Generating Multiple Perspectives in Baseball Summaries by Content Planning

July 2008 • Alice Oh • aoh@mit.edu
Manufacturing index stronger than expected

Index of purchasing managers rose surprisingly in May, but still signaled contraction in the sector.

By Catherine Clifford, CNNMoney.com staff writer
Last Updated: June 2, 2008: 12:09 PM EDT

NEW YORK (CNNMoney.com) -- A key index of manufacturing rose in May, surprising economists, but the purchasing managers' report issued Monday indicated a fourth straight month of sector contraction.

The Institute for Supply Management's (ISM) manufacturing index rose to 49.6 in the month of May, up from the April reading of 48.6. Economists were expecting a reading of 48, according to a consensus estimate compiled by Briefing.com.

The tipping point for the index is 50, with a reading below that reflecting contraction in the sector.

U.S. Manufacturing Sector Contracted in May

Filed at 1:38 p.m. ET

NEW YORK (Reuters) - Manufacturing contracted in May for the fourth consecutive month and inflation pressures surged to their highest in four years, heightening fears the world's largest economy could be sliding toward stagflation.

Combined with data on inflation, the report fueled concerns about rising prices in a weak economy, especially after the price of oil hit a record high last month above $135 a barrel.

The Institute for Supply Management said its index of national factory activity rose in May, to 49.6 from April's 48.6, slightly above market expectations. But it remained below the level of 50 that signals contraction.
Politics

White House slams climate bill

WASHINGTON (Reuters) - The White House on Monday slammed legislation the U.S. Senate will consider this week aimed at controlling climate change, arguing it would cut economic growth and lead to soaring gasoline prices.

"As you can imagine, our opposition to this will be quite strong and we'll be making these points throughout the week," Keith Hennessey, director of President George W. Bush's National Economic Council, said at a White House forum on the economy and taxes.

U.S. gross domestic product could be reduced by as much as 7 percent in the year 2050 and gasoline prices — already at record highs in the United States— could soar by as much as 53 cents a gallon by 2030, he said.

The legislation the Senate will debate, which is not expected to become law this year amid a presidential election, could cut total U.S. global warming emissions by 66 percent by 2050, according to a summary of the measure.

Bush weighs in against climate bill

WASHINGTON (AP) - President Bush weighed in Monday against a Senate bill that would require dramatic cuts in climate-changing greenhouse pollution, cautioning senators "to be very careful about running up enormous costs for future generations of Americans."

The Senate climate bill expected to be debated much of this week would cut emissions of carbon dioxide from burning fossil fuels and other greenhouse gases by about 70 percent over the next four decades. The bill targets power plants, refineries, factories and transportation.

Supporters argue that the shift away from fossil fuels can be made without significant economic damage and that failure to address global warming itself would produce greater economic harm later this century.
Final blow
Celtics deliver knockout, move on to face Lakers
By Marc J. Spears, Globe Staff | May 31, 2008

AUBURN HILLS, Mich. - After being dead for years, the Celtics-Lakers rivalry finally came back to life last night.

The Celtics advanced to the NBA Finals by defeating the Detroit Pistons, 89-81, in Game 6 of the Eastern Conference finals at The Palace of Auburn Hills. Boston won its 20th conference crown and will make its first Finals appearance since 1987. The Celtics will play the Western Conference champion Los Angeles Lakers in the Finals for the 11th time, having won eight.

“Tired and happy to be a part of this, man,” said Celtics forward Paul Pierce, who scored 12 of his 27 points in the fourth quarter. “It’s been a long process. I could write a whole book on my emotions right now. But I’m just happy to be in this position, still with the Boston Celtics.

“It makes me think about a year ago today what I was doing. To be in this position with the same team going to the Finals, it’s nothing I can really put into words.”

Game 1 of the Finals is Thursday at TD Banknorth Garden. Celtics legend John Havlicek presented the Eastern Conference championship trophy.

Once the final buzzer sounded, Kevin Garnett kissed the basketball, Pierce and coach Doc Rivers hugged, and the rest of the players began celebrating, donning East champion hats and T-shirts.

“It’s a good feeling,” said Garnett, who scored 18 points. “It’s kind of surreal, probably hasn’t even hit me yet because we haven’t slept in about four days, going on five days now. Going to the Finals. I’m just hoping to get some sleep. But it does feel good.”

Said Rivers, “We want to be here, and we’re at the exact spot that we thought we would be. But we have some more playing to do.”
What makes a story convey a certain perspective?
Can we make it a tractable problem?
Can you model that computationally?
Can you automatically generate a story with a desired perspective?
Approach

- Narrow problem definition
- Validate problem definition: User study I
- Collect parallel corpus & model domain
- Build reordering algorithm
- Evaluate system: User study II
Ordering Hypothesis

You can induce *multiple perspectives* in event summaries by

- taking a neutral article
- reordering the content of it
Why is Perspective Important?

“Our users tell us that one of the things they value most about our service is our policy of linking openly to other websites. These links offer access to more detailed information, the chance to compare sources or check out a different perspective on the same story.”

---http://news.bbc.co.uk
Why is Perspective Important?

 Sox go homer happy against O's

Red Sox 9, Orioles 4

Full Boxscore | BOS State | BAL State | Standings thru 6/1/2008

Photos

Series at a Glance

Fri, 6/6 BOS 5, BAL 2
Sat, 6/7 BOS 6, BAL 3
Sun, 6/8 BOS 3, BAL 4
Mon, 6/9 BOS @ BAL

O's arms falter

Brian Burre was knocked around for seven runs and 12 hits in four innings, including two home runs, as the O's dropped their third straight to the Sox. Luke Scott helped create three runs, hitting a two-run homer in the fourth, and scoring on Adam Jones' single in the second.

Full story >

Orioles Wrap >

More Orioles Headlines
• Bradford terse about Manny's 500th
• Tuesday's starter a puzzle for Orioles

Sweet Sox-teen

Ian Browne / MLB.com

Manny Ramirez hit his 501st homer in the fourth inning, part of a three-RBI day. Mike Lowell immediately followed with a home run, as the Sox strung together 18 hits.

J.D. Drew had a homer and three RBIs, and Bartolo Colon gave up four runs on seven hits in six-plus innings.

Full story >

Red Sox Wrap >

More Red Sox Headlines
• Manny donates memorabilia to Hall
• Ortiz misses start Sunday
Outline

1. Parallel Corpus & Domain Model
2. Content Planning
3. User Study I
4. Reordering Algorithm
5. User Study II
## New York Yankees at Boston Red Sox

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<tr>
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<th>6</th>
<th>7</th>
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<th>R</th>
<th>H</th>
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**Final**

W: T. Wakefield (1-0)  L: M. Mussina (0-1)

### Recap

#### View: Play-by-Play | Pitch-By-Pitch

#### New York - Top of 1st

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<thead>
<tr>
<th>Name</th>
<th>Action Description</th>
<th>Score</th>
<th>Score</th>
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<tbody>
<tr>
<td>Derek Jeter</td>
<td>D Jeter grounded out to pitcher</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Alex Rodriguez</td>
<td>Strike (looking), Ball, Ball, Strike (foul), Strike (swinging), A Rodriguez struck out swinging</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gary Sheffield</td>
<td>Strike (looking), Ball, Strike (looking), Ball, Ball, Ball, G Sheffield walked</td>
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<td>0</td>
</tr>
<tr>
<td>Hideki Matsui</td>
<td>Ball, Strike (looking), Strike (foul), Strike (swinging), H Matsui struck out swinging</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>End of Inning - 0 Runs, 0 Hits, 0 Errors</td>
<td>0</td>
<td>0</td>
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#### Boston - Bottom of 1st

<table>
<thead>
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<tr>
<td>Mike Mussina</td>
<td>Strike (looking)</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Johnny Damon</td>
<td>J Damon singled to right center</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Trot Nixon</td>
<td>Strike (looking), Ball, Strike (swinging), T Nixon flied out to center</td>
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<td>0</td>
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<tr>
<td>Manny Ramirez</td>
<td>Strike (looking), Ball, Ball, Strike (foul), Ball, Foul, Strike (swinging), M Ramirez struck out swinging, J Damon stole second</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>David Ortiz</td>
<td>Ball, Ball, Strike (looking), Ball, D Ortiz flied out to left</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>End of Inning - 0 Runs, 1 Hits, 0 Errors</td>
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<td>0</td>
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#### New York - Top of 2nd

<table>
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<td>Tino Martinez</td>
<td>Ball, Strike (looking), Ball, Strike (foul), Foul, T Martinez flied out to center</td>
<td>0</td>
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<tr>
<td>Jorge Posada</td>
<td>Strike (looking), Strike (looking), J Posada grounded out to first</td>
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<td>0</td>
</tr>
<tr>
<td>Jason Giambi</td>
<td>Strike (looking), Ball, Strike (foul), Ball, Strike (swinging), J Giambi struck out swinging</td>
<td>0</td>
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Baseball Domain

RED SOX 8, YANKEES 1
Flying high
Sox raise banner, beat Yankees

By Chris Snow, Globe Staff | April 12, 2005

All this day lacked was Neil Diamond himself, singing and yielding to his own temptation. He was there, in the second inning, as Bill Russell, who had set foot in the old yard in four decades, walked to the mound and met his old manager and uniform, standing in the visiting dugout in front of the television screens. It was the kind of moment that conjures recollections of this day from a television clip.

They were all here to see a World Series banner tumble over, and come down. "It's better than my wedding ring," mused Johnny Damon, "You can always wear your wedding ring."

But the men there were baseball to be played, and the Sox put together the Yankees in the 94th Fenway opener.

The game was decided by the performances of the most alluring character, the longest-tenured Sox player (April 26, 1995), who worked seven clinical innings, the fourth, when Rodriguez scored on an Edgar Renteria hit.

But the error that belonged to Rodriguez, who said he was "overaggr..."

The New York Times

RED SOX 8, YANKEES 1
With Rings and Then a Rout, It's a Great Day for Red Sox

By Tyler Kepner
Published April 12, 2005

BOSTON, April 11 - The Yankees have never debated the merits of the Sox' achievement. To the Yankees, there was nothing cheap, or flimsy. So the Sox stormed back to beat them in the playoffs last fall, then changed the Series.

"You're probably a little jealous," Yankees shortstop Derek Jeter said. "You have respect for what they accomplished, and you know how difficult..."

So on a crisp afternoon when they could have been in their clubhouse, the Yankees found no shame in witnessing the celebration of a rival. As the Red Sox gave up 45 World Series rings before their Fenway Park opener on Monday, the Yankees watched from the third-base dugout, even clapping."

As low as $2.99 a week
## Domain Model: Game Events

### Boston - Top of 4th

<table>
<thead>
<tr>
<th>Batter</th>
<th>Pitcher</th>
<th>Play</th>
<th>Inn</th>
<th>Atbat</th>
<th>S</th>
<th>B</th>
<th>H</th>
<th>V</th>
<th>1st</th>
<th>R</th>
<th>O</th>
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<tr>
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<td>Sanchez</td>
<td>Grndout</td>
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<td>4</td>
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<tr>
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<td>Sanchez</td>
<td>Walk</td>
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<td>19</td>
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<td>4</td>
<td>4</td>
<td>1</td>
<td>none</td>
<td>0</td>
<td>1</td>
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<tr>
<td>Ortiz</td>
<td>Sanchez</td>
<td>Homerun</td>
<td>4</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>cora</td>
<td>2</td>
<td>1</td>
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<tr>
<td>Ramirez</td>
<td>Sanchez</td>
<td>Strkout</td>
<td>4</td>
<td>21</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>1</td>
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<td>0</td>
<td>1</td>
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<tr>
<td>Nixon</td>
<td>Sanchez</td>
<td>Single</td>
<td>4</td>
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<td>0</td>
<td>6</td>
<td>1</td>
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<td>0</td>
<td>2</td>
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<tr>
<td>Lowell</td>
<td>Sanchez</td>
<td>Double</td>
<td>4</td>
<td>23</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>nixon</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>
Corpus

- Game logs on mlb.com (360 games)
- Summary articles from
  - AP (espn.com)
  - http://www.mlb.com (2 articles per game)
  - Boston Globe
  - New York Times
  - Washington Post
  - Toronto Star
  - Tampa Bay Tribune
Ortiz made his presence felt with a solo shot to center in the third that just seemed to keep carrying. An inning later, Ortiz was back for more, unloading on a Sanchez offering for a two-run blast to right. Lowell, looking comfortable in his old haunts, ripped a double high off the wall in left later in the inning to make it a 7-1 lead for the Sox.
Outline

1. Parallel Corpus & Domain Model
2. Content Planning
3. User Study I
4. Reordering Algorithm
5. User Study II
Steps in NLG

- Content Selection
  - which feature vectors to include

- Content Planning
  - how the feature vectors are grouped and ordered

- Surface Realization
  - how the feature vectors are written as sentences
Steps in NLG

- Content Selection
  - AP content

- Content Planning
  - regrouping and reordering algorithm

- Surface Realization
  - templates
Ramirez had a three-run homer in an eventful first inning, then added a two-run shot in the sixth.

Ortiz had a solo homer in the third, a two-run homer in the fourth and narrowly missed another in the sixth, settling for a long RBI double off the left-field scoreboard.

Former Marlin Mike Lowell tied a career high with three doubles including an RBI double in the 3-run fourth.
Ramirez had a three-run homer in an eventful first inning, then added a two-run shot in the sixth.

Ortiz had a solo homer in the third, a two-run homer in the fourth and narrowly missed another in the sixth, settling for a long RBI double off the left-field scoreboard.

Former Marlin Mike Lowell tied a career high with three doubles including an RBI double in the 3-run fourth.
Outline

1. Parallel Corpus & Domain Model
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3. User Study I
4. Reordering Algorithm
5. User Study II
User Study I: Purpose

- AP articles and local articles overlap 73% of content
- Can we ignore the rest?
- Is content planning enough?
User Study I: Methodology

- Subjects: 8 MIT students
- Format: online survey
- Question: “Do you think this article was written for the fans of Team A or Team B?”
- Articles:
  - 1 AP (neutral)
  - 2 mlb.com local articles
- 4 games, 12 articles
User Study 1: Input

- Original articles

- Modification 1: Aligned Content
  - Include game event aligned content
  - Throw out commentary, global trends

- Modification 2: AP Content
  - Include content overlapping with AP
  - Throw out all other game events
  - Replace sentences with templates
Subjects’ ratings for each summary on a scale from 1 to 5, where 1 means the summary has been written for Team A, and 5 for Team B. ($n = 8$)

<table>
<thead>
<tr>
<th>Game 1</th>
<th>Team A</th>
<th>AP</th>
<th>Team B</th>
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</thead>
<tbody>
<tr>
<td>Original</td>
<td>1.38</td>
<td>3.5</td>
<td>4.63</td>
</tr>
<tr>
<td>Aligned Content</td>
<td>1.50</td>
<td>3.25</td>
<td>4.38</td>
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<tr>
<td>AP Content</td>
<td>1.75</td>
<td>3.13</td>
<td>4.00</td>
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<table>
<thead>
<tr>
<th>Game 2</th>
<th>Team A</th>
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<th>Team B</th>
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<tbody>
<tr>
<td>Original</td>
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<td>3.75</td>
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<tr>
<td>Aligned Content</td>
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<td>3.63</td>
<td>3.88</td>
</tr>
<tr>
<td>AP Content</td>
<td>2.5</td>
<td>3.38</td>
<td>3.63</td>
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</table>

<table>
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<tr>
<th>Game 3</th>
<th>Team A</th>
<th>AP</th>
<th>Team B</th>
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<tbody>
<tr>
<td>Original</td>
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<tr>
<td>Aligned Content</td>
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<td>AP Content</td>
<td>4.88</td>
<td>4.75</td>
<td>4.75</td>
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User Study I: Results

- User study reveals leaving out non-overlapping content retains most of the perspective.
- Content grouping and ordering contributes significantly to the document’s perspective.
Outline

1. Parallel Corpus & Domain Model
2. Content Planning
3. User Study I
4. Reordering Algorithm
5. User Study II
System Overview

- Start with AP content
  - Content selection simplified
  - Completeness & accuracy of article preserved
- Regroup content according to shared features
- Reorder groups according to
  - Feature weights
  - Chronological order
- Use templates
Ortiz made his presence felt with a solo shot to center in the third that just seemed to keep carrying.

An inning later, Ortiz was back for more, unloading on a Sanchez offering for a two-run blast to right.

Lowell, looking comfortable in his old haunts, ripped a double high off the wall in left later in the inning to make it a 7-1 lead for the Sox.

Ortiz hit a one-run homerun in the third inning. Then, Lowell hit an RBI double in the fourth. Nixon hit a single, and Ortiz hit a 2-run homerun.
Glaus came a few feet shy of having three home runs in the sixth inning, when he sent another pitch from Bedard off the wall in left-center field. He later scored when Shea Hillenbrand chipped in an RBI single. Glaus added a ground-rule double in the ninth, and finished the day with four RBIs.
Aside from Sexson's home run in the sixth, Johjima -- who had the first three-hit game of his career -- had an RBI double in the inning. Betancourt bounced a two-run double into left field and Jose Lopez later added an RBI triple.
Features for Grouping

- Use aligned corpus to identify features that group the feature vectors together
- Assign weights to features according to frequency in corpus
Features for Grouping

For each group
- Compute the score $w_f n$
  - $w_f$ is weight computed for feature $f$ that is shared by all the vectors in a group
  - $n$ is the number of feature vectors in that group
- Do this for all features shared by the feature vectors in the group
More on feature weight learning
Outline

1. Parallel Corpus & Domain Model
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User Study

- 5 games, 4 articles each
- 15 Users
- Online Evaluation

Articles
- Baseline: content ordered chronologically
- Modified AP: aligned content, sentences replaced with templates
- Home & Away: system-generated output
**Game 3**

TGlaus (TOR) had 3 homeruns in the game.
In the first inning, he hit a 2-run homerun.
In the seventh inning, he hit a 1-run homerun.

ARios (TOR) had 4 RBIs.
In the first inning, he hit a 1-run double.
In the second inning, he hit a 2-run homerun.
In the sixth inning, he hit a 1-run sacrifice.

New York scored 4 runs in the first inning.
First, DJeter (NYY) hit a triple.
Then, GSheffield (NYY) hit a 1-run single.
Then, ARodriguez (NYY) hit a 2-run homerun.
Then, JGiambi (NYY) hit a 1-run homerun.

New York had 2 homeruns in the first inning.
ARodriguez(NYY) hit a 2-run homerun.
And, JGiambi(NYY) hit a 1-run homerun.

Toronto had 3 homeruns in the game.
In the first inning, TGlaus(TOR) hit a 2-run homerun.
In the second inning, ARios(TOR) hit a 2-run homerun.
In the seventh inning, TGlaus(TOR) hit a 1-run homerun.

New York scored 1 more runs in the first inning.
DJeter(NYY) hit a triple.
Then, GSheffield(NYY) hit a 1-run single.
Results

Subjects’ ratings for each summary on a scale from 1 to 5, where 1 means the summary has been written for Team A, and 5 for Team B. \((n = 15)\)

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<tr>
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ANOVA shows significantly different perspective ratings for 4 out of 5 games.
### Results: Pairwise Comparisons

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<table>
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Add animation and/or caption here to explain different colors.
Contributions

- Identified content ordering as an important sub-problem for studying perspective
- Validated the ordering hypothesis through web-based study with 8 users
- Collected and analyzed corpus of 360 games and corresponding perspective articles
- Implemented ordering algorithm that injects perspective into neutral articles
- Verified significantly different perspectives in system output through user study for 5 games, 20 summaries, with 15 users
Future Plans

- Publish corpus of game data & summary articles
  - Share corpora?
- Try a different domain (politics? finance?)
  - Share understanding of domains?
- Add a different modality
  - Share expertise on multimedia?