Supporting the New Techniques of Knowledge Discovery in Databases: TDM & AI

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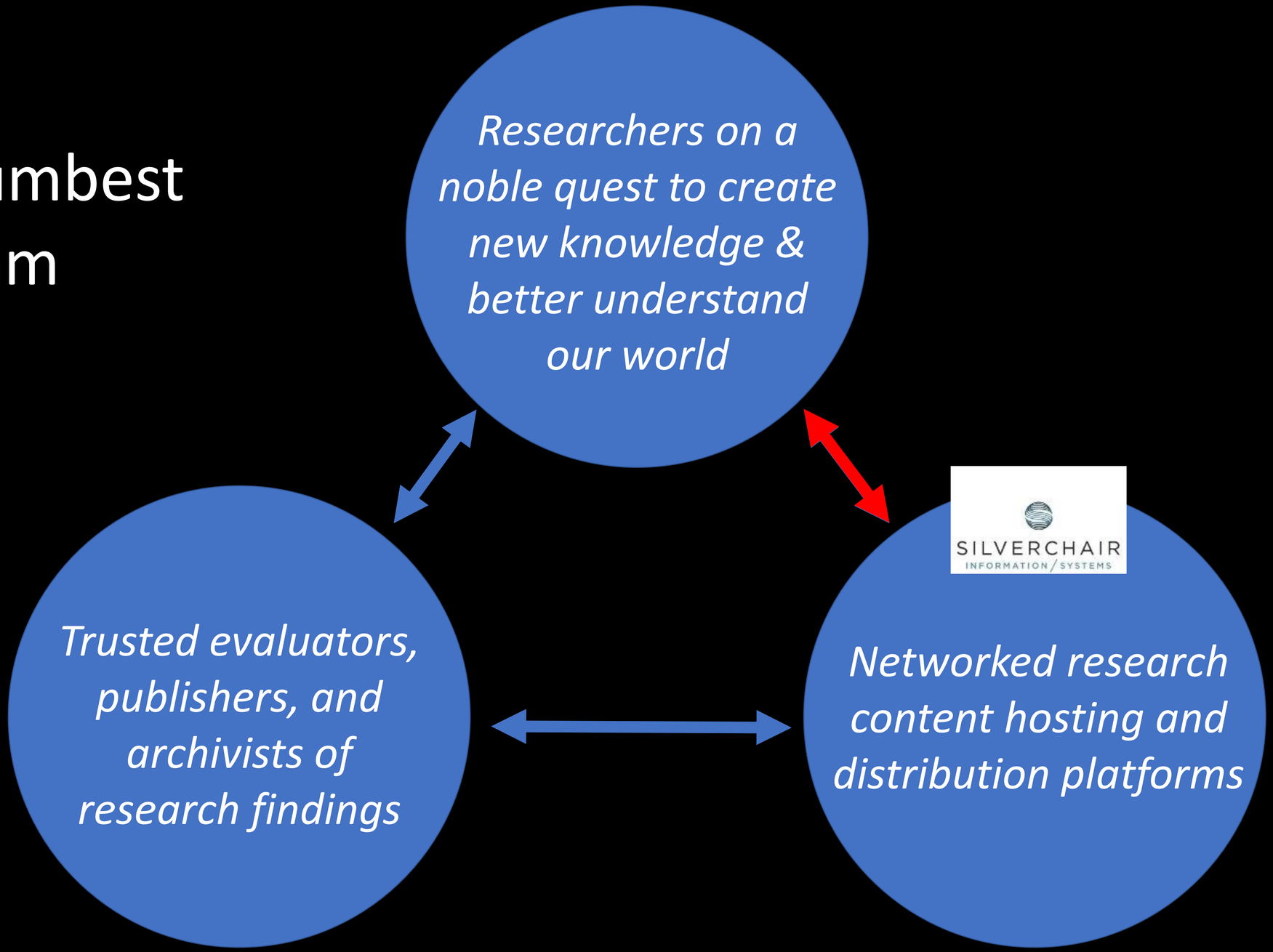
World's Dumbest Diagram



Discovering our discoveries*

*World's dumbest catchphrase

Knowledge Discovery in Research Databases:

- **Traditional** knowledge discovery hypothesis: "Some questions are answered by highly-educated human specialists finding, reading, and synthesizing the right few pieces of information"
    - *Meta-Analysis, Systematic Review, Cohort Study*

- **TDM/AI** knowledge discovery hypothesis: "Some questions can only be answered by specialist-directed algorithms that synthesize thousands, millions, or billions of pieces of information"

Today’s Question

How can scientific and scholarly publishers best prepare and deliver their content to assist (and not hinder) TDM/AI knowledge discovery?

But First

How do TDM/AI knowledge discovery projects actually work?

Knowledge Discovery in Databases (KDD) [1] is divided in four main phases: domain exploration, data preparation, data mining, and interpretation of results.

1. The first phase is responsible for understanding the problem and what data will be used in the knowledge discovery process.
2. **The next phase selects, cleans, and transforms the data to a format that is suitable for a specific data mining algorithm.**
3. In the third phase, the chosen data mining algorithm performs some intelligent techniques to discover patterns that can be of potential use.
4. The last phase is responsible for manipulating the extracted patterns to generate interpretable knowledge for humans…

…Most of the research carried out in this area focus on the data mining phase, which uses artificial intelligence algorithms like decision trees, artificial neural networks, evolutionary computation, among others [2] to discover knowledge. On the other hand, the data preparation phase, responsible for integration, cleaning, and transformation of data, has not been the subject of much research. In fact, Pyle [3] argues that **“data preparation consumes 60 to 90% of the time needed to mine data – and contributes 75 to 90% to the mining project’s success”**.

From: Paulo M. Goncalves Jr. and Roberto S. M. Barros, "Automating Data Preprocessing with DMPML and KDDML," *10th IEEE/ACIS International Conference on Computer and Information Science*, 2011, DOI: 10.1109/ICIS.2011.23.

“I downloaded 2TB of *Arxiv* content last week but I can’t bring myself to open it and start working on analyzing it because I know I have at least 6 months of painstaking content cleanup & preparation ahead of me before I can begin.”

--Mike M., Fast Forward Labs

And Second

What are TDM/AI developers trying to achieve?

Artificial intelligence: don't believe the hype | WIRED UK

www.wired.co.uk/article/sensationalism-ai-hype-innovation

Feb 18, 2017 - **Hype** could be of significant short-term benefit to **artificial intelligence** research, but prove fatal in the long run. Luke Dormehl talks to WIRED ...

Myth Busting Artificial Intelligence | WIRED

https://www.wired.com/insights/2015/02/myth-busting-artificial-intelligence/

We've all been seeing **hype** and excitement around **artificial intelligence**, big data, machine learning and deep learning. There's also a lot of confusion about ...

The Hype—and Hope—of Artificial Intelligence - The New Yorker

www.newyorker.com/business/currency/the-hype-and-hope-of-artificial-intelligence

Aug 26, 2016 - Om Malik on the **hype** about **artificial intelligence**, and the three stages of **A.I.**: recognition intelligence, cognitive intelligence, and virtual ...

'Artificial Intelligence' was 2016's fake news • The Register

https://www.theregister.co.uk/2017/01/02/ai_was_the_fake_news_of_2016/

Jan 2, 2017 - As with the most cynical (or deranged) internet hypesters, the current **"AI" hype** has a grain of truth underpinning it. Today neural nets can ...

Much like “the cloud,” “big data,” and “machine learning” before it, the term “artificial intelligence” has been hijacked by marketers and advertising copywriters.

If the hype leaves you asking “What is A.I., really?,” don’t worry, you’re not alone. I asked various experts to define the term and got different answers. The only thing they all seem to agree on is that artificial intelligence is a set of technologies that try to imitate or augment human intelligence.

To me, the emphasis is on augmentation, in which intelligent software helps us interact and deal with the increasingly digital world we live in.

Om Malik, The New Yorker
http://www.newyorker.com/business/currency/the-hype-and-hope-of-artificial-intelligence

Two Types of Augmentation

General Augmentation

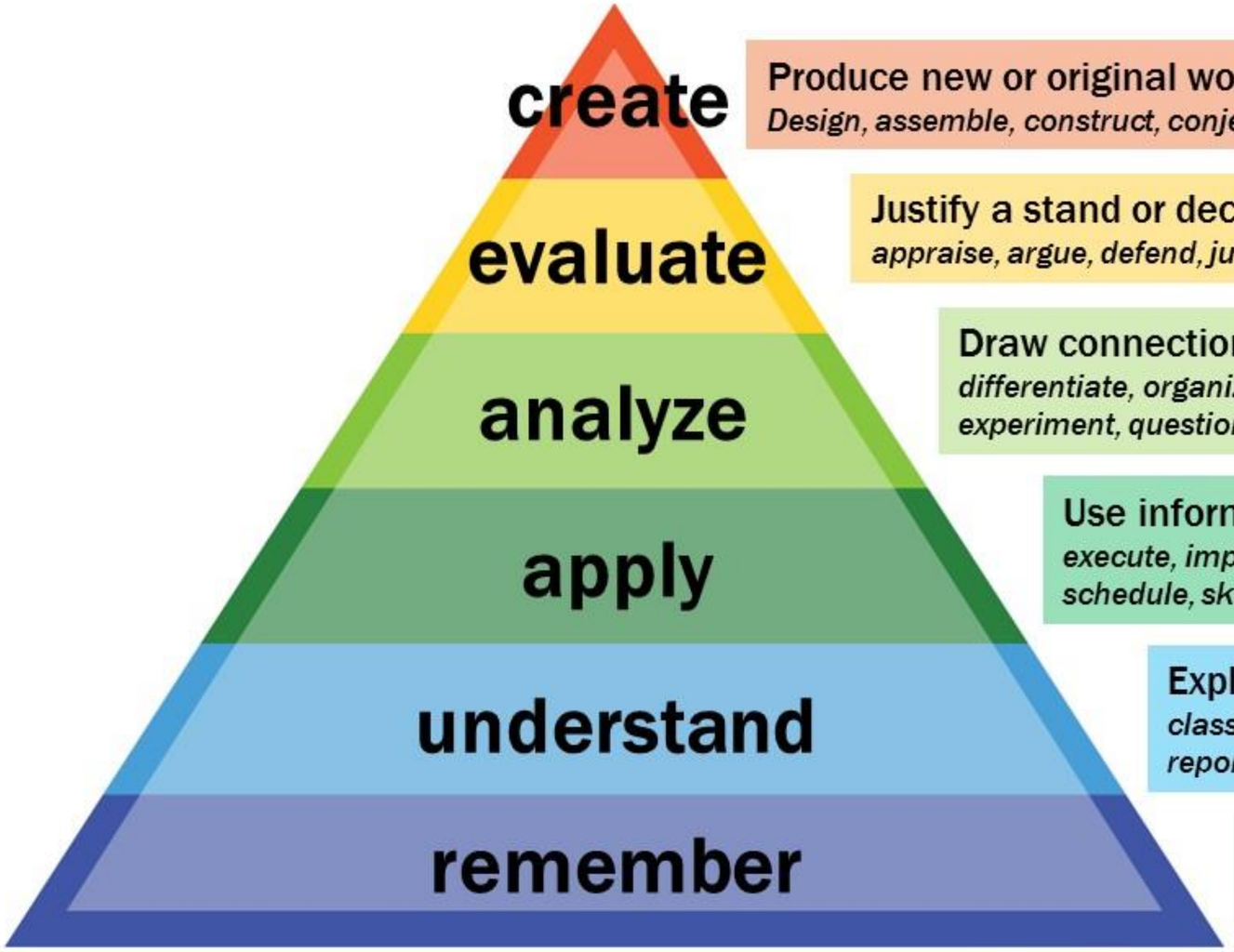
amazon alexa

Cortana

Specific Augmentation

http://www.cnn.com/2017/01/26/health/ai-system-detects-skin-cancer-study/

Bloom's Taxonomy



Produce new or original work
Design, assemble, construct, conjecture, develop, formulate, author, investigate

Justify a stand or decision
appraise, argue, defend, judge, select, support, value, critique, weigh

Draw connections among ideas
differentiate, organize, relate, compare, contrast, distinguish, examine, experiment, question, test

Use information in new situations
execute, implement, solve, use, demonstrate, interpret, operate, schedule, sketch

Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate

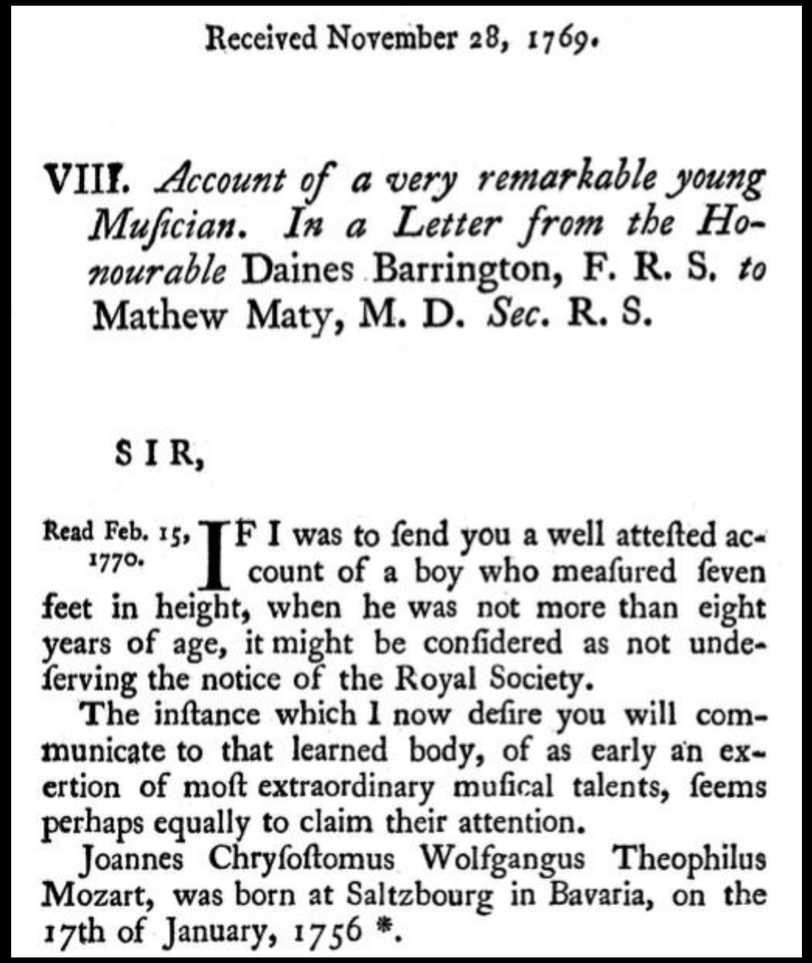
Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state

@cirtlmooc

Bloom, et al. 1956

remember

Recall facts and basic concepts
define, duplicate, list, memorize, repeat, state



Received November 28, 1769.

VIII. *Account of a very remarkable young Muſician. In a Letter from the Honourable* Daines Barrington, F. R. S. *to* Mathew Maty, M. D. *Sec.* R. S.

SIR,

Read Feb. 15, 1770. IF I was to ſend you a well atteſted account of a boy who meaſured ſeven feet in height, when he was not more than eight years of age, it might be conſidered as not undeſerving the notice of the Royal Society.

The inſtance which I now deſire you will communicate to that learned body, of as early an exertion of moſt extraordinary muſical talents, ſeems perhaps equally to claim their attention.

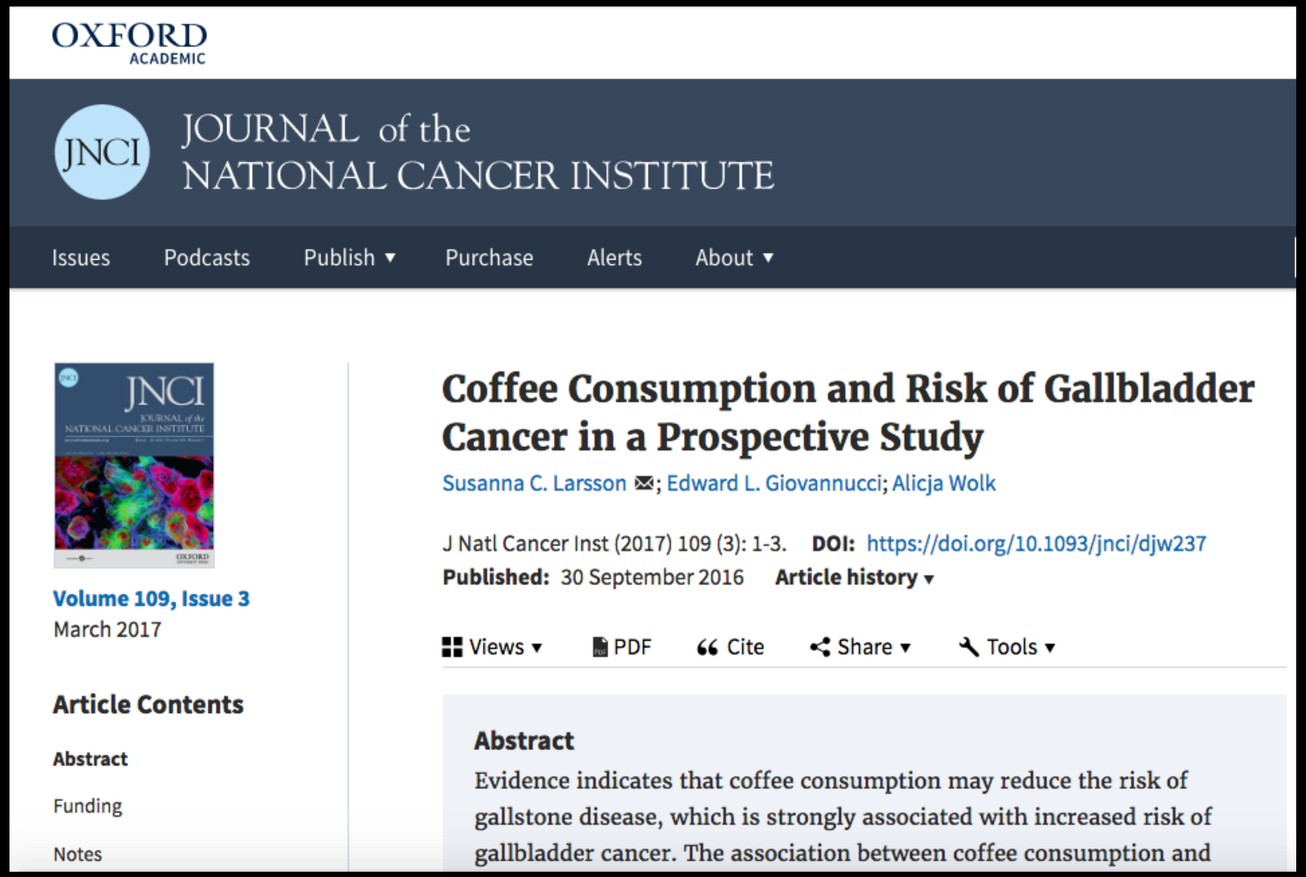
Joannes Chryſoſtomus Wolfgangus Theophilus Mozart, was born at Saltzbourg in Bavaria, on the 17th of January, 1756 *.

- We're pretty good at this*
- The fundamentals of a well-indexed, permanent scholarly record (DOI, WoS, CLOCKSS, etc.)

*For journals, at least

understand

Explain ideas or concepts
classify, describe, discuss, explain, identify, locate, recognize, report, select, translate



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Article Contents

Abstract

Funding

Notes

Coffee Consumption and Risk of Gallbladder Cancer in a Prospective Study

Susanna C. Larsson ✉; Edward L. Giovannucci; Alicja Wolk

J Natl Cancer Inst (2017) 109 (3): 1-3. **DOI:** https://doi.org/10.1093/jnci/djw237
Published: 30 September 2016 **Article history** ▾

Views ▾ PDF Cite Share ▾ Tools ▾

Abstract

Evidence indicates that coffee consumption may reduce the risk of gallstone disease, which is strongly associated with increased risk of gallbladder cancer. The association between coffee consumption and

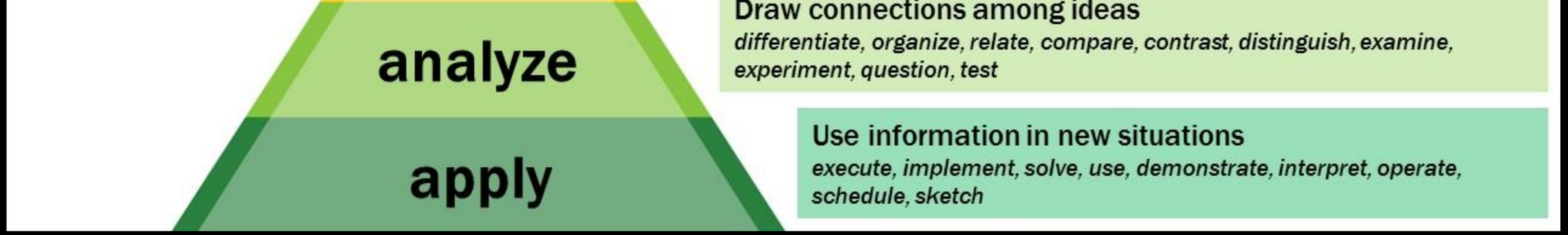
- Also strong in creating interfaces that assist understanding from human readers

Fostering Software Understanding

In some ways we've got a good foundation – detailed, consistent content tagging to aid with software Understanding

- Structure understanding through normalized XML: what is the title, authors, abstract, where the conclusions are in the paper, etc.

Increased indexing of named entities: understanding what is a gene, what is a clinical trial ID, what is a person



What We Already Know about This Topic

- Glucocorticoids are commonly given to prevent nausea and vomiting
- However, glucocorticoids are immunosuppressive and may promote infection
- The authors conducted a meta-analysis of 56 trials (n = 5,607) that evaluated infection, hospital duration, and intraoperative glucose concentration

What This Article Tells Us That Is New

- Glucocorticoids did not impact on any wound infection (odds ratio, 0.84; 95% CI, 0.62 to 1.15) or length of stay (weighted mean difference, −0.27 days; CI, −1.37 to 0.84)
- Glucocorticoids slightly increased peak postoperative glucose concentrations by 20 mg/dl (CI, 11 to 29; $P < 0.001$), an amount that is probably not clinically important
- Single-dose steroid administration for prevention of nausea appears safe

http://anesthesiology.pubs.asahq.org/article.aspx?articleid=2592740

Rheumatology key messages

- Clinical manifestations of Ebola viral disease include muscle pain and arthralgia.
- Musculoskeletal complications post-Ebola viral disease include muscle pain, arthritis, enthesitis and tendon ruptures.
- Immunological mechanisms are postulated for the musculoskeletal manifestations of Ebola viral disease.

https://academic.oup.com/rheumatology/article/doi/10.1093/rheumatology/kex082/3101351/Musculoskeletal-manifestations-of-Ebola-virus

OK, Back to Today's Question

How can scientific and scholarly publishers best prepare and deliver their content to assist (and not hinder) TDM/AI knowledge discovery?

4 Obstacles to Accelerated TDM/AI Knowledge Discovery

1: Interfaces still primarily visual w/narrative text

2: Normalized, detailed underlying XML structure & metadata not shared

3: Limited indexing/tagging above the “Understanding” level

4: Limited ability to take away large amounts of content quickly

Consider Providing Structured Content as a New Product

- Full-text normalized XML (or JSON)
- Separate product/subscription for sale
- Enrich it further or sell it “as is”
- Separate delivery mechanism (no human interface) but can piggyback on existing content workflows
- Accesses a new class of customer w/deep pockets (AI creators or implementers)
- Requires new vetting/legal agreements

We’re Piloting This Now

- We have two pilot partners that will be launching TDM products in early 2018 that includes pre-packaged metadata downloads for subscribers and full-text packages for purchase

Remember the Business Justification

“data preparation consumes 60 to 90% of the time needed to mine data – and contributes 75 to 90% to the mining project’s success”.

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Or Create Your Own Derived Data Products

- Deliver new on-site content analysis tools for end users using a combination of semantics & new text mining/AI techniques (many of which are free to use from Google/Amazon/Microsoft/others)
- Experiments, experiments, experiments (recommendation, auto-summarization, analogues, image analysis, sentiment, prediction, etc.)

Publishers will either do this themselves or it will be done by someone else on the backs of their content

Thank You

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