From Language to the Mind:
Learning to Read
Deception,
Connotation,
and Literary Success

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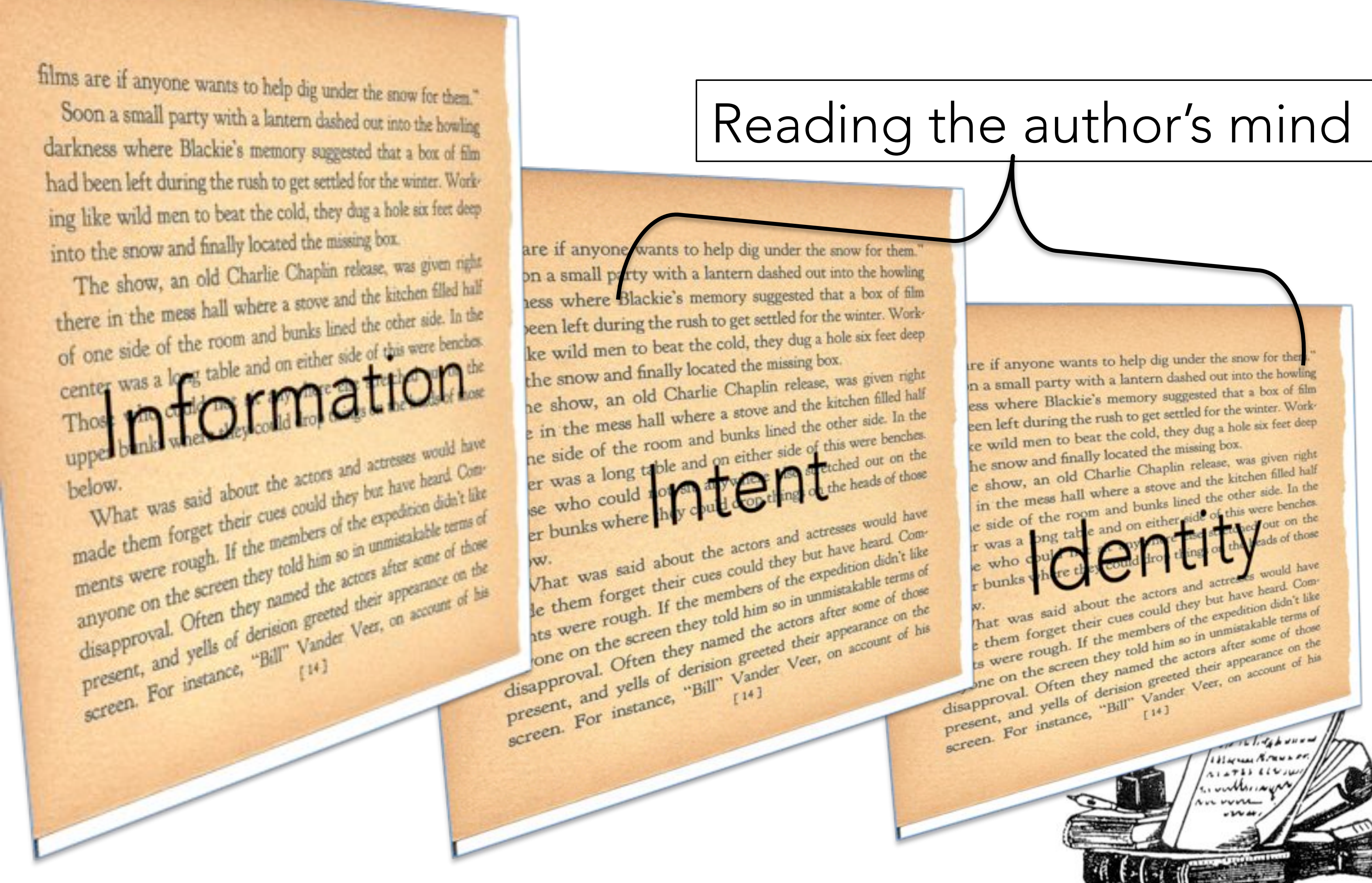
Computer Science & Engineering
UNIVERSITY *of* WASHINGTON

Three Different Layers of Reading



films are if anyone wants to help dig under the snow for them."

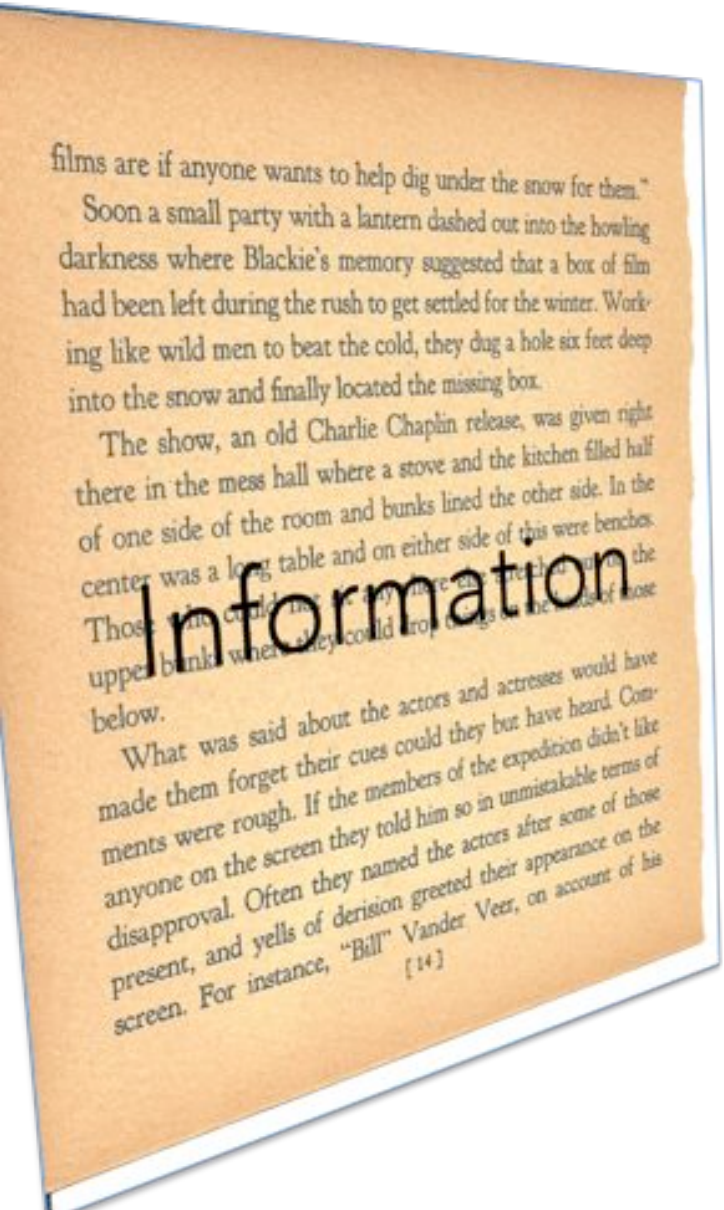
Soon a small party with a lantern dashed out into the howling darkness where Blackie's memory suggested that a box of film had been left during the rush to get settled for the winter. Working like wild men to beat the cold, they dug a hole six feet deep into the snow and finally located the missing box.

The show, an old Charlie Chaplin release, was given right there in the mess hall where a stove and the kitchen filled half of one side of the room and bunks lined the other side. In the center was a long table and on either side of this were benches. Those who could not get a seat stretched out on the upper bunks where they could drop things on the heads of those below.

What was said about the actors and actresses would have made them forget their cues could they but have heard. Comments were rough. If the members of the expedition didn't like anyone on the screen they told him so in unmistakable terms of disapproval. Often they named the actors after some of those present, and yells of derision greeted their appearance on the screen. For instance, "Bill" Vander Veer, on account of his

[14]

Information



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"All the News That's Fit to Print"

The New York Times

Late Edition

NEW YORK, TUESDAY, OCTOBER 20, 1987

30 CENTS

STOCKS PLUNGE 508 POINTS, A DROP OF 22.6%;
604 MILLION VOLUME NEARLY DOUBLES RECORD

U.S. Ships Shell Iran Installation In Gulf Reprisal

Offshore Target Termed a Base for Gunboats

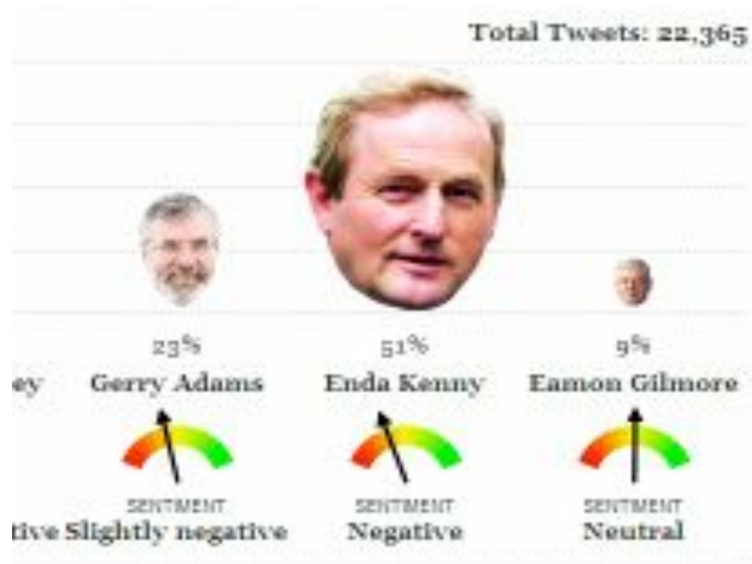
A Huge Blow to the Five-Year Bull Market

Dow's Record Fall

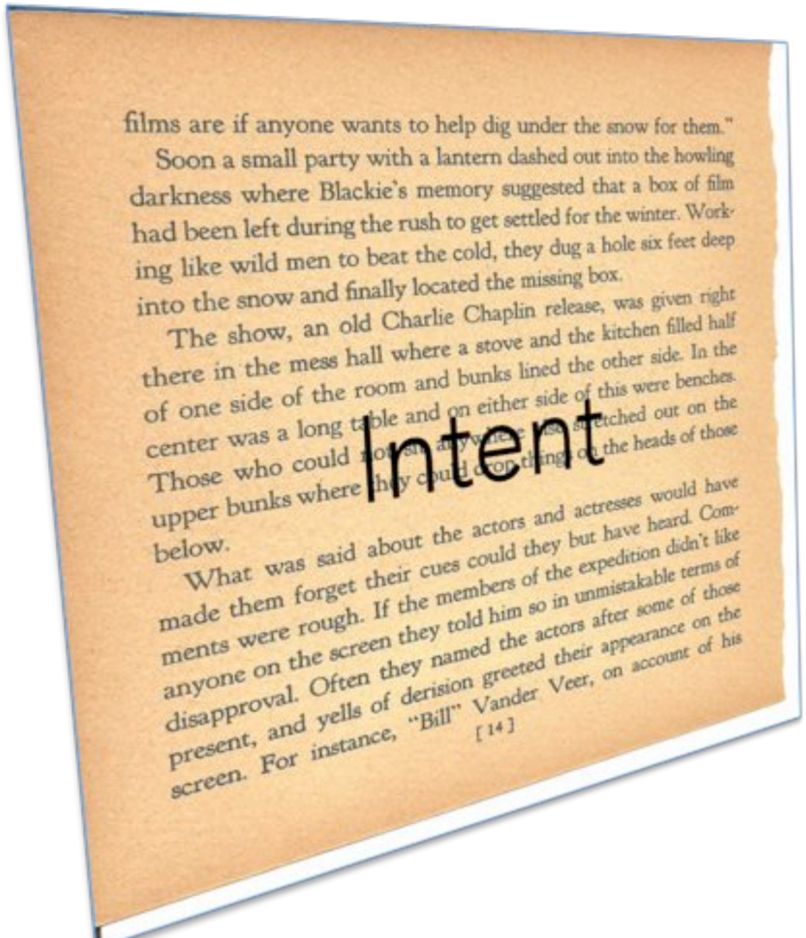
WORLDWIDE IMPACT

Frenzied Trading Raises Fears of Recession — Tape 2 Hours Late

Does 1987 Equal 1929?



Intent



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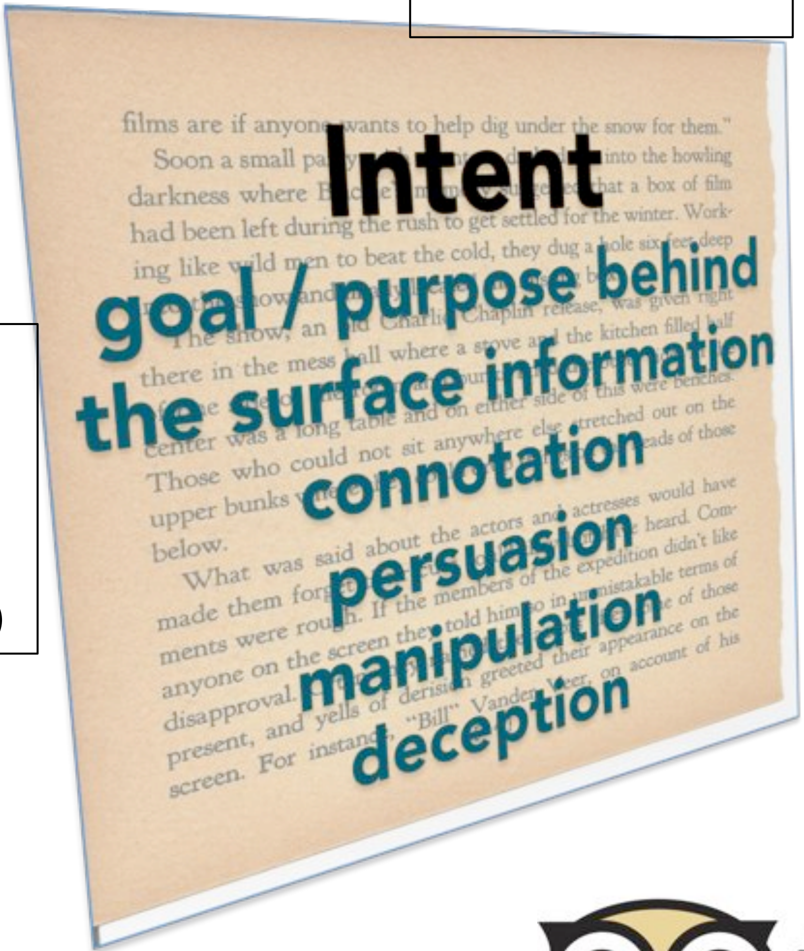
[14]

dodging
(Nguyen et al 2013)

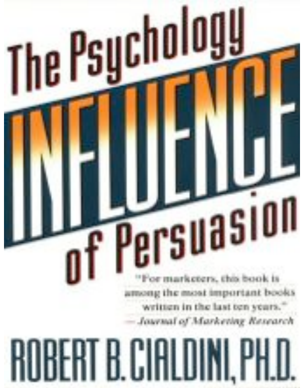
hedging
(Choi et al. 2012)
(Ganter and Strube, 2009)
(Kilicoglu and Bergler 2008)

"Eunsol" Choi

framing in media & political discourse
(Yano et al., 2010)
(Recasens et al., 2013)



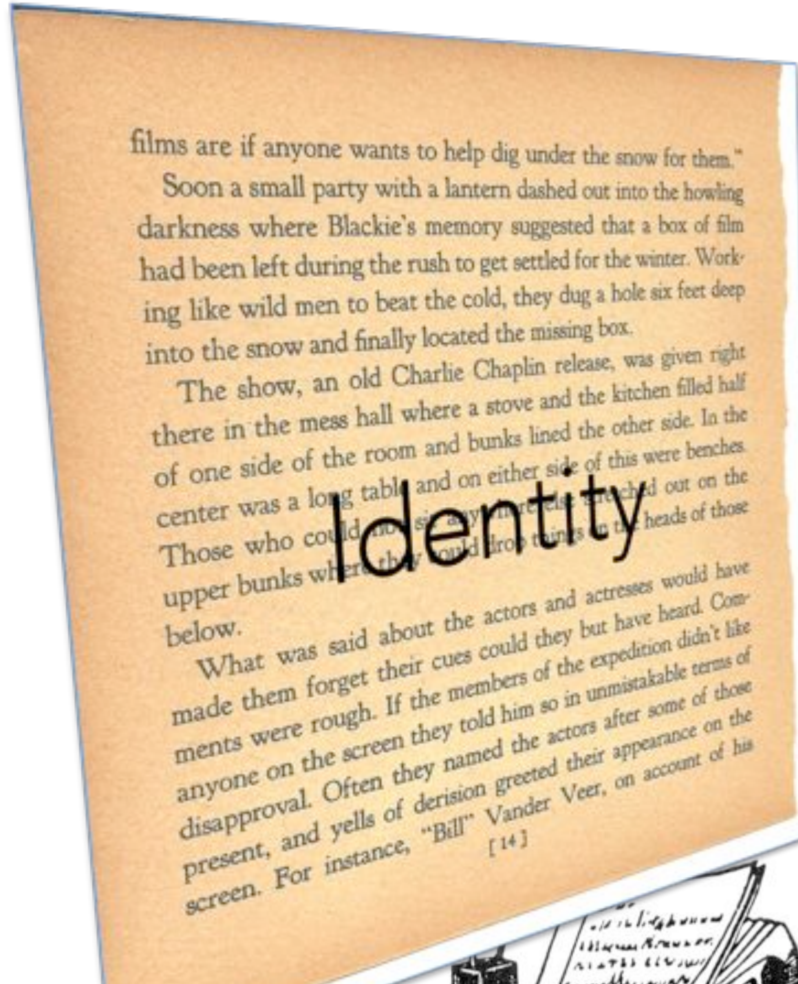
syntactic packaging
"My toy broke"
instead of
"I broke my toy"
(Greene and Resnik 2009)



deception

fake online reviews

Identity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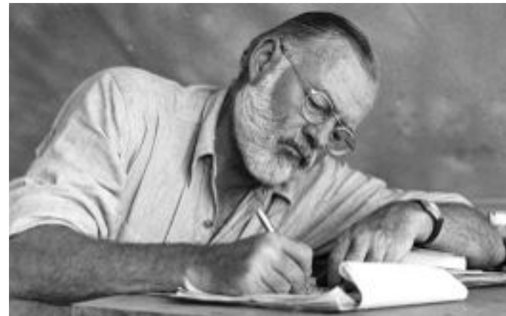
Capote

Hempel



Hemingway

Woolf

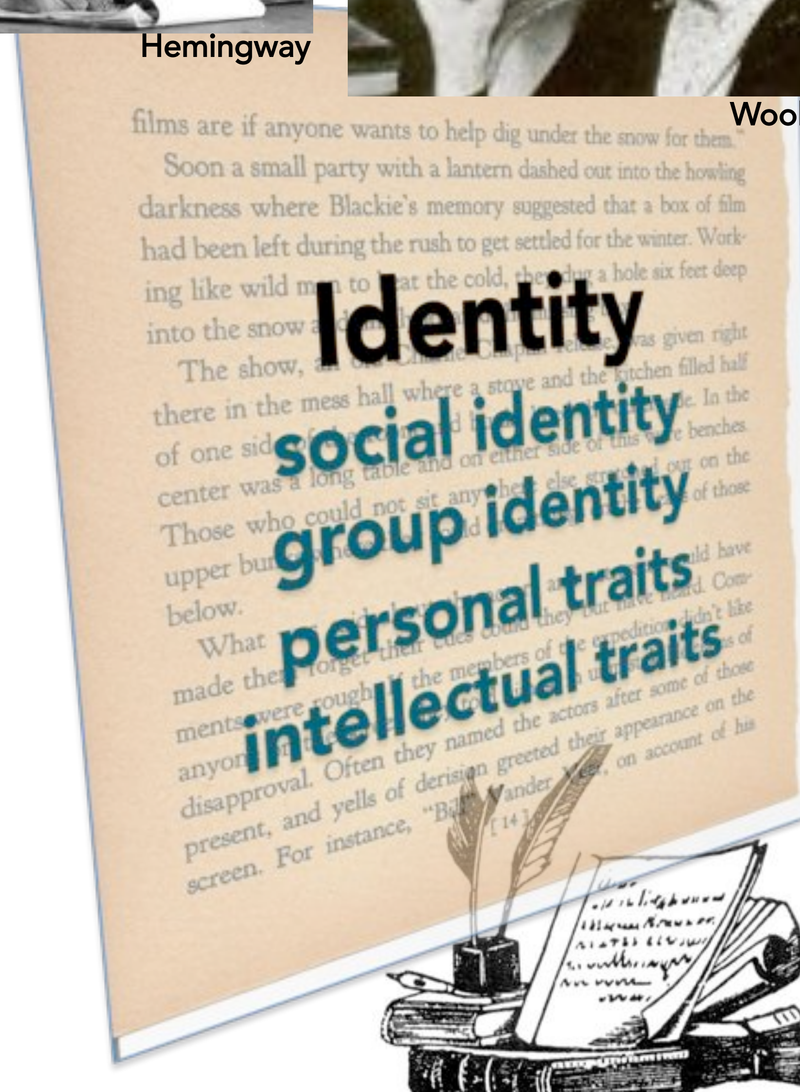
authorship verification

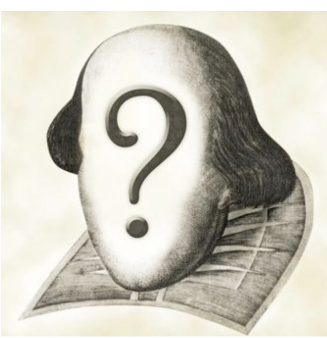
authorship obfuscation

demographics: gender, nationality, age, vocation

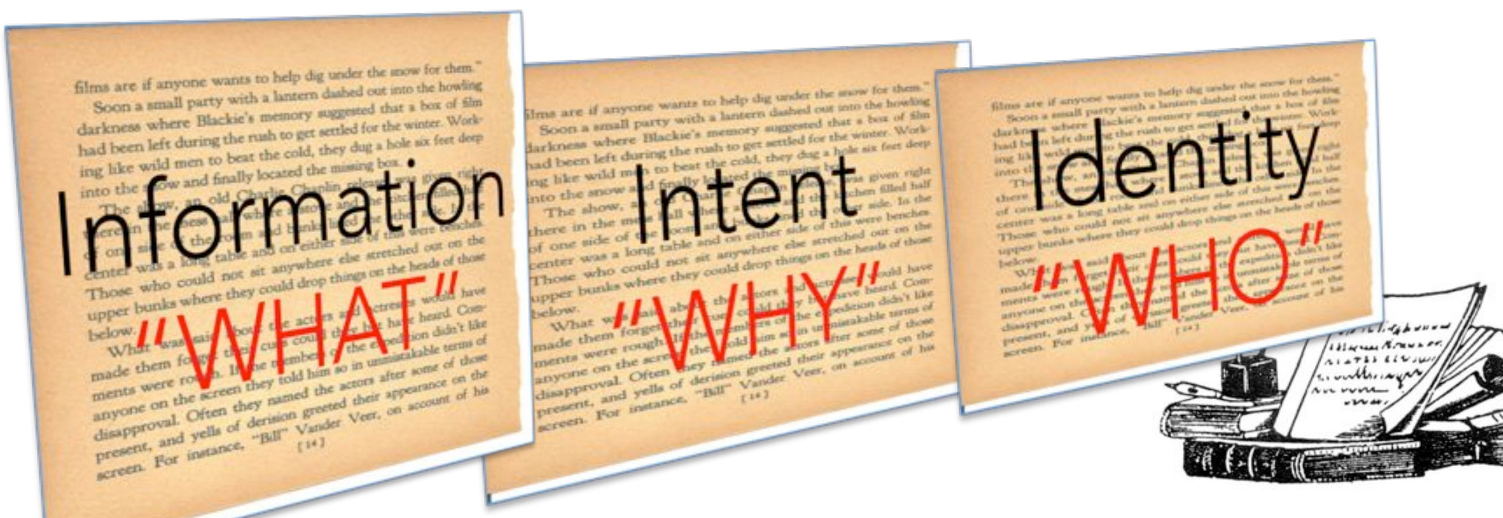
personality, psychological state: happy, authoritative, depressed…

intellectual traits & development: literary success





From Language to the Mind

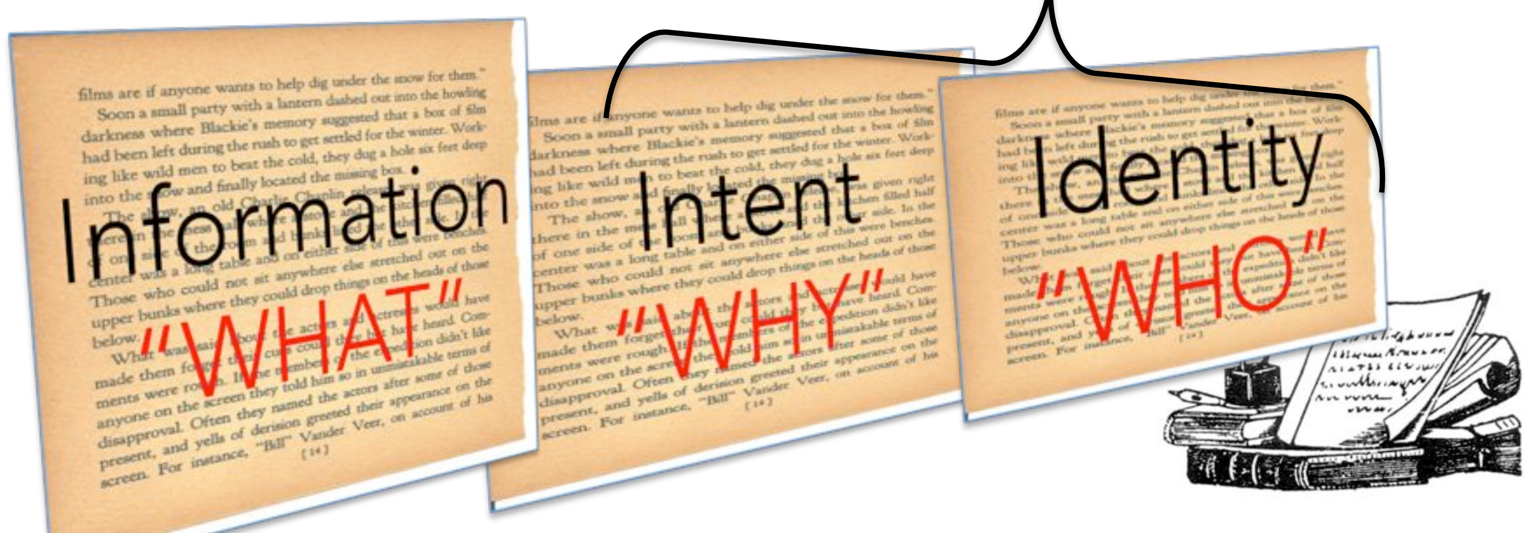


From Language to the Mind

Is it even possible? (without full semantic understanding)

- It is more about "HOW" it is said than "WHAT" is said.

"HOW" it is said
i.e., **Writing Style**



Is it even possible? (without full semantic understanding)

➔ It is more about "HOW" it is said than "WHAT" is said.

(Harpalani et al., ACL 2011)

- Wikipedia
  - Community-based knowledge forums (collective intelligence)
  - anybody can edit
  - susceptible to vandalism --- 7% are vandal edits

- Wikipedia Vandalism
  - ill-intentioned edits to compromise the integrity of Wikipedia.
  - E.g., irrelevant obscenities, humor, or obvious nonsense.

Wikipedia Vandalism

<Edit Title: *Harry Potter*>

- Harry Potter is a teenage boy who likes to smoke crack with his buds. They also run an illegal smuggling business to their headmaster dumbledore. He is dumb!

Wikipedia Vandalism

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Wikipedia Manual of Style

Formatting / Grammar Standards:

- layout, acronyms, punctuations, etc

Content Standards:

- *Neutral point of view*,
- *No original research* (always include citation)
- *Verifiability*
- "What Wikipedia is Not":
  propaganda, opinion, promotion, advertising

- Revelation in "HOW" it is said
- Long distance dependencies (syntactic)

<Edit Title: *Harry Potter*>

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their headmaste

- The theory is that […] is the one […]
- Therefore, […] will […]

<Edit Title: *Global*

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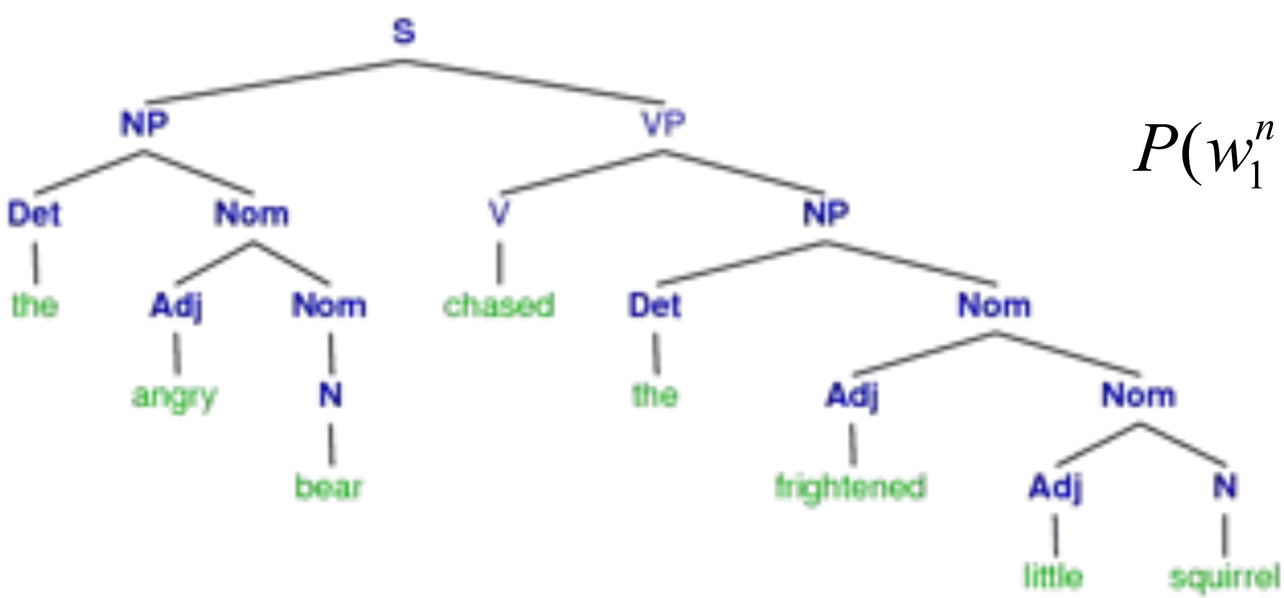
Language Model Classifier

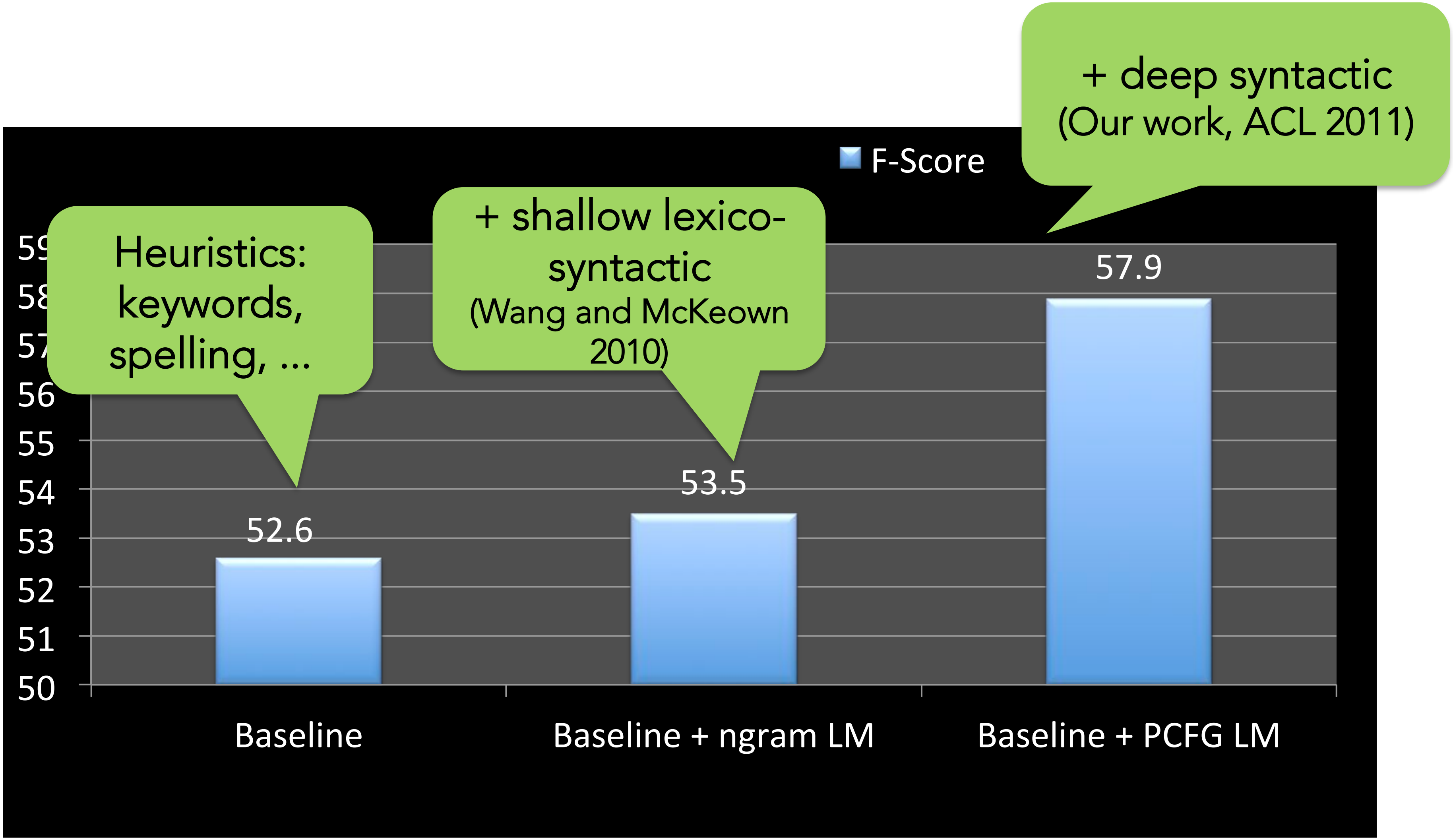
1. N-gram Language Models
   -- most popular choice
2. PCFG Language Models
   -- Chelba (1997), Raghavan et al. (2010),

$$P(w_1^n) = \prod_{k=1}^{n} P(w_k \mid w_{k-1})$$



$$P(w_1^n) = \prod P(A \rightarrow \beta)$$

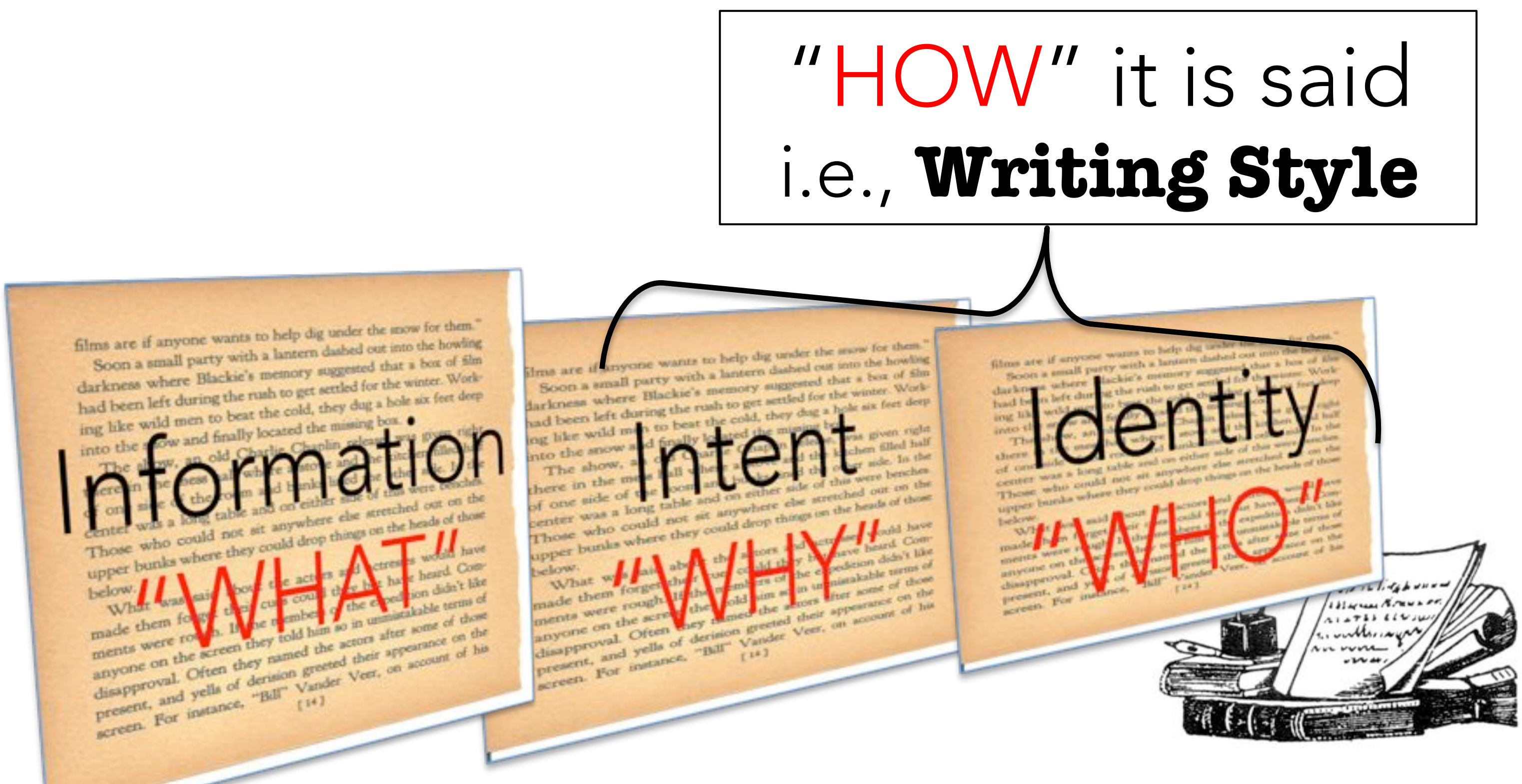
Writing style: can detect vandalism better



From Language to the Mind

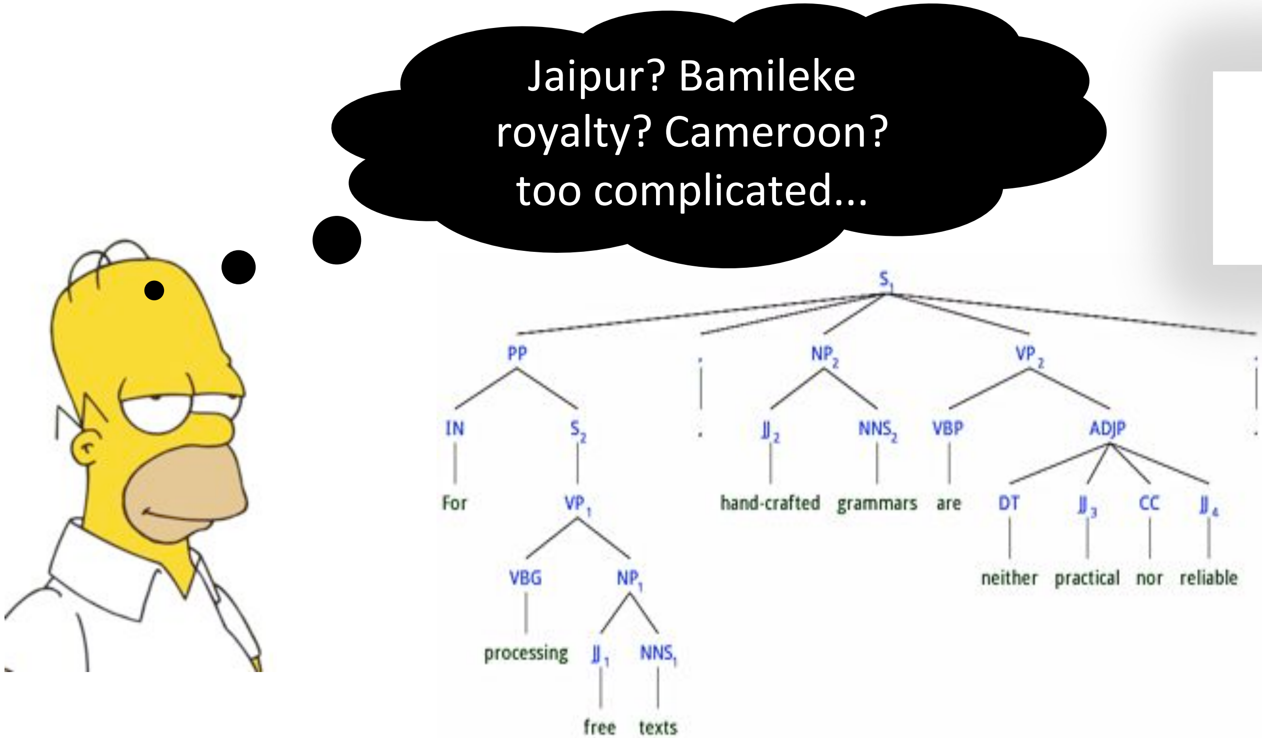
Is it even possible? (without full semantic understanding)

- It is more about "HOW" it is said than "WHAT" is said.
- We --humans– also often rely on "overall impression".



We --humans– also often rely on "overall impression".

Part sculpture, part table, all artisanal. Craftspeople in Jaipur, India, hand carved the delicate rosettes on this low-lying solid mango wood table, which takes its original inspiration from a ceremonial stool used by Bamileke royalty in the African country of Cameroon.



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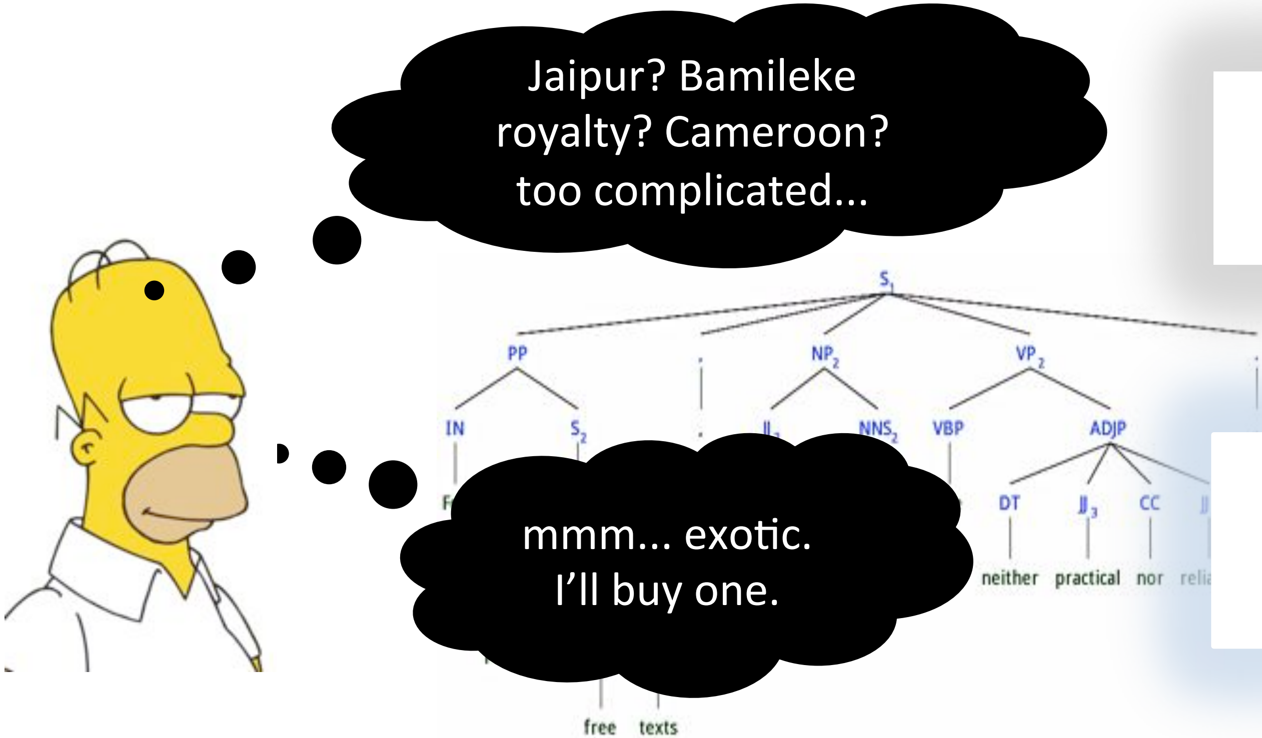

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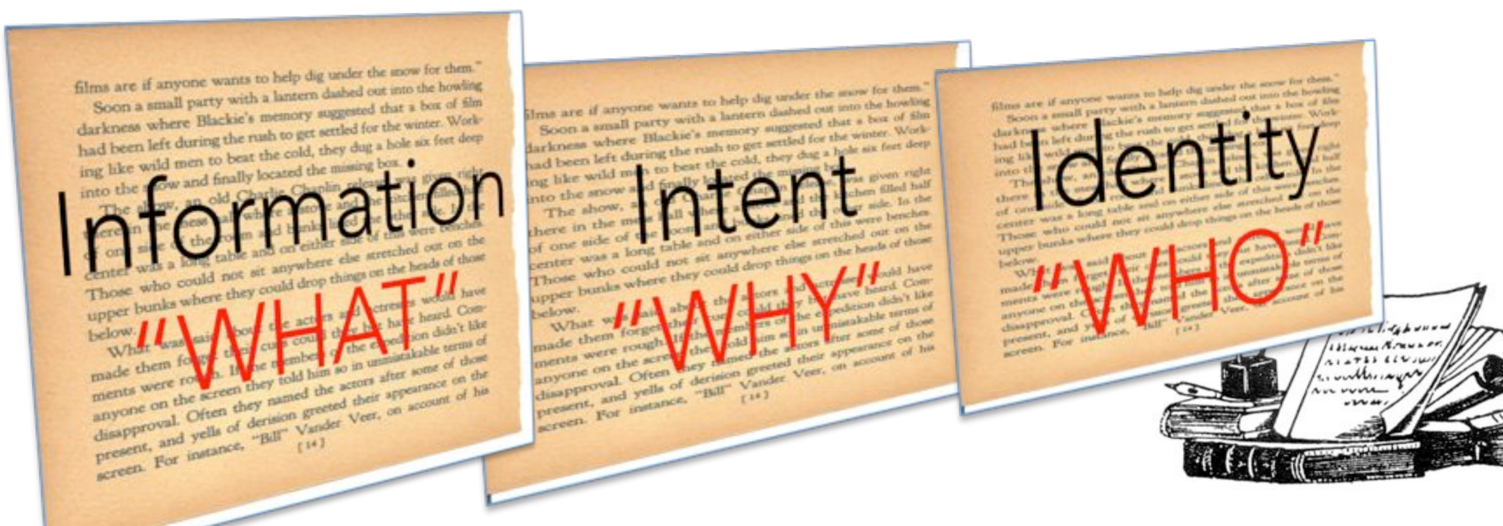
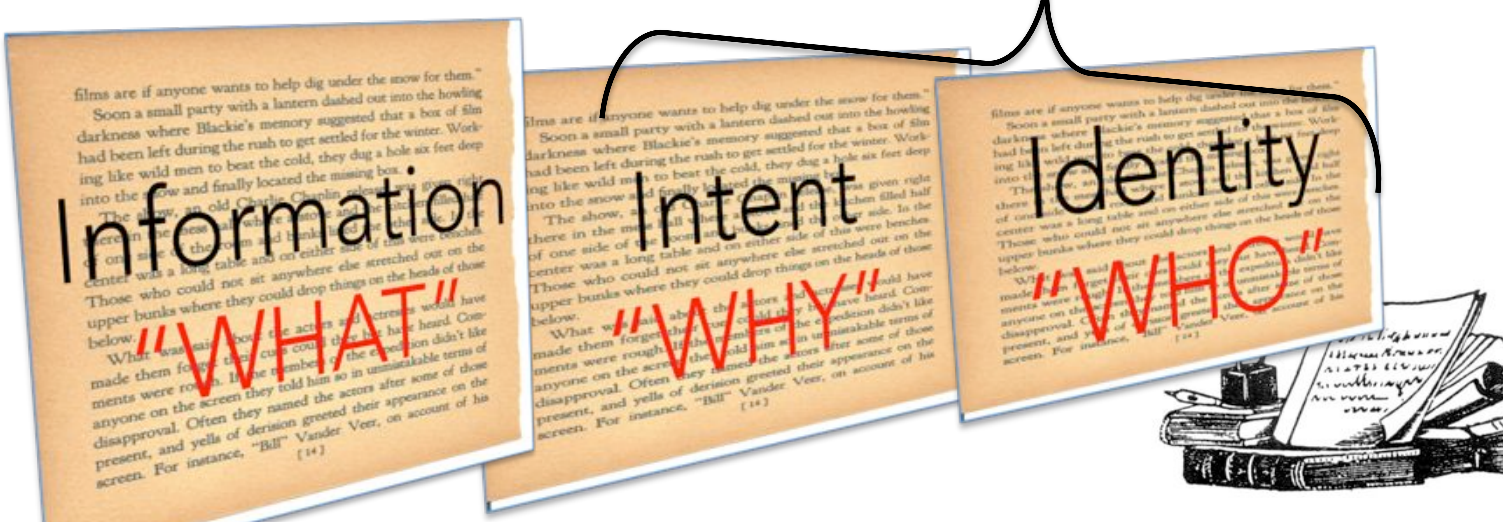
Computers at times can do better than humans!



What is “Writing Style” ?

“HOW” it is said
i.e., **Writing Style**



What is "Writing Style" ?

Blog Post

Research Papers? *New York Times?* *Blogs?*

"So how can you spot a fake review? Unfortunately, it's
... here are a few warning

Research Paper (**ACL**, 2011)

"To obtain a deeper understanding of the nature of
deceptive reviews, we examin...
potentially complementary fra...

The New York Times

"As online retailers increasingly depend on reviews as a sales tool, an industry of fibbers and promoters has sprung up to buy and sell raves for a pittance."

What is "Writing Style" ?

Genre Categorization:

Petrenz and Webber, 2011; Finn et al., 2006; Argamon et al., 2003; Kessler et al., 1997

Authorship Attribution:

Holmes 1985, Raghavan et al., 2010; Koppel and Shler, 2004; Gamon, 2004;

Many more possibilities…

Swanson and Charniak, 2012; Xu et al., 2012; Iyyer et al., 2014; Hardisty et al., 2010

"HOW" it is said
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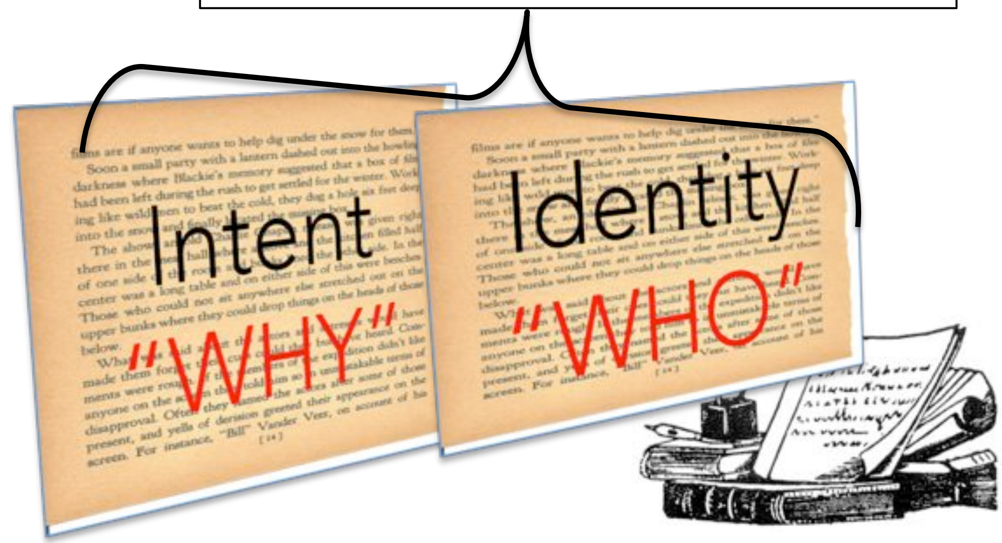
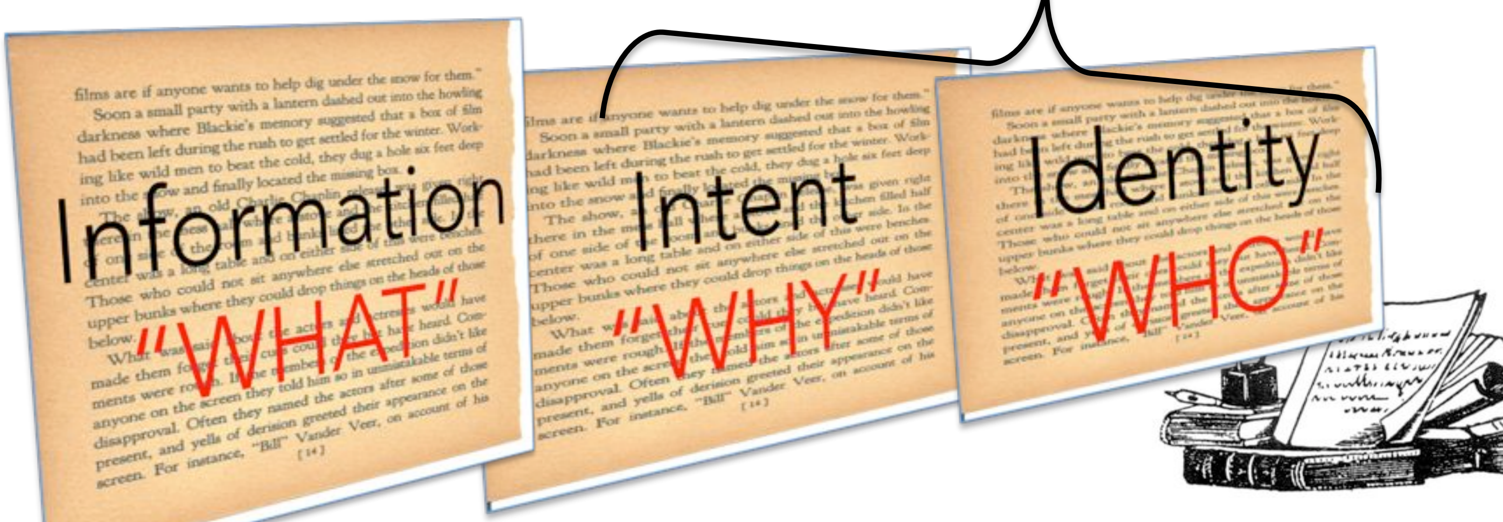


Alan Ritter

From Language to the Mind

Outline of the talk:

"HOW" it is said
i.e., **Writing Style**



From Language to the Mind

Outline of the talk:

- Deceptive Reviews and Essays

II. Success of Novels

III. Connotation of Words

"HOW" it is said
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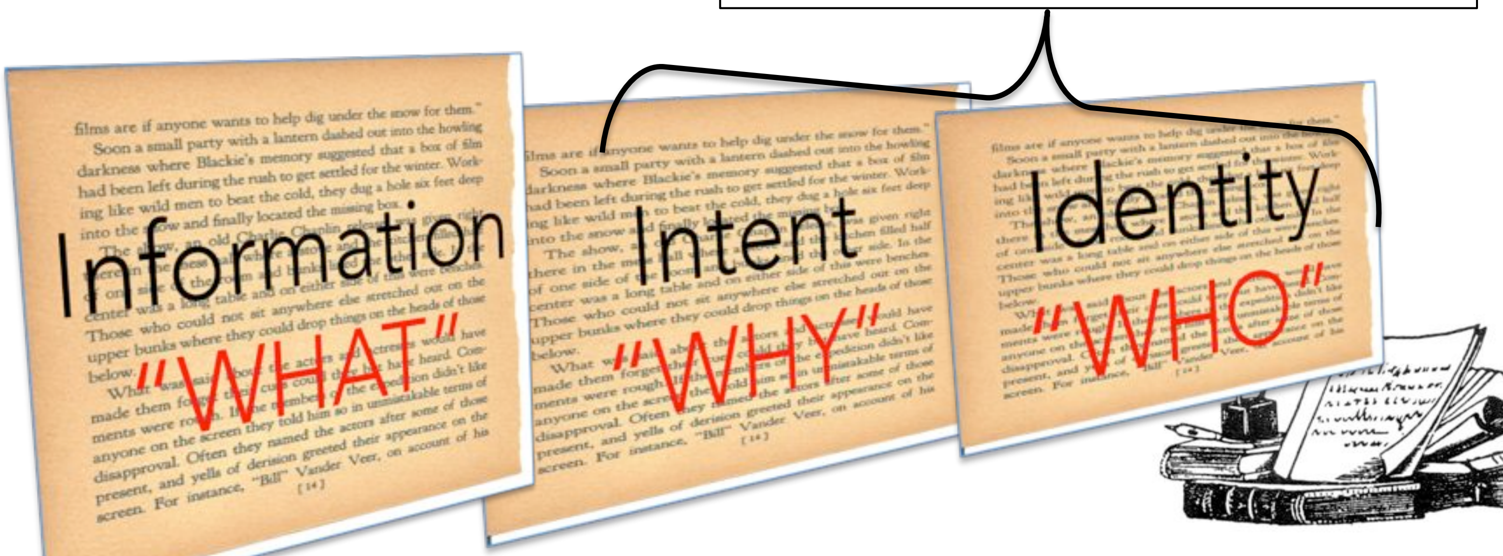

Motivation

Online reviews
= shopping tool

Potential target for fake reviews!

“My husband and I stayed at the James Chicago Hotel for our anniversary. This place is fantastic! We knew as soon as we arrived we made the right choice! The rooms are BEAUTIFUL and the staff very attentive and wonderful! The area of the hotel is great, since I love to shop I couldn’t ask for more! We will definitely be back to Chicago and we will for sure be back to the James Chicago.”

Deceptive or Truthful?

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"I have stayed at many hotels traveling for both business and pleasure and I can honestly say that The James is tops. The service at the hotel is first class. The rooms are modern and very comfortable. The location is perfect within walking distance to all of the great sights and restaurants. Highly recommend to both business travellers and couples."

Gathering Data

- Label existing reviews?
  - Can’t manually do this

Gathering Data

- ~~Label existing reviews?~~
  - Can't manually do this

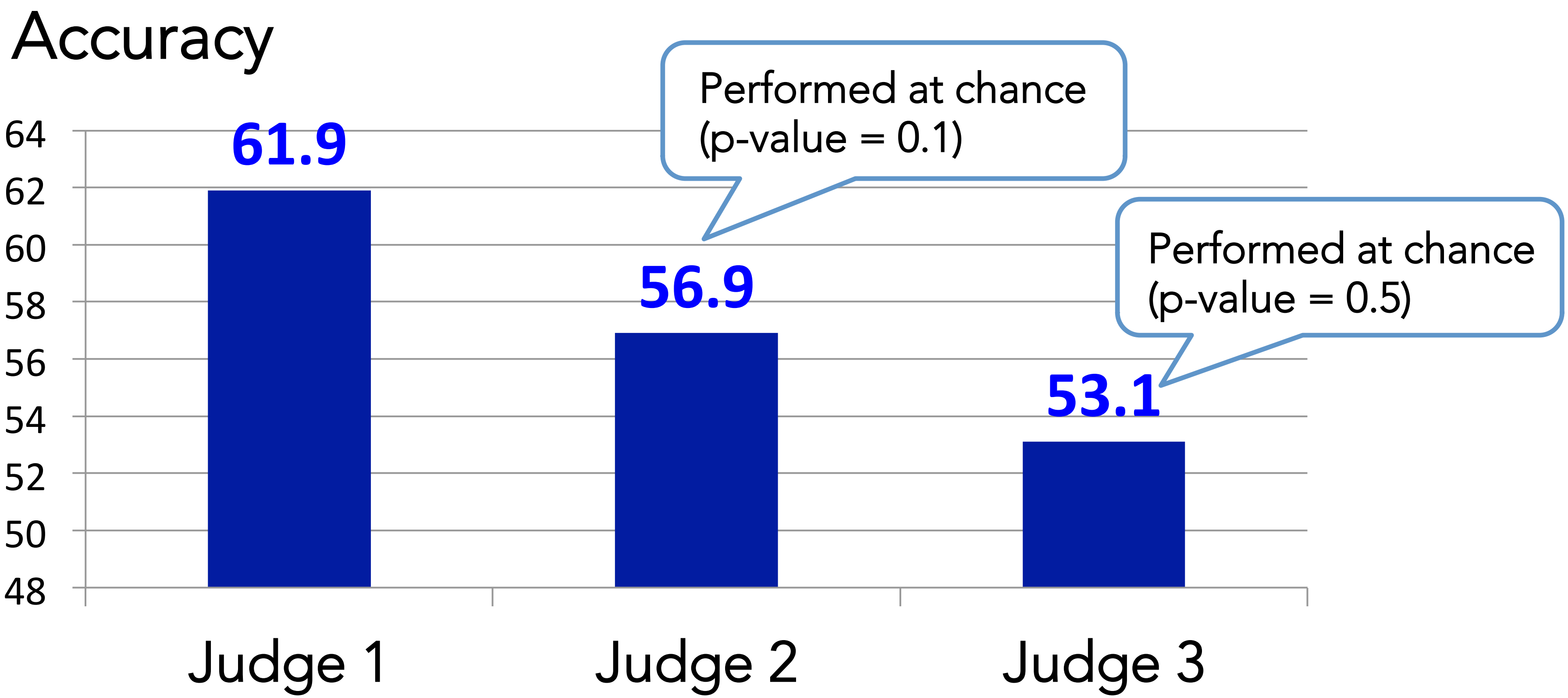
❑ Instead, create new reviews
  - By hiring people to write fake positive reviews
  - Amazon Mechanical Turk
    - 20 hotels
    - 20 reviews / hotel
    - Offer $1 / review
    - 400 reviews

How good are humans in detecting deceptive reviews?

- 80 truthful and 80 deceptive reviews
- 3 undergraduate judges

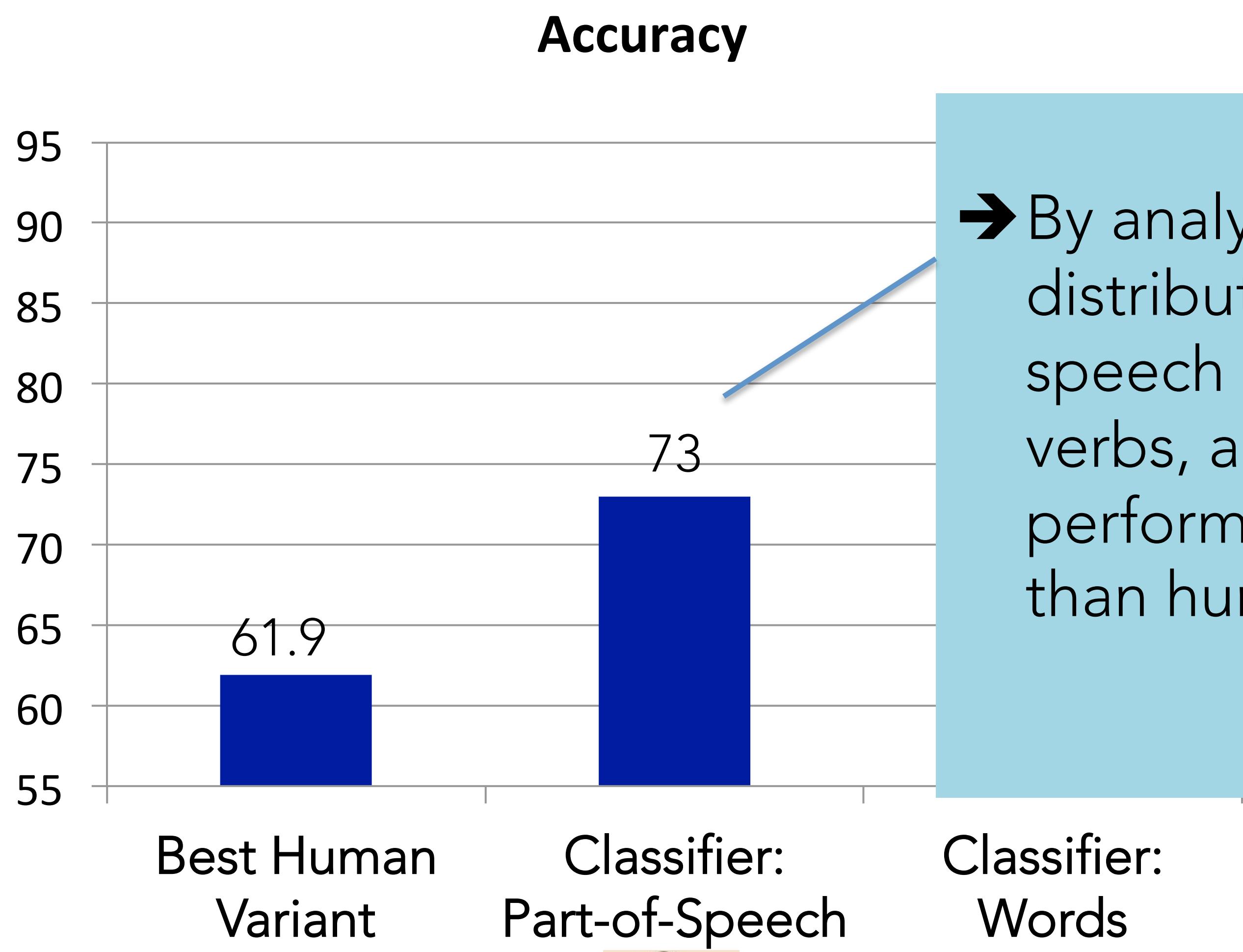
Human Performance

➔ Aligns with previous studies in deception literature:
humans typically perform barely better than chance.
trained experts may perform at ~70%

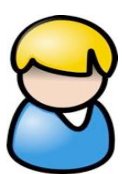


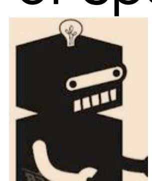
How Well Can Computers Do?

Classifier Performance (SVM with 5-fold CV)



➔ By analyzing *only* the distribution of part-of-speech (e.g., nouns, verbs, adjectives), already performs much better than human judges!





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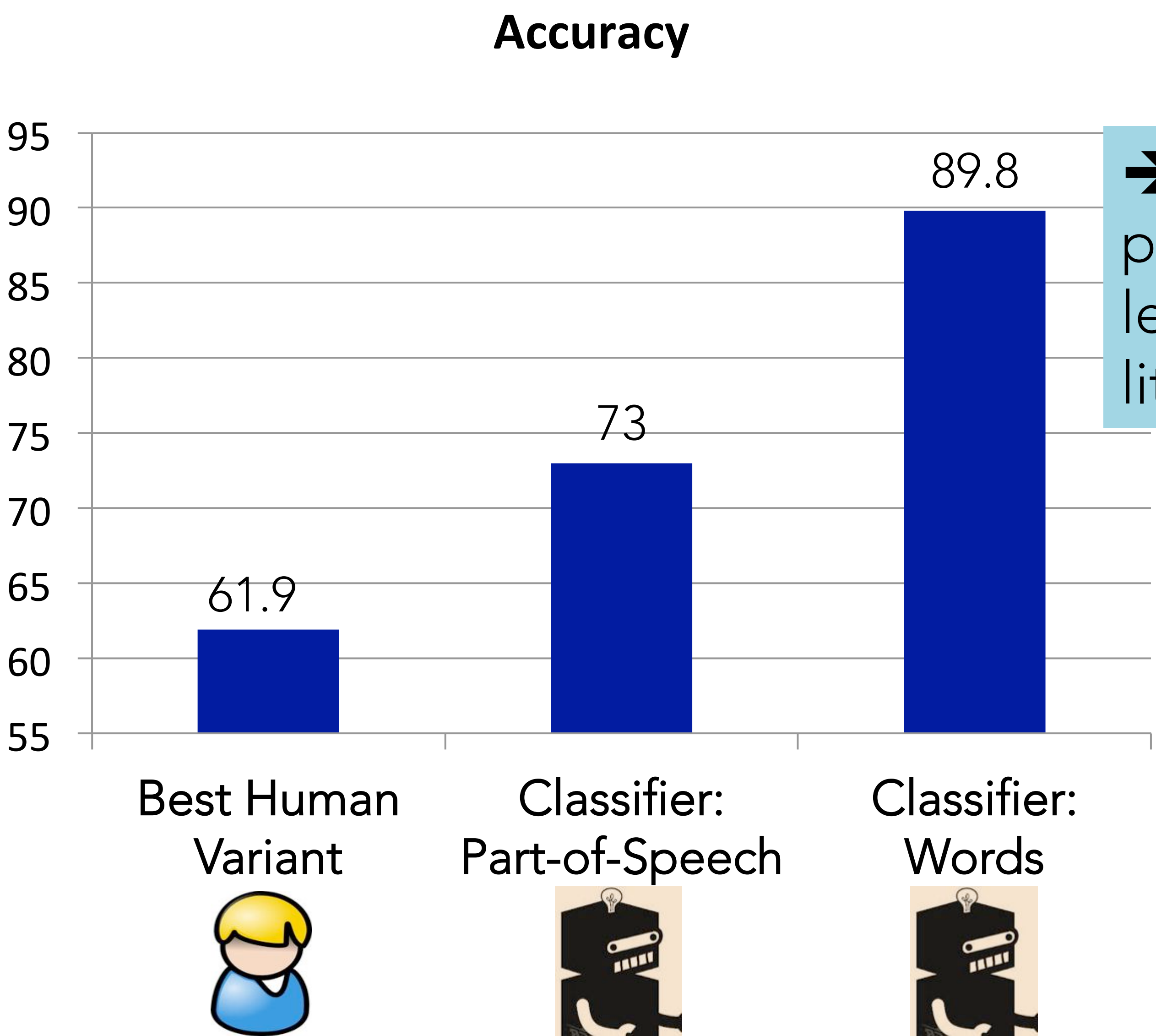

➔ No human performs at this level in deception literature!

Data-driven Discovery of Insights
into
Deceptive Writings

TRUTHFUL/INFORMATIVE			DECEPTIVE/IMAGINATIVE		
Category	**Variant**	**Weight**	**Category**	**Variant**	**Weight**
NOUNS	Singular	0.008	VERBS	Base	-0.057
	Plural	0.002		Past tense	**0.041**
	Proper, singular	**-0.041**		Present participle	-0.089
	Proper, plural	0.091		Singular, present	-0.031
ADJECTIVES	General	0.002		Third person singular, present	**0.026**
	Comparative	0.058			
	Superlative	**-0.164**		Modal	-0.063
PREPOSITIONS	General	0.064	ADVERBS	General	**0.001**
DETERMINERS	General	0.009		Comparative	-0.035
COORD. CONJ.	General	0.094	PRONOUNS	Personal	-0.098
VERBS	Past participle	0.053		Possessive	-0.303
ADVERBS	Superlative	**-0.094**	PRE-DETERMINERS	General	**0.017**

Informative writing (left) --- nouns, adjectives, prepositions
Imaginative writing (right) --- verbs, adverbs, pronouns
Rayson et. al. (2001)

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Truthful Reviews

≈

Informative Writing
(Journalism)

Deceptive Reviews

≈

Imaginative Writing
(Novels)

STRONG DECEPTIVE INDICATORS

A focus on who they were with
In this example, "My husband;" also words like "family."

Greater use of first-person singular
Fake reviews tend to use "I" and "me" more often.

Direct mention of where they stayed
Hotel and city names were less common in truthful reviews, which focus more on details about the hotel itself, like "small" or "bathroom."

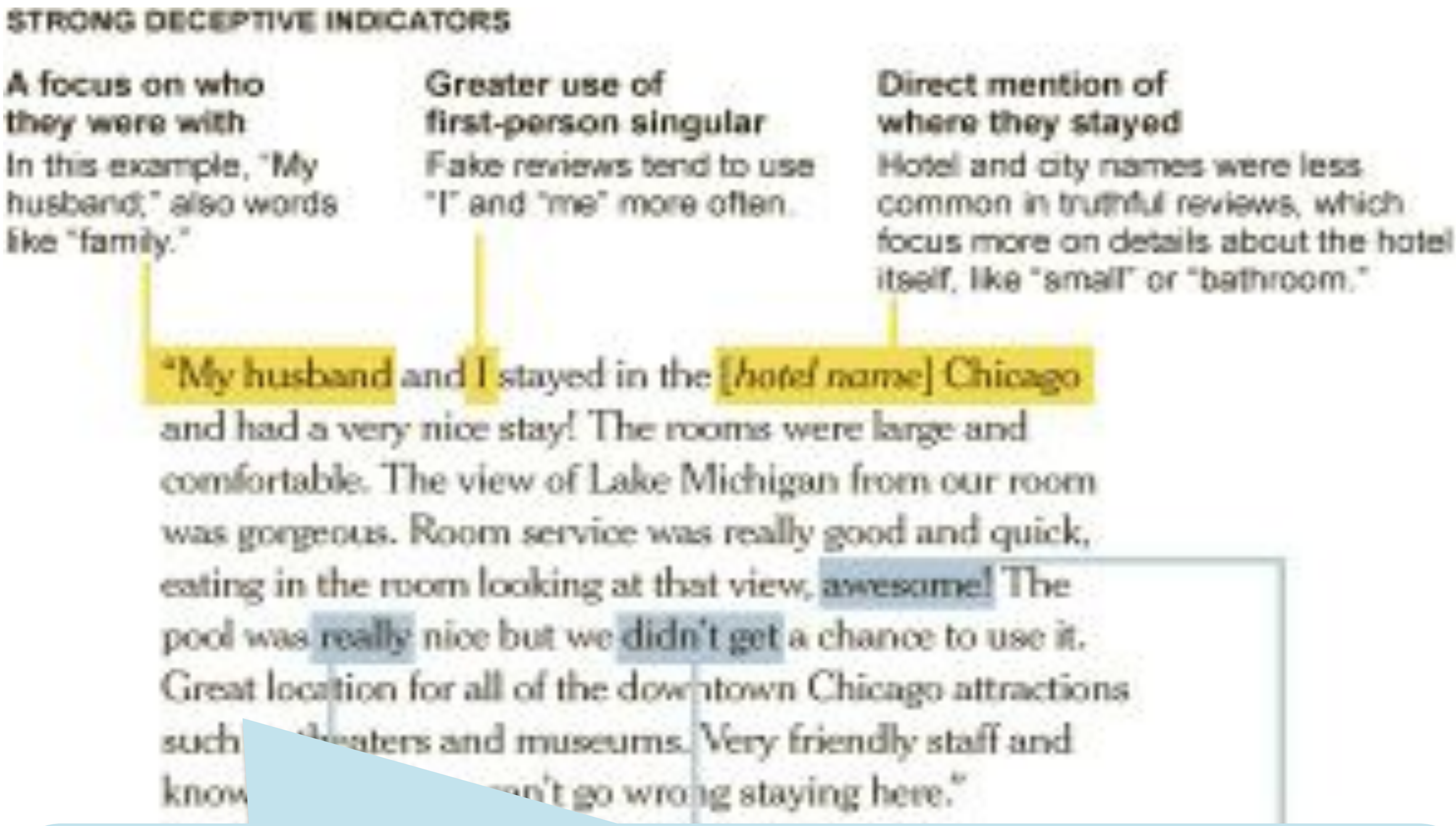
"My husband and I stayed in the [*hotel name*] Chicago and had a very nice stay! The rooms were large and comfortable. The view of Lake Michigan from our room was gorgeous. Room service was really good and quick, eating in the room looking at that view, awesome! The pool was really nice but we didn't get a chance to use it. Great location for all of the downtown Chicago attractions such as theaters and museums. Very friendly staff and knowledgable, you can't go wrong staying here."

SLIGHT DECEPTIVE INDICATORS

High adverb use
"Very" and "really" are both used twice; "here" is used once.

High verb use
"Get", "go", "use", "can't", "didn't", "eating", "had", "looking", "stayed", "was" (three times), "were."

Use of "!" and positive emotion
Deceptive reviews tend to use exclamation points, while truthful reviews used more punctuation of other kinds, including "$."



- lack of spatial, sensorial details (Vrij et al., 2009)
- lack of descriptive adjectives: low, small, shiny
- less use of prepositions

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co The view of Lake Michigan from our room
wa ervice was really good and quick,

instead, story telling:

-- why they were there: "vacation", "business", "anniversary"
-- whom they were with: "husband", "family"

"really" are both used twice; "here" is used once.

"eating", "had", "looking", "stayed", "was" (three times), "were."

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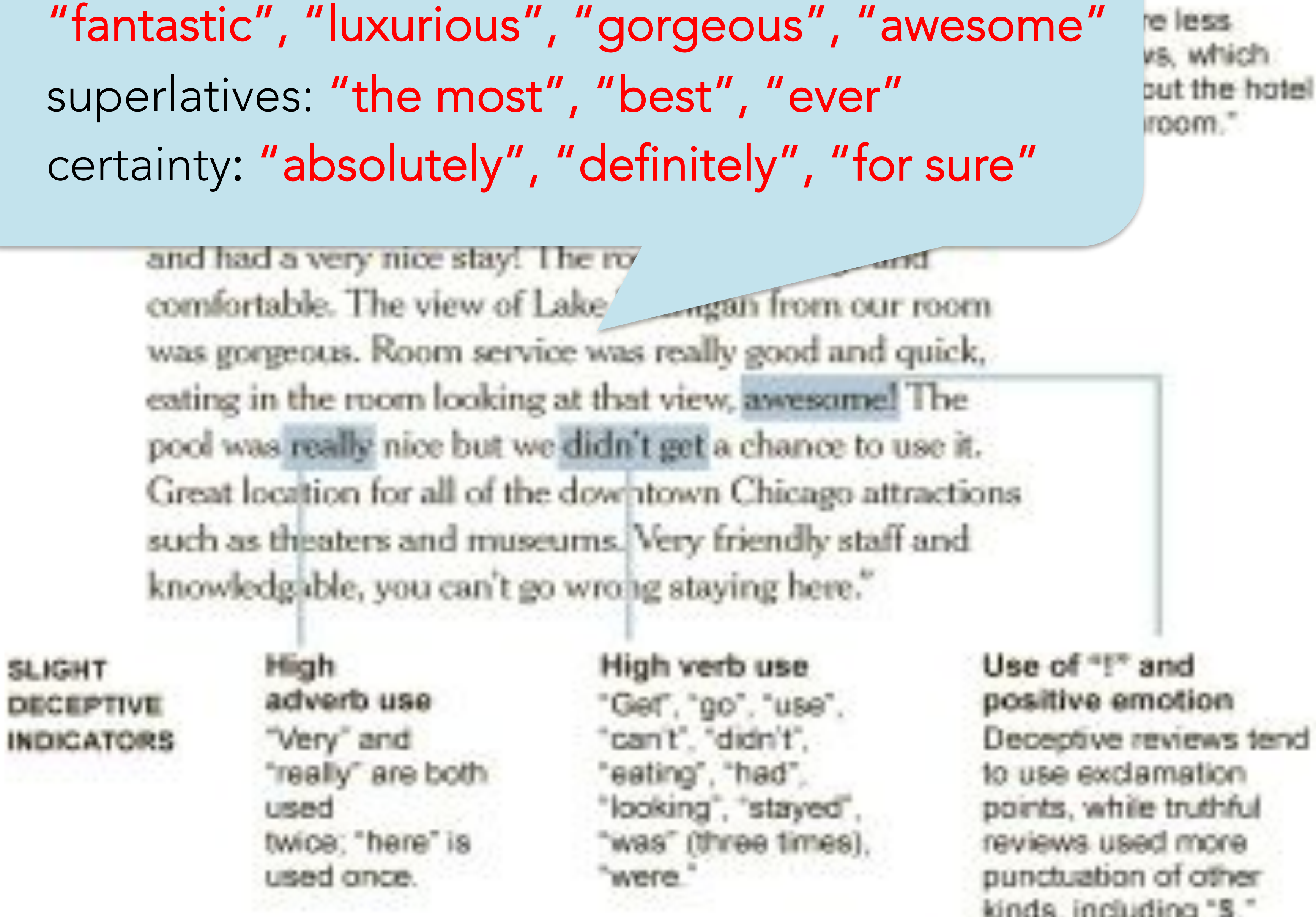
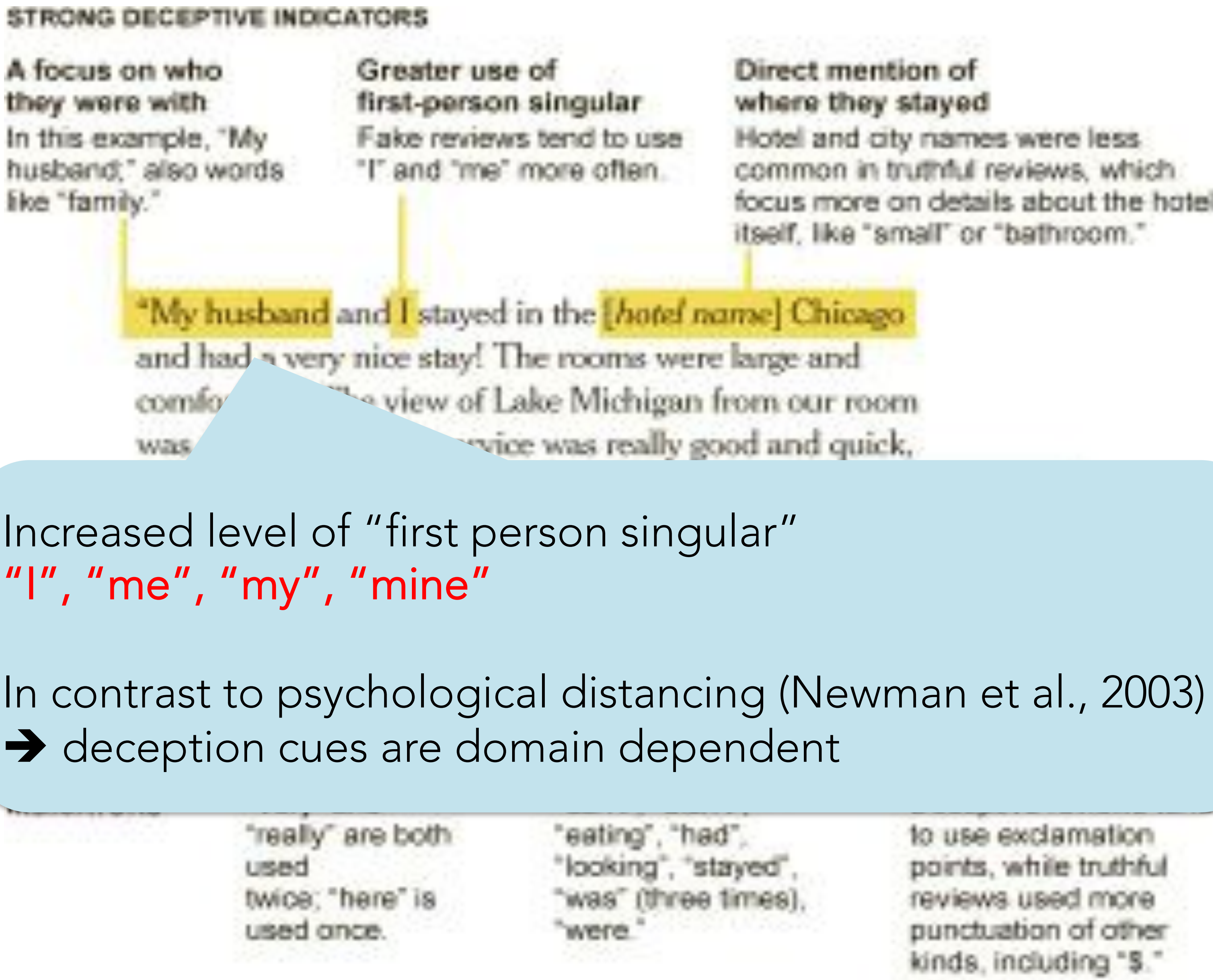
- exaggeration, words over the top: “fantastic”, “luxurious”, “gorgeous”, “awesome”
- superlatives: “the most”, “best”, “ever”
- certainty: “absolutely”, “definitely”, “for sure”





Increased level of "first person singular"
"I", "me", "my", "mine"

In contrast to psychological distancing (Newman et al., 2003)
➔ deception cues are domain dependent

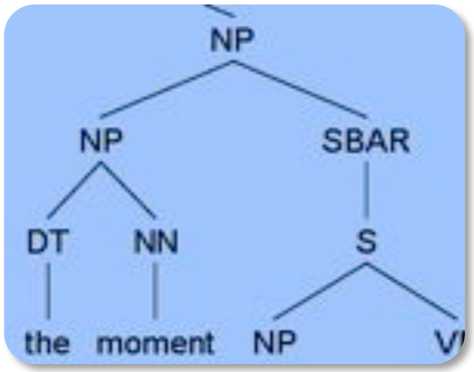
Two Follow-up Work

① Syntax Improves Deception Detection

(Feng et al., **ACL 2012**)

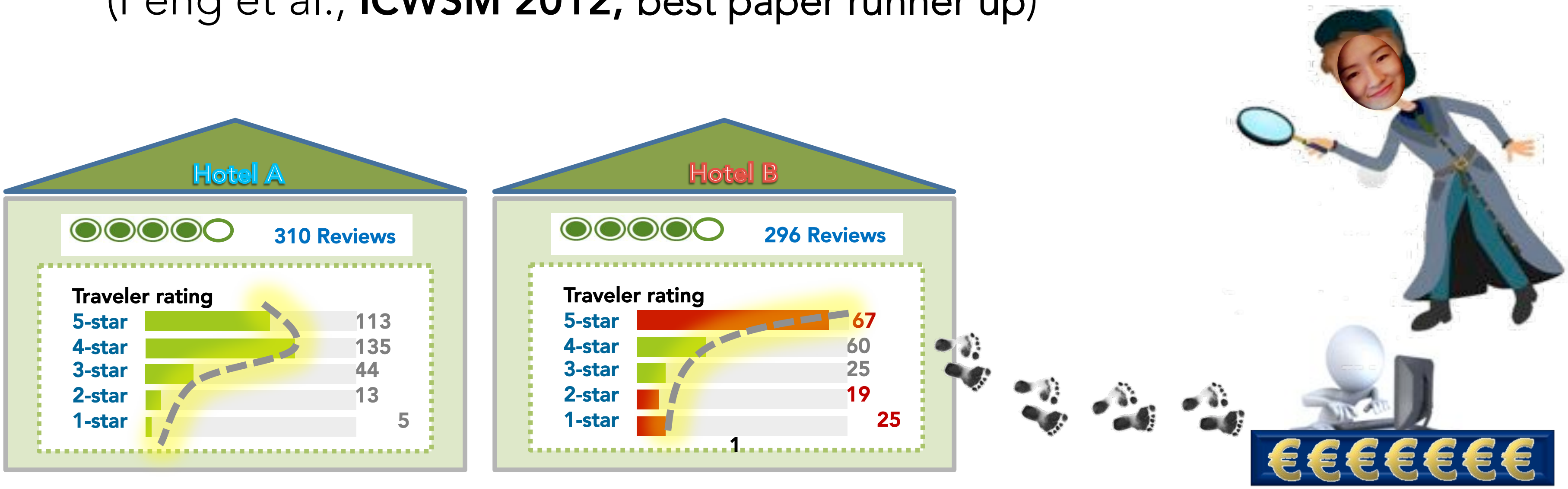
--- 3 product review dataset

---1 essay dataset (Mihalcea and Strapparava (2009))



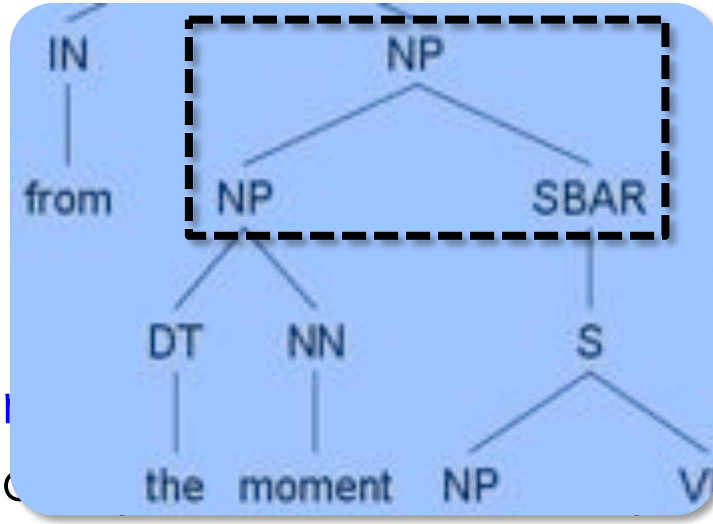
② Natural V.S. Distorted Distributions of Opinions

(Feng et al., **ICWSM 2012, best paper runner up**)



Feng et al. ACL 2012

More of this syntactic structure in deceptive product reivews



I a christening with my fiancé. I was
i <u>from the moment I checked in</u>. The
l modern with color and furnishings.
Front desk staff was pleasant and helpful, especially Susan, <u>who quickly suggested and reserved</u> a table for us at Keefer's Steakhouse for a late dinner. The room itself was fabulous. Extremely comfortable King sized bed, dual head shower, breathtakingly beautiful views, I couldn't ask for more. Next I was treated to a facial as my fiancé took a short run through the city. After a day full of shopping we retired to our room and ordered <u>room service that was on time and delicious</u>.

Conclusion (Part I – Deception)

- Learning to read the “intent” of the author, even a hidden one.
- Humans not good at this task.
- Computers may at times perform better than humans, even without full blown semantic understanding.
- Data-driven discovery of insights to complement hypothesis-driven research
- Domain-dependency of deception cues

Ganganath, Jurafsky, McFarland (EMNLP 2009)
➔ computers predict flirtation intention better than humans can, despite humans having access to vastly richer information (visual features, gesture, etc.).

Conclusion (Part I – Deception)

- Much revelation in "HOW" it is said.
  - ➔Deceptive reviewers write like novelists,
  - ➔truthful reviewers write like journalists,
  - ➔even POS distribution alone can achieve over 70%.
- Syntactic patterns require more attention.
- Need more expressive statistical models to analyze a richer set of elements in writing style

Ott et al. ACL 2011;
Feng et al. ICWSM 2012;
Feng et al. ACL 2012

I really loved my stay at the Talbott. My room was amazing! The bathroom (and I am VERY picky about hotel bathrooms) had ample room for all of my stuff, which is a bonus for me. The staff treated me really well and they were very friendly. I was afraid that I'd get a little lost, since it was my first trip to Chicago, but the staff helped me navigate to the downtown area (Rush St./Michigan Ave.-- which are *very* close by). The room service is 24 hours, which for me, was a bonus because I am up mostly during the nights. This is the *only* place I will ever stay if I visit Chicago again...

Stayed at the Monaco for a romantic weekend getaway and it was simply fantastic. Very convenient for walking to museums, shopping and park nearby. The room has a great box window that you can sit in and enjoy the view. We also requested a goldfish which was a pleasant surprise and added to the charm and uniqueness of the hotel. Helpful staff, wifi, Aveda products, decent restaurant downstairs for brunch, easy to get a taxi and nothing beats the location. I would definitely recommend staying at this hotel, for business or pleasure.

From Language to the Mind

Outline of the talk:

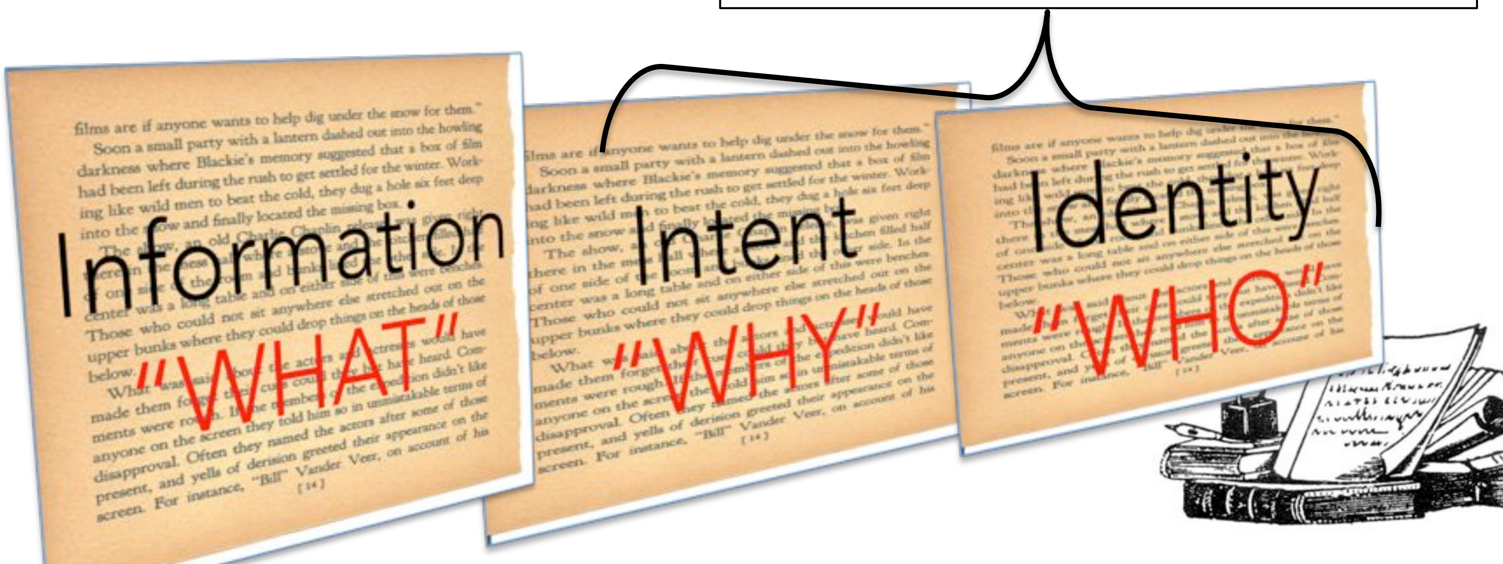
I. Deceptive Reviews and Essays

Success of Novels

III. Connotation of Words

"HOW" it is said

i.e., **Writing Style**

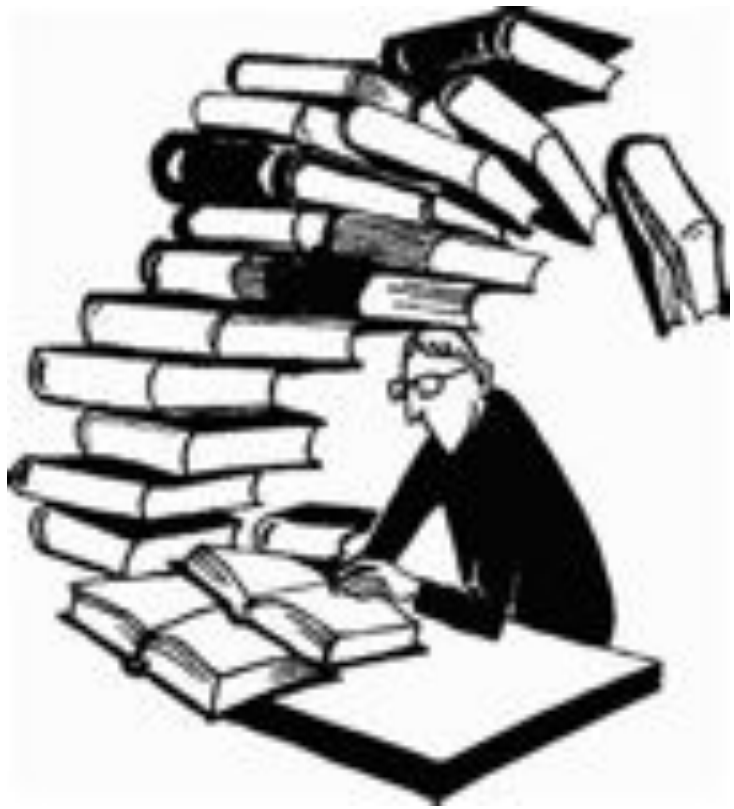


Predicting the success of novels

Novelty

Style of writing

Story line



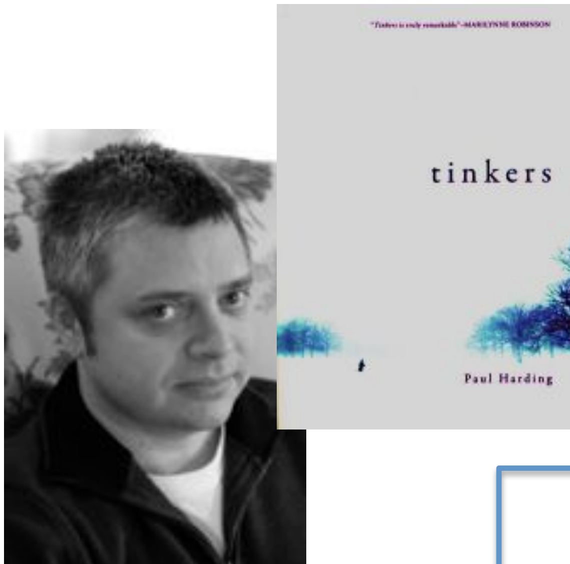
Social context

Luck !

Can Computers Predict the Success of Novels without Really Reading the Book?

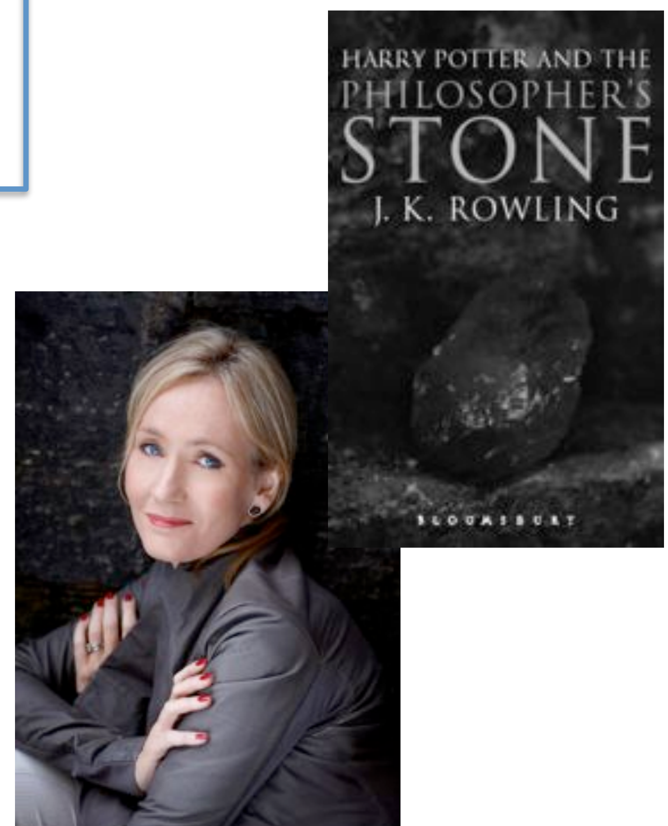
- based <u>only</u> on writing style
- stylistic correlates of successful novels?

Publishers do make mistakes



Paul Harding's "Tinkers" that won 2010 Pulitzer Prize for Fiction was rejected couple times before publication.

Rejected ~12 times before publication.



Can Computers Predict the Success of Novels without Really Reading the Book?

- based <u>only</u> on writing style
- stylistic correlates of successful novels?

How to
define success

How to

quantify success

Popularity v.s. Literary Quality

Best Seller
amazon.com


THE NEW YORK TIMES BOOK REVIEW

Best Sellers

FICTION

1 **MINDSTRETCH**, by Pamela McLaughlin. (Warner, $24.95.) Trang Martinez suspects her Pilates instructor may also be a vicious serial killer. — 1

2 **SAGEKNIGHTS OF DARKHORN**, by Gerry Banion. (Morrow, $26.95.) Astrid Soulblighter attempts to reclaim the throne from the wicked Scarking clan. The fifteenth volume of the "Bloodrealms" series. — 1 — 3

3 **THE BALTHAZAR TABLET**, by Tim Drew. (Doubleday, $24.95.) The murder of a cardinal leads a Yale professor and an underwear model to the Middle East, where they uncover clues to a conspiracy kept hidden by the Shriners. — 3 — 58

4 **GREAT FISH**, by Liz Martin. (Simon & Schuster, $23.95.) The Biblical story of Jonah, retold from the point of view of the whale. — 5 — 18

5 **NICK BOYLE'S SHOCK BLADE: LYNCHPIN**, by Simon Moskowitz. (Broadman & Holman, $24.99.) After a coup by Admiral Chao threatens to destroy the Internet, the ShockBlade team is forced to ally with their Chinese rivals. — 1

NONFICTION

1 **CRACKED LIKE TEETH**, by Dexter Eagan. (Morrow, $25.95.) A memoir of petty crime, drunken brawls, and recovery, by a writer who was addicted to paint thinner by age nine. — 1

2 **EMPANADAS IN WORCESTER**, by James Wirzbicki. (Farar, Straus & Giroux, $27.50.) Traveling from Khartoum to Madras to Rhode Island, a commentator for CNN suggests globalization means a stranger but friendlier world in the 21st century. — 26

3 **WRONG: THE LIBERAL PLAN TO HIJACK YOUR LIFE AND PERVERT YOUR KIDS**, by Katie Crispin. (ReganBooks/HarperCollins, $25.95.) The host of TV's "Smashmouth" takes aim at "Hollywood mind-molesters," "media jihadis," public school teachers, and others. — 1

4 **NEEDS IMPROVEMENT IN ALL AREAS**, by Margot Kilby with Sean Boyland. (ReaganBooks/HarperCollins, $29.95.) An attack on President George W. Bush, written by his former kindergarden teacher. — 3 — 4

5 **JOCKSTRAPS AIN'T FOR EATING**, by J. D. Preggerson. (St. Martin's, $29.95.) The former — 7 — 2

Project Gutenberg Downloads

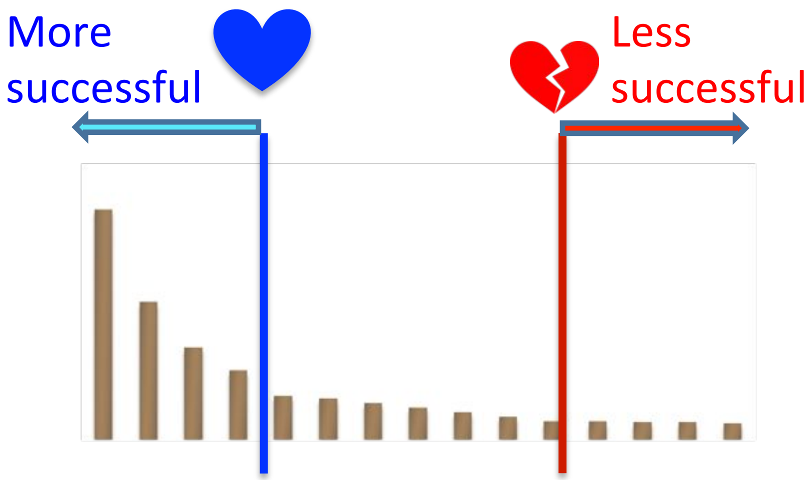
2013-10-10

last 7 days

last 30 days

Dataset

- Project Gutenberg
  - free ebooks.
  - Title, author, genre, download count.
- 50 books per class, 8 genres.



Dataset

- Project Gutenberg
  - offers over *40,000* free ebooks.
  - Title, author, genre, download count.
- 50 books per class, 8 genres.
- <=2 books per author.

~~**Authorship attribution**~~

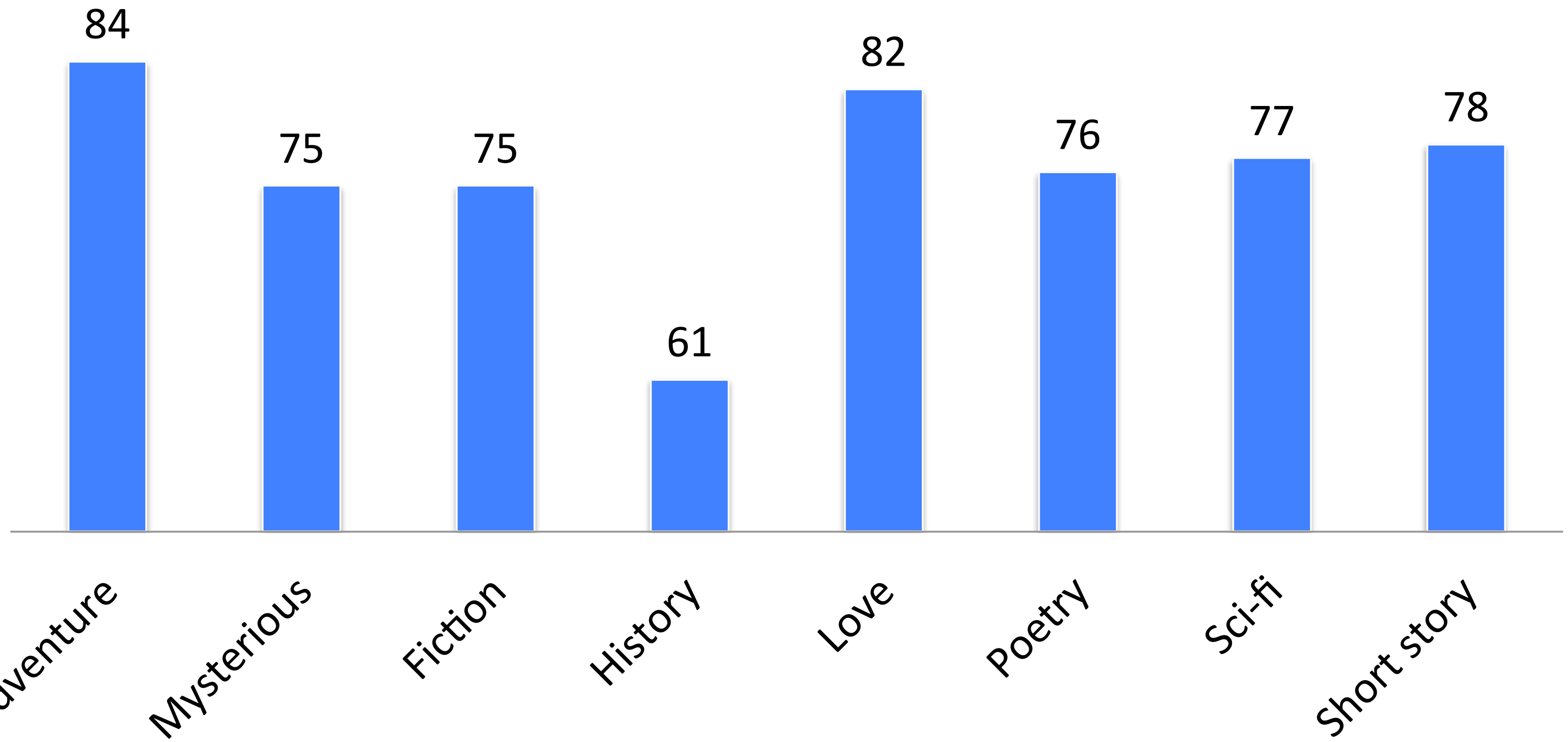
Stylistic Elements as Features

- Lexical Choices
  - unigrams / bigrams
- Word Categories
  - Distribution of POS tags
- Constituents
  - Distribution of Phrasal & Clausal tags in PCFG trees
- Grammatical Rules
  - CFG rules (e.g. NP^VP → NP PP , SBAR → S WHNP)

Experiments

- Setup
  - Feature encoding: tf-idf
  - 80% training, 20 % testing
  - 5-fold cross validation
  - LIBLINEAR (Fan et al., 2008) with L2-regulization

Prediction Results



This is Surprising Because…

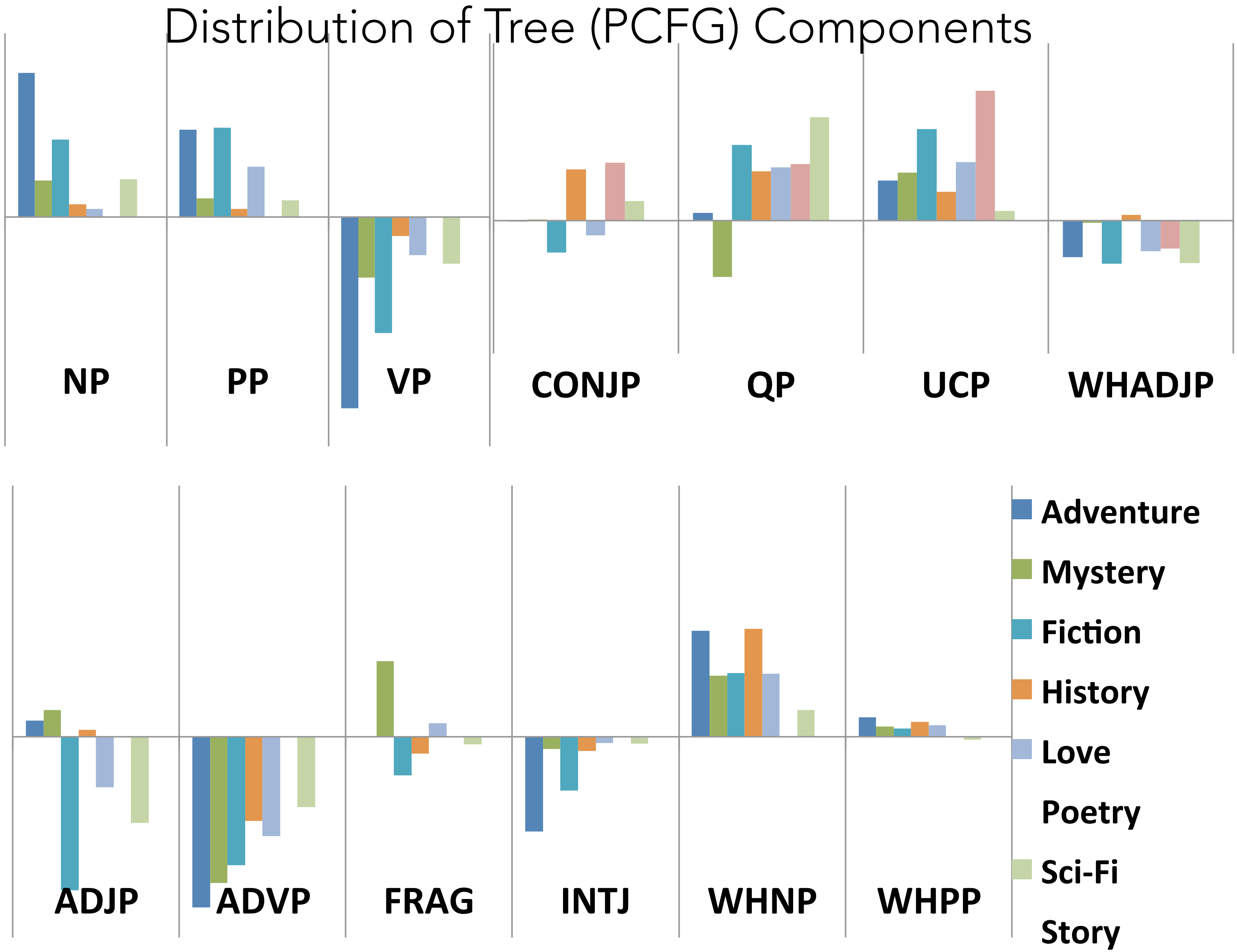
- Not considering any other influencing factor, not actually understanding the story, only looking at writing styles

- Different writers have wildly different writing styles. Should there even be stylistic commonalities shared by those different individuals?

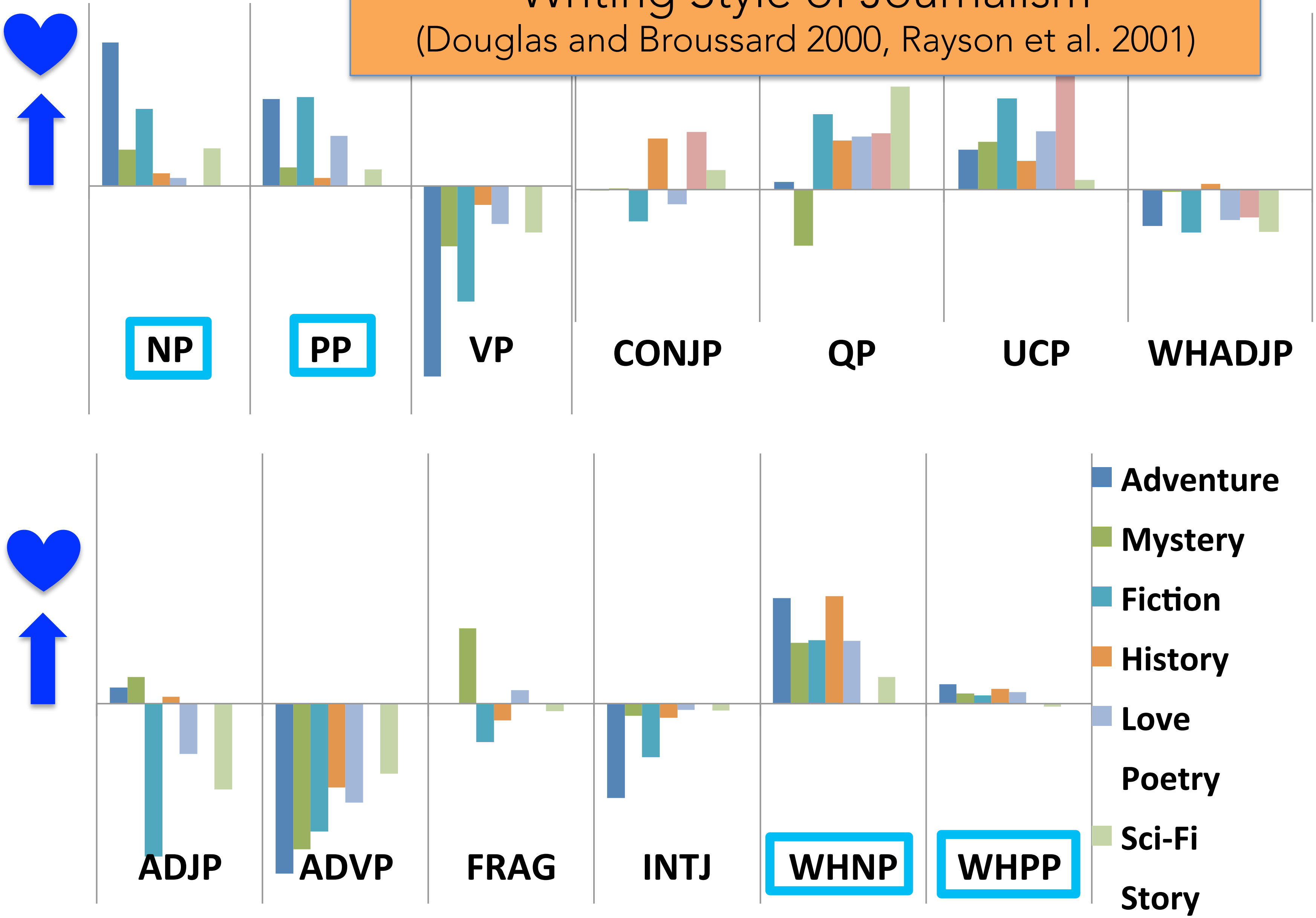
- Testing : only the books by previously unseen authors (who presumably have his/her own unique writing style)

Secret Elements
in Successful Novels

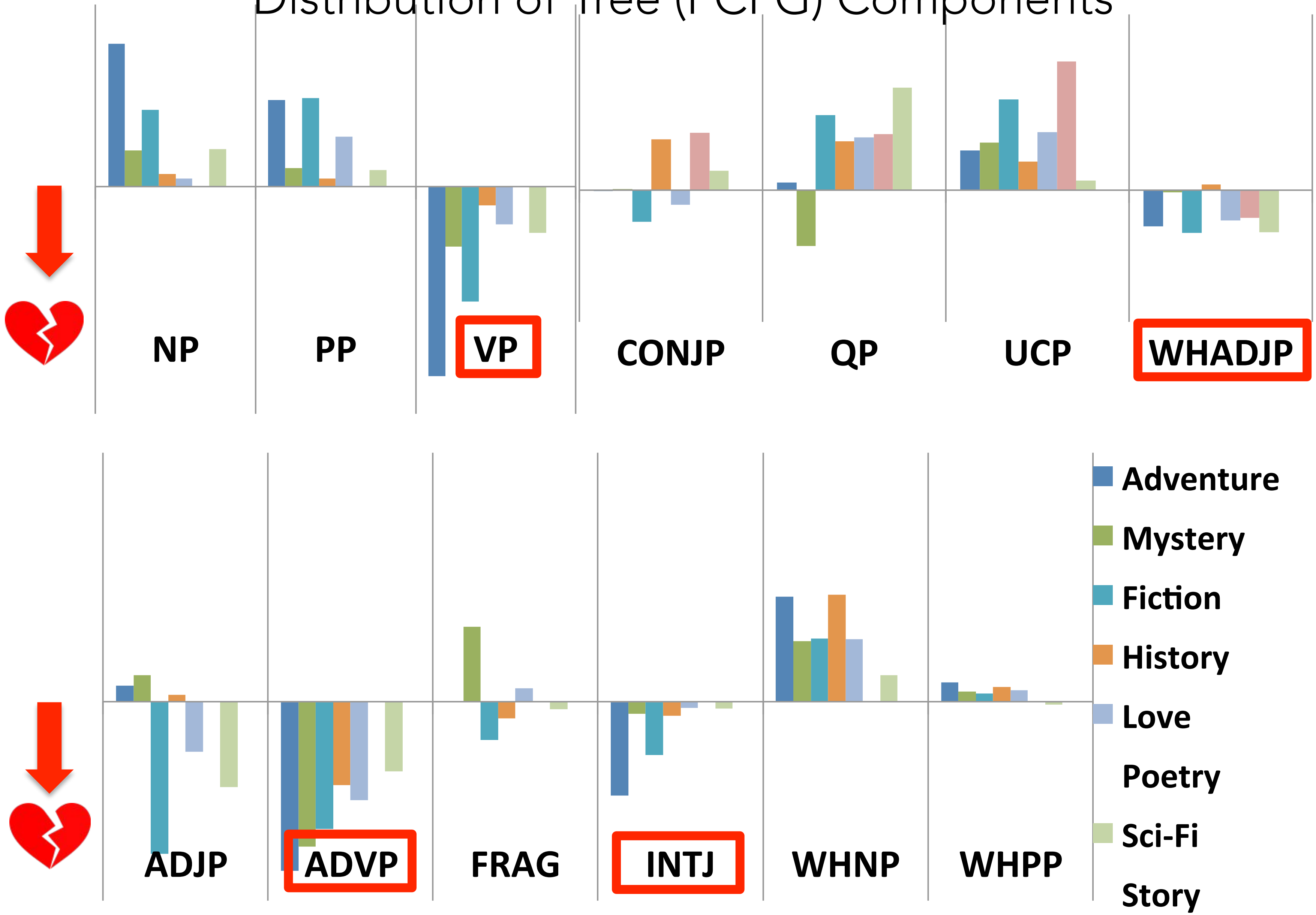
(only as correlates, not to be confused as causality)


Distribution of Tree (PCFG) Components
NP
PP
VP
CONJP
QP
UCP
WHADJP
ADJP
ADVP
FRAG
INTJ
WHNP
WHPP
Adventure
Mystery
Fiction
History
Love
Poetry
Sci-Fi
Story

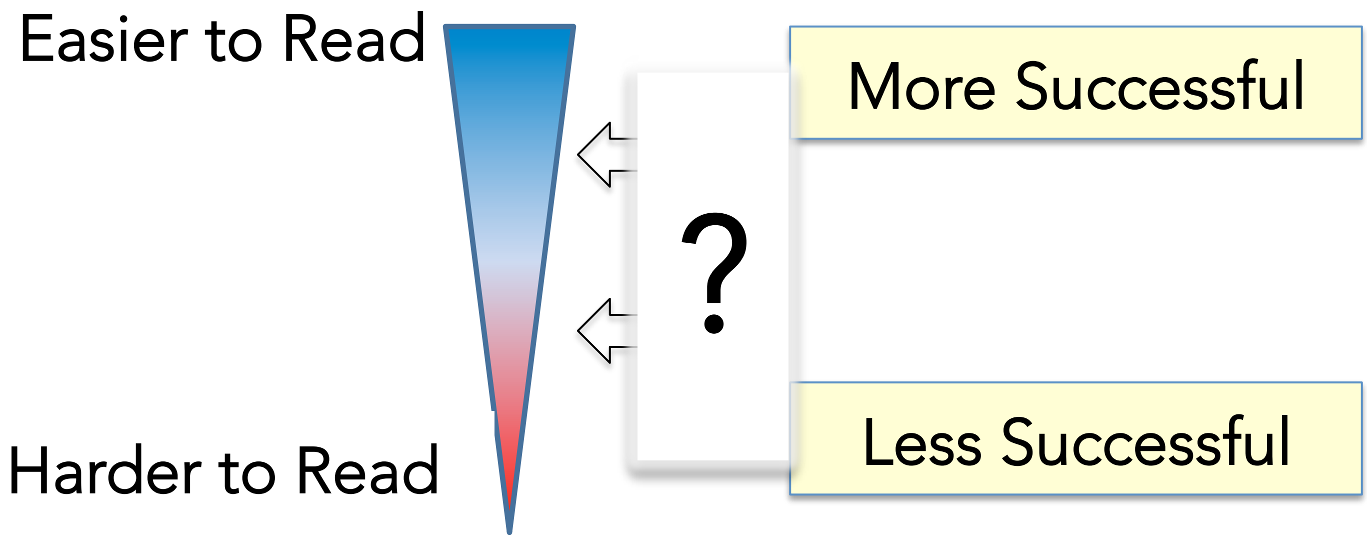
Writing Style of Journalism
(Douglas and Broussard 2000, Rayson et al. 2001)



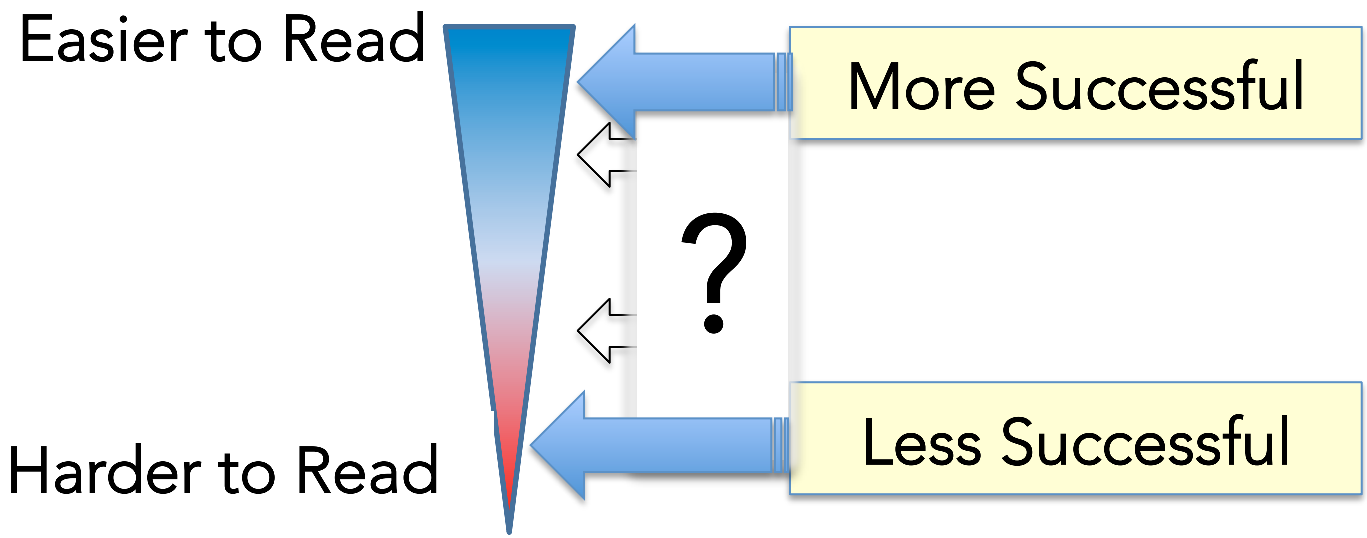
Distribution of Tree (PCFG) Components



Readability & Literary Success

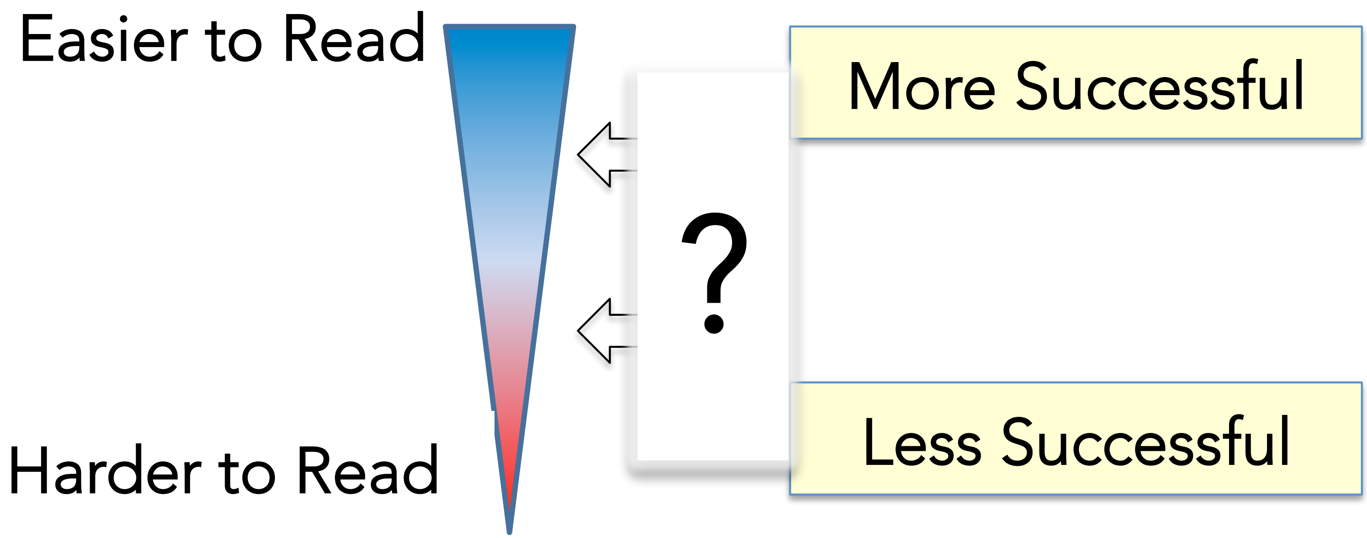


Readability & ~~Literary Success~~ Success in Academic Journals (best paper awards)

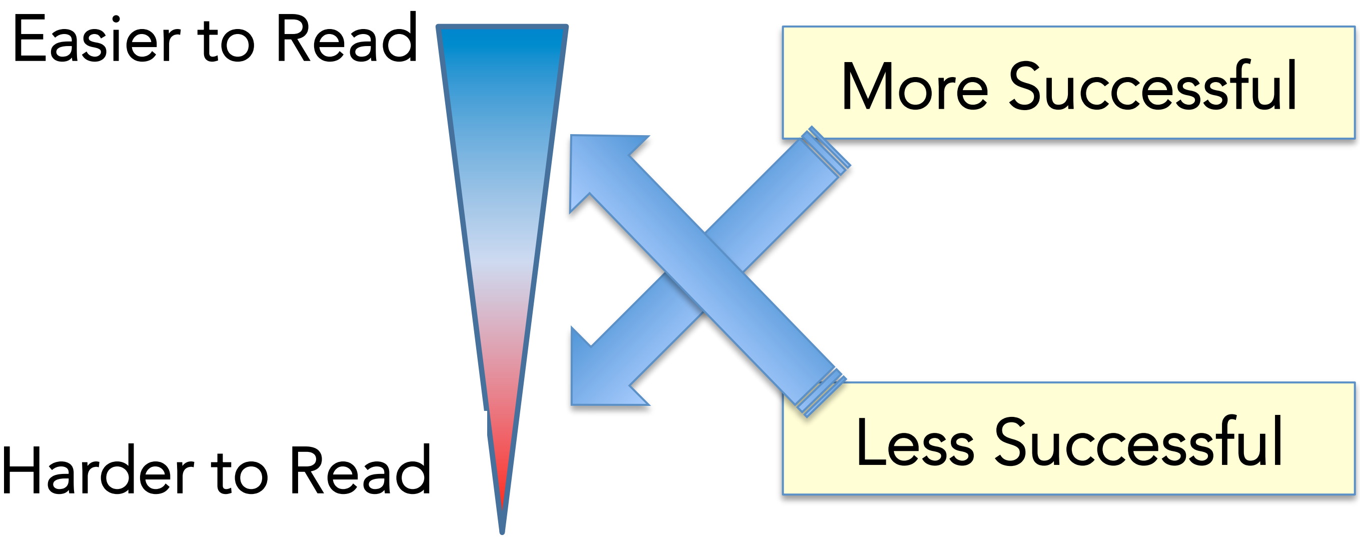


Sawyer et al (2008) @ Journal of Marketing

Readability & Literary Success



Readability & Literary Success



1. Increased use of VP= better readability (Pitler and Nenkova (2008)
2. Readability Indices:

METRIC	More Successful	Less Successful
FOG index	9.88	9.80
Flesch index	87.48	87.64

Insights into Lexical Choices (w.r.t. Adventure Genre)

Less successful: explicit **telling**

- verbs that are **explicitly descriptive** of actions and emotions: want, went, took, promise, cry, shout, jump, glare, urge
- **extreme** words: never, very, breathless, absolutely, perfectly
- **cliche**: love (desires, affair), body parts (face, arms, skin), obvious locations (beach, room, boat, avenue)

More successful: implicit **showing**

- verbs that describe **thought-processing**: recognized, remembered

  except for "*think*", which is a more direct and general word
- verbs for **reports** or **quotes**: said
- **prepositions**: up, into, out, after, in, within
- **discourse connectives:** and, which, though, that, as, after

Testing on Literature beyond Project Gutenberg

To validate whether the “download” counts of Project Gutenburg is a reasonable quantification of success

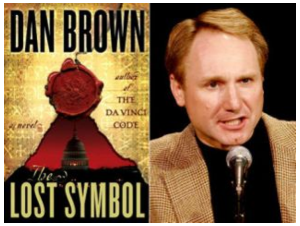
Training on Project Gutenberg, testing on...

	More Successful	Less Successful
Train	**#Download (400)**	**#Download (400)**
Test	 **(10)**	**Amazon Best Sellers Rank** Rank lower than 200,000 **(4)**

Training on Project Gutenberg, testing on...

	More Successful		Less Successful	
Train	**#Download (400)**		**#Download (400)**	
Test		**(10)**	**Amazon Best Sellers Rank** Rank lower than 200,000	**(4)**

Download counts at Project Gutenberg reflect more on literary quality than commercial success



Three Classifiers

- KL-divergence based
  - Distribution of phrasal & clausal tags of PCFG trees
  - Only 26 features, no lexical information
  - Deliberately deficient information to check whether "high-level syntactic commonalities" exist among highly successful novels.
  - Classification based on KL divergence
- Unigram-feature based
- PCFG-grammar rule based
  - including rules covering leaf nodes

Prediction Results = avg 80%

(all results, no cherry picking)

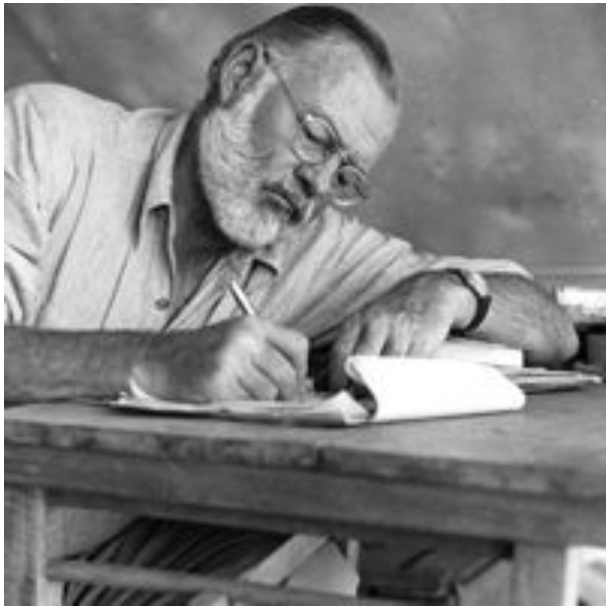
More Successful

Classifier used	# of correct prediction / 10 books
KL Divergence	8/10
SVM with Unigram features	10/10
SVM with PCFG features	10/10

Less Successful

Classifier used	# of correct prediction / 10 books
KL Divergence	3/4
SVM with Unigram features	3/4
SVM with PCFG features	2/4

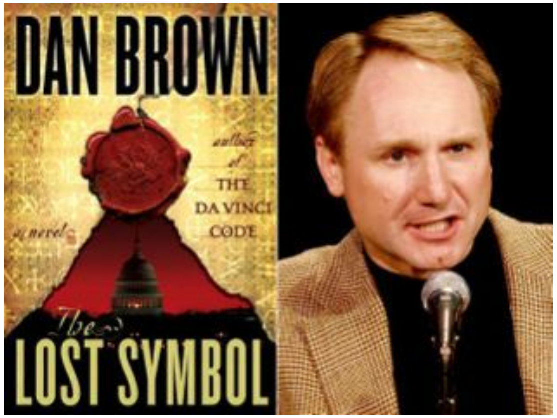
“The old man and the sea” by Ernest Hemingway



Signature style: minimalism
70% simple sentences.

Classifier used	correct prediction ?
KL Divergence	no
SVM with Unigram features	yes
SVM with PCFG features	yes

"The lost symbol" by Dan Brown



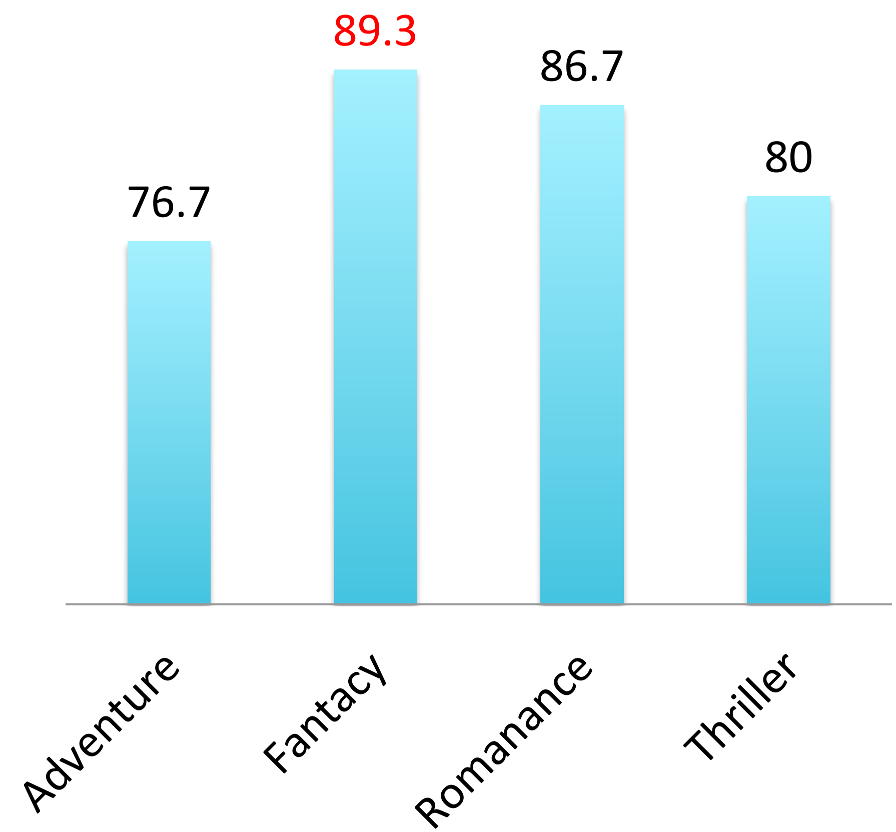
Significant criticisms on the quality of writing despite the commercial success

Classifier used	correct prediction ?
KL Divergence	yes
SVM with Unigram features	yes
SVM with PCFG features	yes

How about Movie Scripts?

Predicting the Success of Movie Scripts

- movie script dataset
  (Danescu-Niculescu-Mizil and Lee, 2011)
- quantifying success: IMDb ratings
  - More successful : >= 8
  - Less successful: <= 5.5
- over 11 genres
- 15 movies per class, per genre



- good perf in some genres, but not all. more investigation with larger dataset needed
- additional factors (actors, directors, budgets) are likely to be more important in this domain

From Language to the Mind

Outline of the talk:

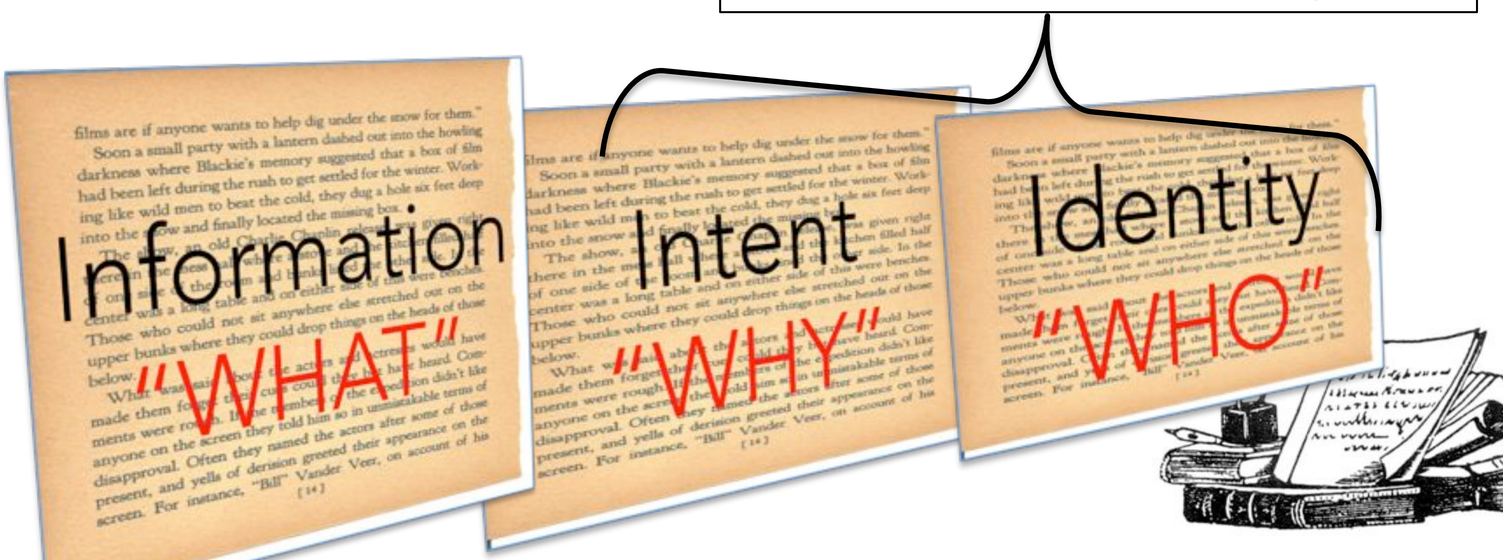
I. Deceptive Reviews and Essays

II. Success of Novels

Connotation of Words

"HOW" it is said

i.e., **Writing Style**



Con•notation

“com-” (“together or with”) | “notare” (“to mark”)

Commonly understood cultural or emotional *association* that some word carries, in addition to its explicit or literal meaning (denotation).

Words	Connotation
music scientist surfing rose	positive
flu emission deforestation bedbug	negative

More explicit
"telling"

the most elegant and unique table that you will never find anywhere else, this absolute exotic beauty will add an antique warmth to your living room.

Creating
an exotic feeling
by "showing"

Part sculpture, part table, all artisanal. Craftspeople in Jaipur, India, hand carved the delicate rosettes on this low-lying solid mango wood table, which takes its original inspiration from a ceremonial stool used by Bamileke royalty in the African country of Cameroon.

Connotation: a Dash of Sentiment beneath the Surface Meaning

Motivation:

1. Intent

➔ overtone / undertone of the writing that the author intends to deliver

2. An element of writing style

➔ showing v.s. telling

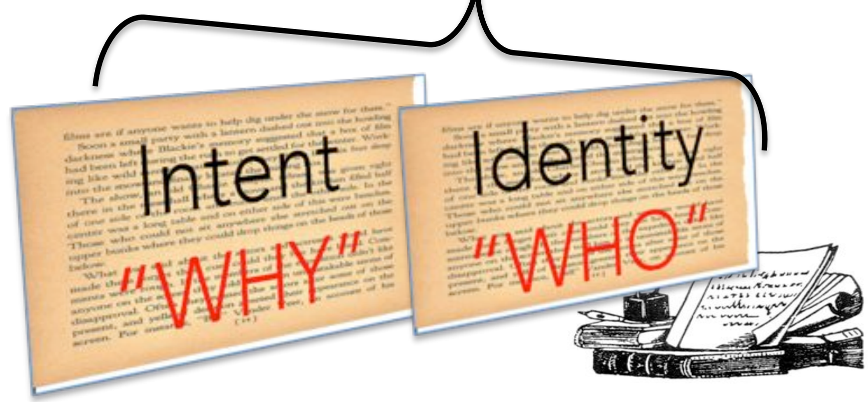
In comparison to sentiment analysis:

➔ more nuanced sentiment

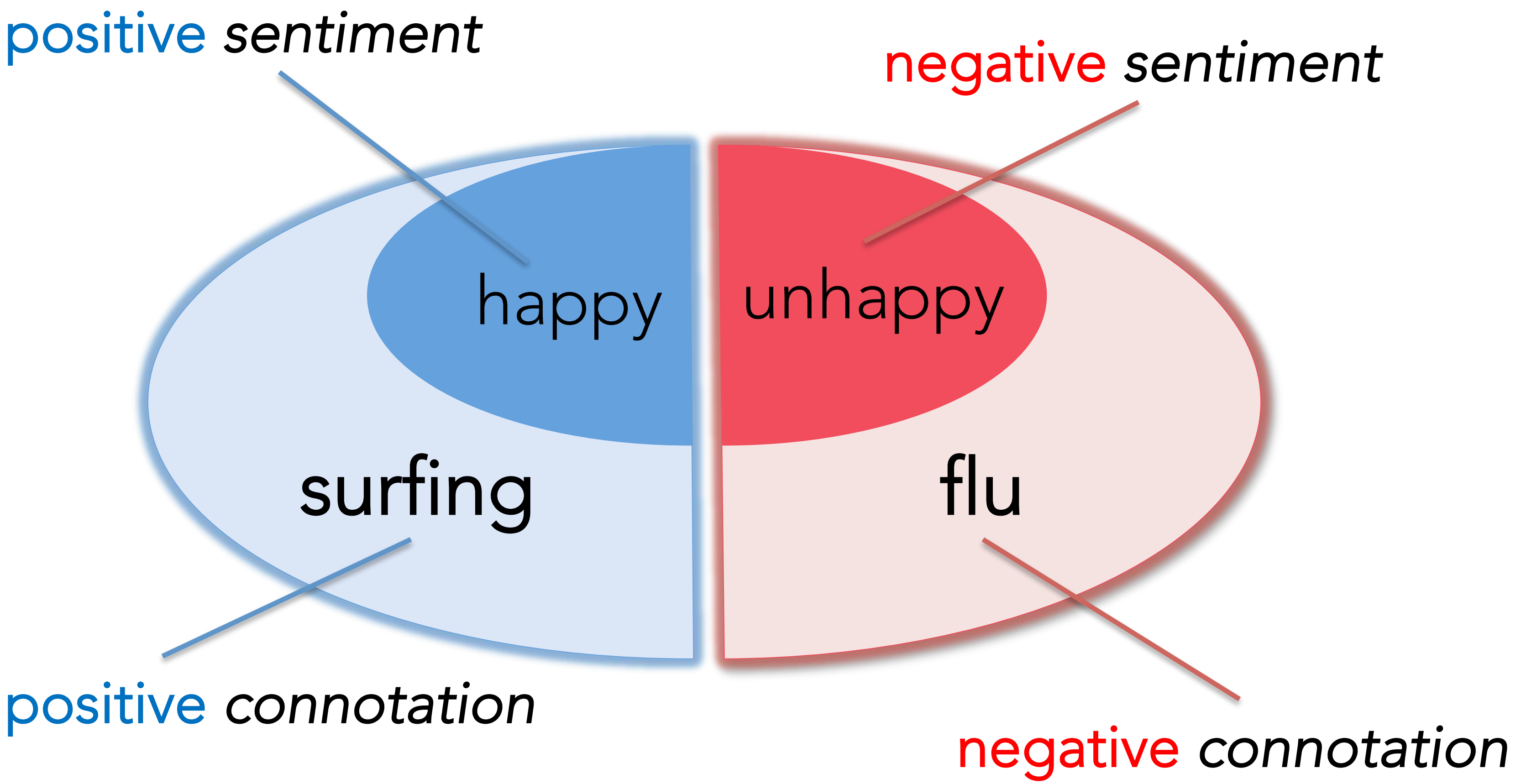
➔ subjectivity via seemingly objective descriptions

"HOW" it is said

i.e., **Writing Style**



Sentiment vs. Connotation



Key Insight: "Connotative Predicate"

Connotative Predicate: (Feng et al. 2011)

- A predicate that has *selectional preference* on the connotative polarity of some of its semantic arguments.
- Semantic Prosody (Sinclair 1991, 2004, louw 1993)

Connotative Predicate	Sentiment of predicate	Preference on arguments	Examples
suffer			"suffer coldness"
cure			"cure cancer"
cause			"cause emission"

20 Positive Connotative Predicates

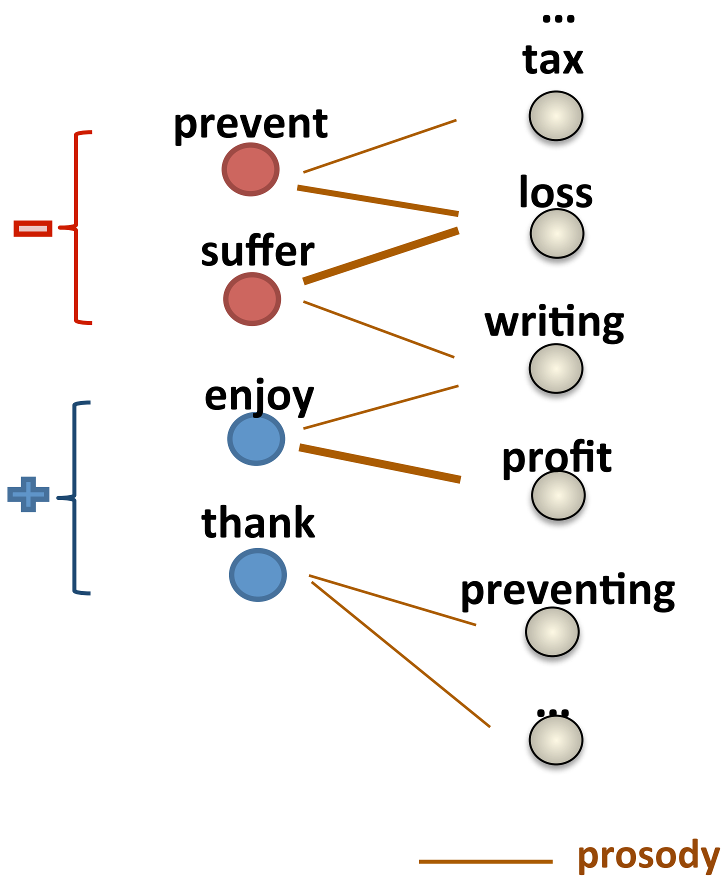
accomplish, achieve, advance, advocate, admire, applaud, appreciate, compliment, congratulate, develop, desire, enhance, enjoy, improve, praise, promote, respect, save, support, win

20 Negative Connotative Predicates

alleviate, accuse, avert, avoid, cause, complain, condemn, criticize, detect, eliminate, eradicate, mitigate, overcome, prevent, prohibit, protest, refrain, suffer, tolerate, withstand

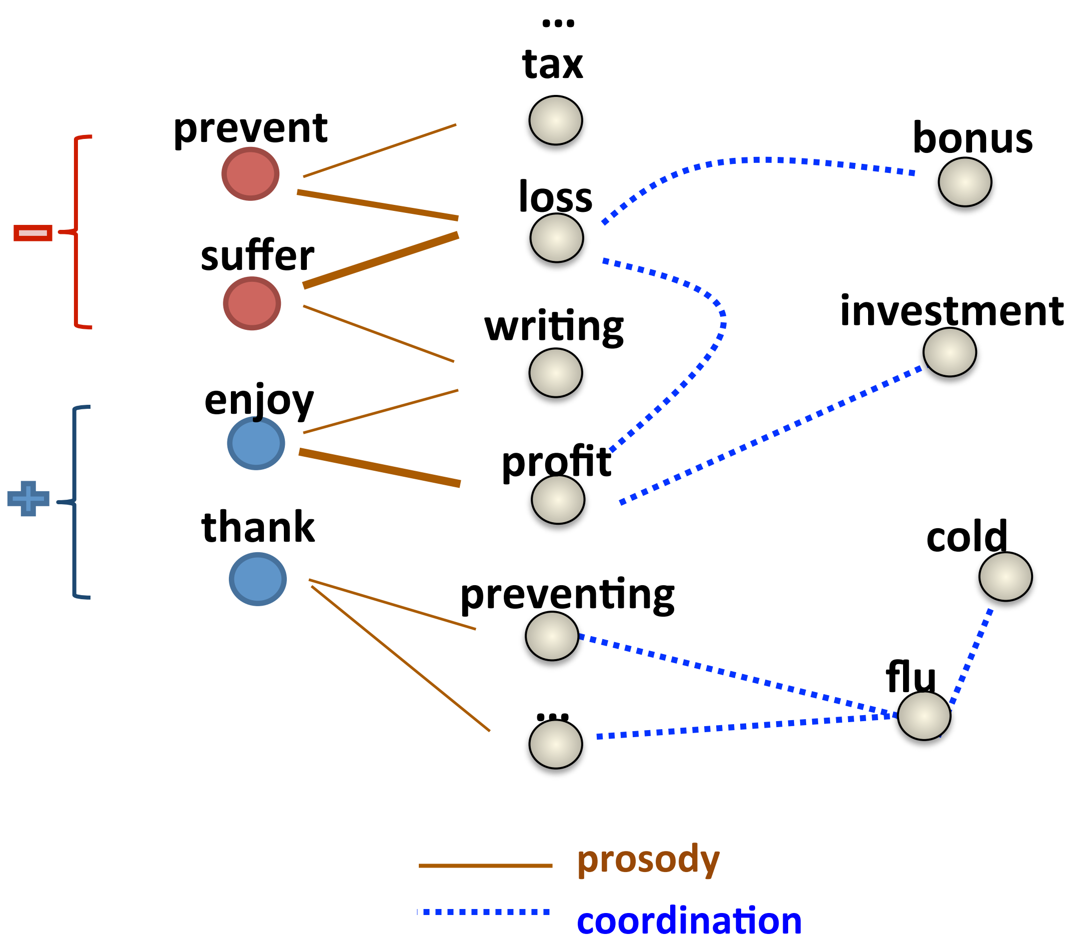
Feng et al. 2011

Network of Words



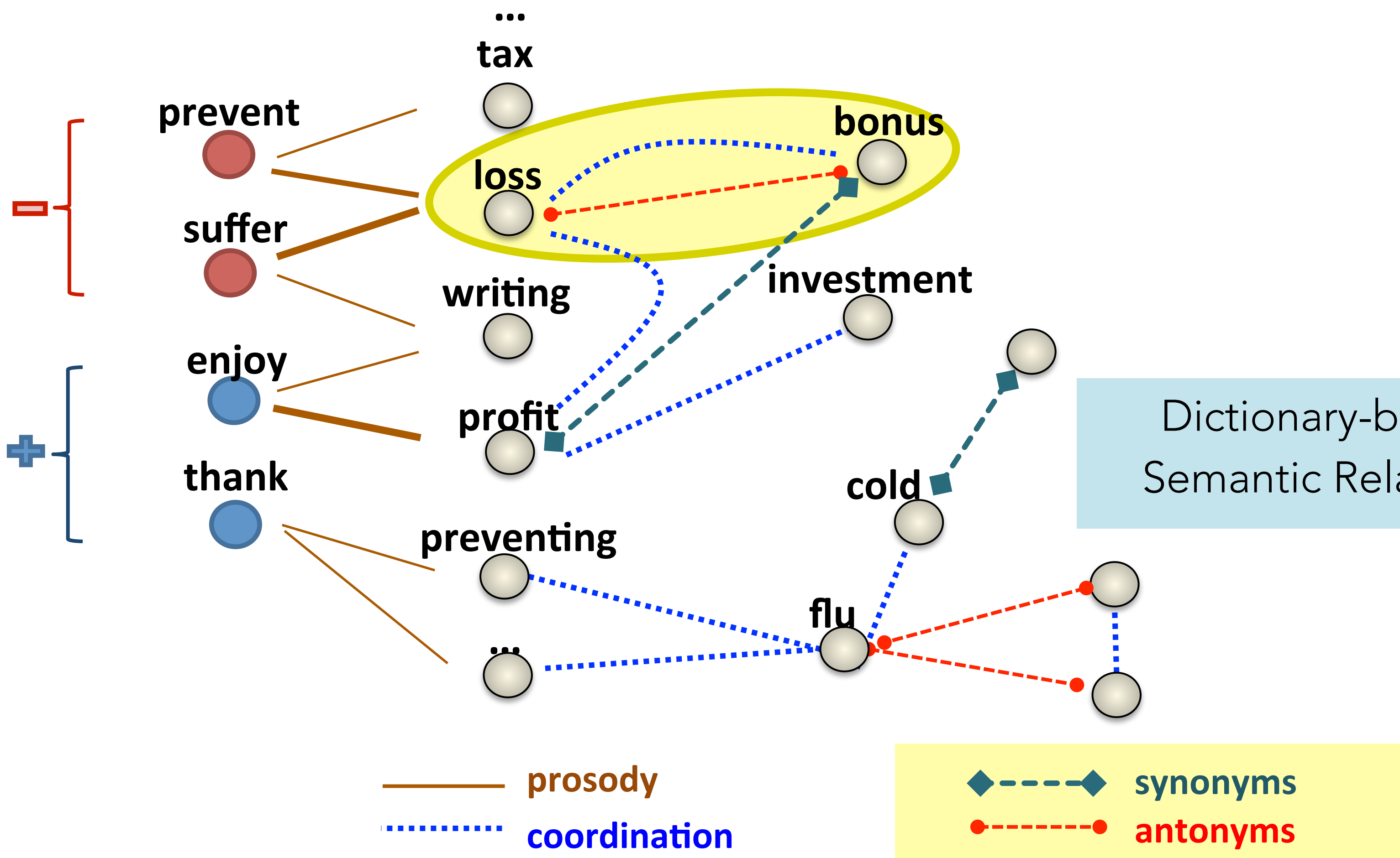
Semantic prosody
(Connotative Predicates – Arguments)

Network of Words



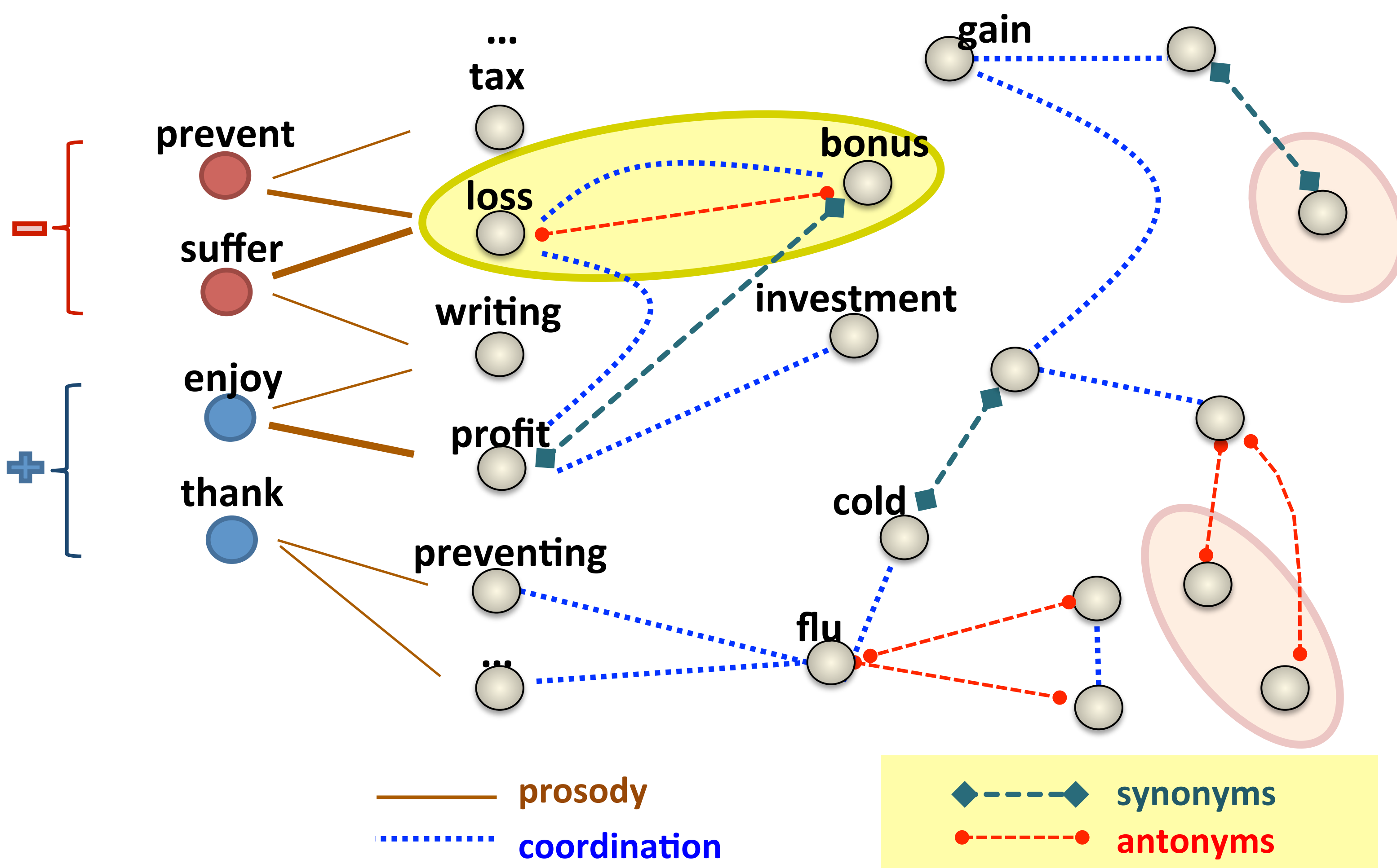
Semantic Parallelism
across coordination
(X and Y)

Network of Words



Dictionary-based
Semantic Relations

Network of Words



Connotation Assignment as Constraint Optimization

1. Integer Linear Programming
2. Linear Programming

~1 million variables
~2 million constraints

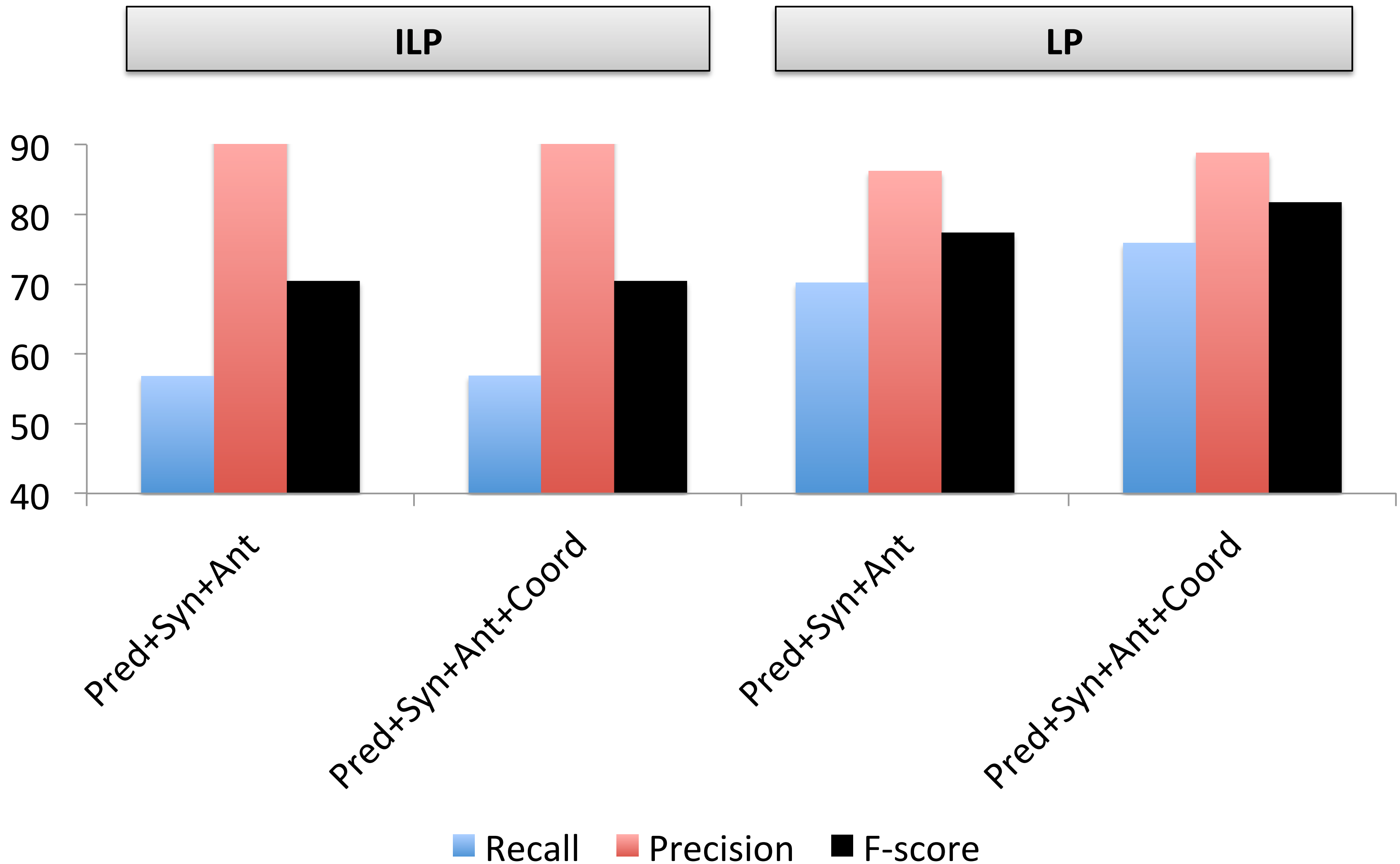
$$\boxed{F = \Phi^{prosody} + \Phi^{coord} + \Phi^{syn} + \Phi^{ant} + \Phi^{neu}}$$

$$\begin{aligned}
\Phi^{prosody} &= \sum_{i,j}^{\mathcal{R}^{pred^+}} w_{i,j}^{pred^+} \cdot x_j + \sum_{i,j}^{\mathcal{R}^{pred^-}} w_{i,j}^{pred^-} \cdot y_j \\
\Phi^{coord} &= \sum_{i,j}^{\mathcal{R}^{coord}} w_{i,j}^{coord} \cdot (dc_{i,j}^{++} + dc_{i,j}^{--}) \\
\Phi^{syn} &= W^{syn} \sum_{i,j}^{\mathcal{R}^{syn}} (ds_{i,j}^{++} + ds_{i,j}^{--}) \\
\Phi^{ant} &= W^{ant} \sum_{i,j}^{\mathcal{R}^{ant}} (da_{i,j}^{++} + da_{i,j}^{--}) \\
\Phi^{neu} &= \alpha \sum_{i,j}^{\mathcal{R}^{pred}} w_{i,j}^{pred} \cdot z_j
\end{aligned}$$

$$\begin{aligned}
ds_{i,j}^{++} &\leq x_i - x_j, \quad ds_{i,j}^{++} \leq x_j - x_i \\
ds_{i,j}^{--} &\leq y_i - y_j, \quad ds_{i,j}^{--} \leq y_j - y_i
\end{aligned}$$

$$\begin{aligned}
da_{i,j}^{++} &\leq x_i - (1 - x_j), \quad da_{i,j}^{++} \leq (1 - x_j) - x_i \\
da_{i,j}^{--} &\leq y_i - (1 - y_j), \quad da_{i,j}^{--} \leq (1 - y_j) - y_i
\end{aligned}$$

ILP/LP Comparison with MPQA

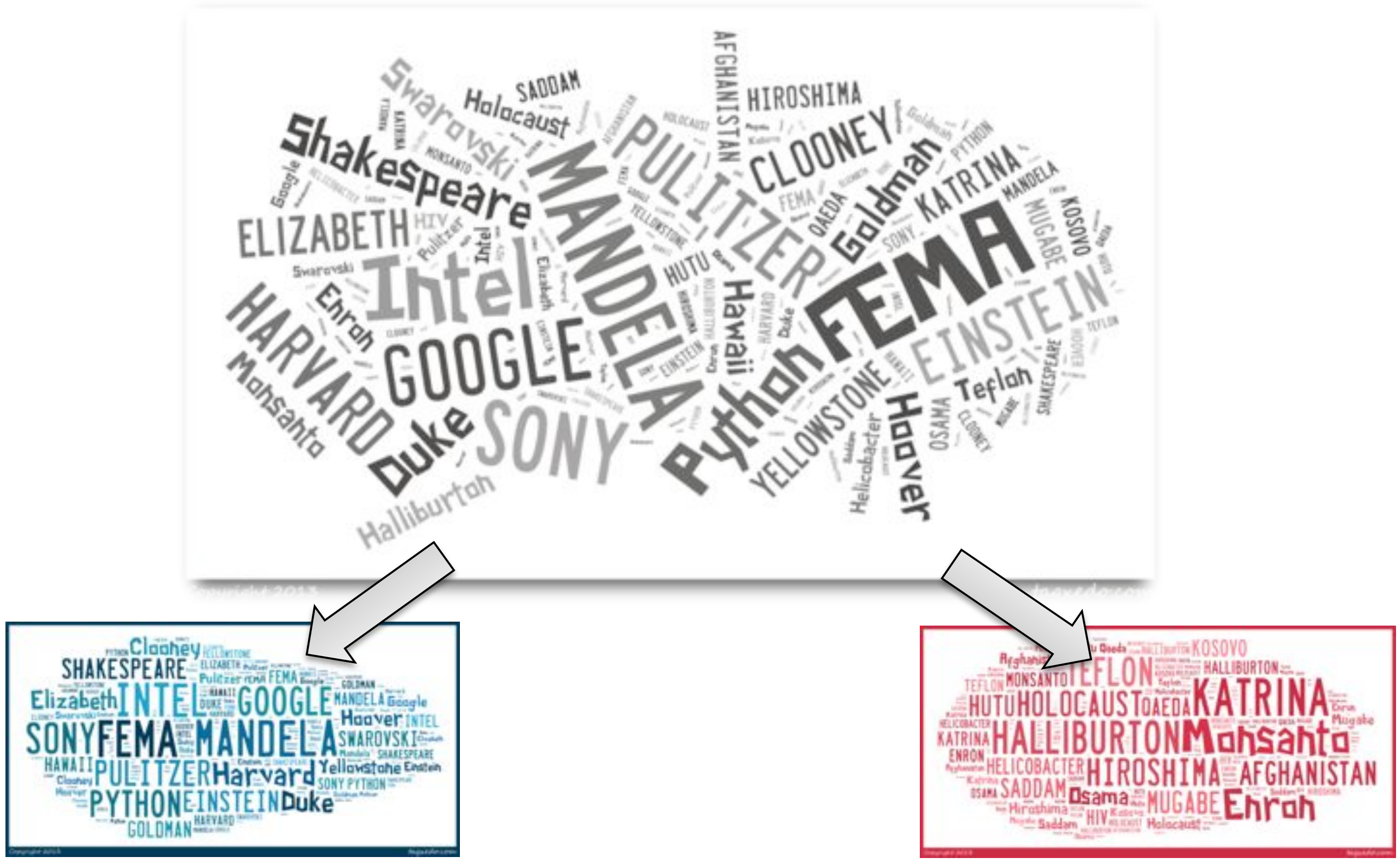


Learning connotation of real world entities

Positive	Negative
FEMA, Mandela, Intel, Google, Python, Sony, Pulitzer, Harvard, Duke, Einstein, Shakespeare, Elizabeth, Clooney, Hoover, Goldman, Swarovski, Hawaii, Yellowstone	Katrina, Monsanto, Halliburton, Enron, Teflon, Hiroshima, Holocaust, Afghanistan, Mugabe, Hutu, Saddam, Osama, Qaeda, Kosovo, Helicobacter, HIV

Potential Application - I

- Learning public perception on named entities.



Potential Application - II

Choosing the right word:

"Jack the Giant Killer" v.s. "Jack the Giant Slayer"

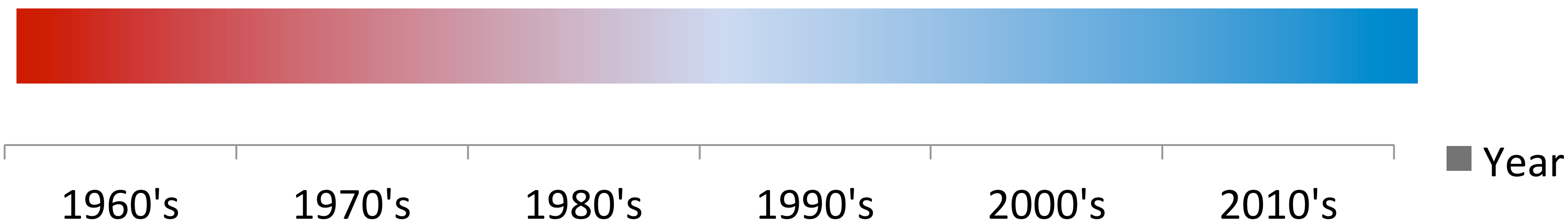
- Slayer has more of "fantasy" connotation
- Killer has more of "crime" connotation

Features by FAST COMPANY
(Mar 8, 2013)

Potential Applications - III

Tracking the connotation of words over time:

- e.g., “geek”



Conclusions & Future Work

- First broad coverage connotation lexicon
- Comparative evaluations of multiple algorithms.
- Available at
- http://homes.cs.washington.edu/~yejin/connotation

Need work for:

- Dealing with WSD and MWE issues in learning
- More interesting dimensions of connotations

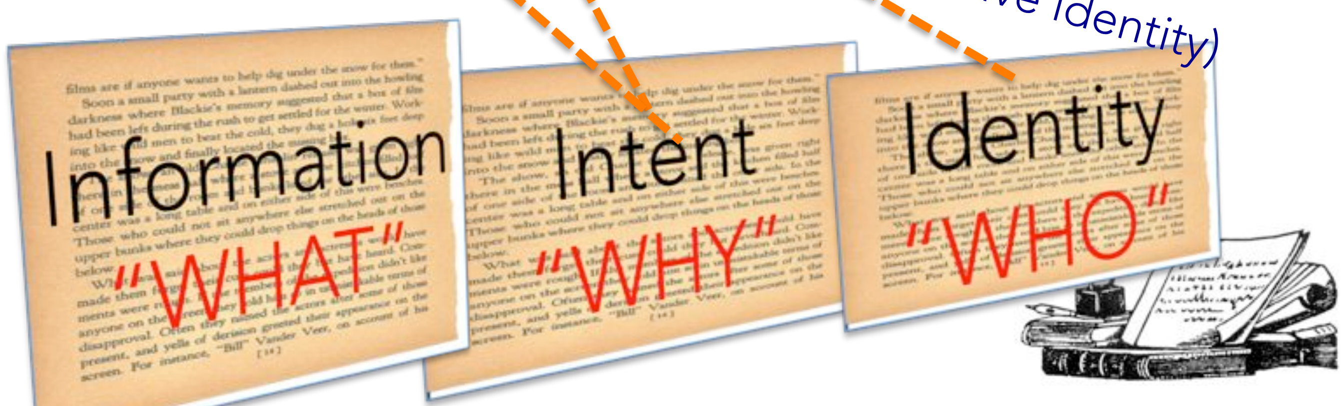
From Language to the Mind

I. Deceptive Reviews
(ACL 2011)

II. Success of Novels
(EMNLP 2013)

III. Connotation of Words

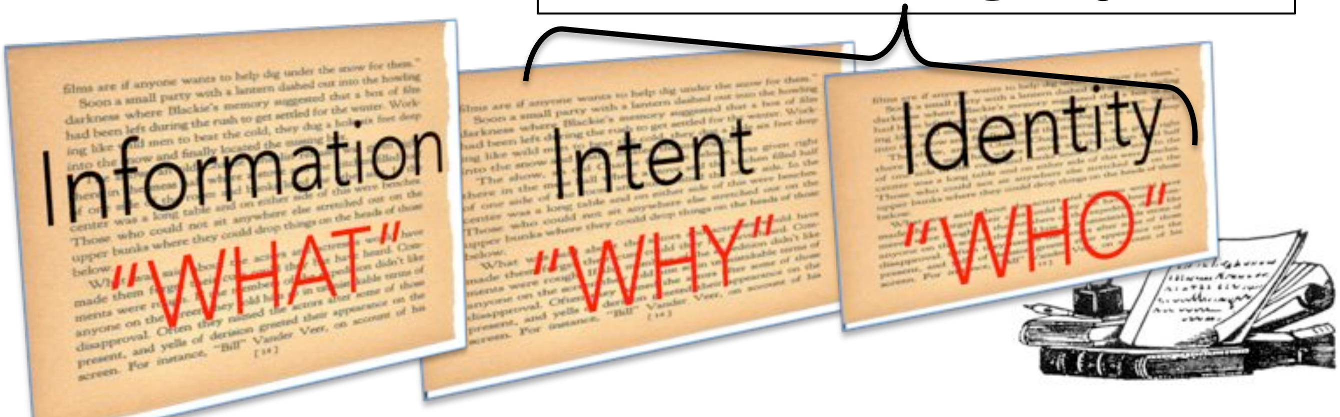
intellectual traits
(~ cognitive identity)



Research Outlook

1. Many more surprising and impactful applications
   --- yet to be discovered, formulated, and explored!
2. Computers may at times perform better than humans.
3. NLP for Digital Humanities (... and for Humanities)
   --- Data-driven discovery of insights vs. hypothesis-driven

"HOW" it is said
i.e., **Writing Style**



NLP for Social Good

- When our work was first published in 2011, no clear legal regulations against fake reviews.
- Not any more! New York law enforcement charged 19 firms $350,000 for facilitating fake reviews (Sep 2013).
  - (not based on automatic detection)

theguardian

News | US | World | Sports | Comment | Culture | Business | Money

News › World news › New York

Fake online reviews crackdown in New York sees 19 companies fined

Attorney general set up a fake yoghurt shop in Brooklyn to ensnare fake online review companies, fined a total of $350,000

Dominic Rushe in New York
Follow @dominicru Follow @guardian
theguardian.com, Monday 23 September 2013 14.42 EDT

NLP for Social Good

Featured in the Atlantic
(Jun 19, 2013)

EMNLP 2013:

"Where Not to Eat? Improving Public Policy by Predicting Hygiene Inspections Using Online Reviews."

King County

Using inspection records from https://Data.KingCounty.gov/

--- collaboration with
Mike Luca @ Harvard Business School


FOOD JULY/AUGUST 2013

How Yelp Might Clean Up the Restaurant Industry

Ever wonder about the risk of vermin infection at your favorite eatery? The re
teaming up with public-health officials to make health ratings count.

EMILY BADGER | JUN 19 2013, 10:05 PM ET

Research Outlook

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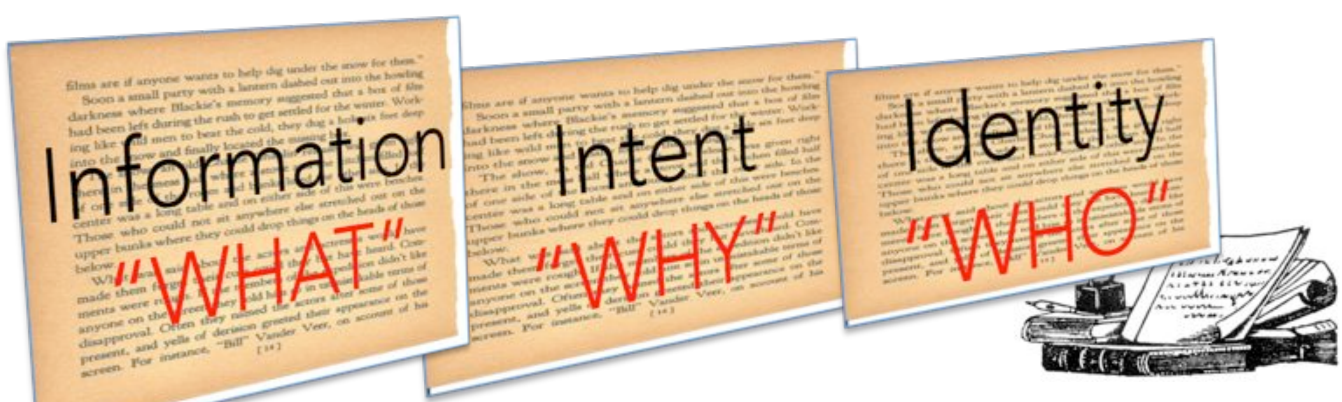
4. Expressive statistical models to analyze a richer set of stylistic elements in writing style: *"deep syntax", "discourse", "plot"*



Bibliography (2011 – 2013)

I. Deception & Public Opinion

- ❑ EMNLP 2013 Where Not to Eat? Improving Public Policy by Predicting Hygiene...
- ❑ ICWSM 2012 Distributional Footprints of Deceptive Product Reviews.
- ❑ ACL 2012 Syntactic Stylometry for Deception Detection
- ❑ ACL 2011 Finding Deceptive Opinion Spam by Any Stretch of the Imagination.

II. Authorship & Writing Style

- ❑ EMNLP 2012 Characterizing Stylistic Elements in Syntactic Structure.
- ❑ CoNLL 2011 Gender Attribution: Tracing Stylometric Evidence Beyond Topic...
- ❑ ACL 2011 Language of Vandalism: Improving Wikipedia Vandalism Detection..

III. Connotation

- ❑ ACL 2013 Connotation Lexicon: A Dash of Sentiment Beneath the Surface Meaning.
- ❑ EMNLP 2011 Learning General Connotation of Words using Graph-based Algorithms.

IV. Literary Success & Linguistic Creativity

- ❑ EMNLP 2013 Success with Style: Using Writing Style to Predict the Success of Novels.
- ❑ EMNLP 2013 Understanding and Quantifying Creativity in Lexical Composition.

Media Coverage (Highlights 2011-2014)

- [ACL 2011] Finding Deceptive Opinion Spam by Any Stretch of the Imagination.
- [ICWSM 2012] Distributional Footprints of Deceptive Product Reviews.
- [EMNLP 2013] Success with Style: Using Writing Style to Predict the Success of Novels.
- [EMNLP 2013] Where Not to Eat? Improving Public Policy by Predicting Hygiene…

Acknowledgements

My PhD	Ritwik Banerjee, Song Feng, Jun Seok Kang, Polina Kuznetsova
Other PhD	Vikas Ashok, Ritwik Bose, Jianfu Chen
MS	Manoj Harpalani, Kailash Gajulapalli, Anupam Gogar, Rohith Menon, Ruchita Sarawgi, Sandesh Singh, Longfei Xing
Professor	Claire Cardie, Jeffrey Hancock, Rob Johnson, Michael Luca
Industry	Michael Hart, Myle Ott