

Crowdsourcing Visual Analysis

Maneesh Agrawala

Jessica Hullman

CS 294-10: Visualization

Fall 2014

**Last Time: Collaborative
Visual Analysis**

A graveyard of “YouTubes for Data”



Many Eyes – circa 4/2012

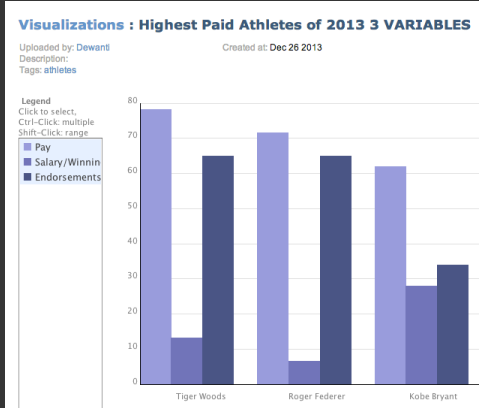
128,478 Visualizations

17,340 Comments

only ~11% of comments provided a plausible hypothesis or explanation for the data in the chart

**Can having access to social information
negatively influence analysis?**

**The Impact of Social Information
on Visual Judgments**



Does information on others' graphical judgments impact the accuracy of a new person's judgment?

Comments

Currently showing

Woods and Federer are equal in endorsements. Bryant barely gets half as many.

Posted: Dec 26 2013
 See view for this comment

Highest Paid Athletes of 2013 3 VARIABLES

Social Influence



Asch 1951

Social Influence

Normative versus Informational
(fitting in) *(being correct)*

Using social signals as evidence when we're choosing:

- Restaurants
- Music (Salganik et al. 2009)
- Tags (Golder et al. 2007)

Controlled Experiment

Does information on others' graphical judgments impact the accuracy of a new person's judgment?

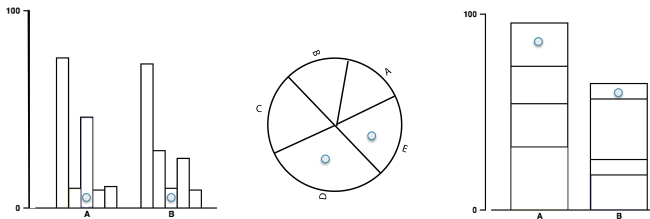
Two conditions:

Non-social: Visual judgment task with no social information

Social: Same task, presented with summary of judgments from non-social group

Participants are incentivized (\$\$) to be correct.

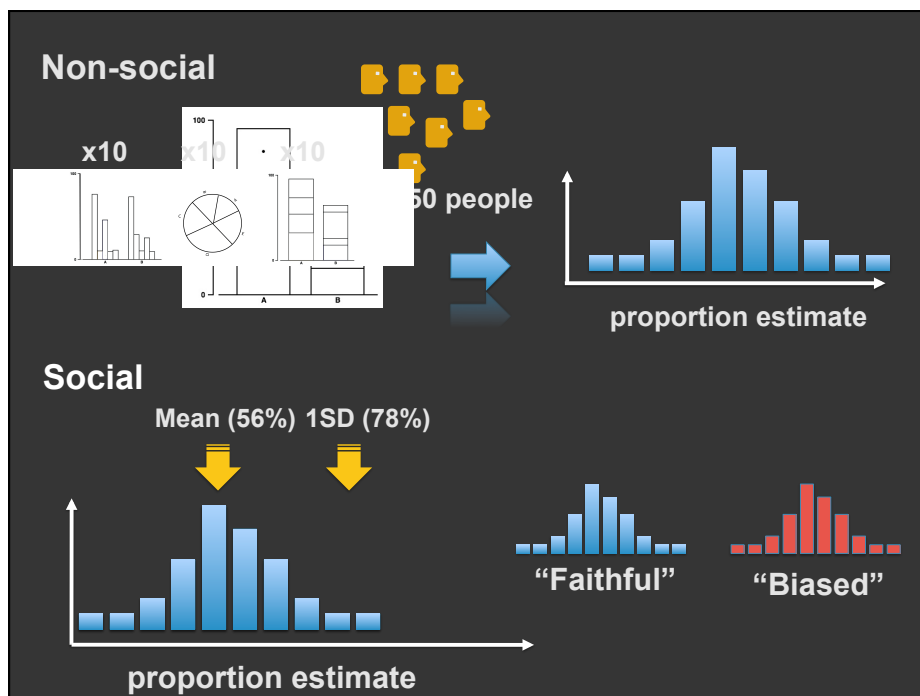
Visual judgment task



Cleveland & McGill 1984

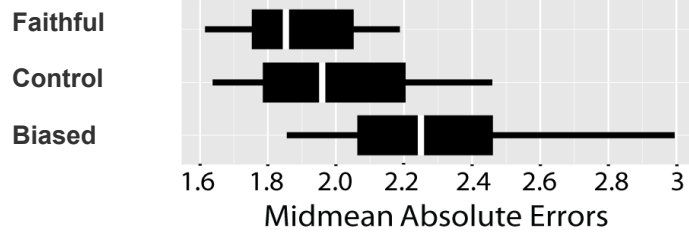
1. Which of the two marked sections is larger?
2. Make a quick visual judgment of what proportion the smaller section is of the larger.

AMT study: Heer & Bostock 2010



Results

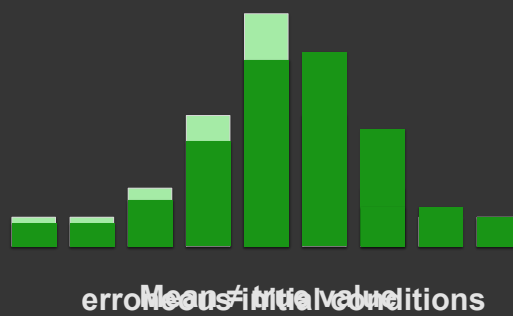
Does information on others' graphical judgments impact the accuracy of a new person's judgment?



Does the amount of social information matter?

Implications

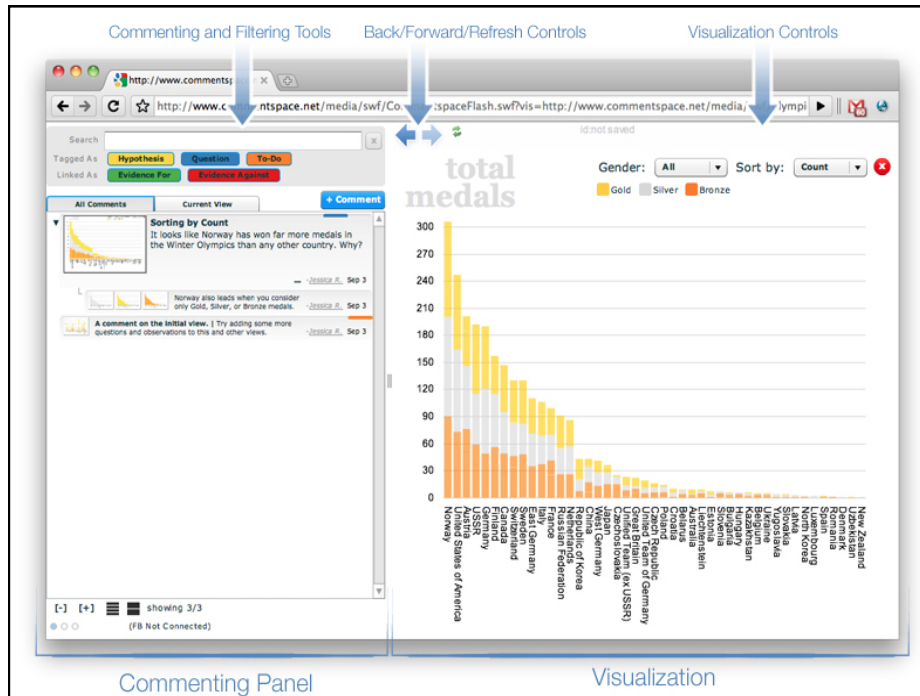
Does social information matter?



Multiple issues when collaborative analysis remains shallow.

Can we augment social data analysis to support deeper analysis and synthesis?

CommentSpace: Structured Support for Social Data Analysis



Tags and links for organization

Sorting by Count
It looks like Norway has won far more medals in the Winter Olympics than any other country. Why?

Question (1) +

- Question
- Hypothesis
- Question
- To-Do

Tags

- Hypothesis
- Question
- To-Do

Links

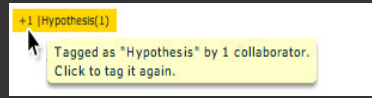
- Evidence For
- Evidence Against
- (Related)

Sorting by Count | It looks like Norway has won far more medals in the Winter Olympics than any other... - Jessica R. Sep 3

Norway also leads when you consider ... - Jessica R. Sep 3

Linked to parent as:
Evidence For (by you)
Reply To (by you)

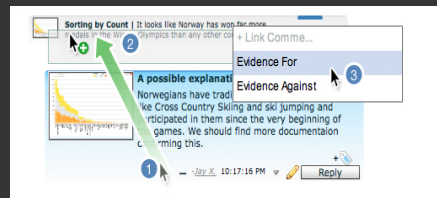
Hypothesis generation/evidence gathering



Contributors highlight important items with tags

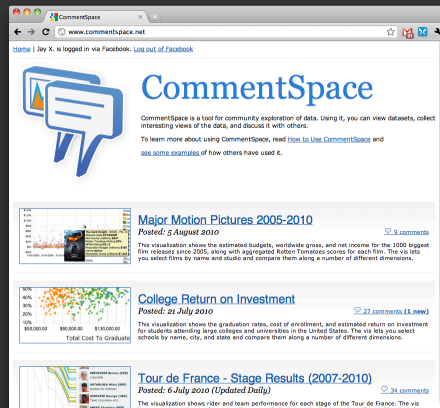


Tags help late-joiners identify and build on important comments



Contributors use links to organize contributions and build narrative

Studies and Deployments



Controlled lab studies to test core analysis subtasks

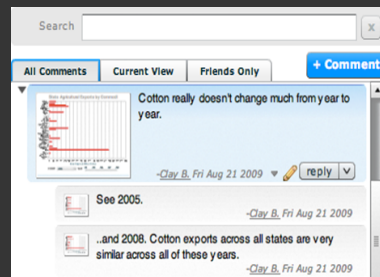
Live deployments (www.commentspace.net)

Study: Use of Tags and Links

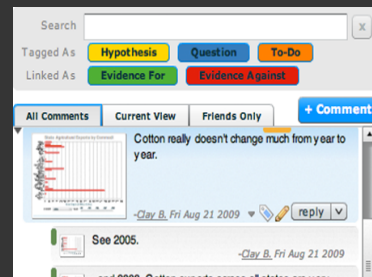
Hypothesis: Tags and links can provide common ground and encourage continued discussion.

A between subjects study (n=24) with 2 conditions.

“No-Tag” Condition



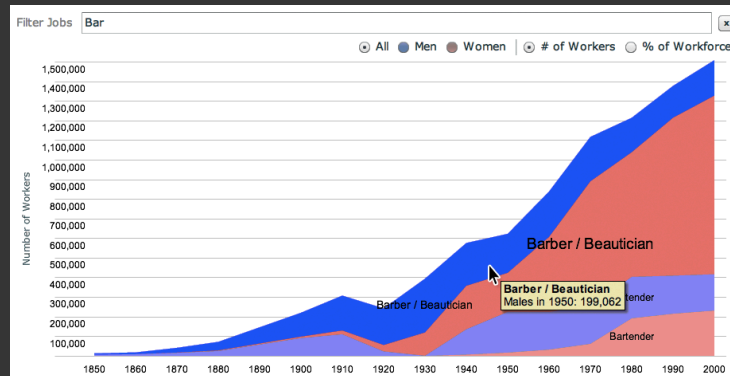
“Tag” Condition



Part 1: Sensemaking from existing comments (classify given hypothesis)

Part 2: Find views and generate comments.

Study: Prompt



Hypothesis: Stereotypically male jobs have remained almost entirely male even as women have joined the work force.



Study: Results

Participants who used tags and links classified comments more **consistently** and **accurately** than those who didn't
(greater in-group agreement) (greater agreement with experts)

Participants using tags and links generated significantly more replies to existing comments

Tag (Median=7)
No-Tag (Median=2)

But

	Justin Timberlake has had one #1 single.	-AnalystC3 Wed Sep 2 2009
<input type="checkbox"/>	Strange pattern.	-AnalystE5 Wed Sep 2 2009
<input type="checkbox"/>	Come with me if you want to live!	-AnalystE5 Wed Sep 2 2009
<input type="checkbox"/>	When Tweens attack.	-AnalystE5 Wed Sep 2 2009
	Mariah Carey's "I'll Be There" is a #1 hit single.	-AnalystC3 Wed Sep 2 2009
<input type="checkbox"/>	I like Rainforest better than 19, but I guess more people liked the anti-war thing with 19.	-AnalystD4 Wed Sep 2 2009
<input type="checkbox"/>	There's just no love for jazz, is there?	-AnalystD4 Wed Sep 2 2009

In open-ended tasks, participants still engaged mostly in superficial, exploratory analysis

We saw very little use of tags or links

Can we use paid crowds to perform small pieces of analysis tasks?

Announcements

Final project

Design new visualization method

- Pose problem, Implement creative solution

Deliverables

- Implementation of solution
- 8-12 page paper in format of conference paper submission
- 1 or 2 design discussion presentations

Schedule

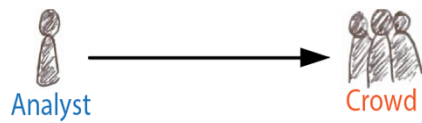
- Project proposal: 10/28
- Project presentation: 11/13-11/20
- Final paper and presentation: 12/2-12/6

Grading

- Groups of **up to 3 people**, graded individually
- Clearly report responsibilities of each member

Crowdsourcing Visual Analysis

Can we use paid crowds to perform small pieces of analysis tasks?



Open ended crowd tasks - problems

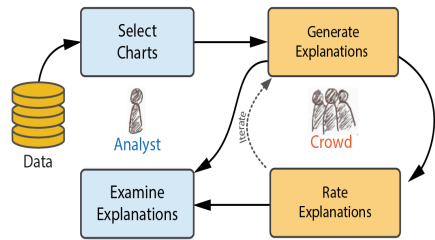
Expectations may be unclear to workers.

Workers may explain irrelevant features.

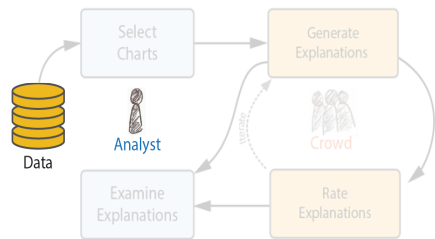
Workers' may give speculative explanations.

Workers may not attend to chart details.

How can we organize crowdsourced visual analysis tasks more effectively?



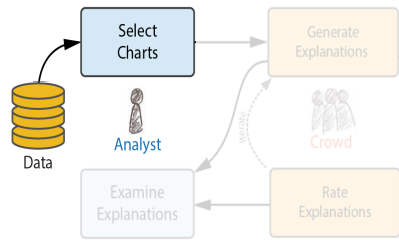
Data



World Oil Production 1965-2010

1	Year	Country	Oil Produced (Thsnds. of Barrels/Day)
2	1965	United States	9014
3	1965	Canada	920
4	1965	Mexico	362
5	1965	Argentina	276
6	1965	Brazil	96
7	1965	Colombia	203
8	1965	Ecuador	8
9	1965	Peru	66
10	1965	Trinidad & Tobago	135
11	1965	Venezuela	3503
12	1965	Other S. & Cent. America	47
13	1965	Azerbaijan	0
14	1965	Denmark	0
15	1965	Italy	48
16	1965	Kazakhstan	0
17	1965	Norway	0
18	1965	Romania	266
19	1965	Russian Federation	0
20	1965	Turkmenistan	0
21	1965	United Kingdom	2
22	1965	Uzbekistan	0
23	1965	Other Europe & Eurasia	5337
24	1965	Iran	1908
25	1965	Iraq	1313
26	1965	Kuwait	2371
27	1965	Oman	0
28	1965	Qatar	233
29	1965	Saudi Arabia	2219
30	1965	Syria	0
31	1965	United Arab Emirates	282
32	1965	Yemen	0

Select Charts



R version 2.12.0 (2018-10-15)
Copyright (C) 2018 The R Foundation for Statistical Computing
ISBN 3-900051-07-0
Platform: i386-apple-darwin9.8.0/1386 (32-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type "license()" or "licence()" for distribution details.

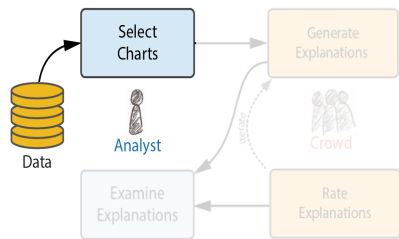
Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type "contributors()" for more information and
"citation()" on how to cite R or R packages in publications.

"demo()" for some demos, "help()" for on-line help, or
"help()" for an HTML browser interface to help.
to quit R.

Type
R (5632) i386-apple-darwin9.8.0
loaded from /Users/willetta/Rapp.history]

Select Charts



R version 2.12.0 (2018-10-15)
Copyright (C) 2018 The R Foundation for Statistical Computing
ISBN 3-900051-07-0
Platform: i386-apple-darwin9.8.0/1386 (32-bit)

R is free software and comes with ABSOLUTELY NO WARRANTY.
You are welcome to redistribute it under certain conditions.
Type "license()" or "licence()" for distribution details.

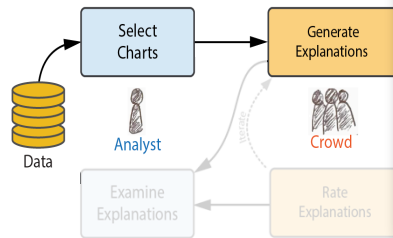
Natural language support but running in an English locale

R is a collaborative project with many contributors.
Type "contributors()" for more information and
"citation()" on how to cite R or R packages in publications.

"demo()" for some demos, "help()" for on-line help, or
"help()" for an HTML browser interface to help.
to quit R.

Type
R (5632) i386-apple-darwin9.8.0
loaded from /Users/willetta/Rapp.history]

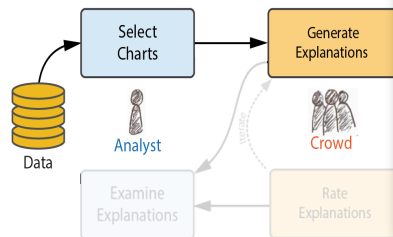
Generate Explanations



Explanation Microtask

A screenshot of a web browser showing an 'Explanation Task' interface. At the top, it says 'Each of the charts in this HT shows the average amount of oil produced per day by one or more countries over the past 50 years'. Below this is a line chart titled 'Oil Produced (Thands. of Barrels/Day) by Year' for the country 'Iran'. The y-axis ranges from 0 to 6,000 and the x-axis from 1965 to 2005. The chart shows a significant peak around 1975 and a sharp dip around 1980. Below the chart, the text reads: 'This chart shows Oil Produced (Thands. of Barrels/Day) by Year. The view is filtered by Country to show only "Iran".' A task instruction follows: '1. Explain why the strong peak or valley highlighted in the chart might have occurred.' There is a text input field and a 'Submit Task' button.

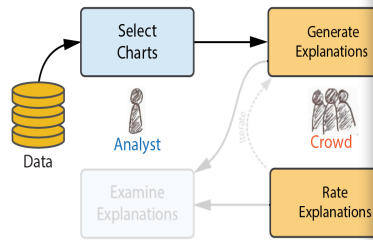
Generate Explanations



Explanation Microtask

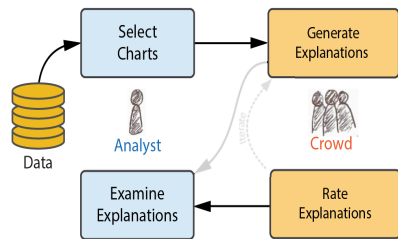
A screenshot of a web browser showing an 'Explanation Task' interface, identical to the one in the top image. It displays a line chart for Iran's oil production from 1965 to 2005, with a task instruction to explain a peak or valley. A large blue arrow points downwards from the 'Submit Task' button area towards a series of three blue boxes, each containing a wavy line representing a generated explanation. Small 'Analyst' icons are placed around these boxes.

Rate Explanations



Rating Microtask

Examine Explanations



Seven Strategies for Crowdsourcing Social Data Analysis

(Typical) Explanation Microtask

Each of the charts in this HIT shows the **average amount of oil produced per day** by one or more countries over the past 50 years

Oil Produced (Thsds. of Barrels/Day)

Year

This chart shows **Oil Produced (Thsds. of Barrels/Day)** by **Year**. The view is filtered by **Country** to show only **'Iran'**.

1. Explain why the chart is interesting.

Submit Task

Problems

Expectations may be unclear to workers.

Workers may explain irrelevant features.

Workers' may give speculative explanations.

Workers may not attend to chart details.

S1. Use feature-oriented prompts.

~~"Explain why the chart is interesting."~~

"Explain the **long term trend** in the chart."

"Explain the **peaks and/or valleys** in the chart (if any exist)."

S2. Provide sample explanations

Explanation Task

proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestAI&workerId=Expert...

Example HITs and Responses

The examples below show the level of detail we would like in your responses.

Example 1

This chart shows Oil Produced (Thsds. of Barrels/Day) by Year. The view is filtered by Country to show only "Iraq".

1. Explain **why** the strong **peak or valley** highlighted in the chart might have occurred.

The peak in 1979 is the result of increasing oil production under the Baath leadership, which nationalized oil production in the country. Production then dropped dramatically during the Iran/Iraq war as production, refinement, and export facilities were damaged and destroyed.

Click the button below to begin the task. You can return to these instructions at any time by clicking the "Show Instructions" link in the HIT.

Begin Task

S3. Include referential subtasks

Each of the charts in this HIT shows the **average amount of oil produced per day** by one or more countries over the past 50 years

This chart shows Oil Produced (Thsds. of Barrels/Day) by Year. The view is filtered by Country to show only "Iran".

1. What **country or countries** are shown in this chart?

2. Explain **why** the strong **peak or valley** highlighted in the chart might have occurred.

3. Provide the **url of a specific web page** (not just a site) that supports your explanation.

Submit Task

http://www.proxy.commentspace.net/media/Item/ContentItem/ContentItem.html?display=ProductionChart&id=32

Explanation Microtask

S5. Include annotation subtasks

Each of the charts in this HIT shows the **average amount of oil produced per day** by one or more countries over the past 50 years

This chart shows **Oil Produced (Thsds. of Barrels/Day) by Year**. The view is filtered by **Country** to show only **"Saudi Arabia"**.

[Show Instructions](#)

1. What **country or countries** are shown in this chart?
2. **Click and drag** on the chart to highlight the strongest **peak or valley**.
3. Explain **why** the strong **peak or valley** highlighted in the chart might have occurred.

[Submit Task](#)

http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...
[http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...](#)
[http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...](#)

Explanation Microtask

S6. Use pre-annotated charts

Each of the charts in this HIT shows the **average amount of oil produced per day** by one or more countries over the past 50 years

This chart shows **Oil Produced (Thsds. of Barrels/Day) by Year**. The view is filtered by **Country** to show only **"Iran"**.

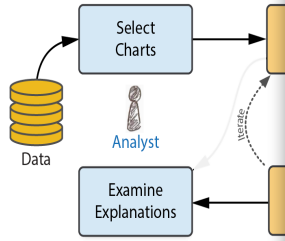
1. What **country or countries** are shown in this chart?
2. Explain **why** the strong **peak or valley** highlighted in the chart might have occurred.
3. Provide the **url of a specific web page** (not just a site) that supports your explanation.

[Submit Task](#)

http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...
[http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...](#)
[http://www.proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestA&workerId=Expert...](#)

S7. Elicit explanations iteratively

Encourage Diverse Explanations



The browser window displays a task titled "Explanation Task" with the URL proxy.commentspace.net/explainTask?studyName=Oil-Demo&assignmentId=TestAll&workerId=Expert.... The task prompt reads: "Explain why the strong peak or valley highlighted in the chart shows the average amount of oil produced per day by one or more countries over the past 50 years".

The chart shows "Oil Produced (Thands. of Barrels/Day) by Year" for Iran from 1965 to 2005. The y-axis ranges from 0 to 6,000. The x-axis shows years from 1965 to 2005. A significant peak is visible around 1975 (reaching approximately 5,500) and a sharp valley around 1980 (dropping to approximately 1,500).

This chart shows Oil Produced (Thands. of Barrels/Day) by Year. The view is filtered by Country to show only "Iran".

1. Explain why the strong peak or valley highlighted in the chart might have occurred.
Give an explanation that is different from the previous responses seen below.

Previous responses:

- "The drop may correspond to decreases in production that resulted from the Iran-Iraq war and the political tumult that followed." (Reference: http://en.wikipedia.org/wiki/Iran_Iraq_war)
- "Political changes resulting from the ouster of the Shah during the Islamic revolution may have triggered major changes in Iran's oil policy." (Reference: <http://www.historians.org/projects/Groundable/Farmino/Farmino6.htm>)

Deployment

Deployment via Mechanical Turk

910 Responses for
64 Charts from
16 Datasets

Quantifying Response Quality

relevance (0-1) Does the response explain the requested feature?

clarity (1-5) How clear and specific is the explanation?

plausibility (1-5) How likely is the explanation to be valid?

$$quality = relevance * (clarity + plausibility) / 2$$

Yes. The response explains **why** the peaks and valleys may have occurred.

Does this response provide an explanation for **why** the highlighted peaks and valleys in the chart might have occurred?

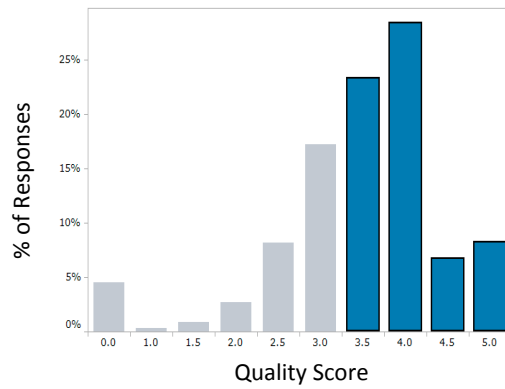
Yes No

How **clear** and **specific** is the response? (Not Clear/Specific) ← 1 2 3 4 5 → (Very Clear/Specific)

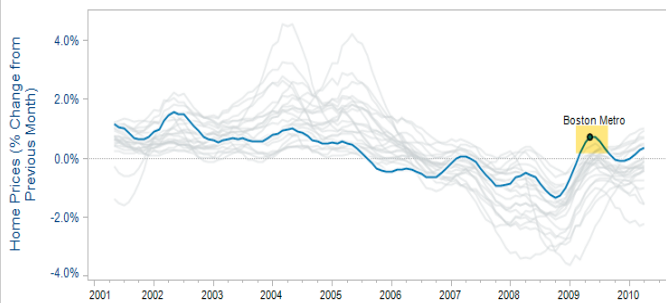
How **plausible** is the response? (Not Plausible) ← 1 2 3 4 5 → (Very Plausible)

Experts scored response quality this way.

Based on our ratings, the majority (63%) of responses were of high quality ($quality \geq 3.5$).



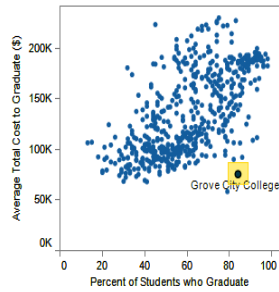
Dataset: US Metro Home Prices (% Change / Month) 2001-2010



“The primary reason for the peak is ...
... annual variation where home prices rise in the spring.
... the \$8,000 home buyer tax credit.

url: <http://articles.boston.com/2011...indices-housing-prices>

Dataset: US College Graduation Rates vs. Cost To Graduate



"Grove City College is Christian **based and** strives to keep tuition rates affordable **for most students.** ... located in a rural community ... selective enrollment ..."

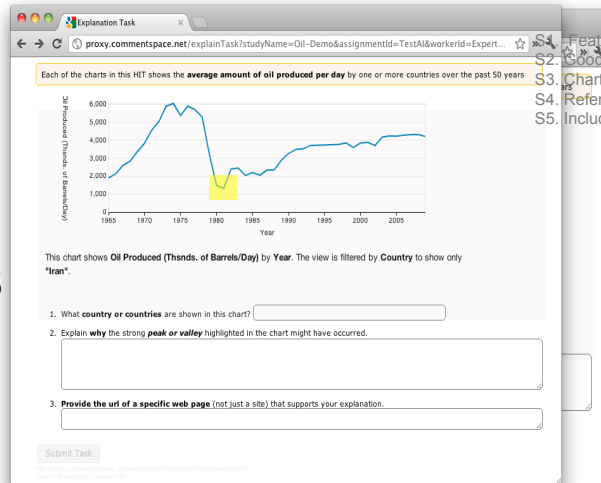
url: <http://stateuniversity.com/...college.html>

Do our strategies improve explanation quality?

Experiment 1 – Strategies S1-S5

No Strategies vs. Strategies (S1-S5)

US



- S1. Feature-oriented prompts.
- S2. Good examples.
- S3. Chart-reading subtasks.
- S4. Reference-gathering subtasks.
- S5. Include annotation subtasks.

Experiment 1 - Strategies S1-S5

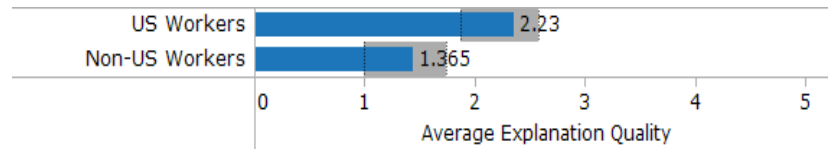
Multiple trials per condition, 4 conditions
(2 interfaces x 2 worker pools)

H1: Results from US workers would be of higher quality than results from non-US workers, but

H2: Employing strategies S1-S5 would increase the quality for both groups.

Experiment 1

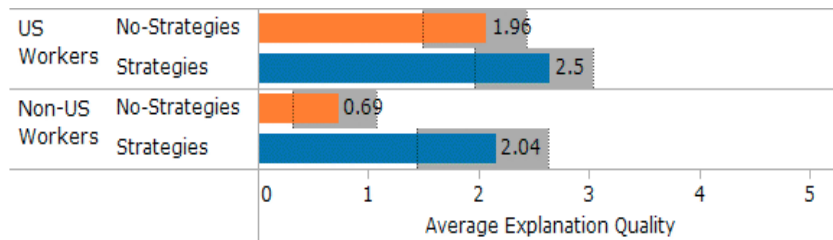
US Workers performed better than Non-US.



Experiment 1

Using S1-S5 increased explanation quality:

196% for Non-US Workers
28% for US Workers



Significant main effects for {
Worker Pool ($F_{1,198} = 12.2, p < 0.01$)
Strategies ($F_{1,198} = 14.5, p < 0.01$)

Experiments

Reference Gathering (S4)

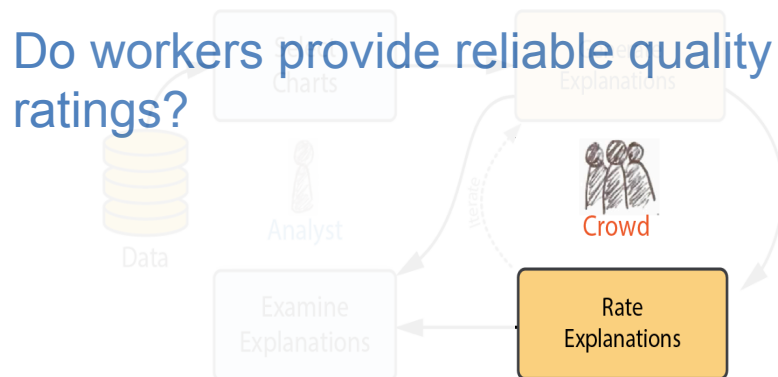
Produced useful references, but slowed workers, increased attrition, and lowered quality.

Annotation Subtasks (S5) and Pre-Annotation (S6)

Both improve attention to detail but are useful in different situations.

Eliciting Explanations Iteratively (S7)

An iterative round produced 71% new explanations, increasing diversity.



Experiment 2 - Rating

Yes. The response explains **why** the peaks and valleys may have occurred.

Does this response provide an explanation for **why** the highlighted peaks and valleys in the chart might have occurred?

Yes No

How **clear** and **specific** is the response? (Not Clear/Specific) ← 1 2 3 4 5 → (Very Clear/Specific)

How **plausible** is the response? (Not Plausible) ← 1 2 3 4 5 → (Very Plausible)

Elicited 1,334 ratings for 192 responses.

Compared against expert quality ratings.

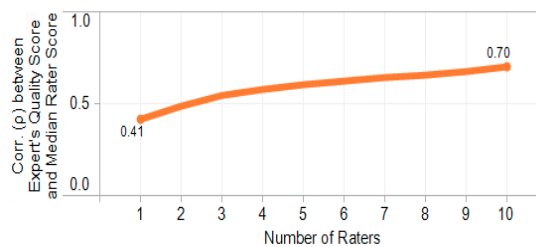
Experiment 2 - Rating

Individual workers' quality scores were moderately correlated with ours.

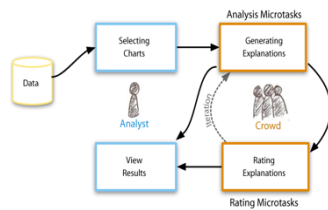
($\rho = 0.41$)

The median quality from multiple workers correlates more strongly with our scores.

($\rho = 0.70$ w/ 10 raters)



Takeaways



- S1. Use feature-oriented prompts.
- S2. Provide good examples.
- S3. Include chart-reading subtasks.
- S4. Include reference-gathering subtasks.
- S5. Include annotation subtasks.
- S6. Pre-annotate charts.
- S7. Elicit Explanations Iteratively

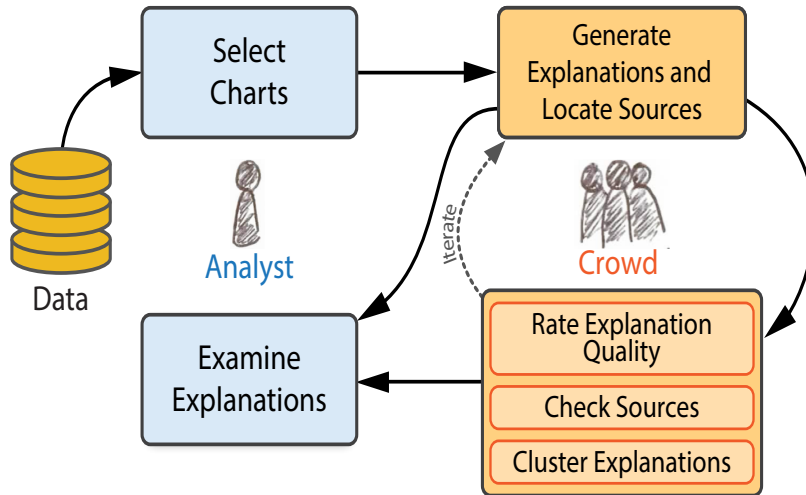
A workflow for generating and assessing explanations for trends and outliers.

Seven strategies for improving crowdsourced explanations.

Generates good explanations (63% were high-quality).

Exposing Provenance and Identifying Redundancy

Adding Additional Crowd Processing



Provenance

Provenance

Back of the charts in this HIT compares the production rate (y-axis) and the total cost to graduate (x-axis) for 554 top US colleges and universities (as ranked by Bloomberg Businessweek in 2010). Each point represents a single college or university.

Brigham Young University (BYU)

Show Instructions

- Demographic information (asked on first HIT only).
What is your nationality? _____
What level of schooling have you completed? _____
What is your native language? _____
How comfortable are you with reading charts and graphs? _____
Are you familiar with college rankings? _____
- What college or university is highlighted in this chart? _____
- Explain why the outlier is highlighted in the chart might be different from the other items. (Give one specific, well-justified answer.) _____
- Provide the url of a specific web page (not just a title) that supports your explanation. _____

Submit Task

Explanation Task

What are the

workers doing?

Provenance

Back of the charts in this HIT compares the production rate (y-axis) and the total cost to graduate (x-axis) for 554 top US colleges and universities (as ranked by Bloomberg Businessweek in 2010). Each point represents a single college or university.

Brigham Young University (BYU)

Show Instructions

- Demographic information (asked on first HIT only).
What is your nationality? _____
What level of schooling have you completed? _____
What is your native language? _____
How comfortable are you with reading charts and graphs? _____
Are you familiar with college rankings? _____
- What college or university is highlighted in this chart? _____
- Explain why the outlier is highlighted in the chart might be different from the other items. (Give one specific, well-justified answer.) _____
- Provide the url of a specific web page (not just a title) that supports your explanation. _____

Submit Task

Explanation Task

brigham young university

Wikipedia: Brigham Young University

Brigham Young University: How Much Does it Cost?

Cross-Domain Access is Limited

The image shows two browser windows. The left window is titled 'Explanation Task' and contains a scatter plot of 'Average Annual Tuition (in thousands, \$)' vs 'Percent of Students who Graduate'. A point for 'Brigham Young University' is highlighted. Below the plot are instructions and a form for providing an explanation. The right window is a BYU website titled 'How Much Does it Cost? Counting the cost of BYU'. A red 'X' is superimposed over the two windows, with blue arrows pointing from the task window to the website window, indicating that the task's instructions refer to a source that is not accessible due to cross-domain restrictions.

Instrumenting Explanation Tasks

Examine a line chart showing employment change in a US city and briefly explain it.
 Requester: visualizationlab.com Reward: \$0.40 per HET HETs Available: 10 Duration: 30 minutes
 Qualifications Required: Location is US

Each of the charts in this HET compares the graduation rate (in %s) and the total cost to graduate (in \$s) for 504 top US colleges and universities (as ranked by Bloomberg Businessweek in 2012). Each point represents a single college or university.

1. What college or university is highlighted in this chart?

2. Explain why the strong outlier highlighted in the chart might be different from the other items. (Try to give one specific, well-justified answer per text box.)

If there are multiple explanations, enter each one in a separate text box.

Using the browser to the right, find text on a web page that justifies each explanation. Select the text and click the "mark as source" button to add it.

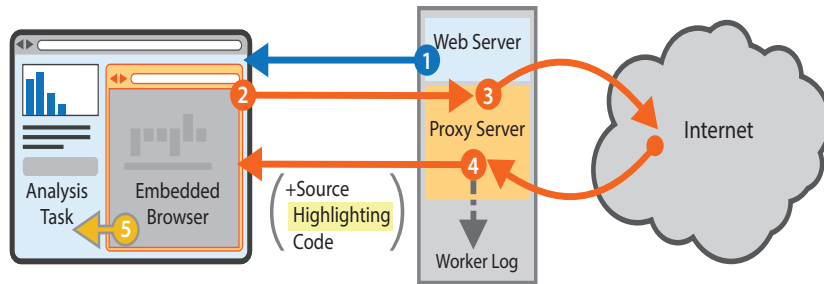
Explanation 1

Source:

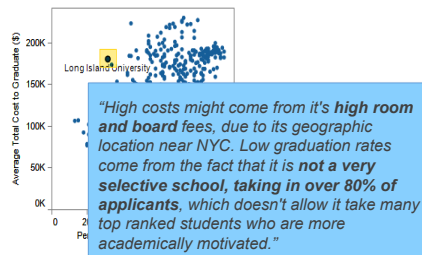
+ Add Another Explanation

Finished with this HET? Let someone else do it?
 Submit HET Return HET

Logging via Proxied Browser



Provenance



Visitation logs

2011-12-11 09:22:04 google.com
 2011-12-11 09:22:04 sqr:help
 2011-12-11 09:23:08 google.com/search?hl=en&source=hp
 2011-12-11 09:23:11 google.com/search?hl=en&q=Long_Island_University
 2011-12-11 09:23:13 google.com/search?q=Long_Island_University
 2011-12-11 09:23:31 google.com/search?q=Long_Island_University
 2011-12-11 09:23:38 google.com/search?q=Long_Island_University
 2011-12-11 09:23:43 google.com/search?q=Long_Island_University
 2011-12-11 09:23:54 google.com/search?q=Long_Island_University
 2011-12-11 09:24:09 colleges.usnews.rankingsandreviews.com

Paragraph-level citations



#123 Regional Universities (North)

2014 Quick Stats

Summary

LIU Post is a private institution that was founded in 1954. It has a total undergraduate enrollment of 8,315. Its setting is suburban, and the campus size is 308 acres. It utilizes a semester-based academic calendar. LIU Post's ranking in the 2014 edition of Best Colleges is Regional Universities (North), 123. Its tuition and fees are \$34,070 (2013-14).

2014 Quick Stats

720 Northern Boulevard
 Brockville, NY 11548-1300
 Phone: (516) 299-2000

2013-2014 Tuition

\$34,070 tuition and fees

Students

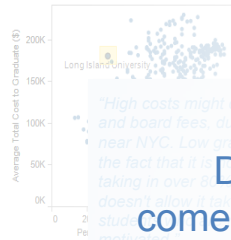
8,315 enrolled
 25% male / 75% female

Admissions

rolling admission
 78.8% accepted

[More Information](#)

Provenance



"High costs might come from its high room and board fees, due to its geographic location near NYC. Low graduation rates come from the fact that it is taking in over 60% of its students who don't have a strong academic motivation."

Did the facts and inference come directly from the source or did the worker add to them?

Paragraph-level citations

LIU Post is a private institution that was founded in 1954. It has a total undergraduate enrollment of 8,315, its setting is suburban, and the campus size is 306 acres. It utilizes a semester-based academic calendar. LIU Post's ranking in the 2014 edition of Best Colleges is Regional Universities (North), 123. Its tuition and fees are \$34,070 (2013-14).

2013-2014 Tuition \$34,070 tuition and fees

Students 8,315 enrolled
25% male / 75% female

Admissions rolling admission
78.8% acceptance

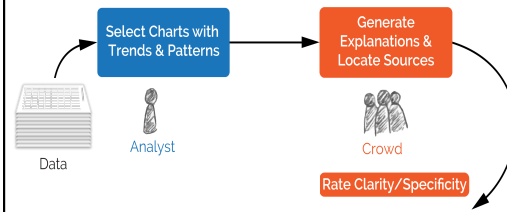
720 Northern Boulevard
Brookville, NY 11548-1300
Phone: (516) 299-2000

More Information

Visitation logs

- 2011-12-11 09:22:04 google.com
- 2011-12-11 09:22:04 sr:help
- 2011-12-11 09:23:08 google.com/search?hl=en&source=ls
- 2011-12-11 09:23:11 google.com/search?hl=en&q=Long Is
- 2011-12-11 09:23:13 google.com/search?q=Long Island Un
- 2011-12-11 09:23:31 google.com/search?q=Long Island Un
- 2011-12-11 09:23:38 google.com/search?q=Long Island Un
- 2011-12-11 09:23:43 google.com/search?q=Long Island Un
- 2011-12-11 09:23:54 colleges.usnews.rankingsandreviews.c

Source-Checking Microtasks

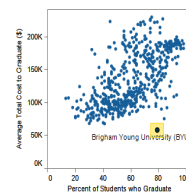


A second group of workers **verifies links** and attributes explanations to the **source** or the **worker**.
(75% accurate in our preliminary tests)

Redundancy

Redundancy

Many explanations provided by workers are redundant.



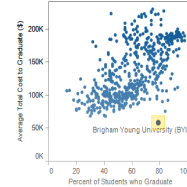
"The Church of Jesus Christ of Latter Day Saints pays a significant part of the tuition costs..."

"The cost of attendance at BYU is subsidized by the LDS church."

"98% of their students are members of LDS and they have lowered tuition..."

Redundancy

Many explanations provided by workers are redundant.



"The Church of Jesus Christ of Latter Day Saints pays a significant part of the tuition costs..."



Duplicate results for analysts to examine.

"The cost of attendance at BYU is subsidized by the LDS church."

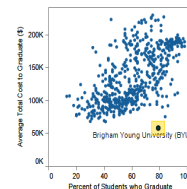


Redundancy can signal high support and corroborating sources.

"98% of their students are members of LDS and they have lowered tuition..."

Redundancy

Automated text similarity methods don't deal well with these kinds of content.

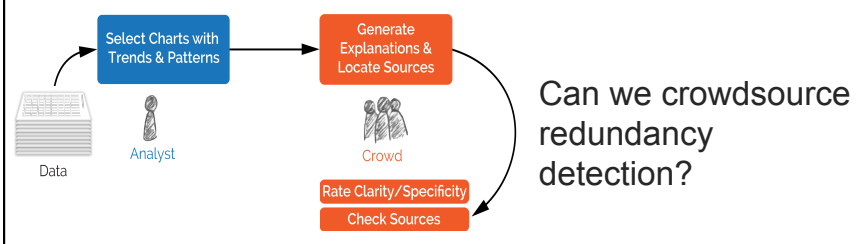


"The Church of Jesus Christ of Latter Day Saints pays a significant part of the tuition costs..."

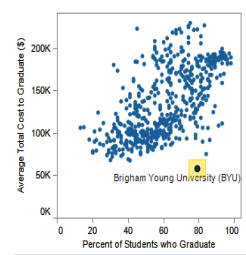
"The cost of attendance at BYU is subsidized by the LDS church."

"98% of their students are members of LDS and they have lowered tuition..."

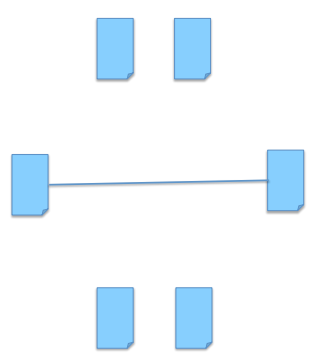
Redundancy



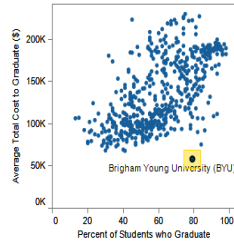
Clustering via Distributed Comparison



- "98% of their students are members of LDS and they have lowered tuition..."
- "The cost of attendance at BYU is subsidized by the LDS church."
- "...students are mostly members of the church and bound by the honor code..."
- "The Church of Jesus Christ of Latter Day



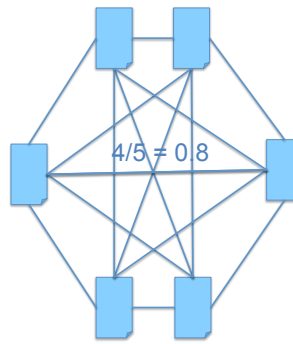
Clustering via Distributed Comparison



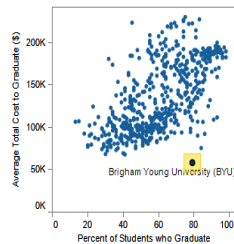
"98% of their students are members of LDS and they have lowered tuition..."

"The cost of attendance at BYU is subsidized by the LDS church."

- Do these two responses give the same general explanation for the peaks and valleys in the chart?
- Yes. Both responses give the same general explanation.
- No. The responses do not give the same explanation.



Clustering via Distributed Comparison



"98% of their students are members of LDS and they have lowered tuition..."

"The cost of attendance at BYU is subsidized by the LDS church."

- Do these two responses give the same general explanation for the peaks and valleys in the chart?
- Yes. Both responses give the same general explanation.
- No. The responses do not give the same explanation.



Simple tasks for workers



Scales poorly ()
Sensitive to **clustering method**
Workers have **little context**

Clustering via Color-Coding

Prompt: Explain why the strong **peak or valley** highlighted in the chart might have occurred.

Response R2: "A new medical school is providing jobs"(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

Response R7: "The Medical Center of the Americas opened a new medical school and in 2008 construction on a new series of projects began at the University of Texas El Paso."(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)


Response R3: "Expansion of Fort Bliss"(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

Response R1: "Increase of construction jobs."(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)


Response R4: "It would appear that the marked growth in jobs up until 2008 coincides with growth of businesses in the area. Notable amongst these businesses are the three school districts that service the city and growth in the health services industry."(Reference: www.google.com/search&q=el+pasos+employers+2007)

Response R5: "The high peak in 2008 was during the time when the economy was overheated. After that time the economy slipped into a recession which caused the employment status of many people to change. This is why after 2008 the graph shows a sharp drop in employment." (Reference: www.google.com/url?r=http://en.wikipedia.org/wiki/Labor_2009_recession&sa=1&ei=aa54Tps0P8agDKGDCVCAAwed=DCBQZ7AB8ug=AFQCN9u3xk-IIE1T0K4Cg5OPFQ)

Individual workers cluster the whole set.

 Workers have complete context

Individual workers can cluster badly

 Hard to integrate clusterings from multiple workers

How to Integrate Color-Clusterings?

Prompt: Explain why the strong **peak or valley** highlighted in the chart might have occurred.

Response R2: "A new medical school is providing jobs"(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

Response R7: "The Medical Center of the Americas opened a new medical school and in 2008 construction on a new series of projects began at the University of Texas El Paso."(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

Response R3: "Expansion of Fort Bliss"(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

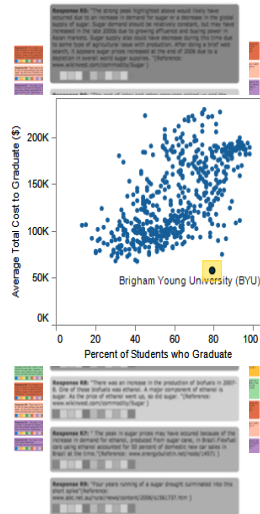
Response R1: "Increase of construction jobs."(Reference: newspapertree.com/opinion/3561-the-el-paso-stimulus)

Response R4: "It would appear that the marked growth in jobs up until 2008 coincides with growth of businesses in the area. Notable amongst these businesses are the three school districts that service the city and growth in the health services industry."(Reference: www.google.com/search&q=el+pasos+employers+2007)

Response R5: "The high peak in 2008 was during the time when the economy was overheated. After that time the economy slipped into a recession which caused the employment status of many people to change. This is why after 2008 the graph shows a sharp drop in employment." (Reference: www.google.com/url?r=http://en.wikipedia.org/wiki/Labor_2009_recession&sa=1&ei=aa54Tps0P8agDKGDCVCAAwed=DCBQZ7AB8ug=AFQCN9u3xk-IIE1T0K4Cg5OPFQ)

1. A **single worker's clustering** is preferable to a combination of multiple clusterings.
2. **Clusters reproduced by multiple independent workers** are likely to reflect actual redundancy.
3. Errors tend to be either **noisy or easy to catch.**

How to Integrate Color-Clusterings?

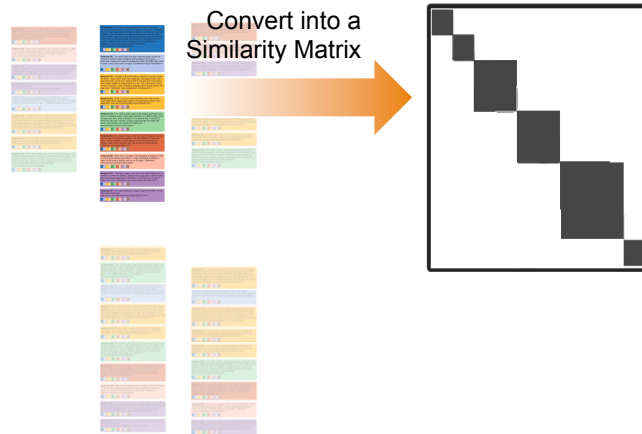


Selecting the Most-Representative Clustering

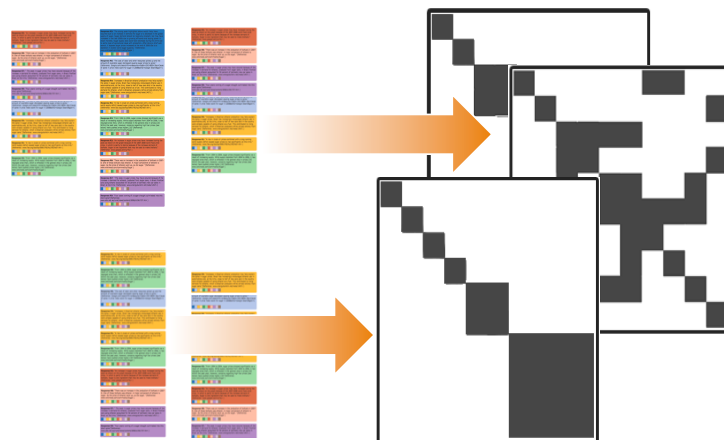
How to Integrate Color-Clusterings?



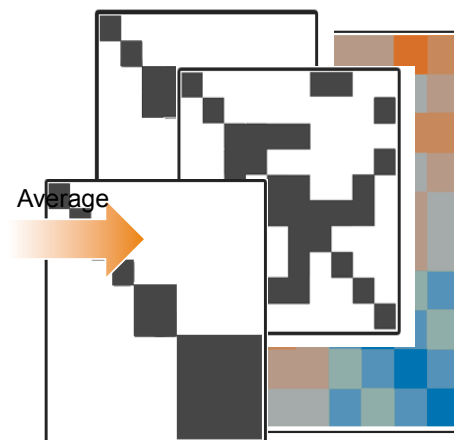
Selecting the Most-Representative Clustering



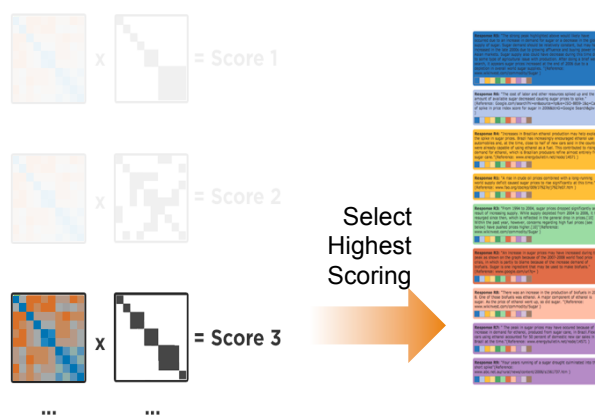
Selecting the Most-Representative Clustering



Selecting the Most-Representative Clustering

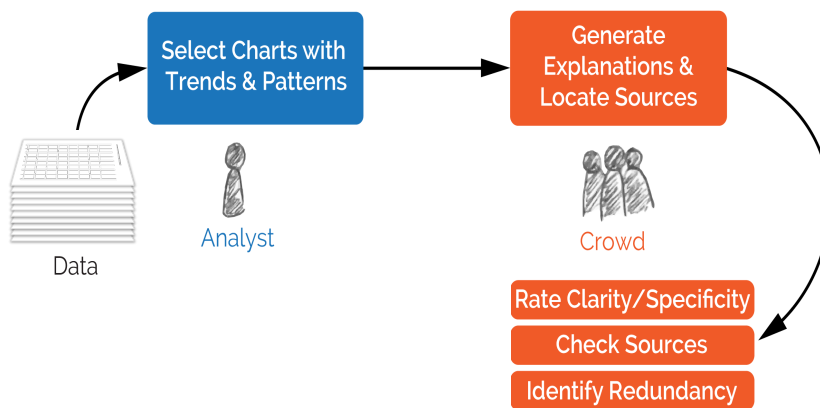


Selecting the Most-Representative Clustering

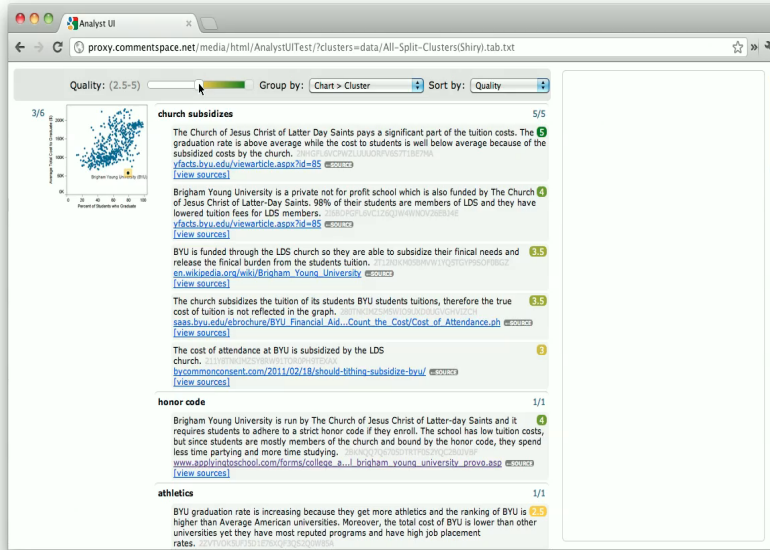


Managing the Crowd's Work

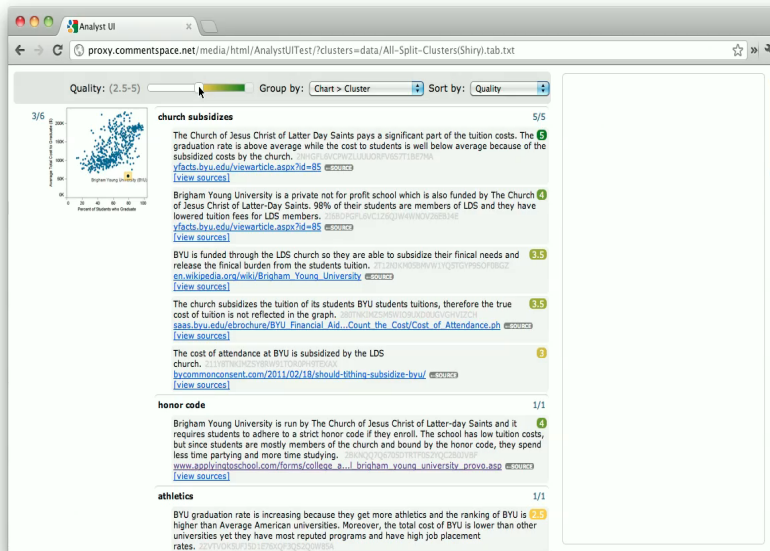
Managing the Crowd's Work



Explanation Management Interface



Explanation Management Interface



Open Questions

Open Questions

Segmenting Explanations

Explanation 1

The expansion of Fort Bliss and base realignments added 14,000 jobs in the region in between 2005 and 2008.

Source:

Use the embedded browser on the right to find evidence for your explanation. Select text that supports your answer and click to include it here.

+ Add Another Explanation

Open Questions

Segmenting Explanations

Explanation 1
The expansion of Fort Bliss and base realignments added 14,000 jobs in the region in between 2005 and 2008.

Source:
Use the embedded browser on the right to find evidence for your explanation. Select text that supports your answer and click to include it here.

+ Add Another Explanation

Crowd Composition



cheap low-skill crowds
vs.
more knowledgeable trusted ones

Conclusion

