User acceptance of vacuum toilets and grey water systems in The Netherlands, Norway and Germany

Authors:

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Sanitation Challenge, Wageningen, 19 May 2008

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Content of presentation

- Research results into user acceptance
  - Vacuum toilets
  - Grey water systems
- 5 projects
  - The Netherlands
  - Norway
  - Germany

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Introduction

- Increasing interest
- Changes in households due to different working principles
- User acceptance key issue

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Introduction

- Separation of black and grey water
- Vacuum toilets
- Decentralized grey water systems

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Overview projects

Project (year of realization)	Short description
Kaja – Ås, Norway (1996)	24 student apartments equipped with a vacuum toilet system and a local grey water treatment system (biofilter + constructed wetland).
Torvetua – Bergen, Norway (1997)	40 single houses equipped with a vacuum toilet system and two local grey water treatment systems (biofilter + constructed wetland).
Wohnen&Arbeiten - Freiburg, Germany (1999)	14 apartments and 4 offices equipped with a vacuum toilet system and a membrane filter system for grey water treatment
Flintenbreite – Lübeck, Germany (2000)	30 houses equipped with a vacuum toilet system and two local grey water treatment systems (constructed wetlands).
Casa Vita – Deventer, The Netherlands (2007)	32 new apartments equipped with a vacuum toilet system, no local grey water treatment

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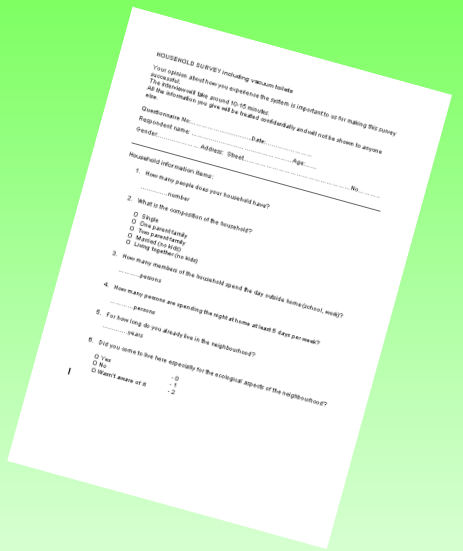
Method interviews

- Standardized interview
  - household descriptors
  - invisibility
  - user comfort
  - robustness



- 20 households, except for Wohnen & Arbeiten

- October 2005 – December 2007

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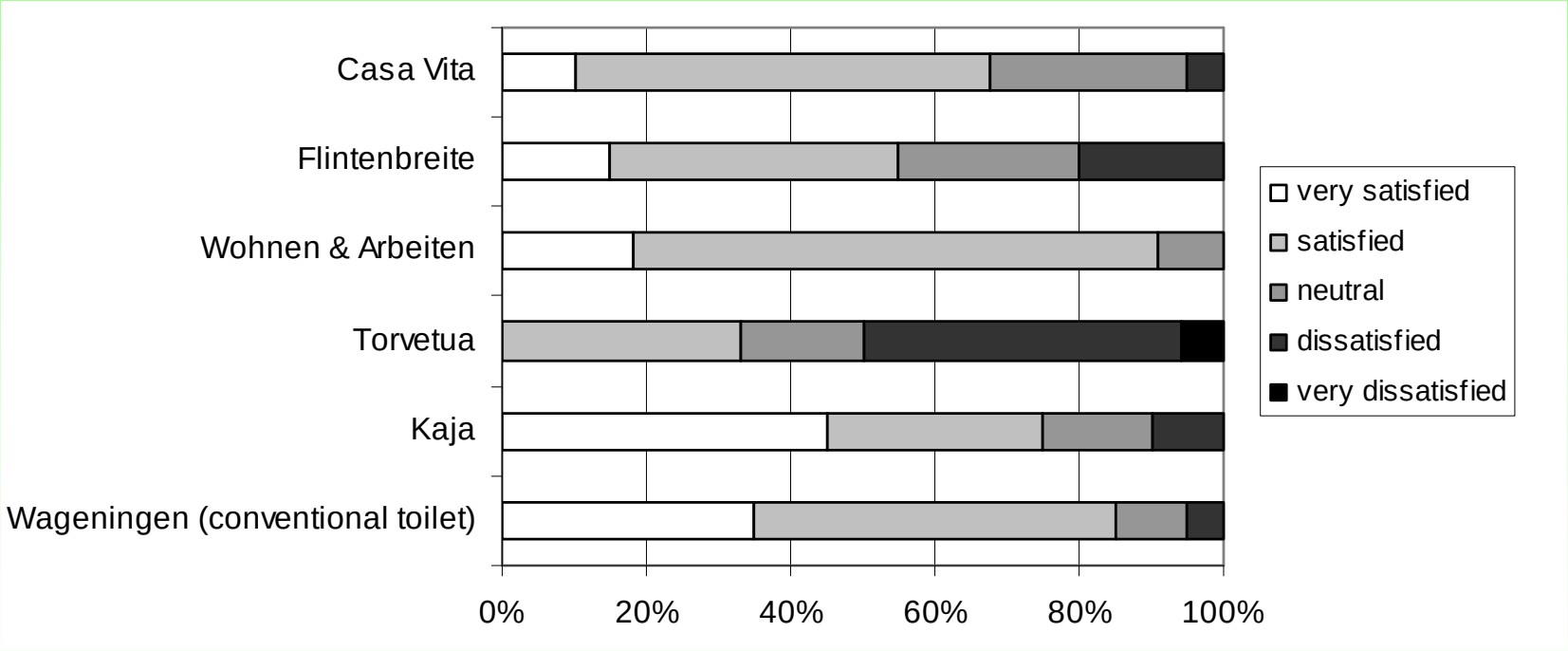
Results interviews

Satisfaction of households with their vacuum toilet systems



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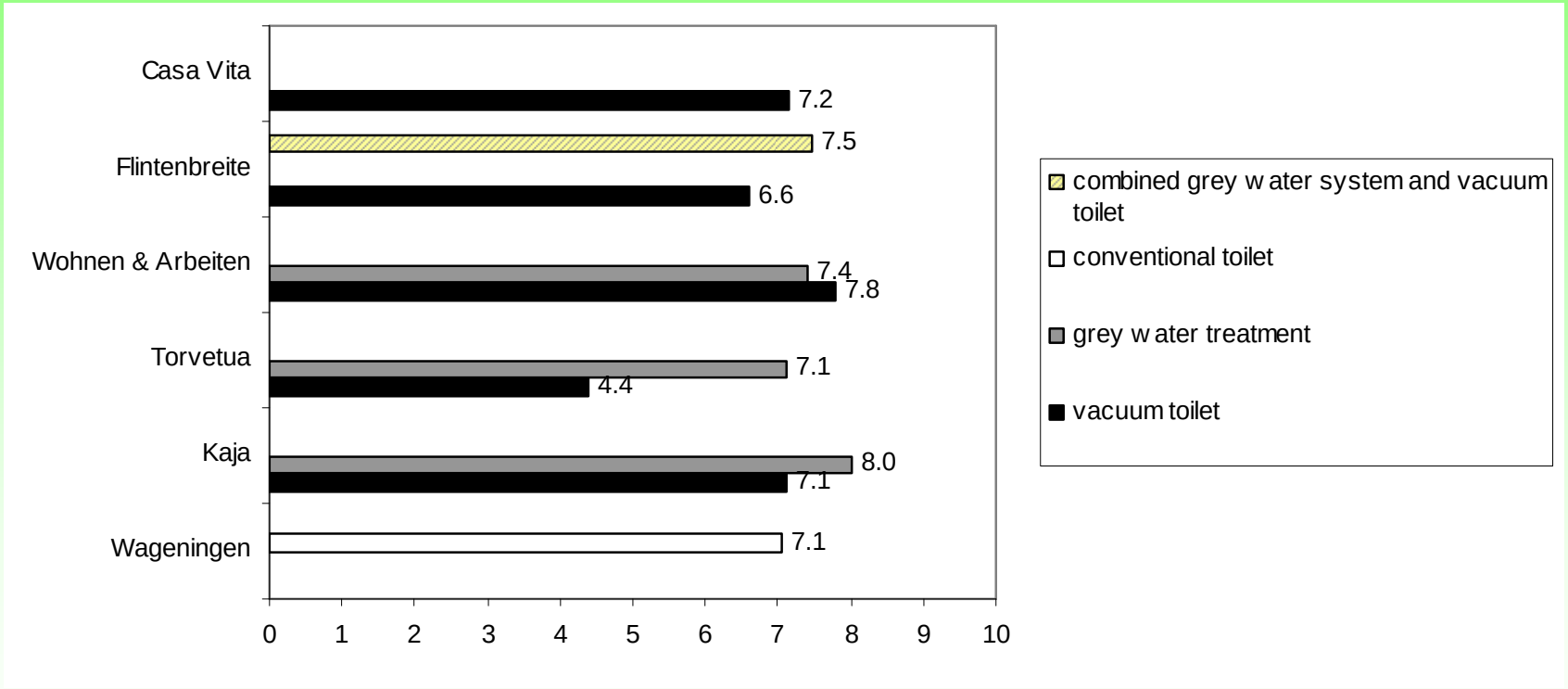
Results interviews

Average marks given by the households



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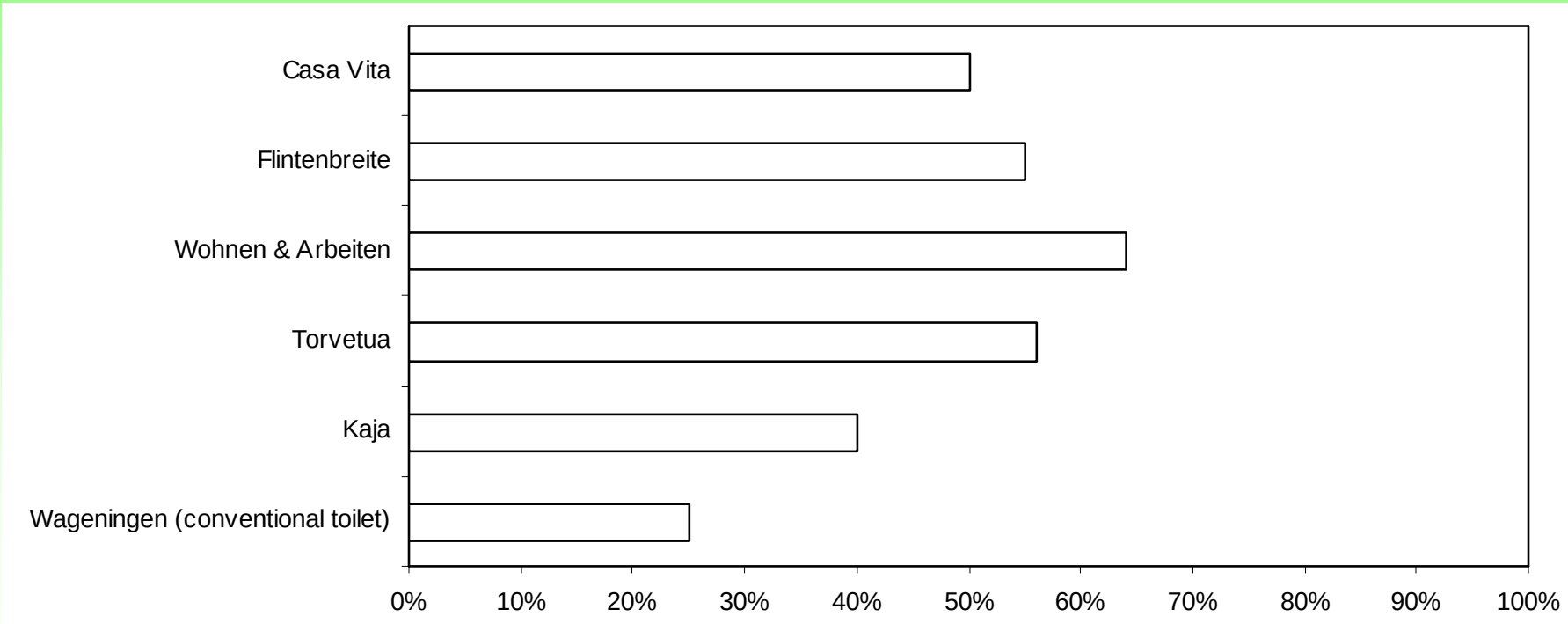
Results interviews

Percentage of households that considers the flushing sound of their toilet unpleasant



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Sound level measurements

- Casa Vita and Lemmerweg-Oost in Sneek, The Netherlands

- Different types/brands of vacuum toilets
  - Casa Vita (manufacturer Jets)
  - Lemmerweg-Oost (manufacturer Roediger)
  - Three other vacuum toilets
    - Jets (same type as in Deventer)
    - Evac
    - Roediger with silencer

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Sound level measurements

- Lid open and closed

- Two conventional water flushing toilets
  - One standard flushing toilet
  - One shelf toilet (“Dutch toilet”)

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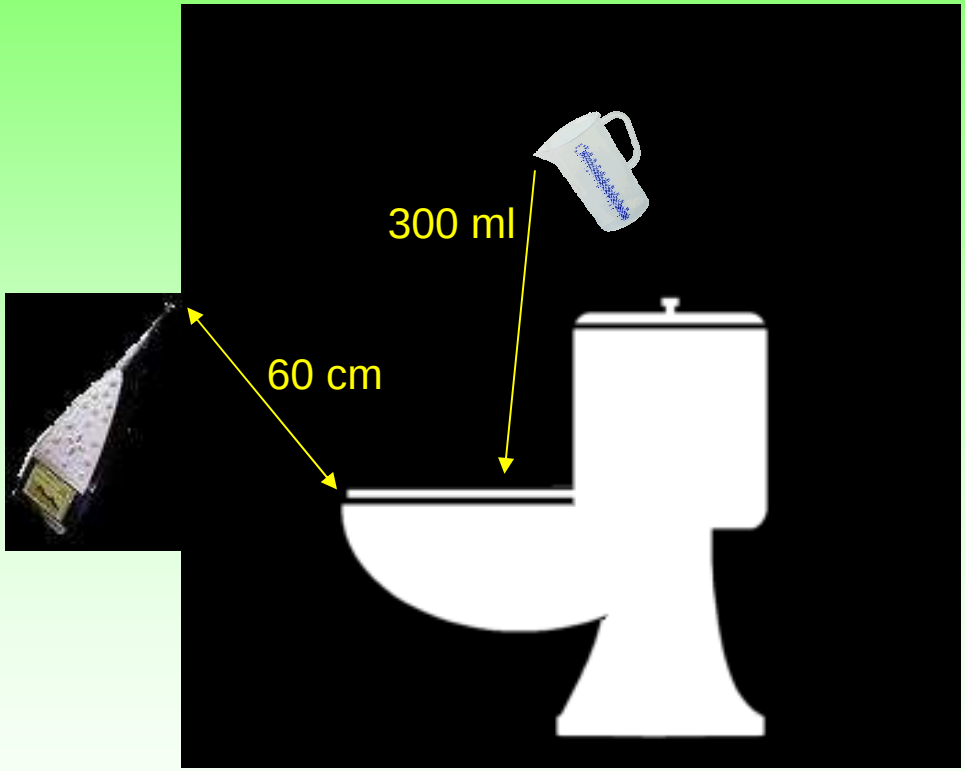
Method sound level measurements



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Results sound level measurements

Results in dB(A)	**Lid**	**Maximal decibel production after correction for the reflections**
Deventer (Casa Vita), Jets	closed	91
	open	95
Sneek, Roediger	closed	102
	open	104
Sneek, Evac	closed	93
	open	97
Sneek, Jets	closed	95
	open	99
Sneek, Roediger + silencer	closed	89
	open	93
Conventional Dutch toilet	closed	80
	open	87
Conventional toilet	closed	83
	open	85
Average results	**Average decibel production after correction for the reflections**	
Vacuum toilet: average with standard deviation	96 +/- 5	
Conventional toilet: average with standard deviation	84 +/- 3	

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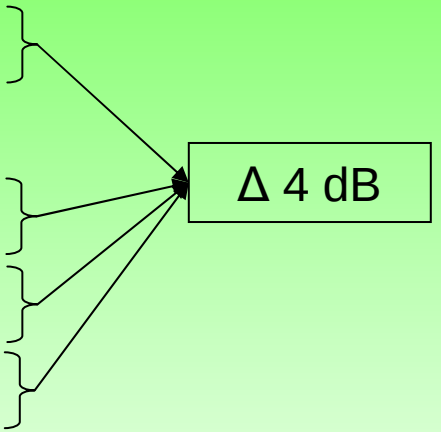

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4 dB ↓

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Silencer

11 – 13 dB ↓

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11 – 13 dB ↓

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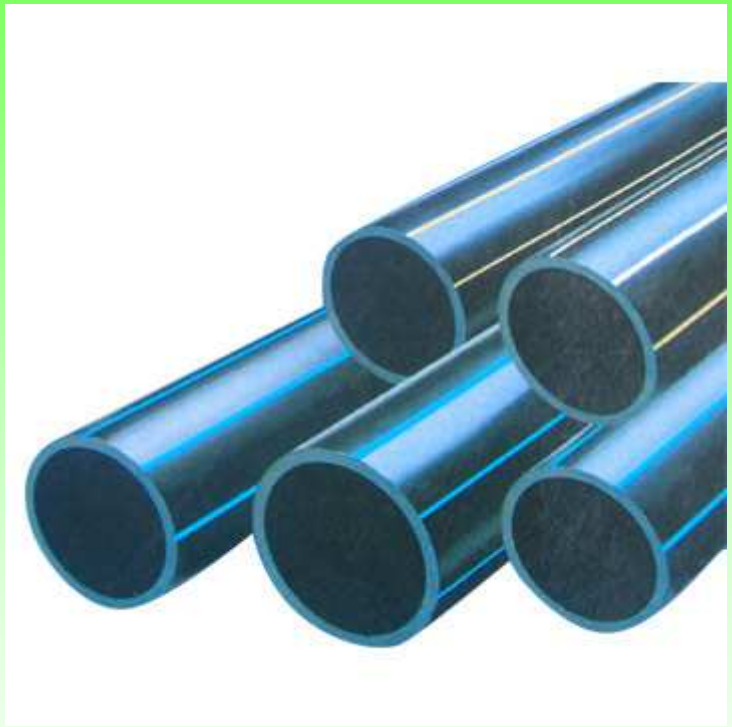
Other possible improvements

- Optimisation of:
  - pipe dimensions
  - piping of the system
  - valves of vacuum toilet / backplate



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Conclusions

- High appreciation of the grey water treatment systems (7.1 – 8)
- Average lower satisfaction level for vacuum toilets
- Appreciation generally high
- 40 – 65% considers the sound unpleasant vs. 25% of the control group

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Conclusions

- Maximum sound level is 10 -12 dB louder
- To increase acceptance sound production has to be reduced
  - Optimisation pipe diameters/piping system
  - Optimisation of valve / backplate

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Outlook

- Sound level → more attention of the manufacturers
- Results in user acceptance and operational functioning will be continued
- Tauw has installed energy meters and logs possible blockages/failures

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Acknowledgement

This study was supported by the European Commission through the 6th Framework Integrated Project SWITCH (Sustainable Water management Improving Tomorrow's Cities' Health)

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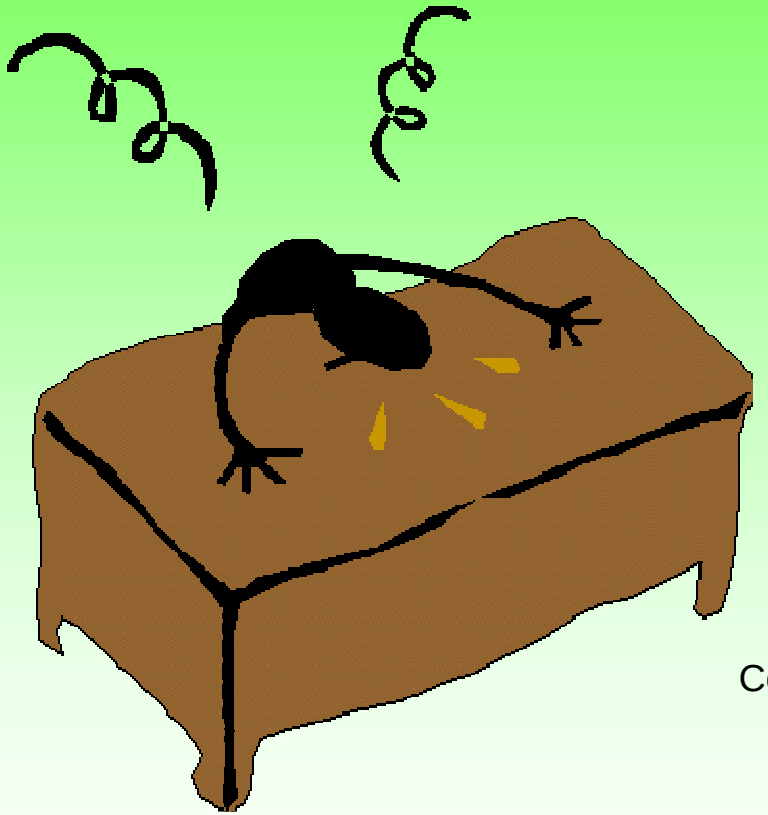
Questions??



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