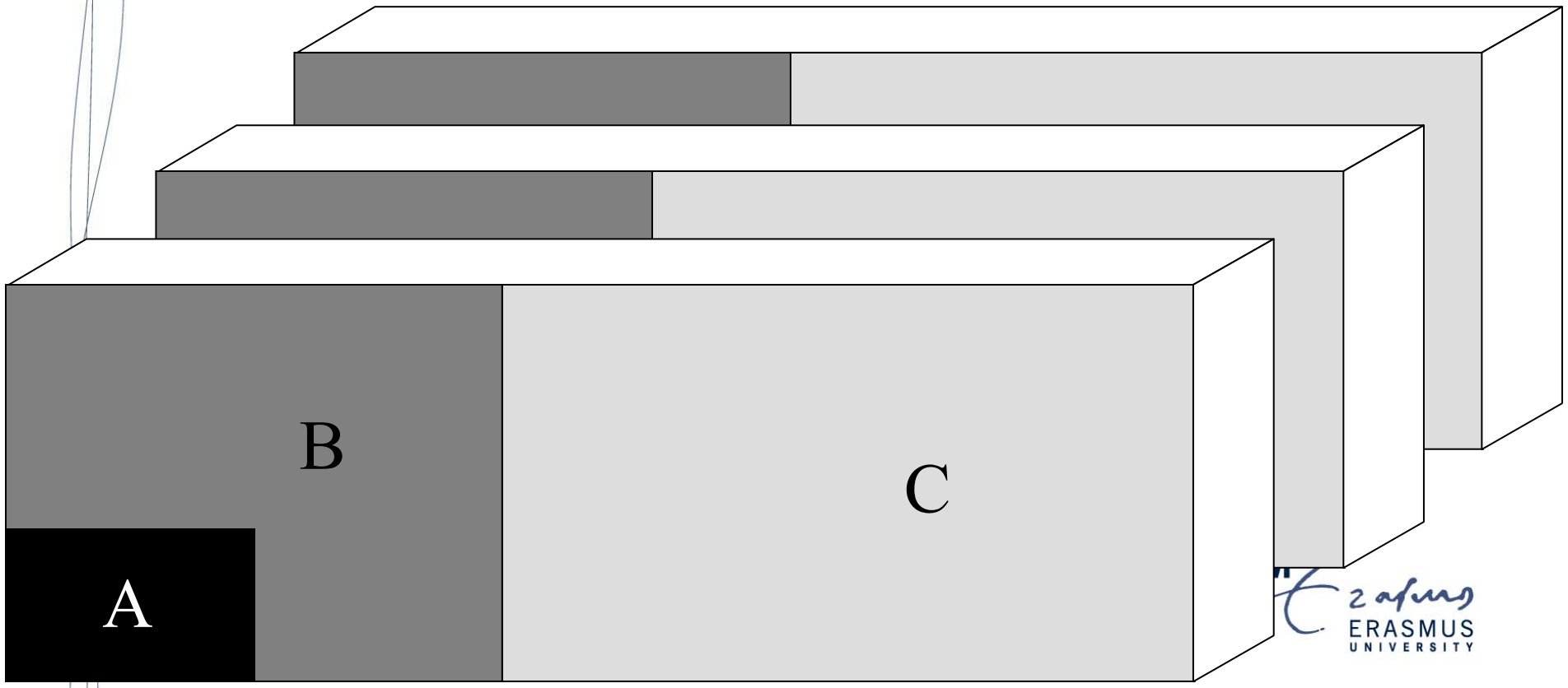
Is a machine efficient?

Improving storage

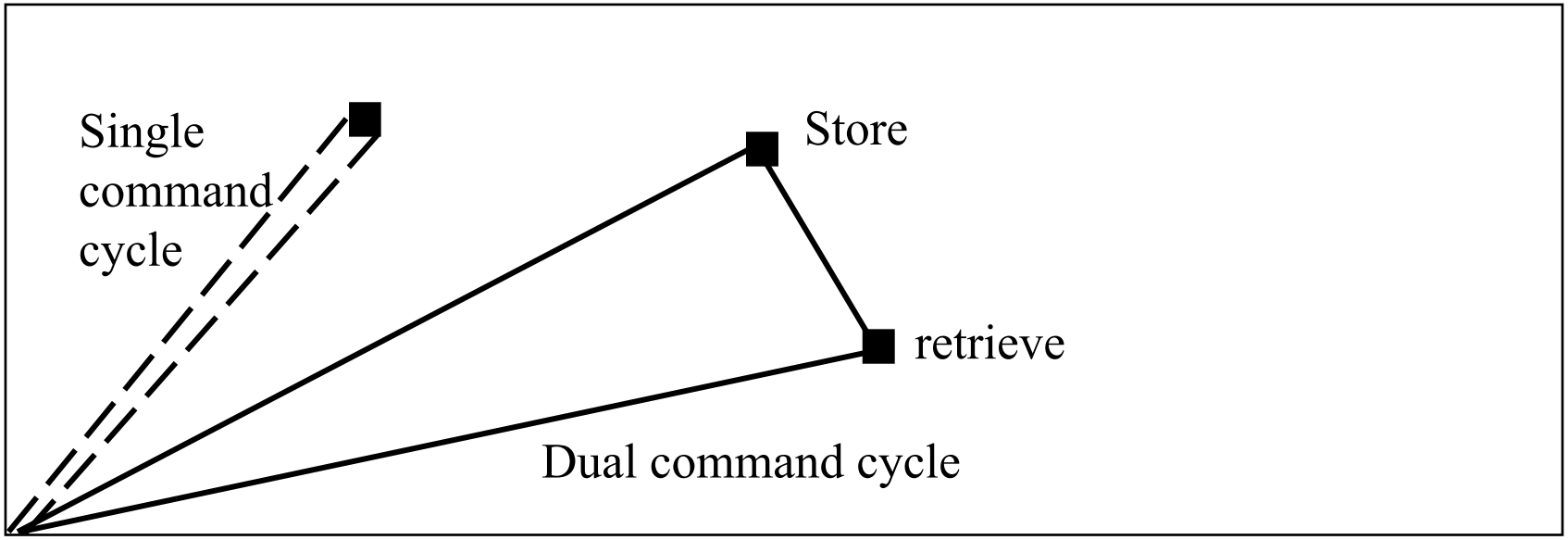
- Storage assignment method
- Number of storage classes
- Positioning of the storage classes



Is a machine efficient?

Improving job sequencing

- Sequencing restrictions (e.g., due dates)
- Type of operation (single or dual command)
- Scheduling approach (block or dynamic)
- Sequencing method



Conclusions

- Check all criteria when deciding between manual work and automation. Don't forget the intangible factors.
- Make a fair comparison. Don't compare a perfectly tuned automated system to a badly organized manual system.
- Consider extensions to your WMS to achieve a really efficient operation.
- Web links:
  - www.roodbergen.com/warehouse
  - www.fbk.eur.nl/OZ/LOGISTICA

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