

Aug JSM 2010 1

Social Constructions of Rankings

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www.StatLit.org/2010SchieldASA6up.pdf

Aug JSM 2010 2

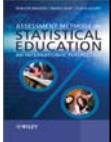
Statistical Competence vs. Statistical Literacy

Statistical competence is the ability to produce, analyze and summarize detailed statistics in surveys and studies. ... needed by 'data producers.'

Statistical literacy is the ability to read and interpret summary statistics in the everyday media: in graphs, tables, statements and essays. ...needed by data consumers.

Schield in *Assessment Methods in Statistical Education*

In teaching rankings, different topics are appropriate depending on the type of class.



Aug JSM 2010 3

Rankings: Numerical Ratings

Numerical rankings are common in everyday media.
For example: top 10, second place or 3rd ranked.

Classification of numerical ratings:

1. Judgment: expert/connoisseur
2. Number-based, single-factor
3. Number-based, multi-factor

Note: Judgment-based scores (#1) can be used in forming multi-factor rankings (#3). In US News Colleges survey, college Dean's give their opinions.

Aug JSM 2010 4

1. Judgment Rankings: Subjective



Aug JSM 2010 5

1. Judgment Rankings: Top 10 Love Poems

1. **How Do I Love Thee?** Elizabeth Barrett Browning
2. **O My Love's Like a Red, Red Rose,** Robert Burns
3. **i love you much** (most beautiful darling), ee cummings
4. **The Garden of Love,** William Blake
5. **When You Are Old,** William Butler Yeats
6. **I Do Not Love You,** Pablo Neruda
7. **I Would Live in Your Love,** Sara Teasdale
8. **Let These Be Your Desires,** Kahlil Gibran
9. **Love Not Me,** John Wilbye
10. **The Healing Heart,** Gary R. Hess

http://hubpages.com/hub/Top_10_best_love_poems by ebourne

World's Best Looking Bottom Belongs to Bulgarian Girl

Society | November 2, 2007, Friday



The world's best looking bottoms belong to a Bulgarian woman and Romanian man, according to judges in a backside beauty contest.

Kristina Dimitrova, 19, and 24-year-old Andrei Andrei saw off 41 other finalists from 28 countries in the Sloggi-sponsored competition in the southern German city of Munich.

Beyond a EUR 10,000 cash prize, Kristina and Andrei each won a modelling contract for the company's next international advertising campaign as well as a year-long insurance policy for their rear ends in case of injury.

Organisers say more than 15,000 candidates applied online to convince the jury about the quality of their behinds.

Aug JSM 2010 7

2. Number-Based Rankings: Single-Factor

The screenshot shows the State Farm website's navigation bar with 'Insurance', 'Mutual Funds', and 'State Farm Bank'. Below the navigation, a sidebar lists various insurance categories. The main content area is titled 'Most Frequently Stolen Cars' and includes a list of 10 vehicles.

Rank	Vehicle
1.	1995 Honda Civic
2.	1991 Honda Accord
3.	1989 Toyota Camry
4.	1997 Ford F150 Series
5.	1994 Chevrolet C/K 1500 Pickup
6.	1994 Acura Integra
7.	2004 Dodge Ram Pickup
8.	1994 Nissan Sentra
9.	1989 Toyota Pickup
10.	2007 Toyota Corolla

Aug JSM 2010 8

The graphic features a background of various international flags and scattered banknotes, with the text 'THE WORLD'S BIGGEST DEBTOR NATIONS' overlaid in white.

Aug JSM 2010 9

Single Factor Rankings Have Few Subtleties

Subtleties that are true of all rankings include

- Ranks ignore the difference in the underlying scores
- Ranks can make small differences big.
- Ranks can make big differences small.

The Excel formula for single-factor ranks is simple:

- = Rank(A2, A\$2:A\$9, 1) if lower score is best
- = Rank(A2, A\$2:A\$9, 0) if higher score is best

Aug JSM 2010 10

Movie Gross Receipts USA Box office As of 7/2010

1.	Avatar (2009) \$750M	← Biggest difference: 149M
2.	Titanic (1997) \$601 M	
3.	The Dark Knight (2008) \$533M	
4.	Star Wars IV - A New Hope (1977) \$461M	
5.	Shrek 2 (2004) \$436M	
6.	E.T.: The Extra-Terrestrial (1982) \$435M	← Smallest difference 1.6M
7.	Star Wars I - Phantom Menace (1999) \$431M	
8.	Pirates of Caribbean -- Dead Man's Chest (2006) \$423M	
9.	Spider-Man (2002) \$404M	
10.	Transformers: Revenge of the Fallen (2009) \$402M	
11.	Toy Story 3 (2010) \$382M	
12.	Star Wars III - Revenge of Sith (2005) \$380M	

<http://www.imdb.com/boxoffice/alltimegross>

Aug JSM 2010 11

3. Multi-factor Ratings: Objectivity is Critical

The advertisement shows a woman's back with the text 'Sunscreen and bug spray Ratings SKIN DEEP Do combination products work? READ MORE ON Consumer Reports Health.org'.

Aug JSM 2010 12

#3: Multi-factor #-Based Ranks are Extremely Sensitive to Assumptions

Three key assumptions:

- #1. how the underlying data was scaled.
- #2. what factors were included or excluded, or
- #3. how the factors were weighted.

Aug JSM 2010 13

**Multi-factor #-Based Ranks:
#1: Sensitivity to Scaling**

1. **Un-scaled:** Factors with larger numbers dominate. E.g., Using height and weight. Weight dominates.
2. **Z-score Scaling use average and std. deviation**
OK for symmetric distributions, not for skewed
 Example: Heights versus incomes (skewed)
 - Tall: $Z = 2$; High-income: $Z = 10$.
 - Median height: $Z = 0$; Median Income: $Z = -0.5$
 Skew positive >> Symmetric >> Skew negative
Z magnifies small differences (compresses big):
 10% difference scaled same as 50% difference.

Aug JSM 2010 14

**Statistical Competence vs.
Statistical Literacy**

Statistical Competence involves data production.
 Statistical Literacy involves data consumption.

Data consumers of rankings seldom know:

- #1. how the underlying data was scaled.
- #2. what factors were included or excluded, or
- #3. how these factors were weighted.

Data consumers can think critically about the last two.
 Data producers must understand all three but rely on subject-matter experts for #2 and #3 so teaching a statistical competence class focuses on #1.

Aug JSM 2010

**#2: Influence of Factors on Ranks.
What factors to include or exclude?**

Construct five different ways to determine which country won the last Olympic games:
“Winner” is the country with highest # of:

- (1) gold medals
- (2) medals
- (3) medals per 100,000 population
- (4) medals per 100 contestants
- (5) medals per million \$ GNP
- (6) “medals”: Gold=3, Silver=2, Bronze=1

Aug JSM 2010 16

**#3: Influence of Weights on Ranks.
Different Magnitude; Same Sign**

Consider the composite scores of major-league baseball teams based on wins and batting.

Changing weights could reverse scores and ranks

- Team A: **Wins (80/120)**, Hits (400/800).
- Team B: Wins (40/120), **Hits (600/800)**.

Composite scores based on weighted wins and hits:
 Score1: $6*fWins + 4*fHits$: **A = 5.8**; B = 3.2
 Score2: $4*fWins + 6*fHits$: A = 4.0; **B = 6.0**

Aug JSM 2010

**#3: Influence of Weights on Ranks.
Same Magnitude; Different Sign**

In order to construct a ranking that makes a *small town* with a *small college* rank highly:

1. Make size of town a negative.
2. Make size of college a negative.

In order to construct a ranking that makes a *large city* with a *large university* rank highly do the opposite of the above.
 This requires “hypothetical thinking.”

Aug JSM 2010 18

Conclusion:

Aspects of a topic taught depend on the goal: statistical literacy or statistical competence.

Multi-factor ranks are very sensitive to

- #1. how the related measures are scaled
- #2. what factors are included (and excluded)
- #3. how the related measures are weighted

First is important for statistical competence.
 Last two are essential for statistical literacy.