

HUMAN-CENTERED
DESIGN

Distributing Cognition

Scott Klemmer

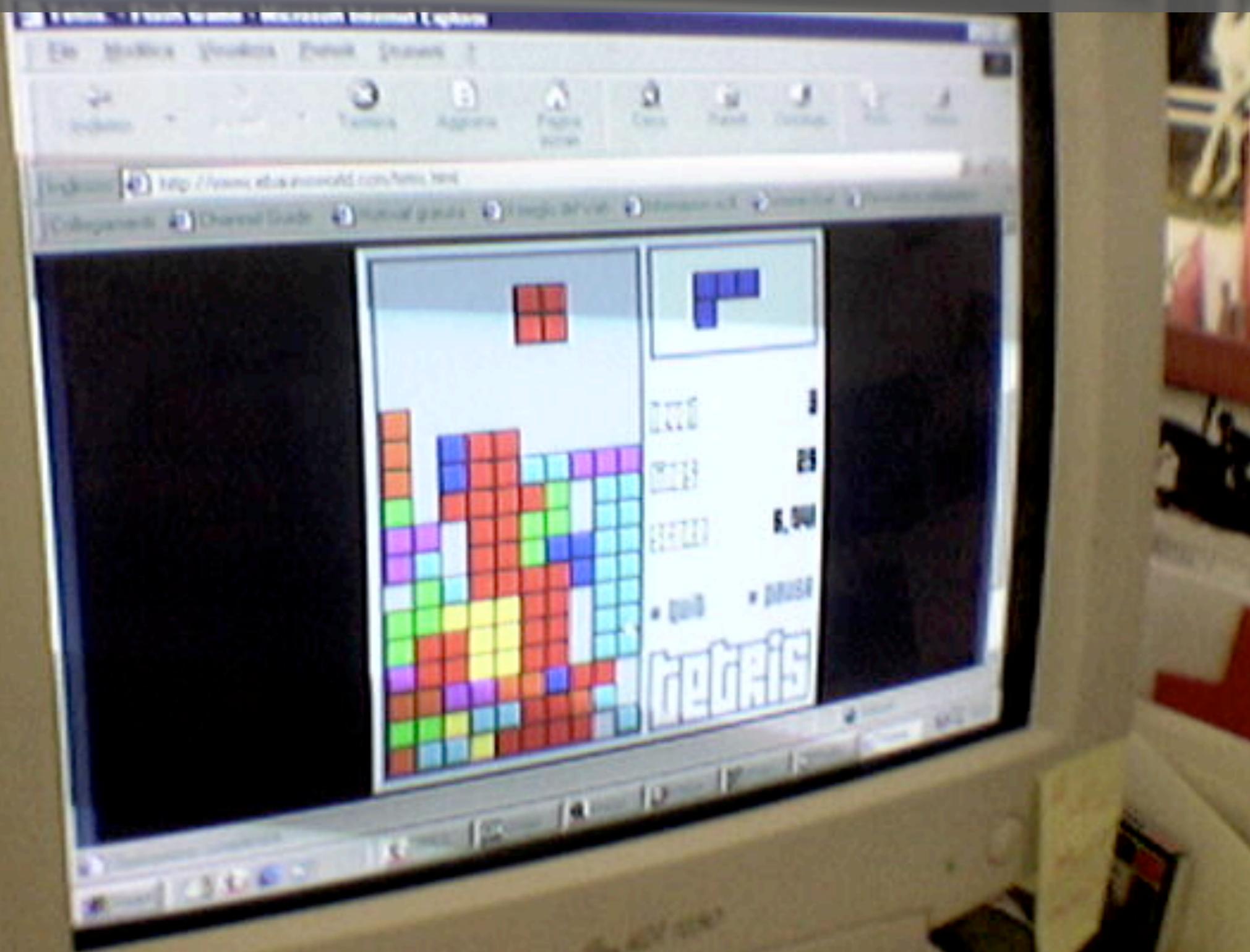
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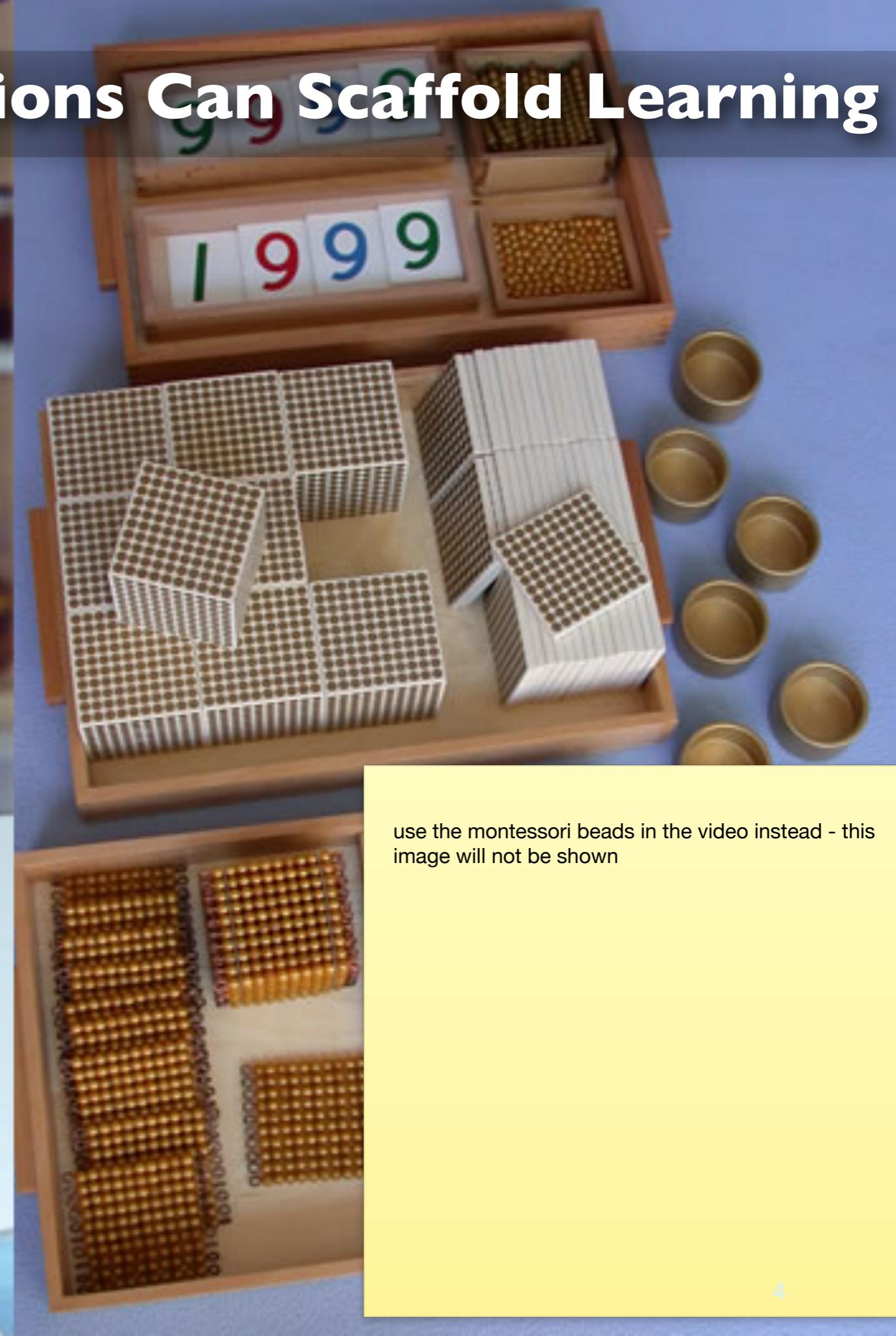
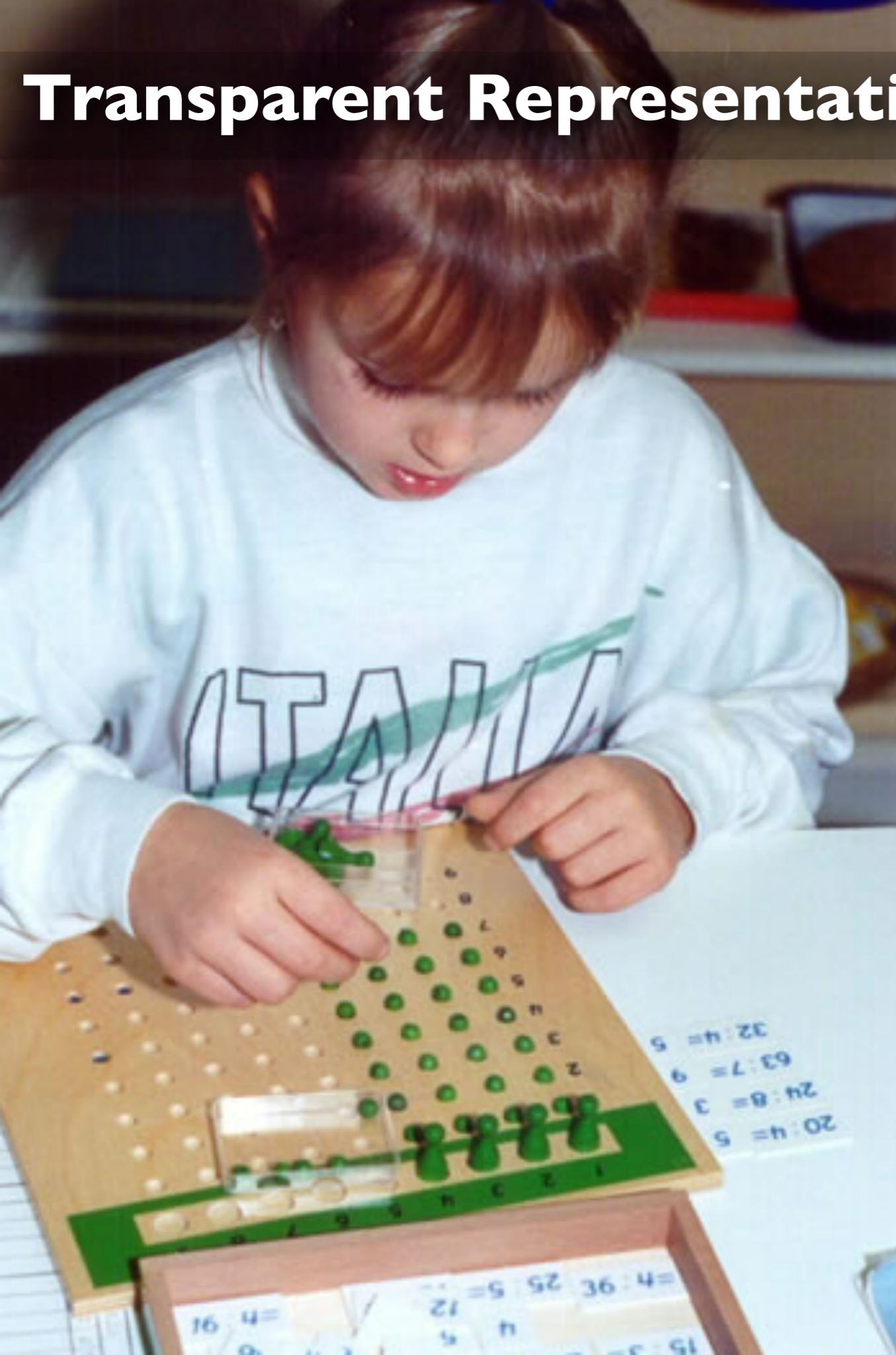
When interfaces help people distribute cognition, it can...

- Encourage experimentation
- Scaffold learning and reduce errors through redundancy
- Show (only) differences that matter
- Convert slow calculation into fast perception
- Support chunking, especially by experts
- Increase efficiency
- Facilitate collaboration

external feedback: cheap experimentation



Transparent Representations Can Scaffold Learning

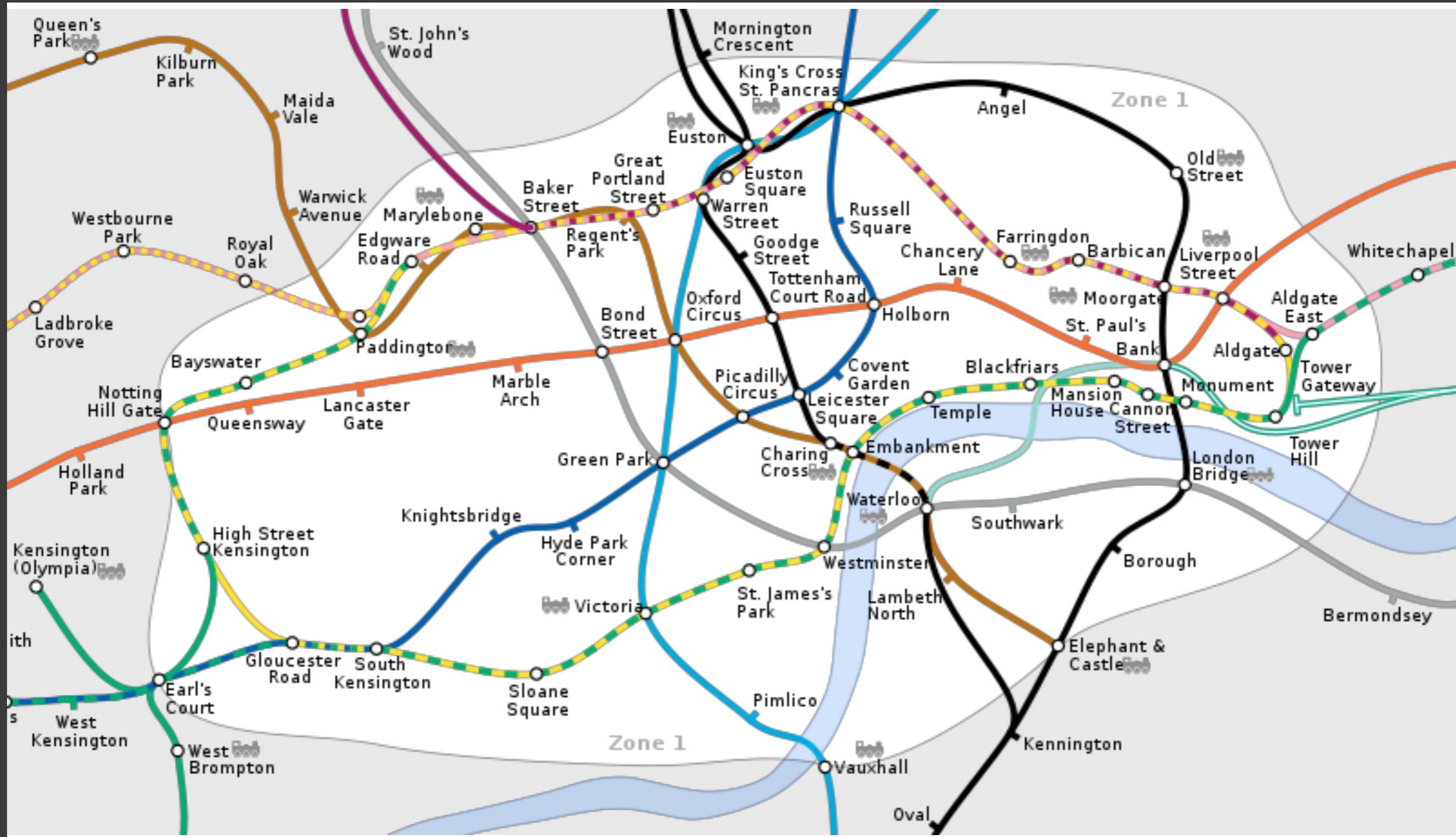


use the montessori beads in the video instead - this image will not be shown

A Good Representation...

- ...shows all of the relevant information, and nothing else. Should enable:
- Comparison
- Exploration
- Problem solving

London Underground



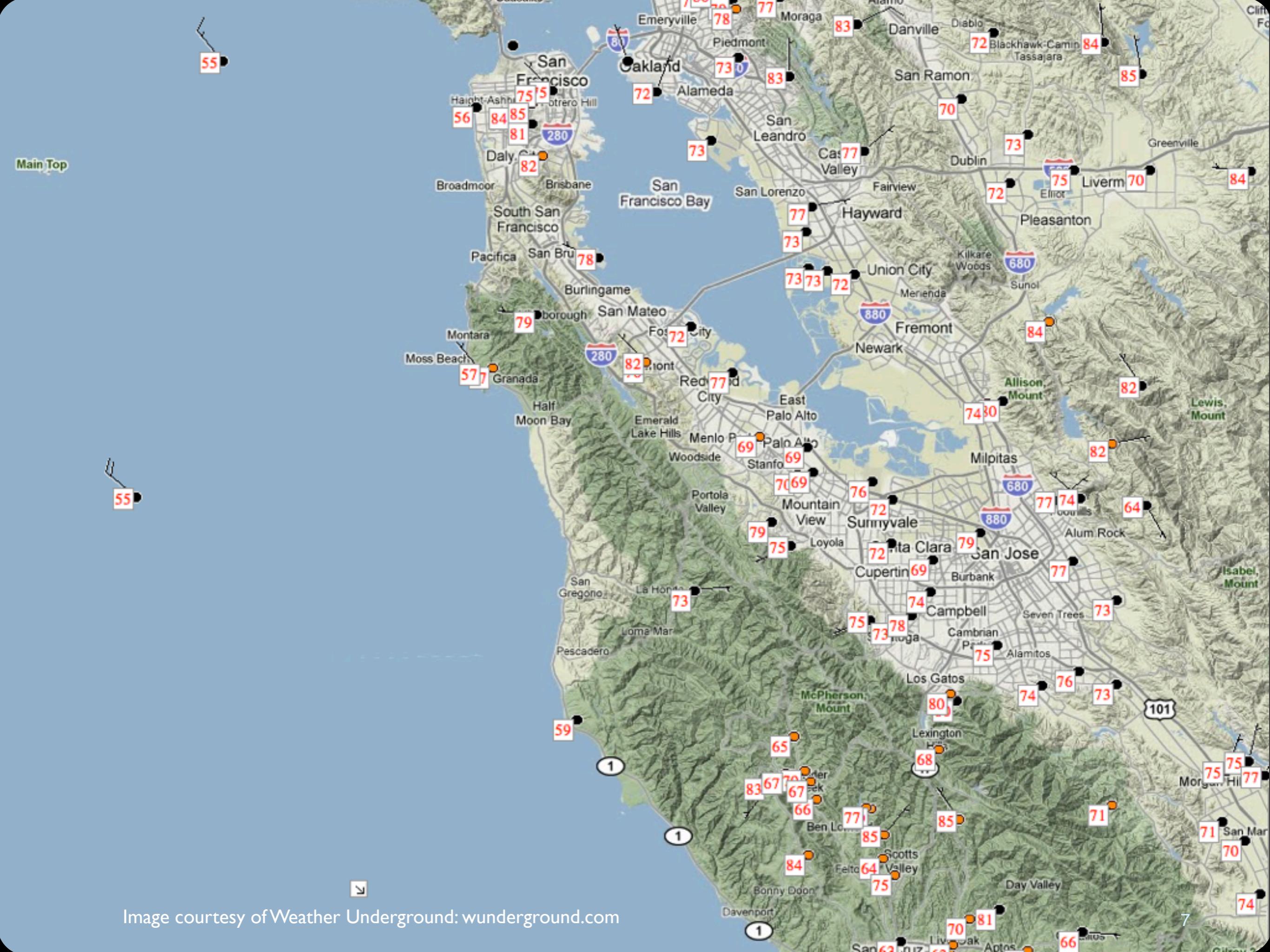


Image courtesy of Weather Underground: wunderground.com

Ordinal data with hue

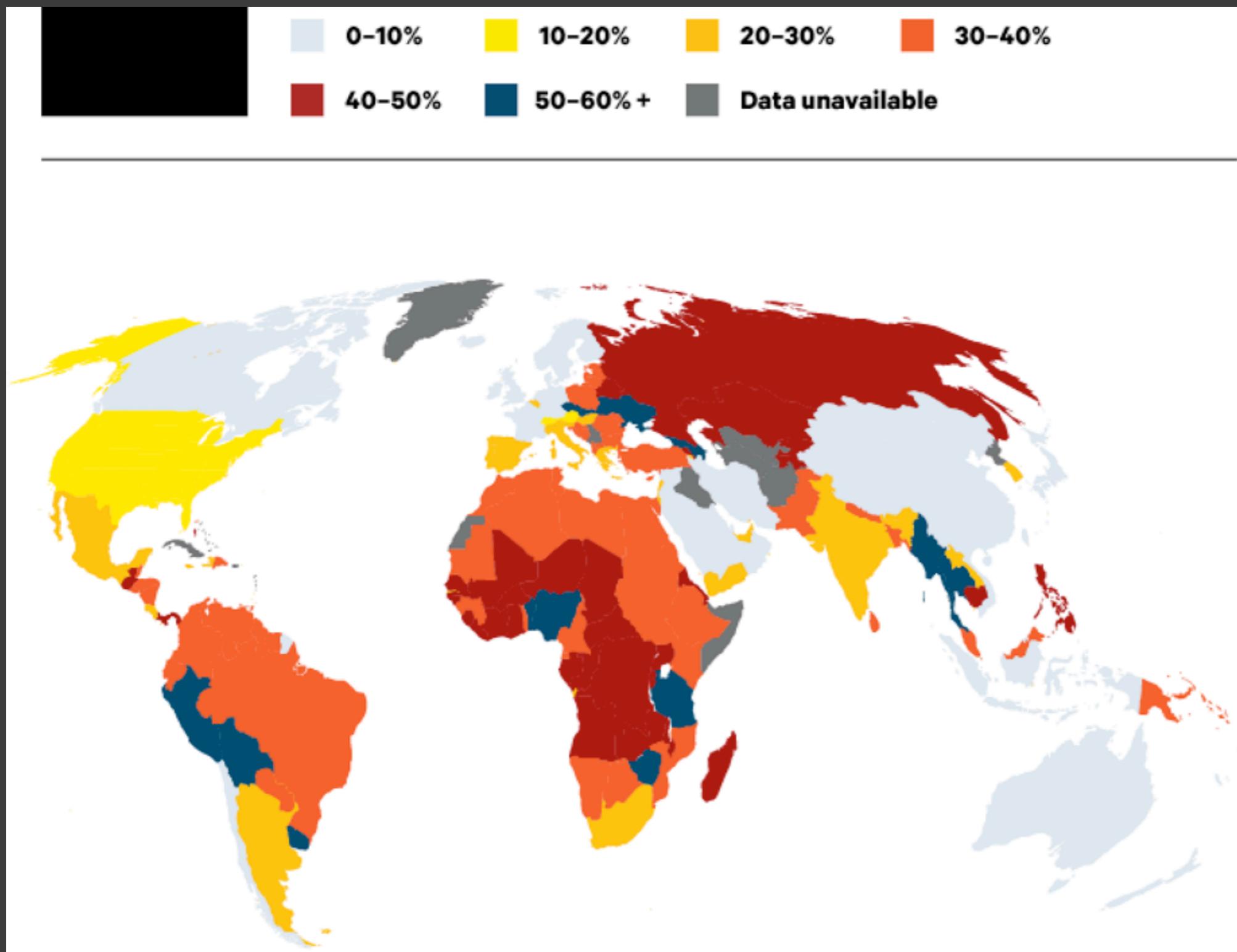


Image: Wired Magazine, Shadow Markets of the World, December 2011 · Data: Schneider et al., 2010

Ordinal data with luminance



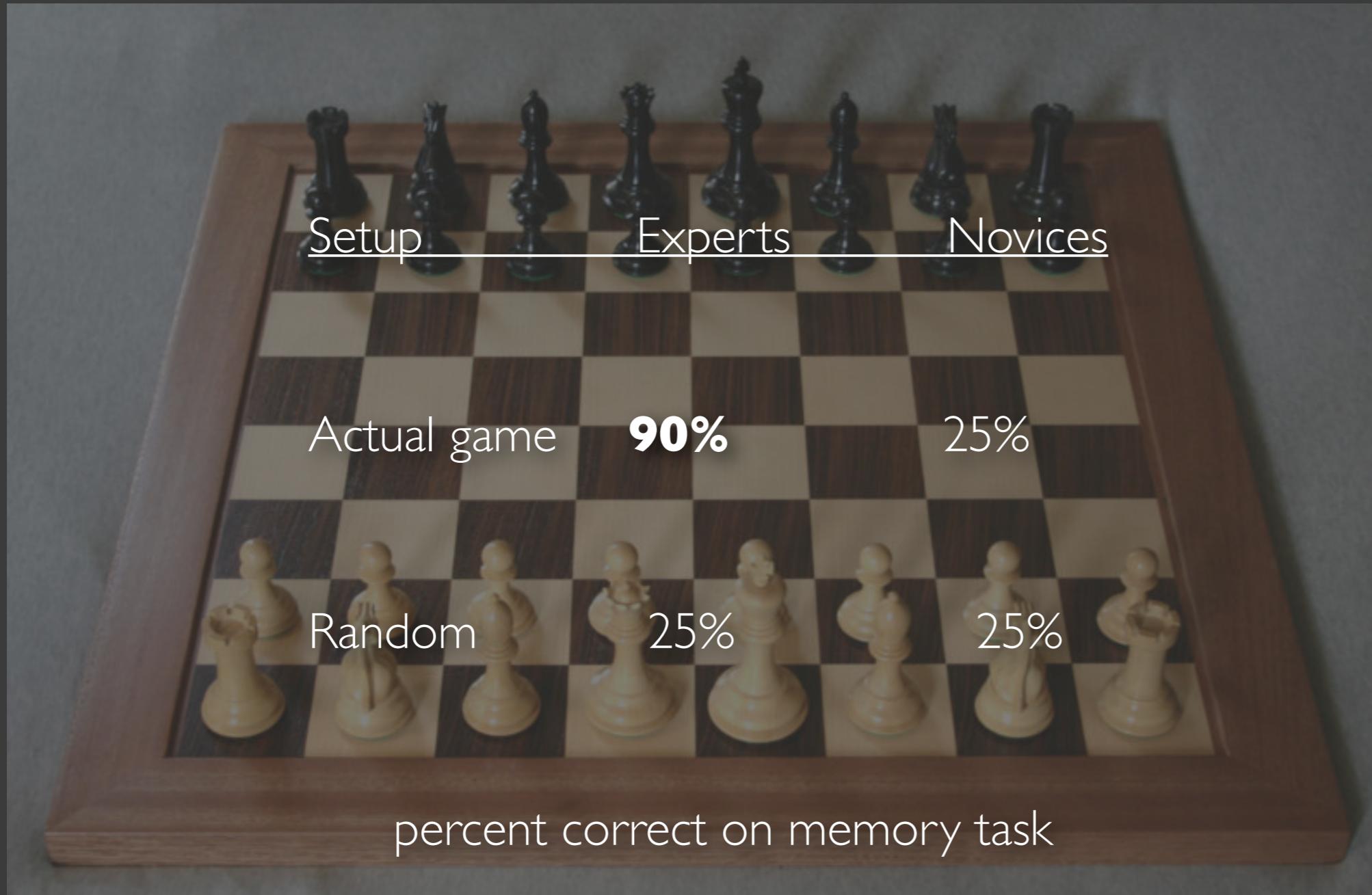
Image: Schneider et al., *New Estimates for Shadow Economies, 2010* · Principle: Tufte, *Visual Explanations*

Chase and Simon, 1973: Experts learn to “chunk” visual stimuli



Image Courtesy Wikipedia: http://en.wikipedia.org/wiki/File:Chess_board_opening_stannton.jpg

Chase and Simon, 1973: Experts learn to “chunk” visual stimuli



Chunking in Interfaces

Ideally, we want a one-to-one mapping between concepts and gestures. User interfaces should be designed with a clear objective of the mental model we are trying to establish. Phrasing can reinforce the chunks or structure of the model.

Worth 10,000 Words?

Informational Equivalence

Informational Equivalence

\neq

Computational Equivalence

A pair of parallel lines is cut by a transversal

Draw two parallel lines intersected by a transverse

How a Cockpit Remembers its Speed

When interfaces help people distribute cognition, it can...

- Encourage experimentation (Tetris)
- Scaffold learning and reduce errors (Montessori blocks)
- Show (only) differences that matter (London Underground)
- Convert slow calculation into fast perception (Map coloring)
- Support chunking, especially by experts (Chess & gestures)
- Increase efficiency (diagrams)
- Facilitate collaboration (cockpits)

Poor Representations: Common but Deadly



Welcome Scott Klemmer

CURRENT SERVICES

AFTER COMPLETING THIS SCREEN, YOU WILL BE RETURNED TO THE LOGIN SCREEN TO ENTER YOUR ID AND NEW PASSWORD.

REMEMBER YOUR NEW PASSWORD FOR ALL FUTURE LOGINS.

(use the help panel, [?](#), for syntax rule)

LogOut

The password you typed is not valid. Please change it.

Account ID: Scott_klemmer_3496

Company Name: Stanford University

Visitor E-Mail: srk@cs.stanford.edu

IBM Sponsor E-Mail: mtopkara@us.ibm.com

Visitor Telephone: 19147847899

Reason For Visit: hci/se symposium

Beginning Date: Sep 30 2010

Last Date: Oct 2 2010

New Password: [?](#)

Reenter New Password: [?](#)

[Change password](#) [Clear](#)

NASA IT Summit 2011 Registration Site [\(View Details\)](#)

Registration Information **Agenda** Checkout Confirmation



The following errors were detected:

- You must fill out all required fields.

Please select which sessions you plan to attend:

Monday, August 15 -

General Session

KEYNOTE SPEAKER: Lynn Tilton, Chief Executive Officer, Patriarch Partners LLC

Date: 8/15/2011 8:00 AM - 9:15 AM (Pacific Time)

Location: Yerba 7-9

Mission IT Supporting Science & Engineering

Title: NASA Supercomputing and Its Impact on Agency Missions

Speaker: Rupak Biswas, Ames Research Center

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 5-6

Waves of the Future

Title: Becoming a Social Organization: Taking a Strategic Approach to Social Media

Featured Speaker: Anthony Bradley, Gartner

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 7

Infrastructure & Operations

Title: Preparing for Mobile Enterprise Applications

Speaker: Norman Smith, Science Applications International Corp.

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 3-4

IT Security

Title: Effective Network Security in a Dynamic World

Speaker: Jason Brvenik, Sourcefire

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 1-2

Innovation

Title: Identity in the Clouds

Speaker: Dick Hardt, Sxip Identity

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 10-11

CIOs Speak

Panel: Inclusion & Collaboration: Fueling Innovation

Featured Speakers: Shari Slate, Moderator, Cisco Systems; Robin Bienfait, Research in Motion; Larry Quinlan, Deloitte Touche Tohmatsu Limited; Candi Castleberry-Singleton, University of Pittsburgh Medical Center; and Stephen Pemberton, Walgreens

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 9

Education

Title: OSS! An Innovative Solution to Support the STEM Workforce of Tomorrow

Speaker: Brenda J. Collins, Ames Research Center

Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 12-13

Collaboration

Title: 21st Century Libraries

Speakers: Robin Dixon, Goddard Space Flight Center; Dudee Chiang and Alexander Smith, Jet Propulsion Laboratory; and Greta Lowe, Langley Research Center

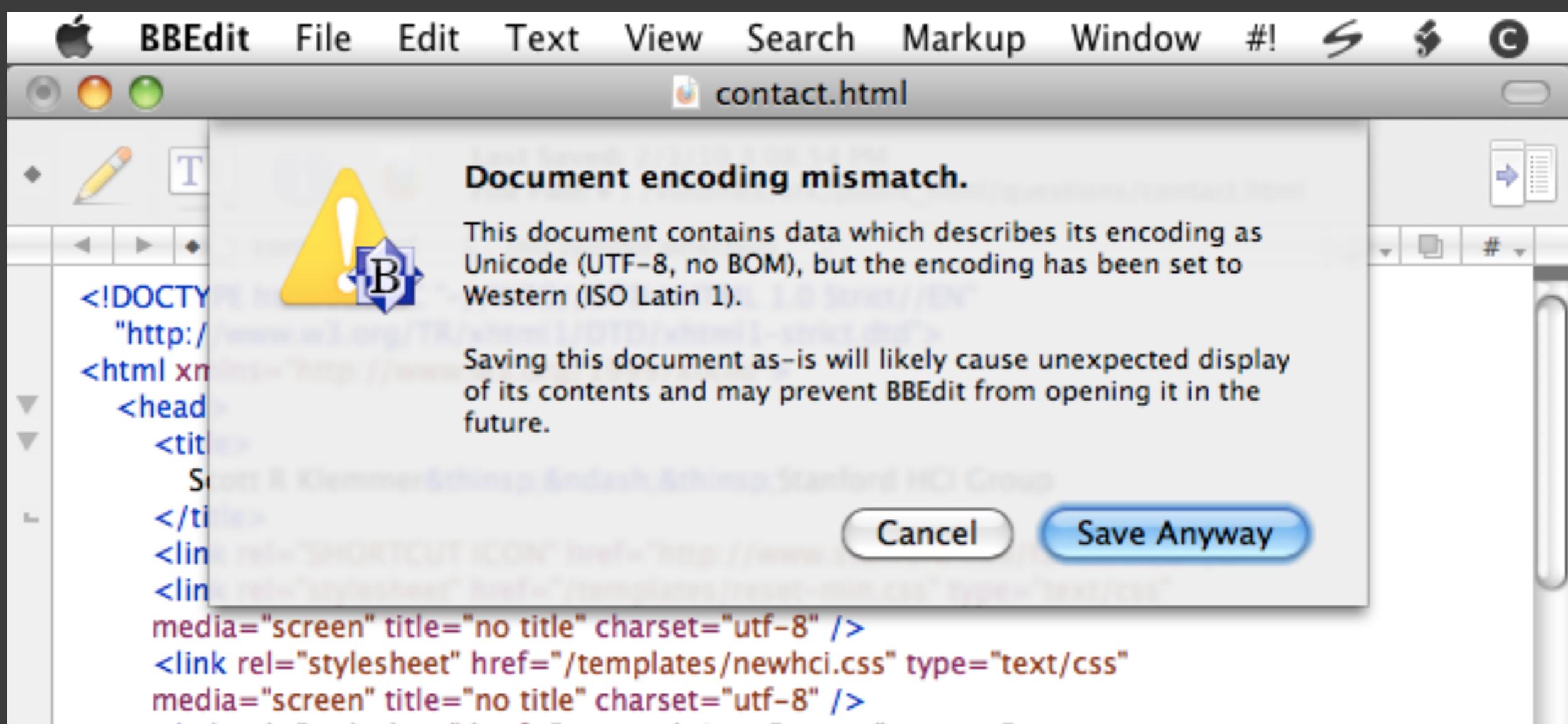
Date: 8/15/2011 9:45 AM - 10:45 AM (Pacific Time)

Location: Yerba 14-15

Mission IT Supporting Science & Engineering

Title: Computing Needs Assessment

Speaker: Karen Petraska, NASA Agency





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/Users/srk/Desktop/L1010235.jpg

Do you wish to overwrite the existing files, skip the existing files, or rename the exported files to avoid collision?

Overwrite

Skip

Cancel

Use Unique Names

Further Reading

- Don Norman, *Things that Make Us Smart*
- Ed Hutchins, *Cognition in the Wild*
- Herbert Simon, *Sciences of the Artificial*
- Edward Tufte, *Visual Explanations*