



VisWeek 08
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Daisy Map: A Visualization Tool For Student Assessments Data

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From Theory to Practice: Design, Vision and Visualization Workshop

Ilknur Icke^a

iicke@gc.cuny.edu

^(a) Dept. of Computer Science,
Graduate Center,
City University of New York,
365 Fifth Ave.
New York, NY, 10016

Elizabeth Sklar^{a,b}

sklar@sci.brooklyn.cuny.edu

^(b) Dept. of Computer and Information Science,
Brooklyn College of the
City University of New York,
Brooklyn, NY, 11210

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Motivation



- Computers are ubiquitous in schools today.
- Education data is gathered covering a wide range of information on:
 - student assessments
 - student enrolment
 - financial aspects
- Amount of data collected is overwhelming to educators, administrators, policy-makers.
- Our work explores the use of intelligent data analysis and visualization techniques to help make sense of education data.

Academic Assessments Case Study



- We worked with Children's Progress Inc.(*) to develop visualization and analysis tools on their student assessment application named CPAA.
- The CPAA covers **core concepts** that are essential to early childhood development, grouped into **language arts** and **mathematics** categories (listening, pre-reading, alphabet knowledge, phonemic awareness, reading, writing mechanics, numbers and quantities, numeracy, operations, measurement and patterns).

* <http://www.childrensprogress.com>

CPAA Overview



- The **core concepts** are divided into **prime questions** which address specific concept components.
- For example; phonemic awareness is comprised of prime questions related to: **rhyming**, **initial sound**, **blending**, and **syllable counting**.
- The concepts were chosen to reflect US national and state academic standards for language arts and mathematics for ages 4-8.

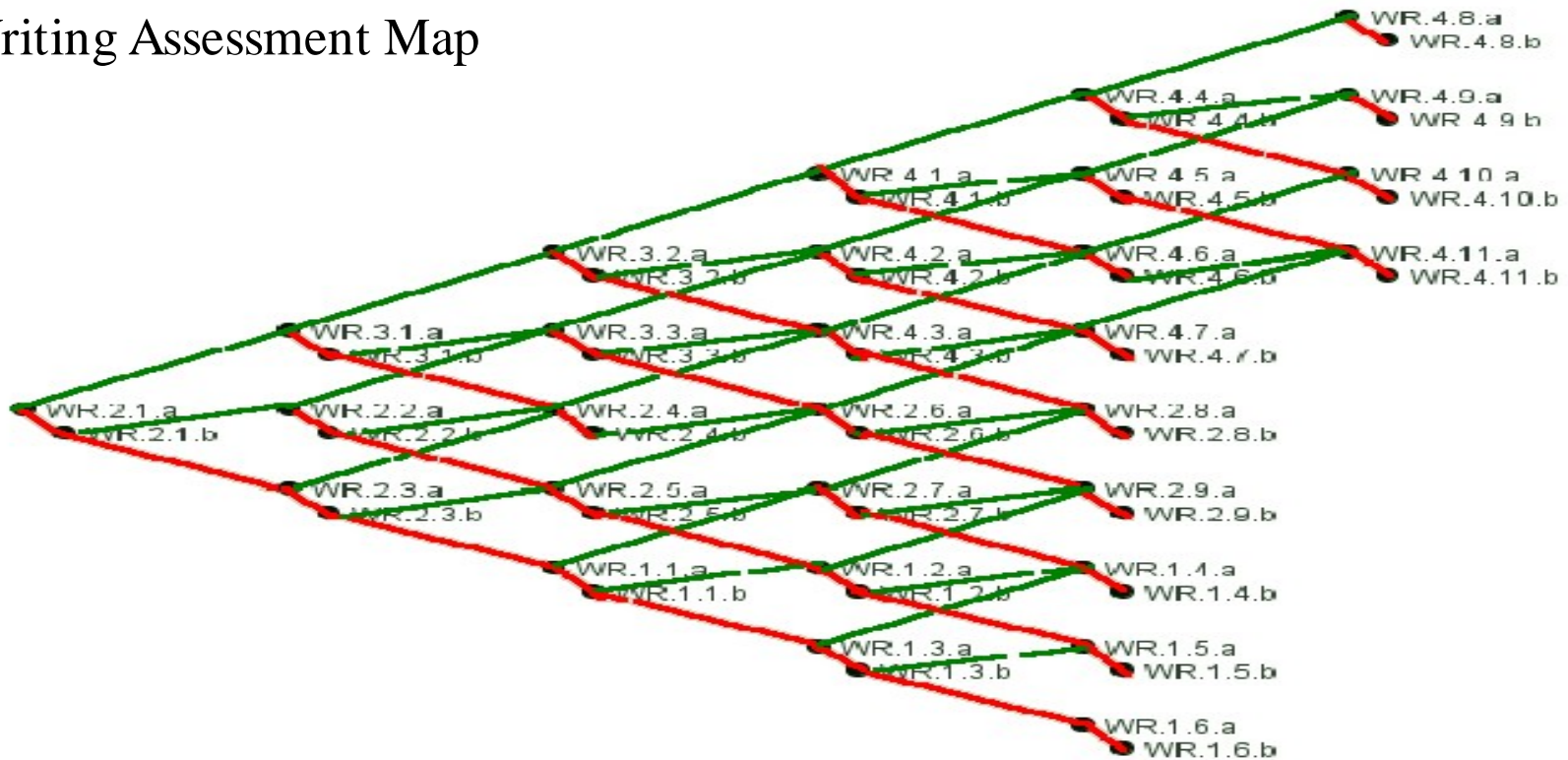
CPAA-Adaptive Assessment



- The prime questions are organized within the assessment in an **adaptive** manner.
- If a child answers a particular prime question correctly, then she will receive a more difficult prime question; if not, she will receive a **hint**.
- A hint is the same question again, presented in a *different format*.
- Each incorrect response choice has a particular outcome that provides a *different kind of hint* to guide the child to the correct answer.

Assessment Map

Writing Assessment Map

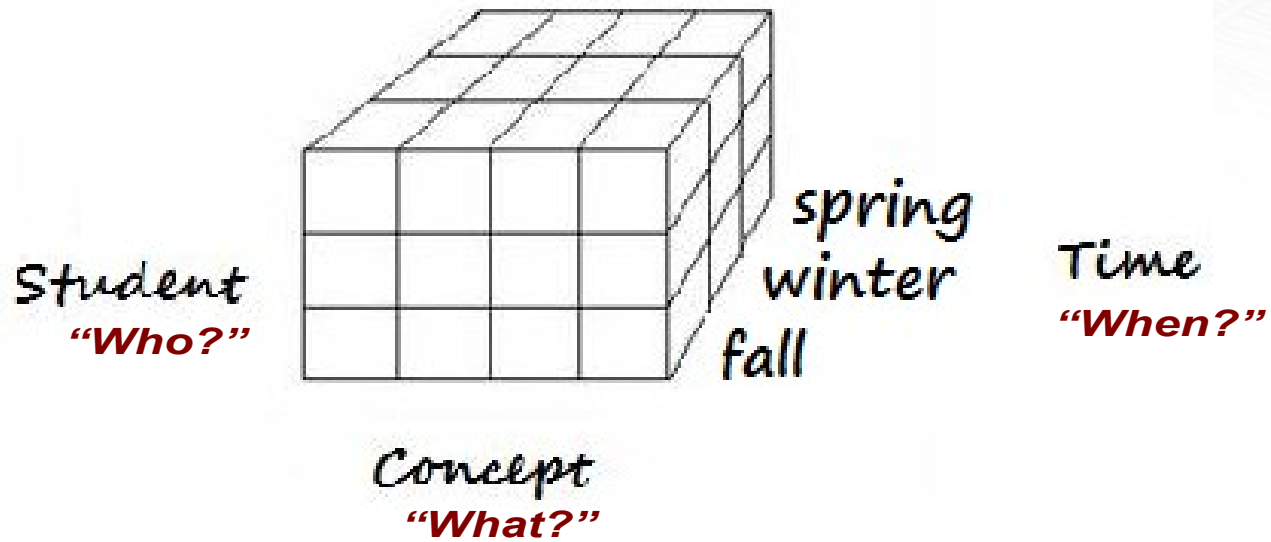


Scoring



- Each assessment covers multiple concepts (Reading(re), Writing(wr), Measurement(me), Operations(op), Pattern Forming(pf) and so on).
- Children receive one of the four scores from each concept :
 - **1** Below expectation
 - **2** Approaching expectation
 - **3** At expectation
 - **4** Above expectation
- These scores are State standard.
- Assessments are repeated from time to time within a year (fall, winter, spring) and across different grades (from pre-k to 3rd grade).

Data Cube of Assessment Scores

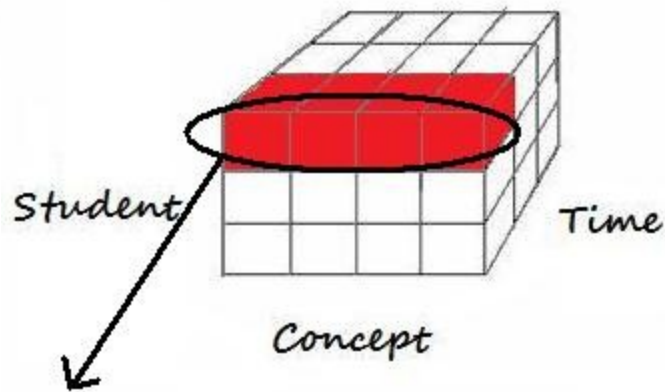


Task: Design a Visualization Tool



- We want a high-level visualization tool to help us monitor how a group of students performed on assessments over a period of time.
- We want to see the scores on each concept *within an assessment*.
- We want to see the changes in scores *across different assessments*.
- This is like displaying the data cube(3D) on the screen(2D).

From Data Cube to Daisy Map

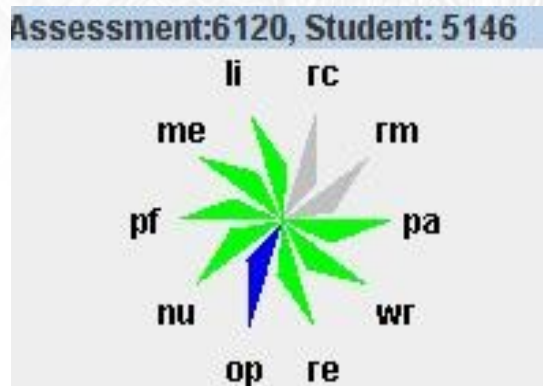


| li | me | pf | nu | op | re | wr | pa | rm | rc |
|----|----|----|----|----|----|----|----|----|----|
| 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 0 | 0 |

Assessment: 6120, Student: 5146



Color Coding of Scores



Scores: 1 2 3 4

No score

1:Red 2:Yellow 3:Blue 4:Green No Score(0): Gray

- Each petal represents the score received for one concept.
- Color of the petal depends on the score.
- More suitable for humans to examine visually than a bunch of numbers since humans are great *pattern recognizers*.

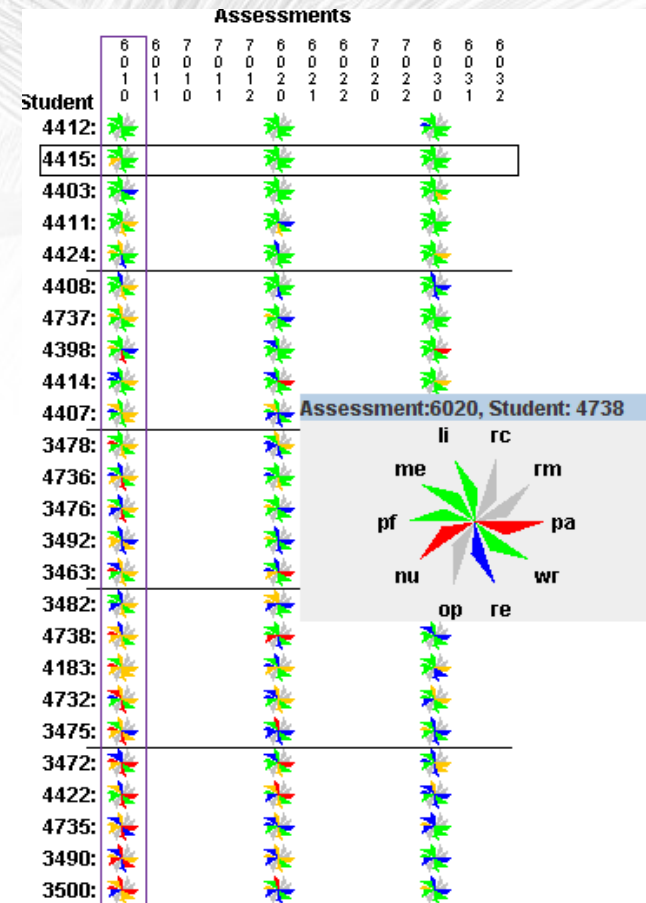
Visualization Application



- We built a visualization tool based on our *Daisy Map* design.
- Each student assignment is represented by a daisy.
- **Goal 1:** Each **row** represents **one student's** performance across time.
- **Goal 2:** Each **column** shows the performance of **all students** on **one assessment**.

Visualization Goal 2

- Performance of all students on one assessment



Conclusion



- Daisy Map design worked well for our task.
- In general, Daisy Map works well in representing a small number of categorical data items.
- Color coding the scores as petals of the daisies is more effective than putting the numbers on the screen.
- Daisy Map helped us visualize the 3D data cube of student assessments on the 2D screen.
- We were able to *simultaneously* visualize one student's performance across time (horizontally) as well as a group of students' performance on the same assessment (vertically).

Thank you!

Ilknur Icke

<http://www.cs.gc.cuny.edu/~iicke>

iicke@gc.cuny.edu