

COMP272: Theory of Computing - A Study on the Learning Effectiveness of Visualizations

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Metamorphosis of the Cube

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COMP272 - Theory of Computing

- Spring 2002, 2003, 2004
- 99 students
- Just-in-Time Teaching
- Topics: finite automata, pushdown automata, Turing machines
- Material is rather abstract (mathematical)

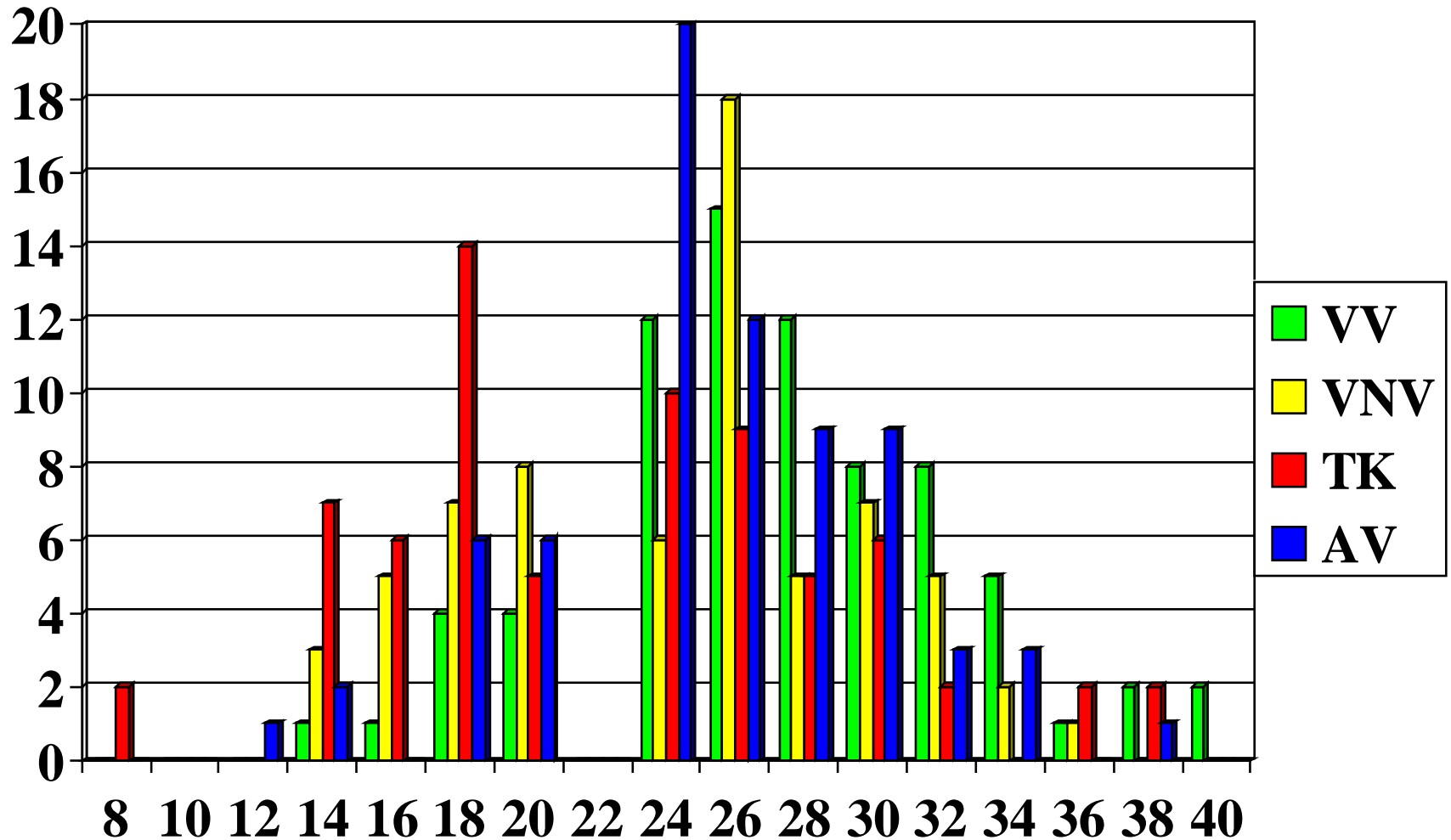
Learning Styles

- **Visual/Verbal:** Text and picture
- **Visual/Nonverbal:** Picture
- **Tactile/Kinesthetic:** Hands-on exercises
- **Auditory/Verbal:** Listen
- Questionnaire at http://www.metamath.com/multiple/multiple_choice_questions.cgi
- Example

Learning Styles in COMP272

- Visual/Verbal: 42
- Visual/Nonverbal: 24
- Tactile/Kinesthetic: 11
- Auditory/Verbal: 14

Learning Styles in COMP272



Animation Tests

- 4 tests
- Immediately after material was taught
- Start with 6 questions
- Then all students see verbal explanation
- Then half of the students (random) see animations
- Then 6 questions similar to first batch

Bloom Taxonomy of Visualizations

(Naps et al., ITiCSE 2002 and 2003)

- **Viewing:** definitions, step-by-step explanations of algorithms
- **Responding:** step exercises
- **Changing:** run algorithms on own input data

Bloom Taxonomy of Visualizations

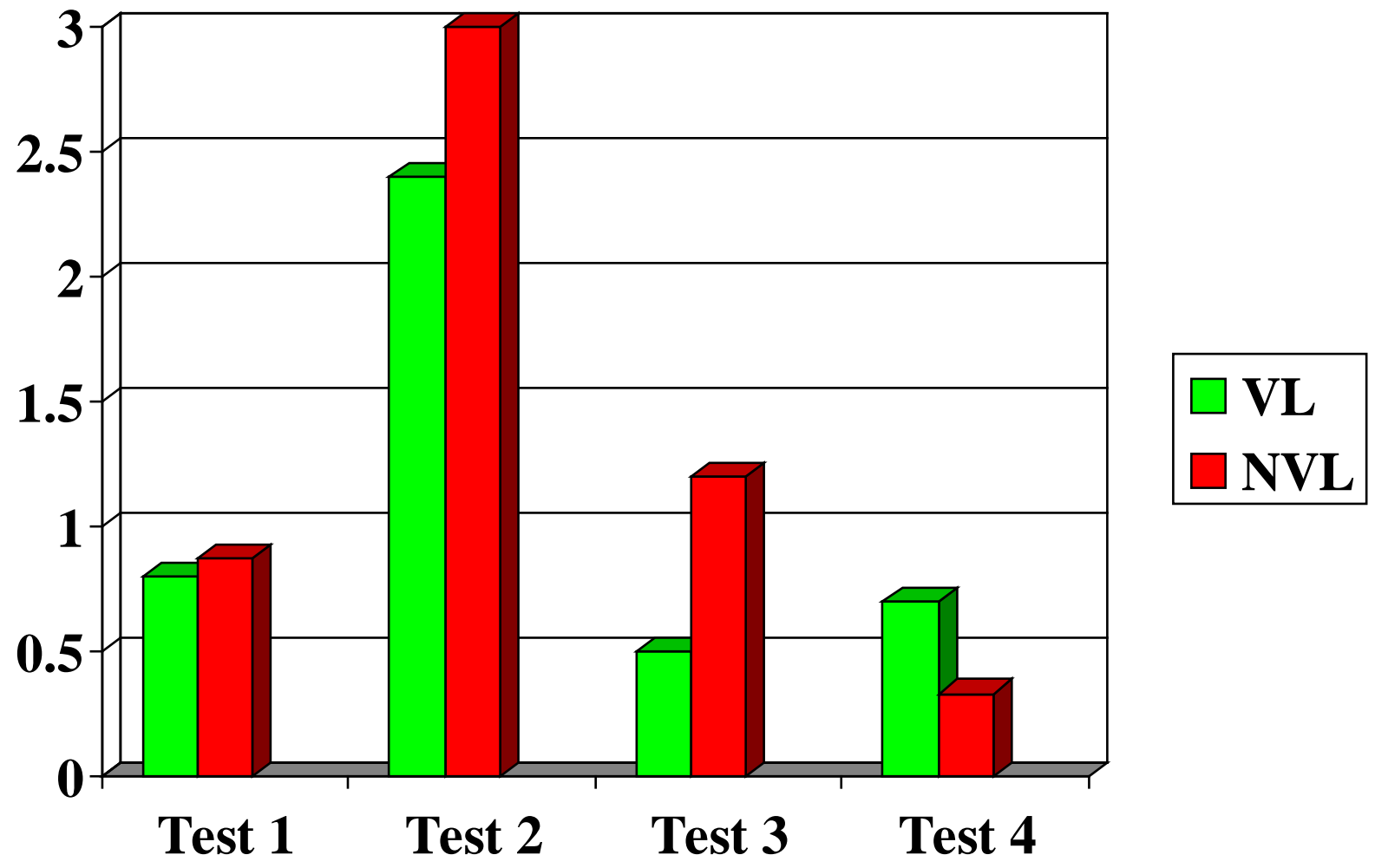
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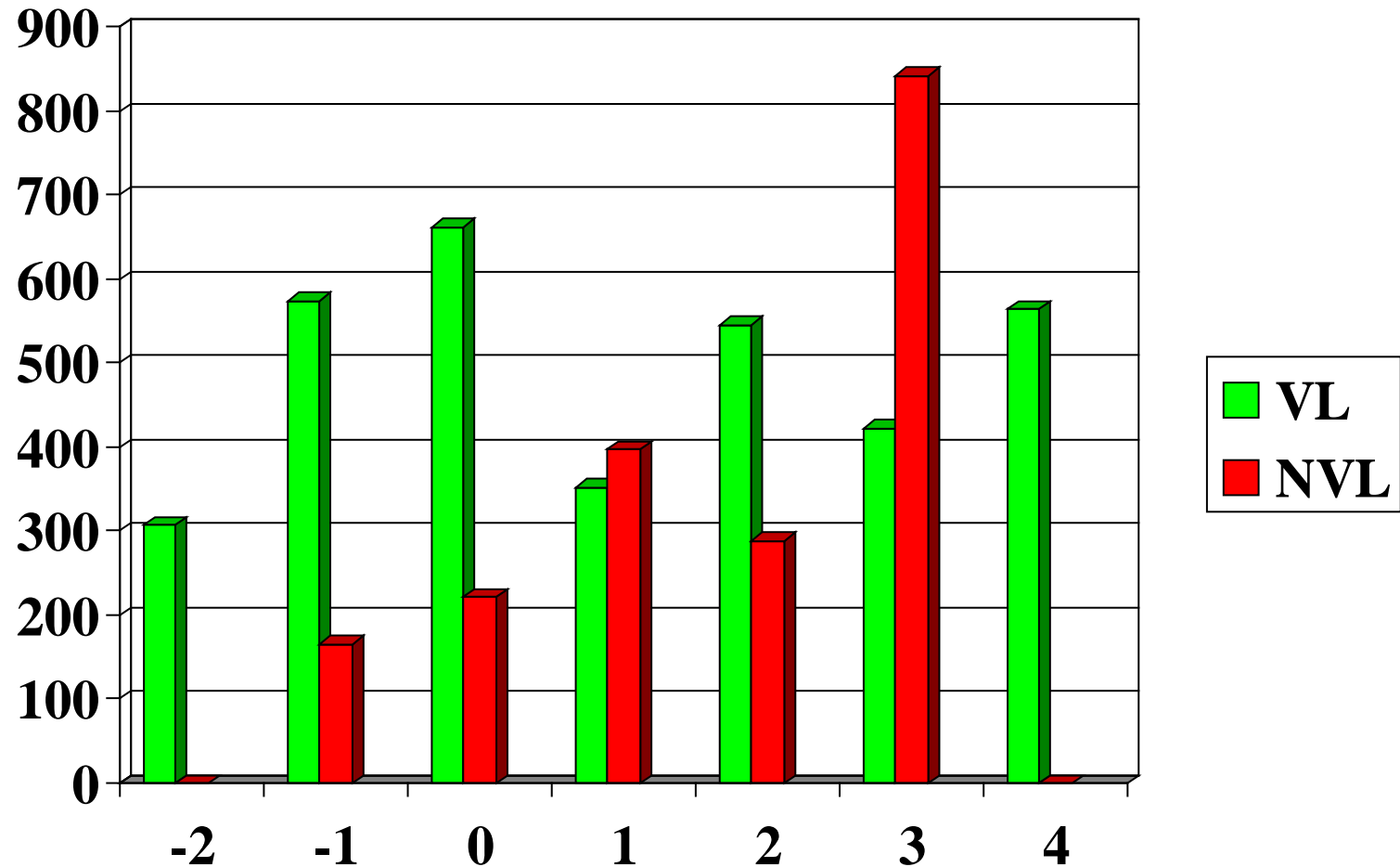
Lot's of Statistical Data

- We recorded all inputs and mouse clicks with time stamps
- We know all right/wrong answers
- We know how long students spent on questions/animations
- We know whether they chose to see animations twice
- ...

Average Improvement



More Time = More Success?



Why?

- Verbal explanations too good?
- Animations not good enough?
- Wrong questions?
- Are non-visual learners more clever?
- What did our tests measure?

We need help from a psychologist

More Studies

- *COMP272, Spring 2005 (?)*
- *Soongsil University, Seoul, 2004*
- *???*

Thank You!

The End

