

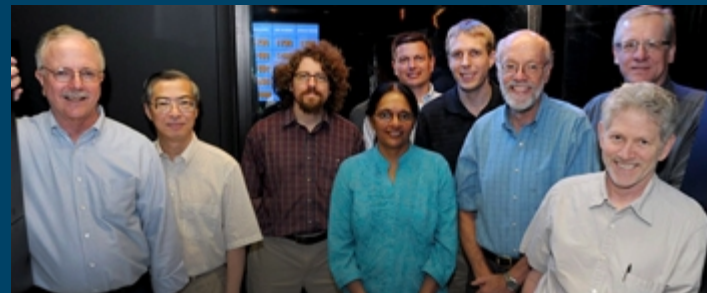
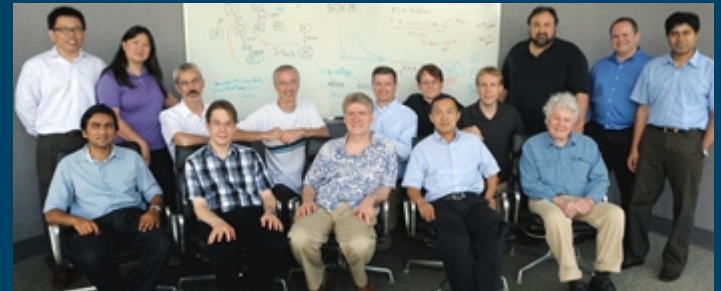
IBM Watson:

From general knowledge to
oncology expert



An IBM Grand Challenge

Build a system that rivals a human's ability to answer questions posed in natural language with accuracy, confidence, and speed.



Grand Challenges advance the science of computing

Chess: *Deep Blue* 1997

- Limited number of moves and states
- Explicit, unambiguous **mathematical** rules



Human Language: *Watson* 2011

- Ambiguous, contextual and implicit
- Grounded in **human understanding**
- Infinite expressions with same meaning



Jeopardy!

- Questions covers a broad range of topics (History, literature, politics, arts, science etc)
- Fast responses, with accuracy and confidence
- Word plays, slang, alternative spelling, subtle meaning, ironies, riddles

THE "GU"	CODE NAMES	NAME THE NAMESPACE	HELLO WORLD	MOVIES	BEFORE & AFTER
\$200	\$200	\$200	\$200	\$200	\$200
\$400	\$400	\$400	\$400	\$400	\$400
\$600	\$600	\$600	\$600	\$600	\$600
\$800	\$800	\$800	\$800	\$800	\$800
\$1000	\$1000	\$1000	\$1000	\$1000	\$1000

Jeopardy!

Category

BEATLES PEOPLE

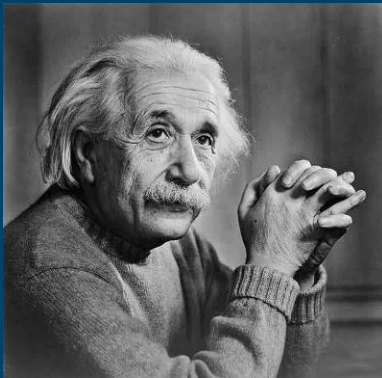
Clue

**This title gal,
"children at your feet,
wonder how you
manage to make
ends meet"**

Answer

Lady Madonna

Unstructured data is complex



Where was Einstein born?

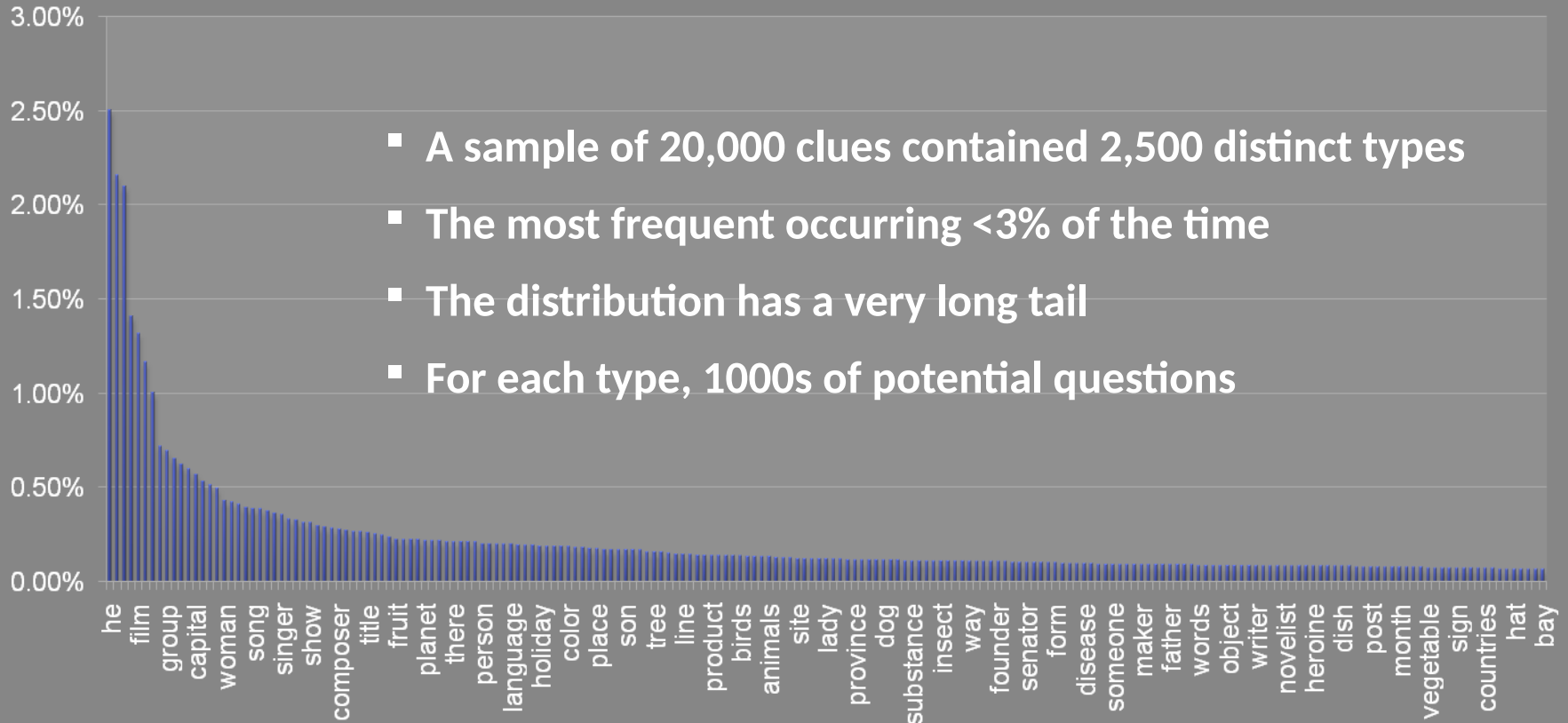
Person	Born In
A. Einstein	Ulm

Structured

Unstructured

“One day, from among his city views of Ulm, Otto chose a watercolor to send to Albert Einstein as a remembrance of Einstein’s birthplace.”

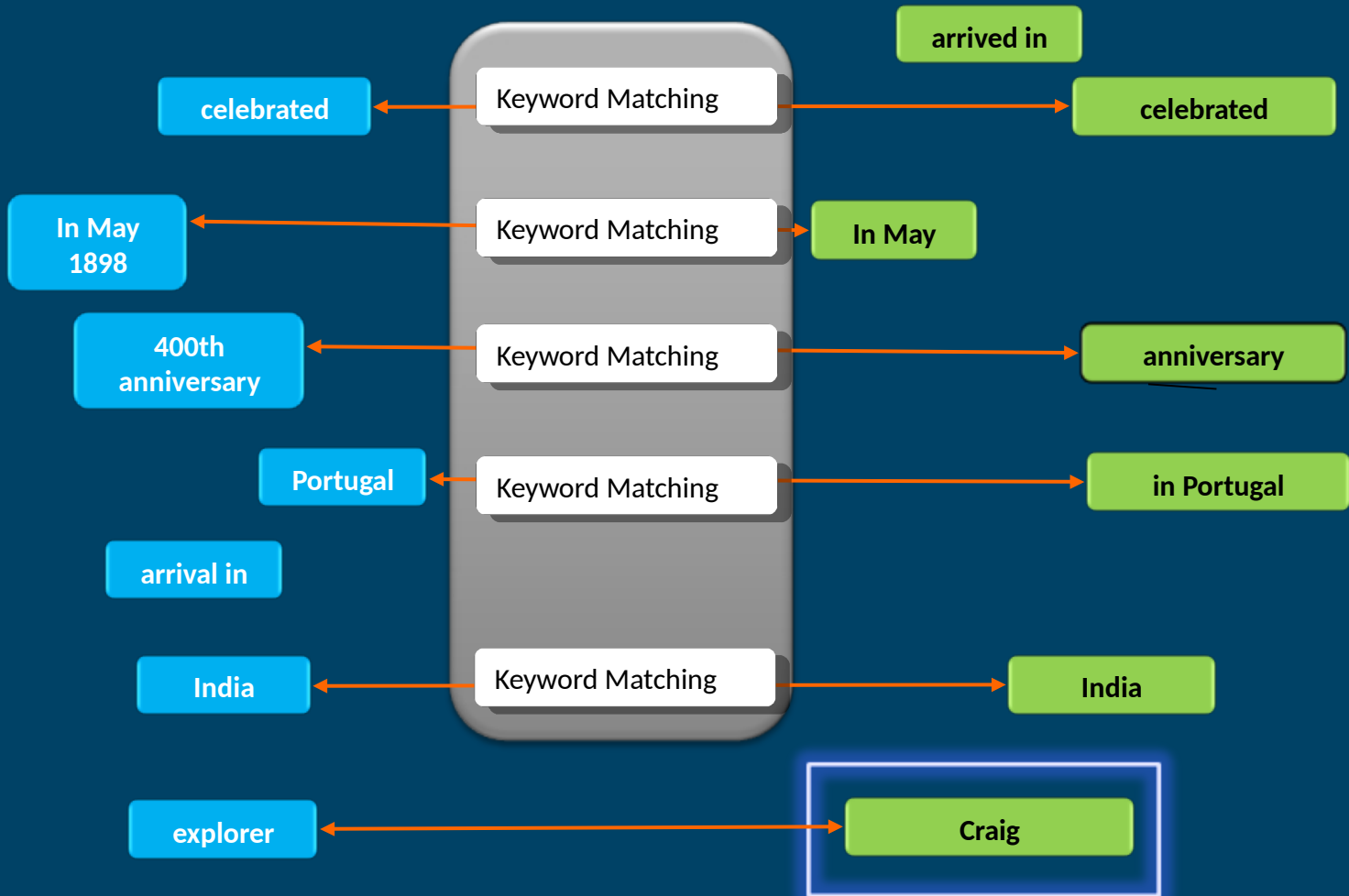
Broad Domain

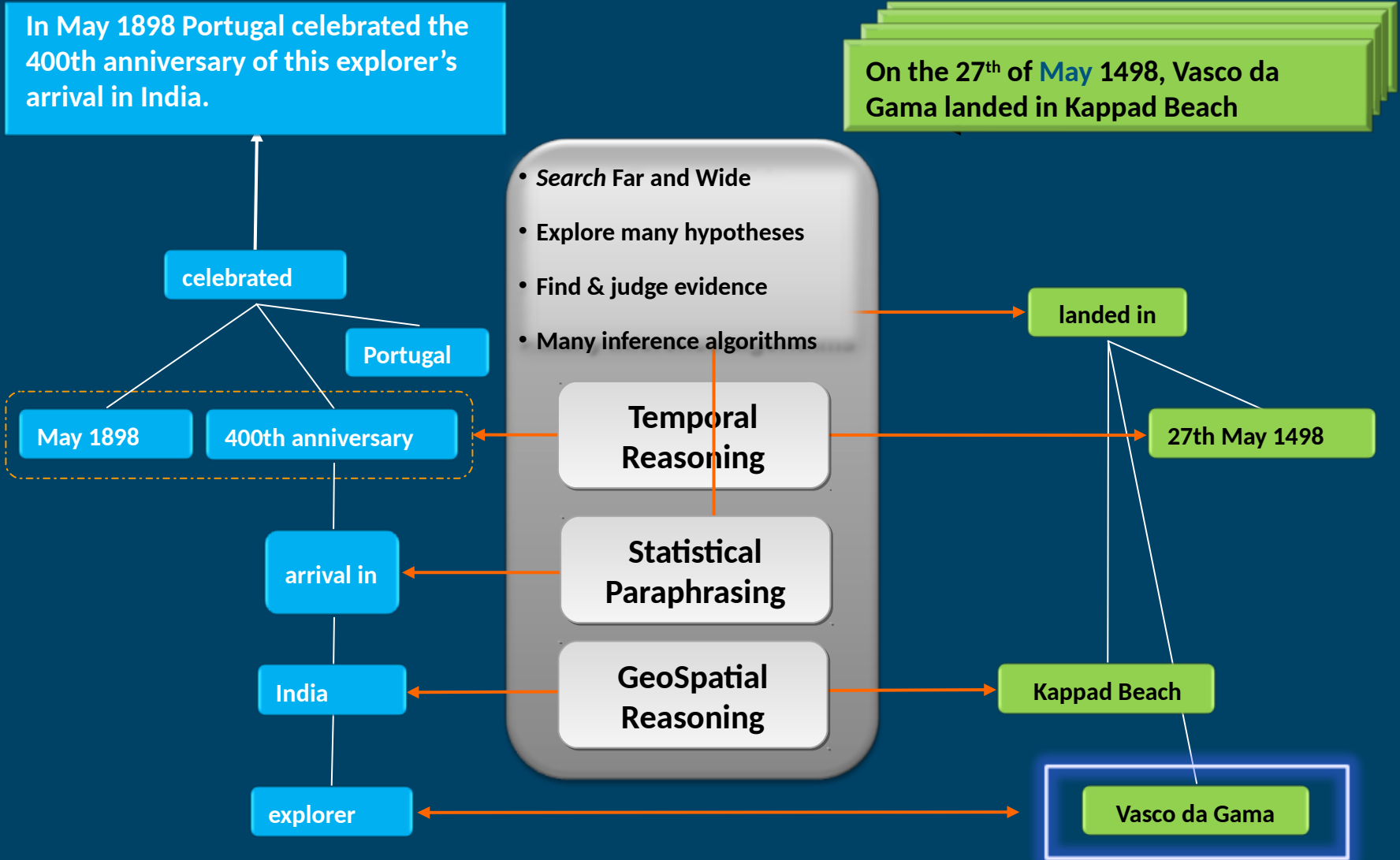


- A sample of 20,000 clues contained 2,500 distinct types
- The most frequent occurring <3% of the time
- The distribution has a very long tail
- For each type, 1000s of potential questions

In May 1898 Portugal celebrated the 400th anniversary of this explorer's arrival in India.

In May, Craig arrived in India after he celebrated his anniversary in Portugal.



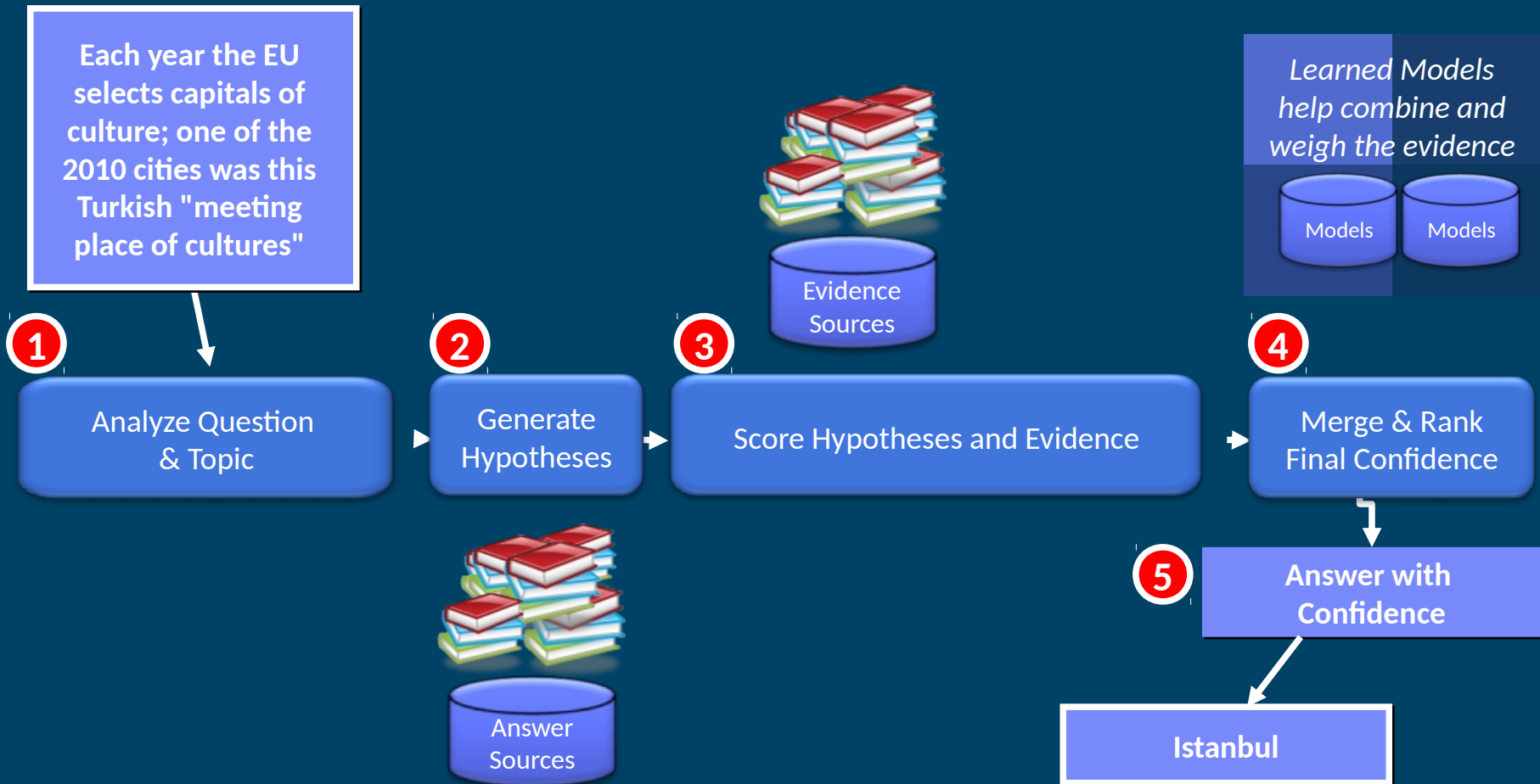


Behind the Mask

The first person mentioned by name in the 'The Man in the Iron Mask' is this hero of a previous book by the same author

Raoul de Bragelonne

IBM DeepQA: How Watson answers questions

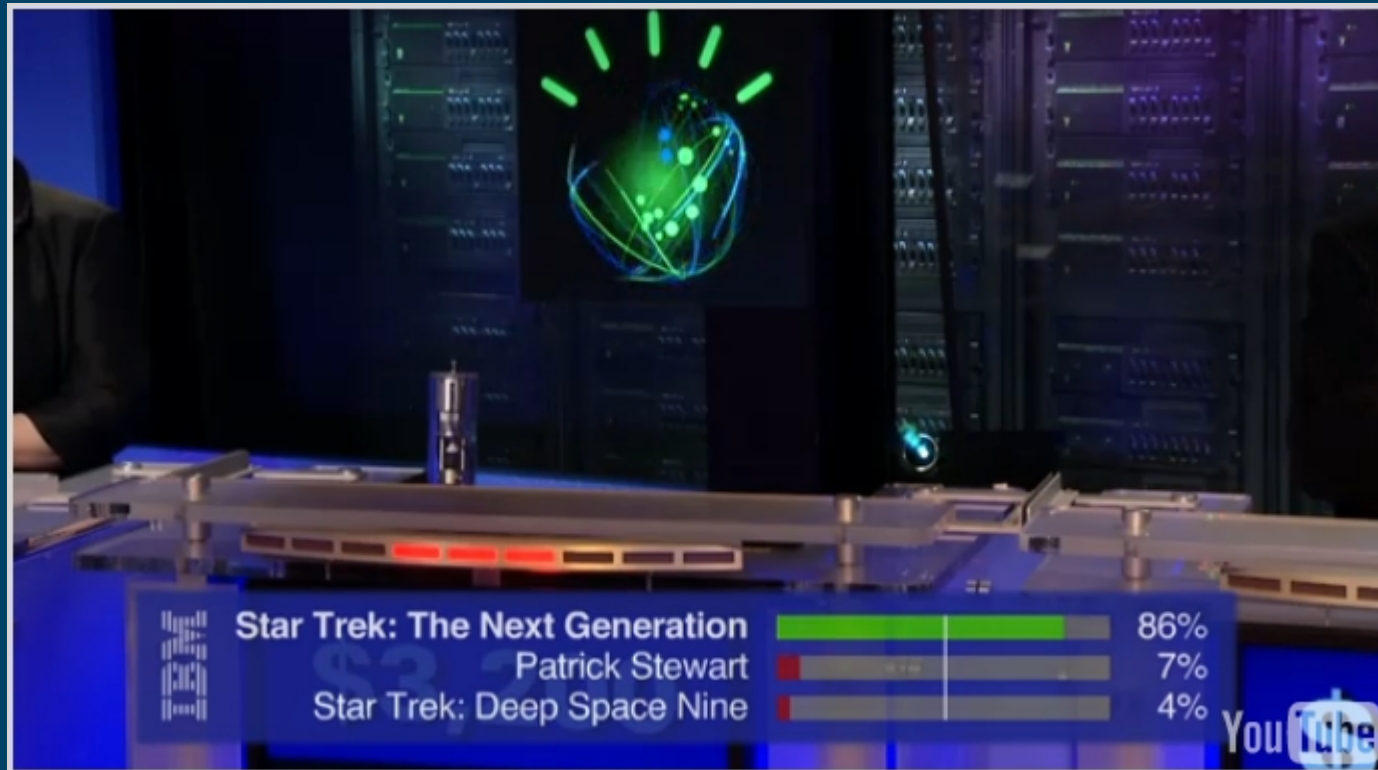


Watson – a Workload Optimized System

- 90 x IBM Power 750 servers
- 2880 POWER7 3.55 GHz cores
- 500 GBps on-chip bandwidth
- 15 Terabytes of memory
- 500 GB of data (in memory)
- Software - IBM DeepQA
 - Unstructured Information Management Architecture (UIMA) – supports scale-out of text and multimodal analysis applications
 - UIMA-AS - scale-out using asynchronous messaging
 - Apache Hadoop - pre-processes data to create in-memory datasets used at run-time



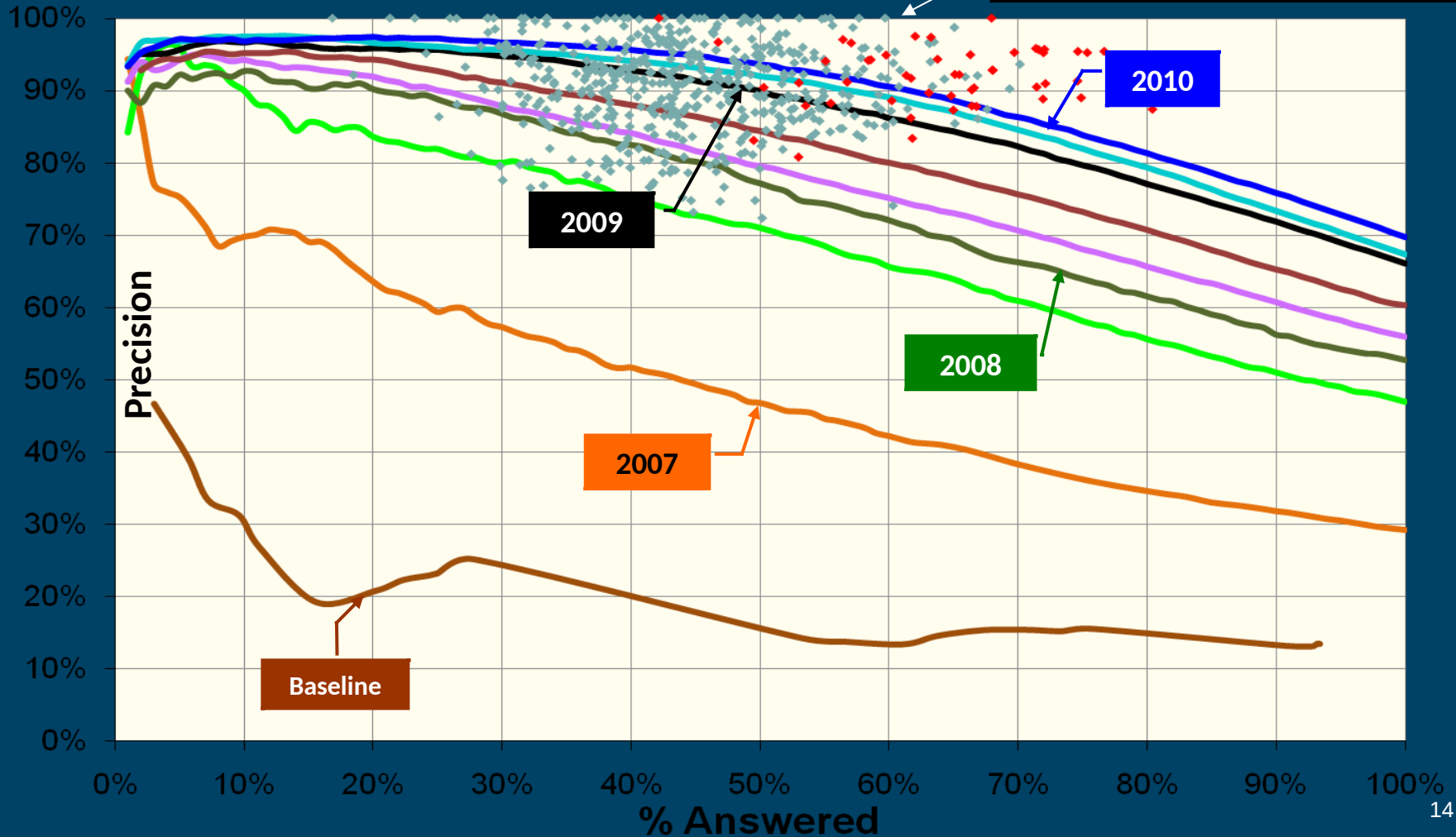
Cognitive systems - Sparring Matches to provide learning



In 55 real-time sparring against former Tournament of Champion Players in 2010, Watson won 71% of the games

Progress to precision and confidence

Blue Dots = Jeopardy! winners
Red Dots = Ken Jennings



February 14th 2011

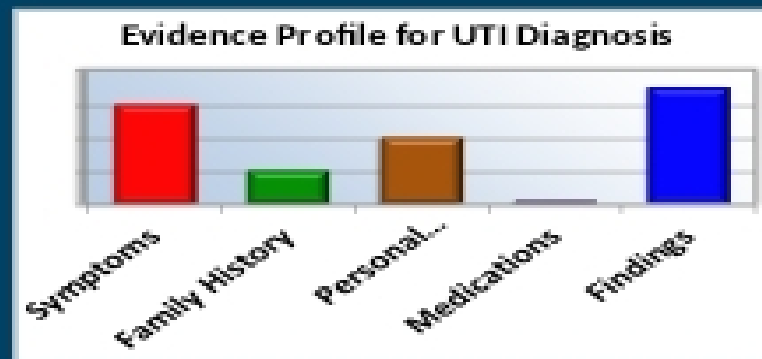


Watson can answer questions of fact ...

- Jeopardy! Questions
 - Q: “Each year the EU selects capitals of culture; one of the 2010 cities was this Turkish "meeting place of cultures"”
 - A: “What is Istanbul?”
 - Watson had ingested around 60 Million documents (200 Million Pages) from across many different sources in the Internet
- Patient Care Questions
 - Q: Given the patient record or summary, what treatment is appropriate for this patient?
 - A: Treatment options or pre-treatment approval
 - Watson has ingested reference materials from around a dozen different Medical sources

In Healthcare, the Input (Question) is even more complex

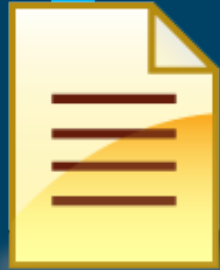
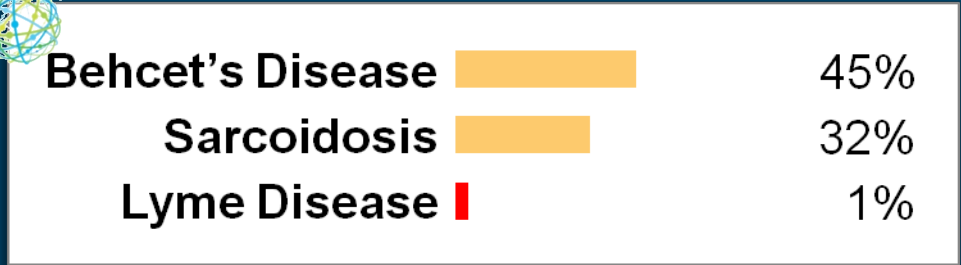
A 58-year-old woman presented to her primary care physician after several days of **dizziness**, **anorexia**, **dry mouth**, **increased thirst**, and **frequent urination**. She had also had a **fever** and reported that **food would “get stuck” when she was swallowing**. She reported no **pain** in her abdomen, back, or flank and no **cough**, **shortness of breath**, **diarrhea**, or **dysuria**. Her family history included **oral** and **bladder cancer** in her mother, **Graves' disease** in two sisters, **hemochromatosis** in one sister, and idiopathic thrombocytopenic **purpura** in one sister. Her history was notable for **cutaneous lupus**, **hyperlipidemia**, **osteoporosis**, **frequent urinary tract infections**, three uncomplicated cesarean sections, a left oophorectomy for a benign cyst, and primary **hypothyroidism**, which had been diagnosed a year earlier. Her medications were **levothyroxine**, **hydroxychloroquine**, **pravastatin**, and **alendronate**. A **urine dipstick was positive for leukocyte esterase and nitrites**. The patient was given a prescription for ciprofloxacin for a urinary tract infection and was advised to drink plenty of fluids. On a follow-up visit with her physician 3 days later, her fever had resolved, but she reported continued weakness and dizziness despite drinking a lot of fluids. She felt better when lying down. Her **supine blood pressure was 120/80 mm Hg**, and **her pulse was 88 beats per minute**; on standing, her **systolic blood pressure was 84 mm Hg**, and her **pulse was 92 beats per minute**. A urine specimen obtained at her initial presentation had been cultured and **grew more than 100,000 colonies of *Escherichia coli***, which is sensitive to ciprofloxacin.



Present Factors

- ✓ Red, painful eye
- ✓ Blurred vision
- ✓ Family history of arthritis

Q: What diagnosis explains the patient's condition?



Medical Record



Absent Factors

- Circular rash
- Fatigue
- Headache

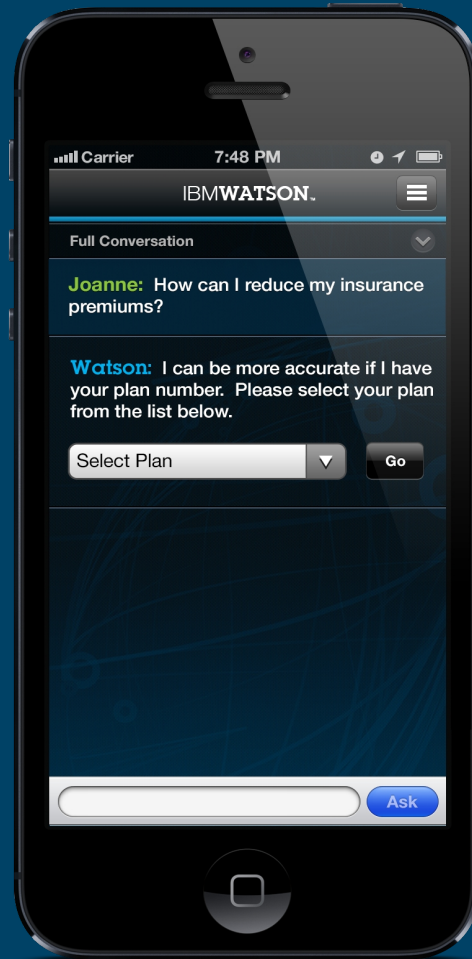
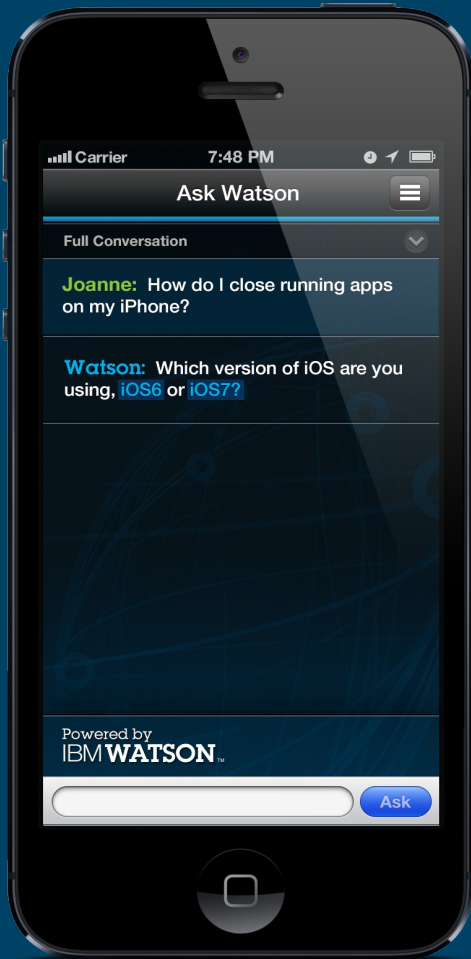
The first symptom of Lyme disease (also called Lyme's disease) is a **rash**, called the "bull's-eye rash," which is a circular rash with a red outer ring and a white inner ring. The rash is often accompanied by other symptoms, such as fever, fatigue, and joint pain. Symptoms are often described as happening in three stages (although not everyone experiences all three):

1. A **circular rash**, typically within 1-2 weeks of infection, often is the first sign of infection. ...

Lyme disease is caused by the bacterium *Borrelia burgdorferi* and is transmitted to humans through the bite of infected blacklegged ticks. Typical symptoms include **high temperature**, **headache**, **fatigue**, and a characteristic **skin rash** called **erythema migrans**.



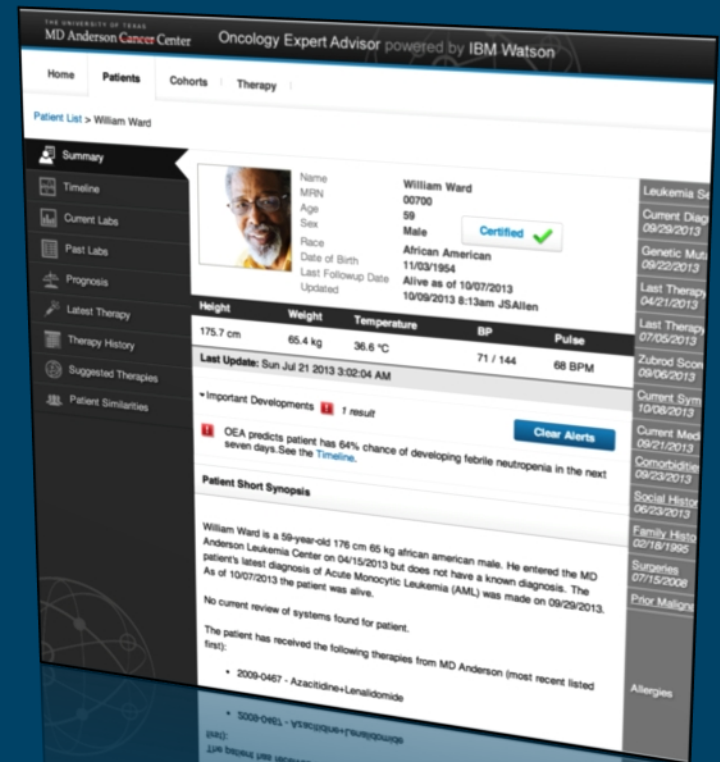
Dialoguing in practice



MD Anderson Oncology Expert Advisor

Democratize health care by enabling clinicians to get a clear understanding of their patient, identify relevant SOC and Clinical Trial treatments, and a prediction and appropriate responses to adverse events

- Uses deep evaluation of clinical notes to create relevant patient summary
- Micro-segmentation of patient similarity to historical care population
- SOC guideline evaluation, overlaid with clinical expertise, clinical literature, and micro-segmentation to identify relevant SOC and CT therapies
- Micro-segmentation to predict potential adverse events
- SOC guideline evaluation, overlaid with clinical expertise and clinical literature to identify relevant clinical responses to adverse events and oncological emergencies



Evolving demographics are transforming customer expectations

~50%

of incoming calls are not initially resolved but 61% could have been resolved with better access to info

91%

Smartphone users would get answers online if the resource was tailored to their needs

2 hours

Per day that a typical contact center agent spends searching for information



“You don’t know me”

Intolerance of mass-market, impersonalized approaches

“It’s too hard”

Need the right information in the right place at the right time

“I just want to get it done”

Don’t want to be forced into a certain channel to take action. Want control.

Watson Engagement Advisor

- Transforming the customer experience
 - Reduce client turnover
 - Maintain existing client relationships
 - Build advocacy
- Growing top-line revenue
 - Engage the under-engaged
 - Personalize the experience
 - Omni-channel always-on environment
- Improving bottom line results
 - Increase first call resolution
 - Faster resolution through evidence based insights
 - Reduce operation costs by empowering agents and advancing self-service



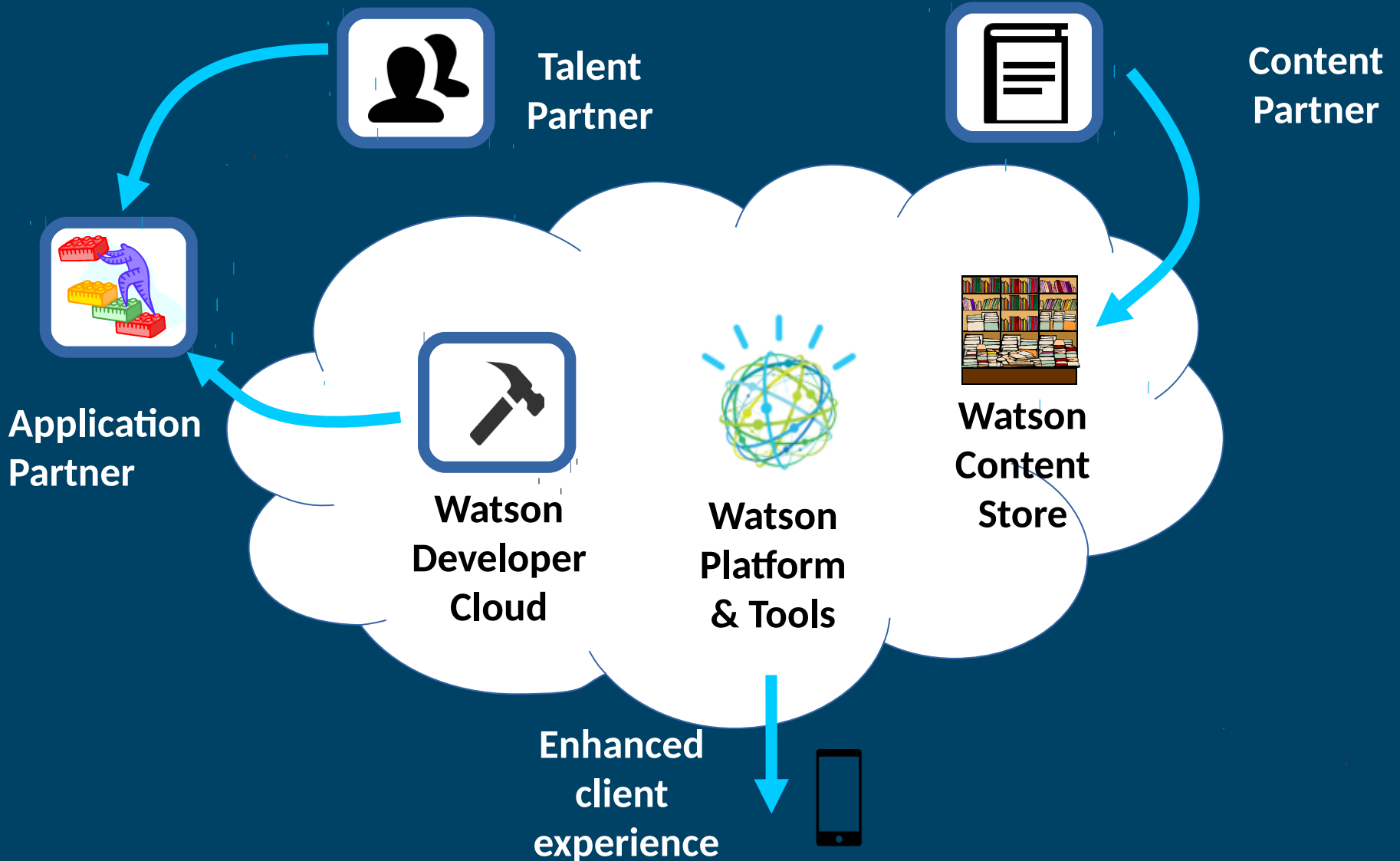
Watson Analytics

Uses natural language, cognitive capability on front end, to help users do math, and ask questions about data

- Enables anyone to independently discover new patterns to inform better decisions
- Targeted horizontals: Sales and Marketing
- Cloud-based model supports adoption for departmental groups by enabling quick startup and evaluation



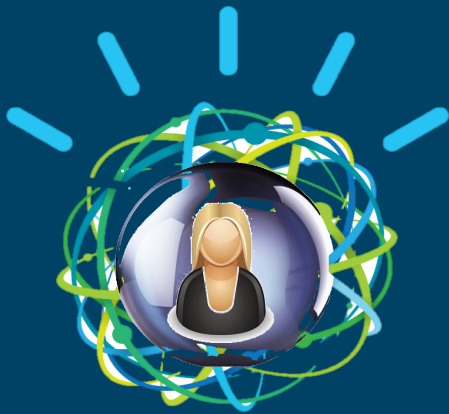
Cognitive Computing on the IBM Cloud - Watson Ecosystem Program



Future: Addressing additional question types

- Who were all of the Heisman trophy winners from 1983 to 2003
 - Enumerated lists
- How do I charge my smart phone?
 - Procedures
- How many square feet are in an acre?
 - Conversion and calculation
- What were sales of Almonds in California for the last quarter?
 - Enquiry
- How does Box Office Average per Studio contribute to Genre?
 - Correlation and Analytics

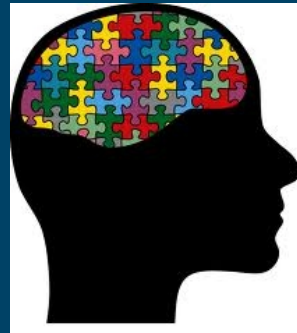
Personality Analytics (System U)



Psycholinguistic Analytics

- Understands me
- Engages me
- Establishes trust

=



Cognitive Analytics

+



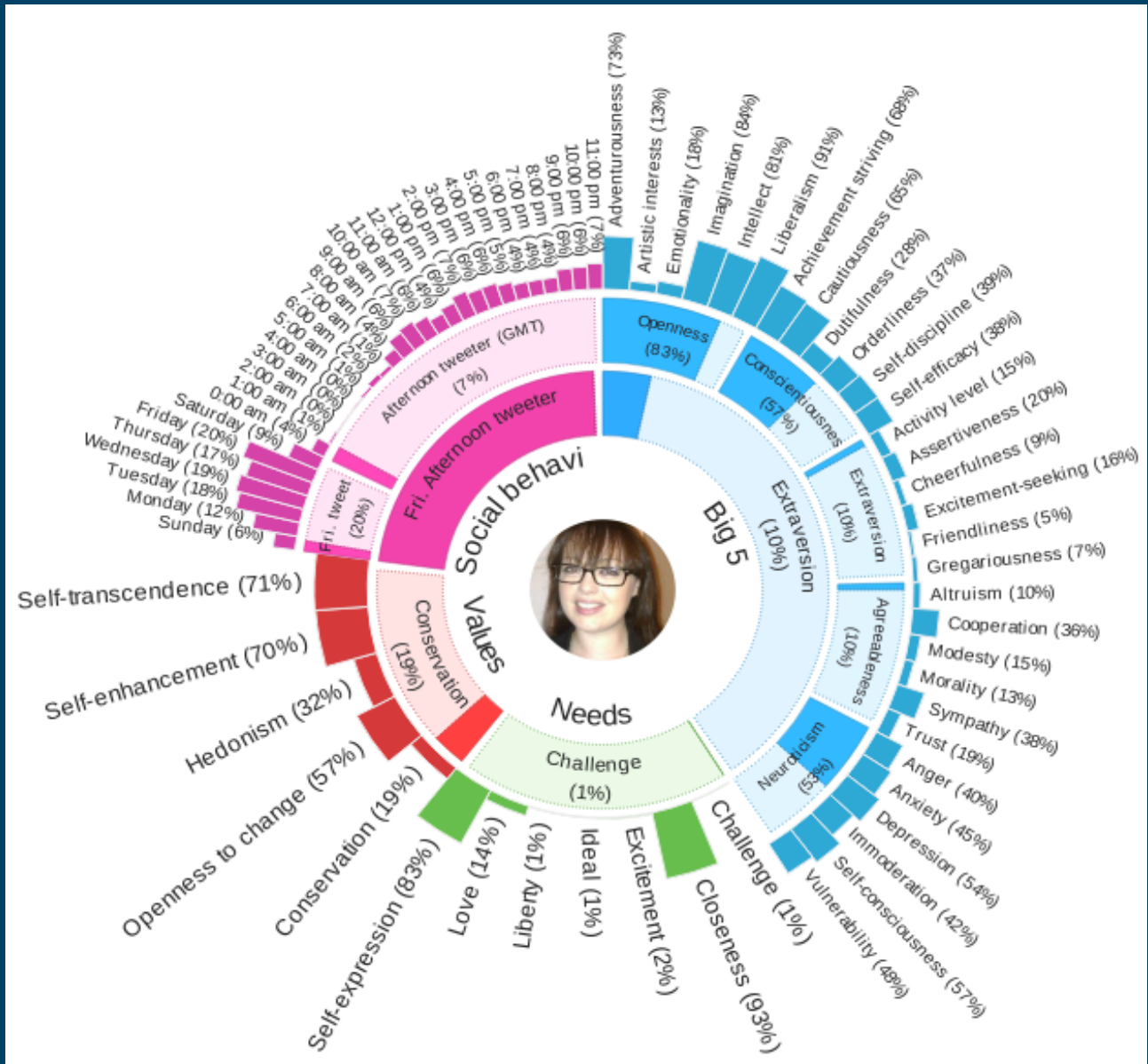
Text Analytics

*Who is this individual like?
What does she believe?
What motivates her?*

*What are my early adopters/super fans like?
Who are those living a healthy lifestyle?*

'System U' in Action

Watson needs just **200** tweets to extract a full spectrum of your psychological, cognitive and social traits



It's just data...



The day Watson the super computer learned to swear

Could this actually be a breakthrough?

BY NEW STATESMAN | PUBLISHED 10 JANUARY 2013 19:00

Library

 Like <16
 +1 <1
 Tweet <14



- ▶ Ok, so there is "tokenism" in selecting women, say firms
RAYMOND DOHERTY
- ▶ "Take my money, HBO!": Why you won't be able to watch Game of Thrones online anytime soon in the UK
ALEX HERN
- ▶ Grant Shapps rebuked by UK Statistics Authority for misrepresenting benefit figures
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Conclusions

- Watson is the first proof point of a new era of computing: cognitive systems
- Having proven itself through “Jeopardy!” Watson is now being put to work solving complex problems in a variety of industries
- The original system was based upon a simple “challenge-response” model whereas current implementations can hold a “dialogue” with the questioner to gather more evidence
- The cloud-based Watson Ecosystem is the key route for many organisations to develop and deliver cognitive applications to their customers
- We are just at the start of the journey today. Much more capability is coming

IBM Watson



Thank you!

