The Short Useful Life of PCs: Can People Work Faster with More Powerful Computers?

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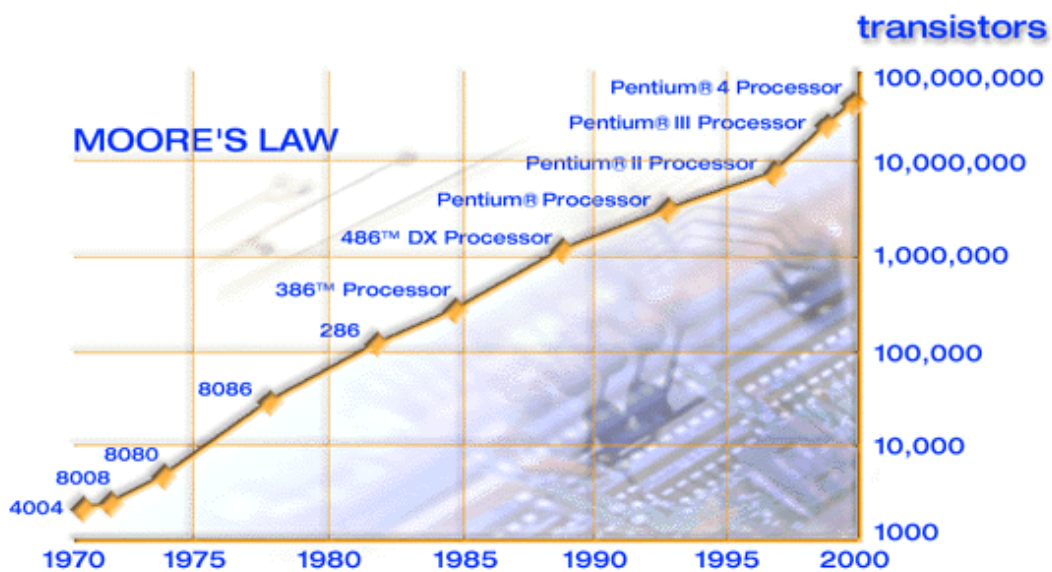
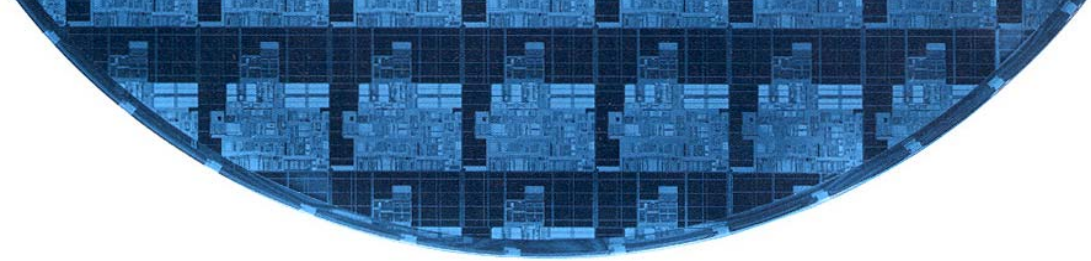


PCs and Environmental Sustainability

- **315 Million PCs** will become obsolete in 2004.
- The useful life of a PC is **2-3 years.**
- The technical life span of the hardware is about **20 years**.
- The production of one PC with CRT monitor requires **500 – 1500 kg** raw materials (Wuppertal-Institute, Digital Europe Project)

Reasons for the High Churn Rate

- People buy new and more powerful computers for three rational reasons:
  1. They want to use **new functionality**.
  2. They want to use **old functionality more efficiently.**
  3. They are forced by threatening incompatibility.
- **We are only looking at reason 2.**
  Is it empirically true?



This wafer represents Moore's Law at work. The Intel® Itanium® 2 processors here hold over 220 million transistors each.

This isn't science for science's sake.
It's science for your
company's sake. Because as we work
to fulfill Moore's Law, year
after year, companies everywhere can
do more at lower cost.
And that's not just a good law.

It's very good business.

Sophisticated tools perform tests to ensure the highest-quality processor.

Processor production, constantly monitored by smart machines and smart people.

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Hypothesis

- The hardware and software of a PC affects office worker performance.

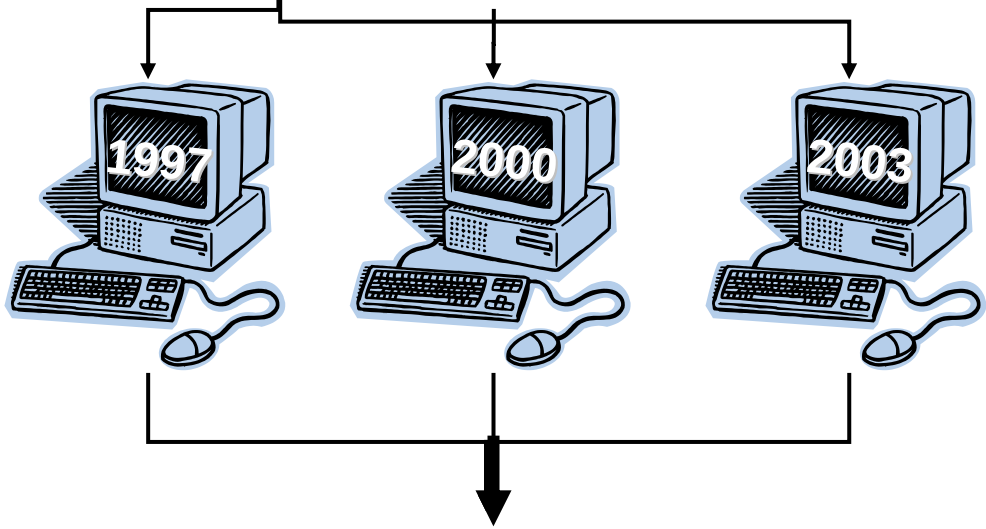
Operationalisation:

- Three PCs typical for the years 1997, 2000 and 2003
- Operating systems Windows NT, Windows 2000 and Windows XP, respectively, with corresponding “Office” Application Software
- Text editing tasks and file handling tasks that could be executed on each of the three systems

Experimental Design

42 subjects… (all PC users)

… performed 4 tasks (2 file handling and 2 text editing tasks) on each of …



… 3 computers connected to the same monitor, keyboard and mouse in randomized order.

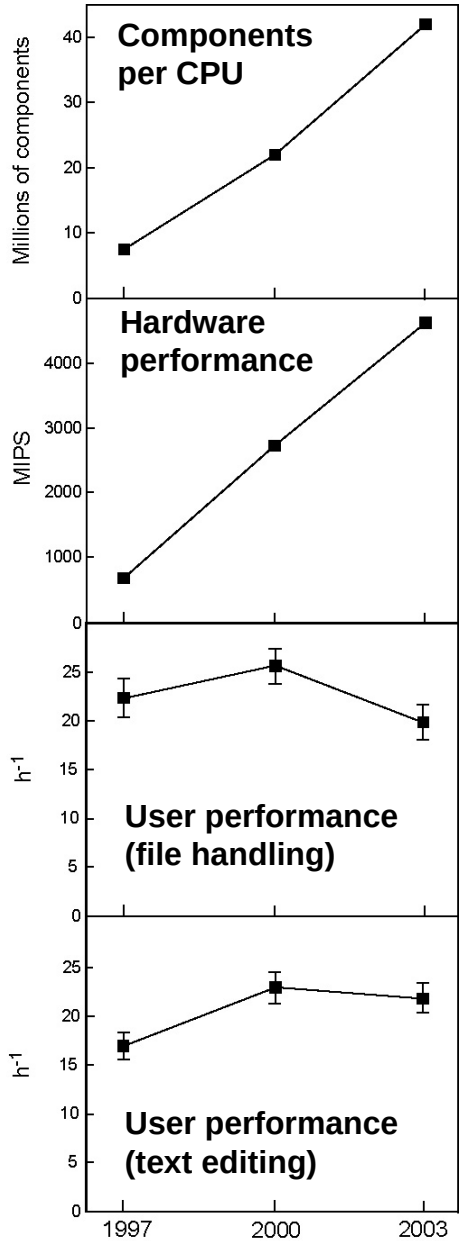
We measured:

- **time needed for completing the tasks**
- **computer-related human activity (using a key logger)**
- **computer activity (using a performance logger)**

Results

Two significant pair-wise differences:

- File handling task: Subjects performed significantly better on the 2000 system than on the 2003 system
- Subjects performed significantly better on the text editing task on the 2000 system than on the 1997 system



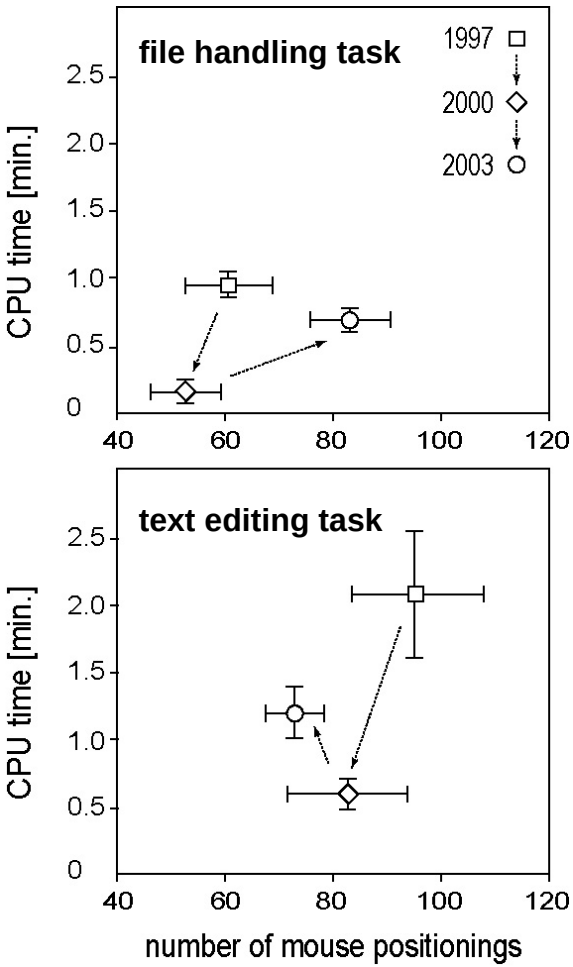
Discussion

Can this result be explained by higher familiarity of the subjects with the “Windows 2000” system?

No, because:

- According to the questionnaires the subjects had to answer, this was the system they were **least** familiar with.
- All subjects used the PC for their daily work in the same organisation, and Windows 2000 has **never been in use** at heir workplace.
- Five months before the experiment was conducted, the organisation started **replacing NT by XP** operating systems.
- Almost all subjects were using Windows **XP for their daily work** at the time of the test.

What does counteract hardware efficiency?



- **Hardware workload** measured by CPU time used for the task
- **User workload** measured by the number of mouse positionings used to do the task
- For the file handling task, the combination of higher machine **and** higher user workload with the 2003 explains the significant decrease in effiency:

Both the faster processor and the user need more time to do the same things.

Conclusions

- Changing over to a new computer that is eight times faster and running newer software does not necessarilty lead to more efficient work for typical office tasks.
- It is even possible that both the faster machine and the user need to work longer to complete the same tasks.
- One of the reasons for replacing PCs long before the end of their technical life span is at least doubtful.