Expert Crowds

Crowdsourcing and Human Computation
Lecture 24
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TA: Ellie Pavlick

Website: crowdsourcing-class.org

Thanks to Maria Christoforaki & Panos Ipeirotis for today's slides!

Recruiting is hard

- MTurk, CrowdFlower, ODesk, or Freelancer gives us access to a lot of people
- But are they useful for specialized skills?

Attracting Contributors via Online Advertising

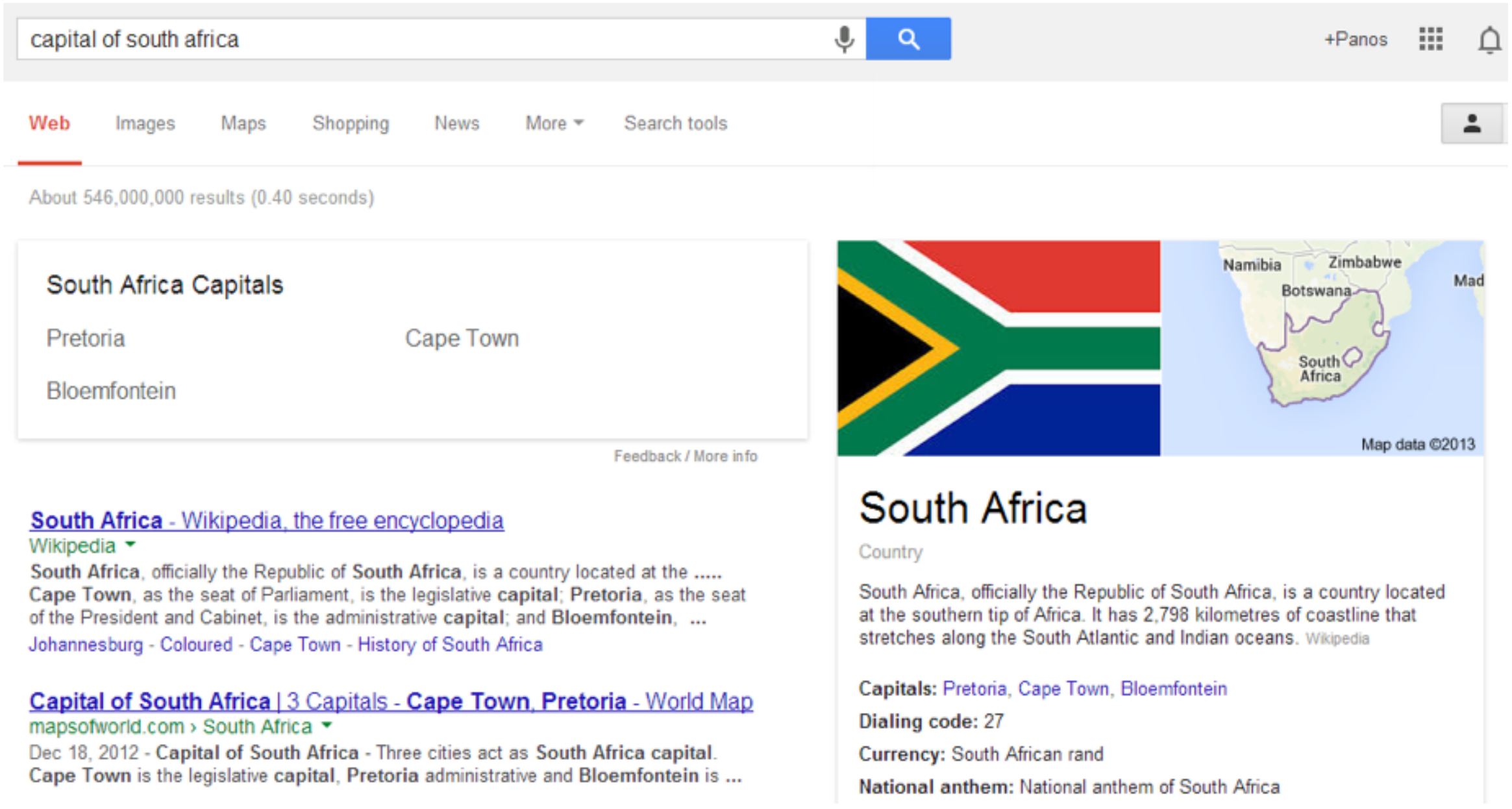
- Panos Ipeirotis spent a sabbatical at Google, and they tasked him with finding experts to fill in their Knowledge Graph

"We have a billion users… leverage their knowledge …"

"Let's create a new crowdsourcing system…"

"Crowdsource in a predictable manner, with knowledgeable users, without introducing monetary rewards"

Knowledge Graph: Things not Strings



Still incomplete…

- “Symptom of strep throat”
- “Side effects of treximet”
- “Who is Cristiano Ronaldo dating”
- “When is Jay Z playing in New York”
- “What is the customer service number for Google”
- …

Quizz

Correct Answers: 33/67 Correct (%): 49%

What is a symptom of Morgellons

Red eye

Choreoathetosis

Skin lesion

Insomnia

I don't know

Question 1 out of 10

Calibration vs. Collection

- **Calibration** questions (known answer):
  Evaluating user competence on topic at hand
- **Collection** questions (unknown answer):
  Asking questions for things we do not know
- *Trust more answers coming from competent users*

Tradeoff

Learn more about user quality vs. getting answers
(technical solution: use a Markov Decision Process)

Challenges

- Why would **anyone** come and play this game?
- Why would **knowledgeable** users come?
- Wouldn’t it be simpler to **just pay**?

Attracting Visitors: Ad Campaigns

Quiz on disease symptoms

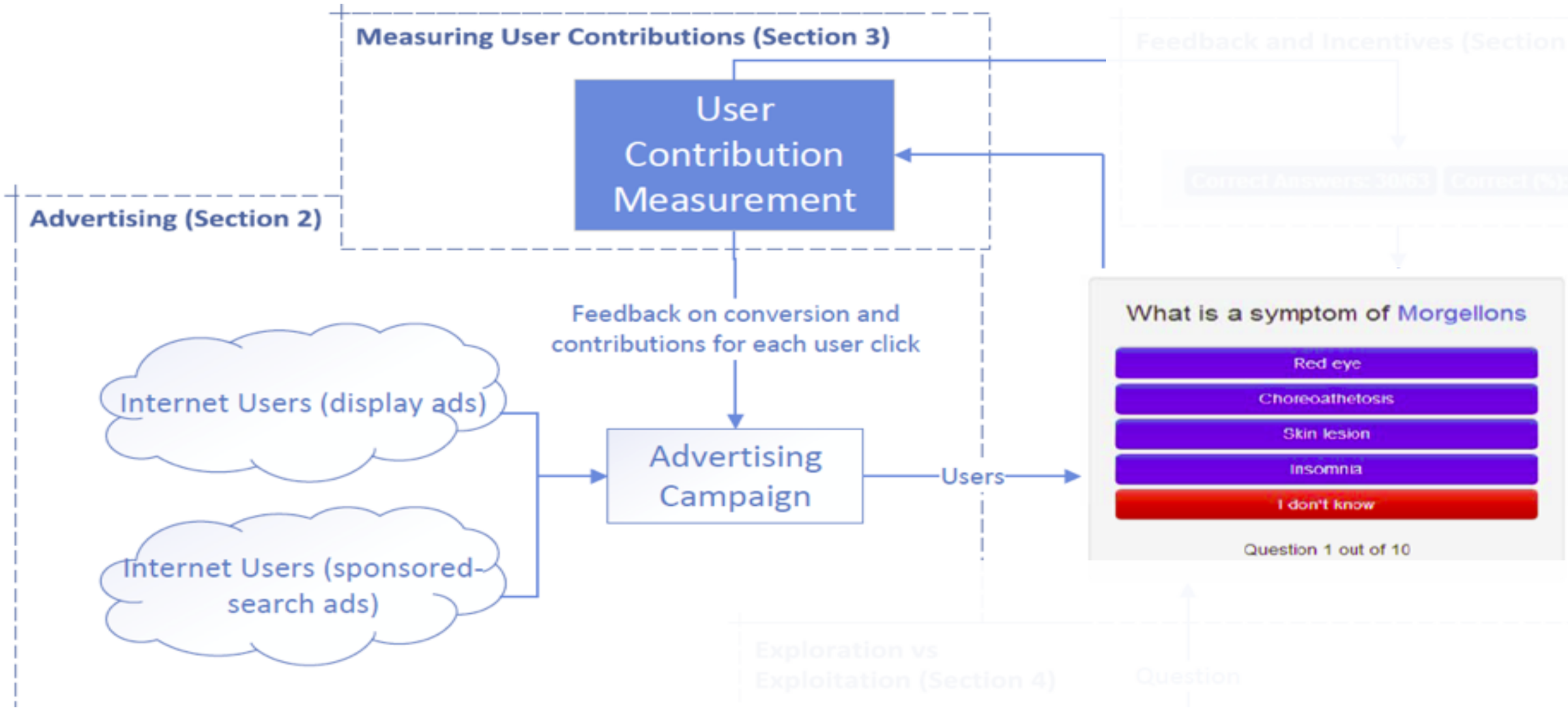
Test how well you can recognize various disease symptoms

www.quizz.us

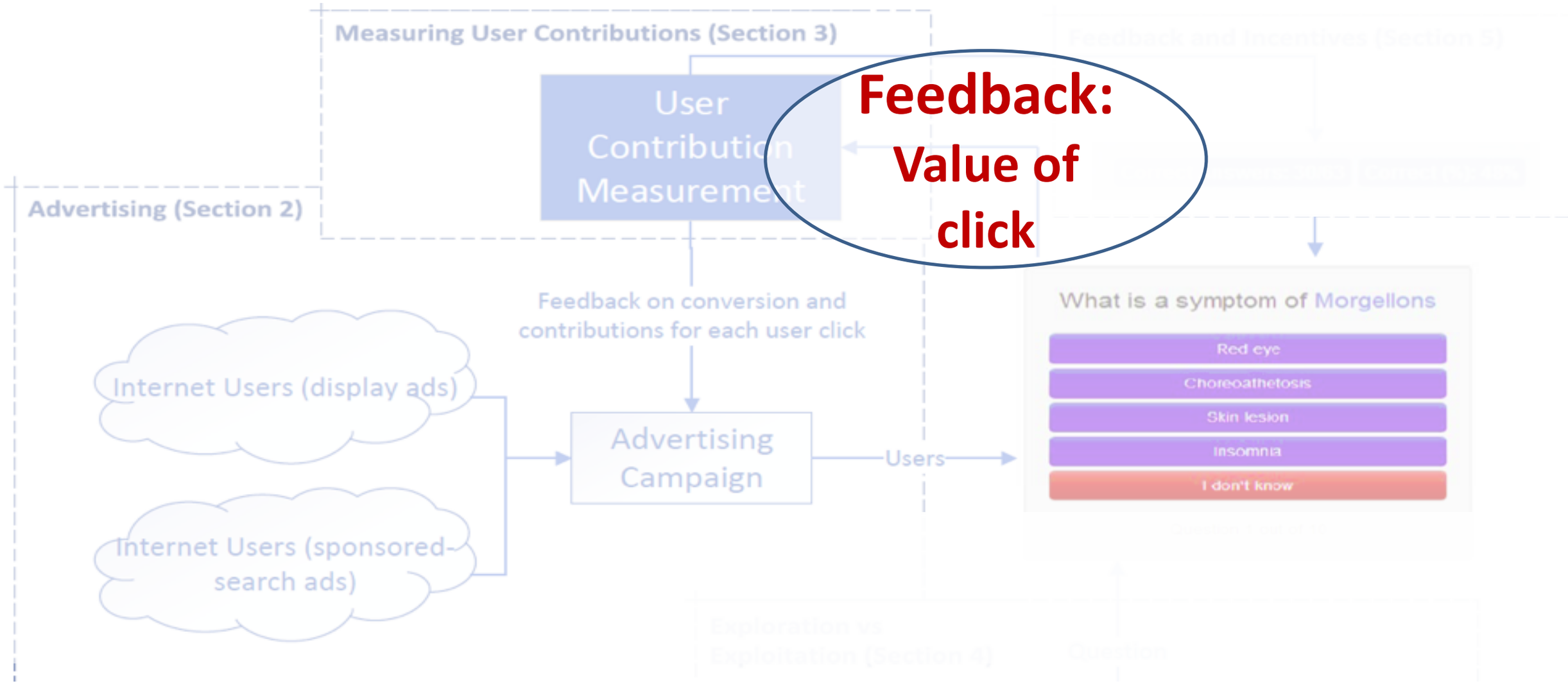
Running Ad Campaigns: Objectives

- We want to attract good users, not just clicks
- We do not want to think hard about keyword selection, appropriate ad text, etc.
- We want automation across thousands of topics
(from treatment side effects to celebrity dating)

Solution: Treat Quizz as eCommerce Site



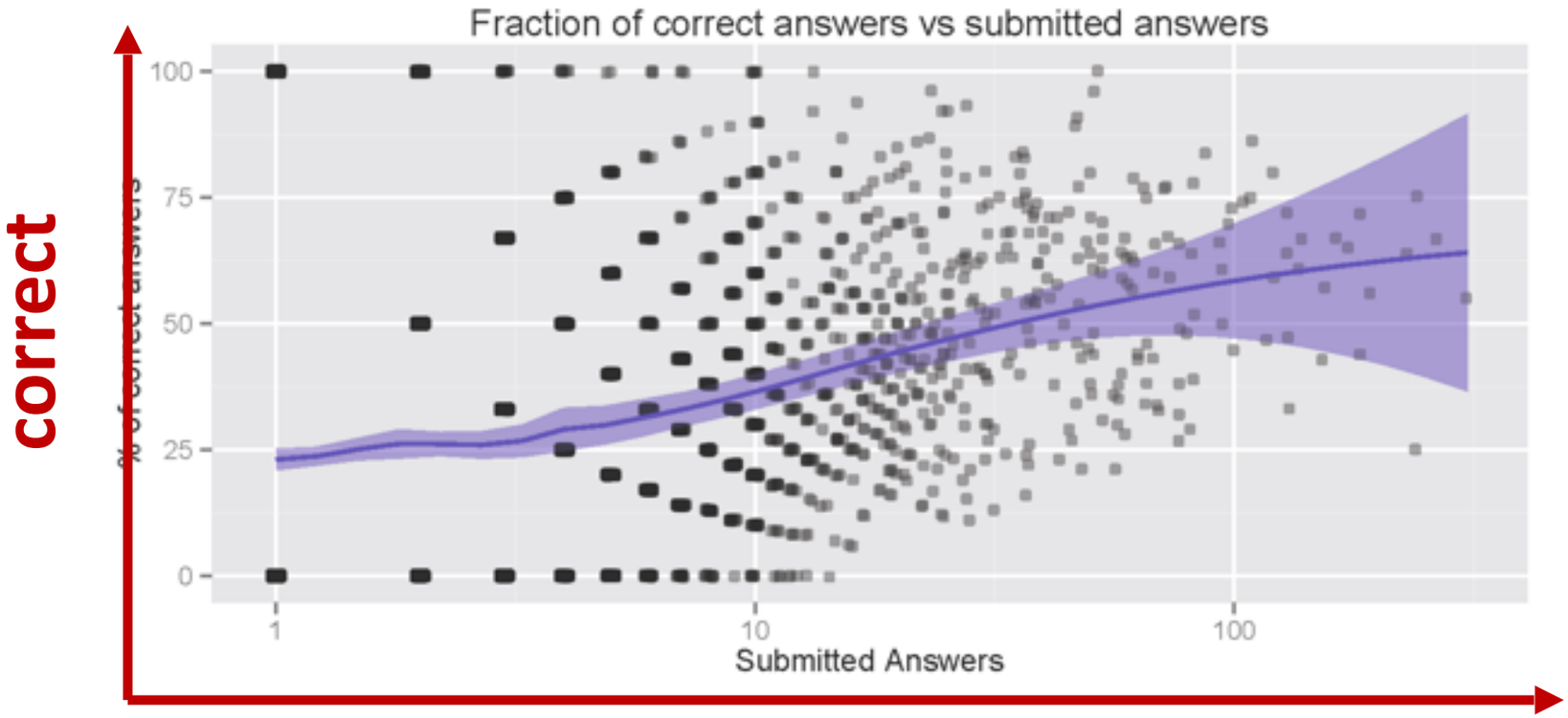
Solution: Treat Quizz as eCommerce Site



Example of Targeting: Medical Quizzes

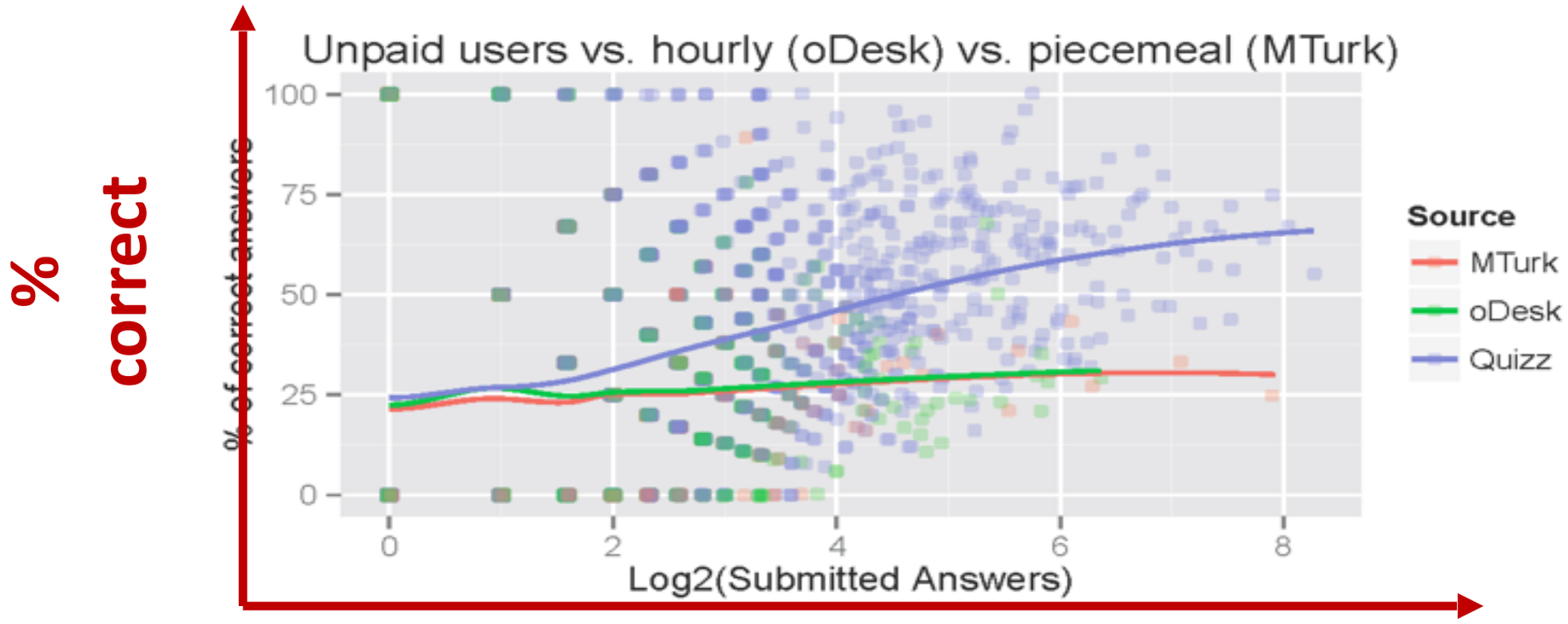
- Medical topics They the best performing quizzes…
- Users coming from sites such as Mayo Clinic, WebMD
- Likely “prosumers” (proactive consumers, not professionals

Self-selection and participation



- Low performing users naturally drop out
- With paid users, monetary incentives keep them

Comparison with paid crowdsourcing



- **Best** paid user
  - 68% quality, 40 answers (~1.5 minutes per question)
  - Quality-equivalency: 13 answers @ 99% accuracy, 23 answers @ 90% accuracy
  - 5 cents/question, or $3/hr to match advertising cost of unpaid users
- Knowledgeable users are much faster and more efficient

Targeted Advertising

- New way to run crowdsourcing, targeting with ads
- Engages unpaid users, avoids problems with extrinsic rewards
- Provides access to expert users, not available labor platforms
- Experts not always professionals (e.g., Mayo Clinic users)

Online Labor Markets

- Help employers and employees connect
- Face a similar challenge
- How do they assess worker skills?

mobileworks
oDesk + Elance
freelancer.com
amazon mechanical turk™
Artificial Artificial Intelligence

Skill Testing

- Skill certification through testing
- Workers take online tests
- Display score on profile
- Tests licensed from companies ExpertRating
- Domain-experts paid to create questions
- Static question banks

ExpertRating Categories

- Airlines and Aviation
- Building & Construction
- Career guidance
- Clothing and Fashion
- Engineering
- English language skills
- Finance & Accounting
- Food and hospitality
- Foreign language skills
- Graphic design
- Healthcare
- IT & Computer skills
- Law
- Management
- Media
- Medical transcription and billing
- Office temp skills
- Sales and Marketing

Problems

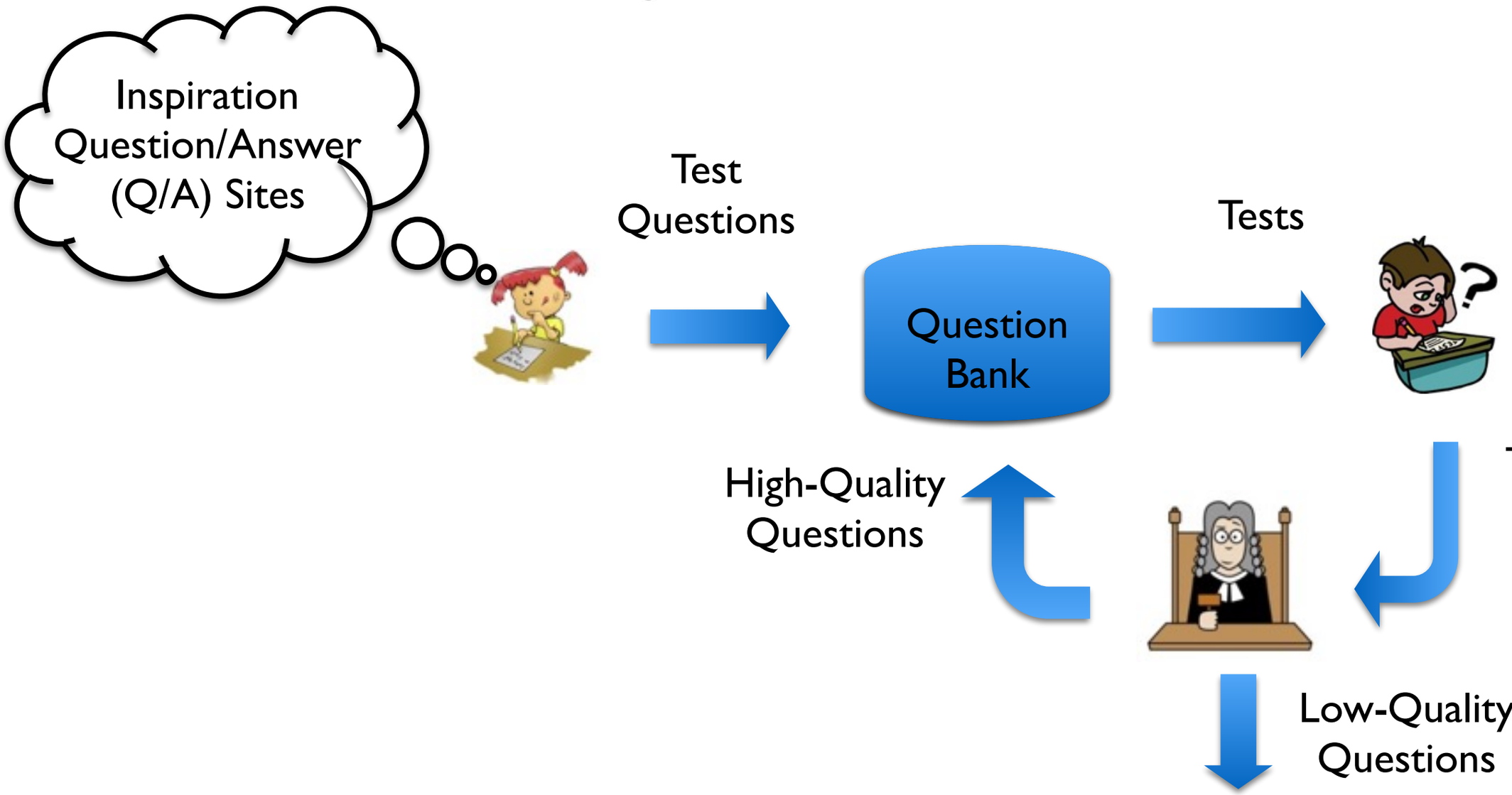
- Static Question Banks
  - Questions become outdated
  - Cheating
- Lack of evaluation
  - Questionable long-term performance predictors
  - Questions may have errors or ambiguities

STEP: A Scalable Testing and Evaluation Platform

Christoforaki and Ipeirotis (2014)

- Continuously generate new questions
  - Make tests more cheating proof
  - Keep questions up-to-date
- Evaluate question quality
  - Identify errors or ambiguities
  - Use real-market performance data for evaluation

STEP system summary



Stack Overflow

"A Q/A site for professional and enthusiast programmers"

- 3 million subscribed users
- 8 million questions
- 35K tags
- 91% at least one answer

Topic	Questions	%
Java	737,563	8.9
Javascript	723,150	8.7
C#	714,774	8.6
PHP	658,827	8.0
Android	585,017	7.1
Jquery	545,776	6.6
Python	355,093	4.3
HTML	352,146	4.2
C++	325,667	3.9
mysql	280,946	3.4

Stack Overflow Challenges

- Volume of questions
  - Large base of candidate questions for tests

Why is subtracting these two times (in 1927) giving a strange result?

2851

823

If I run the following program, which parses two date strings referencing times one second apart and compares them:

```
public static void main(String[] args) throws ParseException {
    SimpleDateFormat sf = new SimpleDateFormat("yyyy-MM-dd HH:mm:ss");
    String str3 = "1927-12-31 23:54:07";
    String str4 = "1927-12-31 23:54:08";
```

5575

+600

It's a time zone change on December 31st in Shanghai.

See this page for details of 1927 in Shanghai. Basically at midnight at the end of 1927, the clocks went back 5 minutes and 52 seconds. So "1927-12-31 23:54:08" actually happened twice, and it looks like Java is parsing it as the *later* possible instant for that local date/time - hence the difference.

Just another episode in the often weird and wonderful world of time zones.

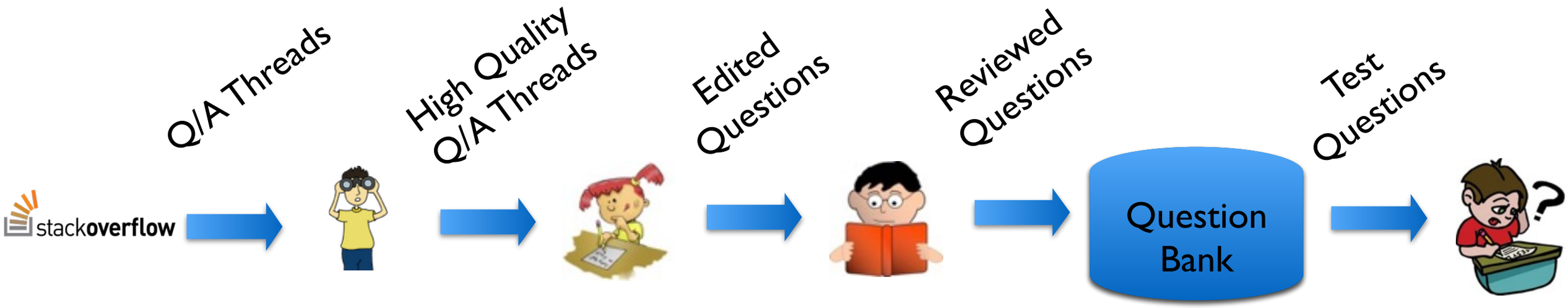
EDIT: Stop the press! History changes...

Question Spotter

- Identifies promising Q/A threads
- Train classifier with obtained labels: ~90% precision

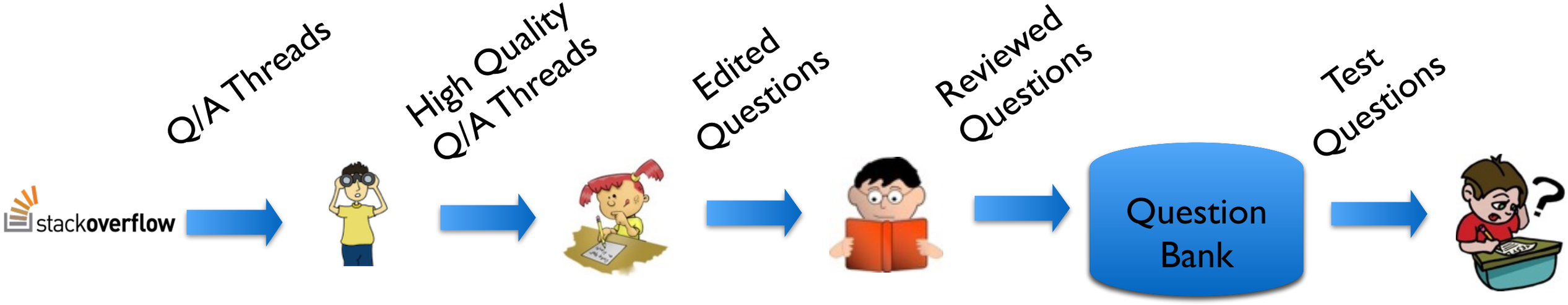
  Features

  – Question text length
  – Answer count
  – Answer score entropy
  – Popularity distribution of tags
  – Question popularity score
  – Weekly view count
  – Max answer author reputatio



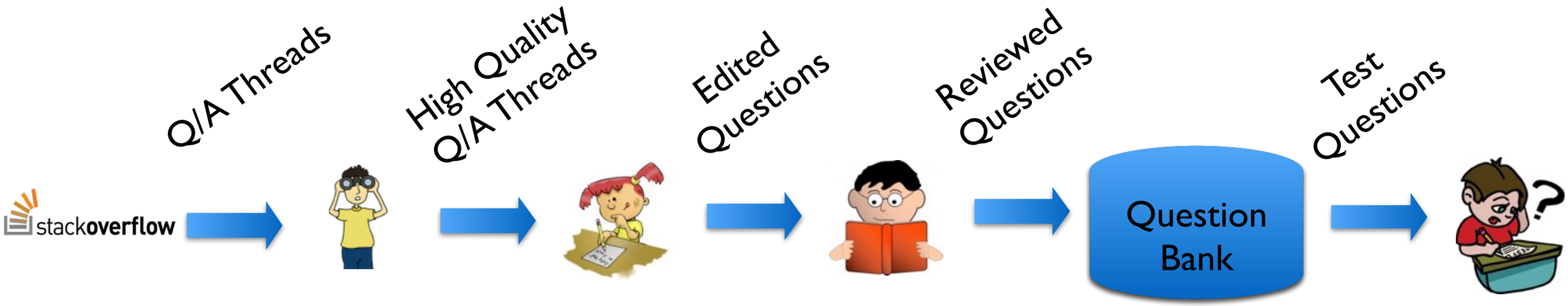
Question Editor

- Humans with expertise in topic at hand
- Visit and read promising Q/A thread
- Reformulate into multiple choice test-question
- Discard questions not considered appropriate



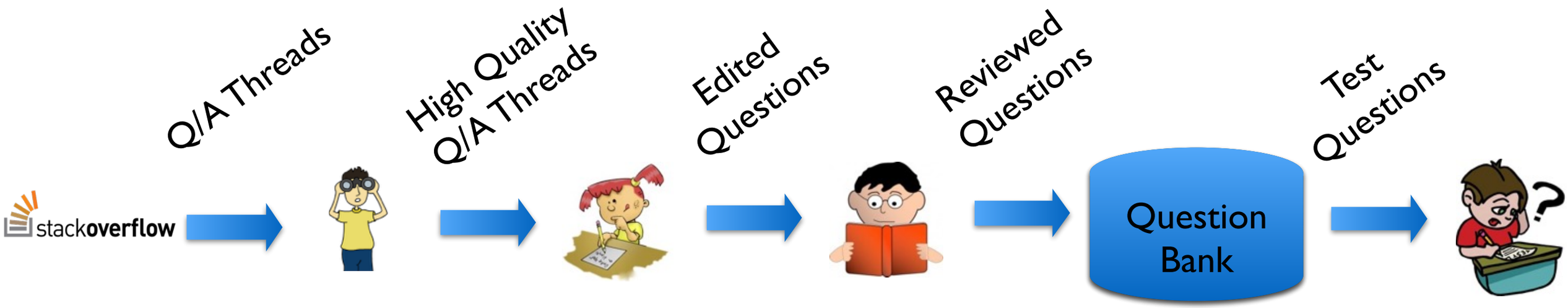
Question Reviewer

- Have a good handle of English Language, Check for spelling, grammar
- Check for compliance with test standards
  - Vocabulary usage
  - Question text length
  - Answer count
  - Answer text length
- Reviewers do not need to be topic experts

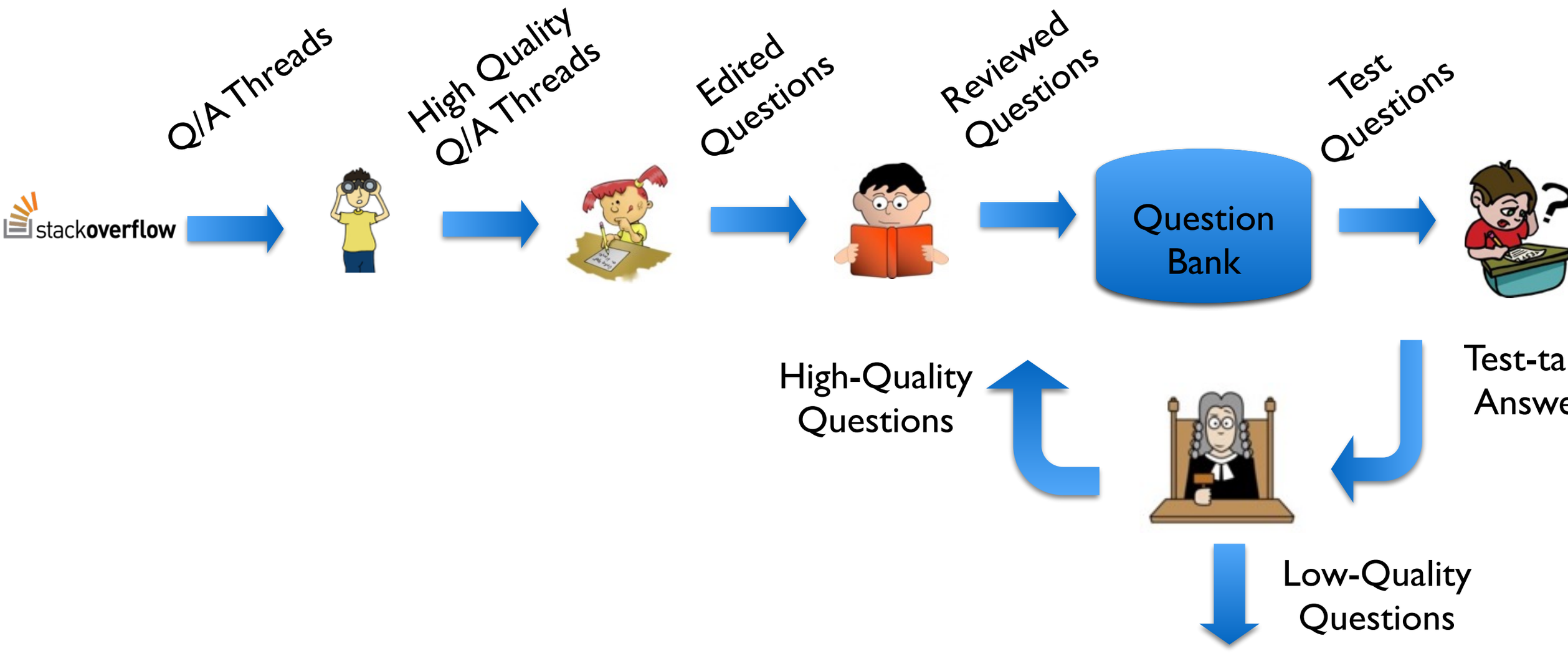


Question Bank

- Experimental Question Bank
  - Stores newly created questions
  - Not used for test-taker evaluation
  - Gather answers waiting for evaluation
- Production Question Bank
  - Are used for the test-taker evaluation



System Overview

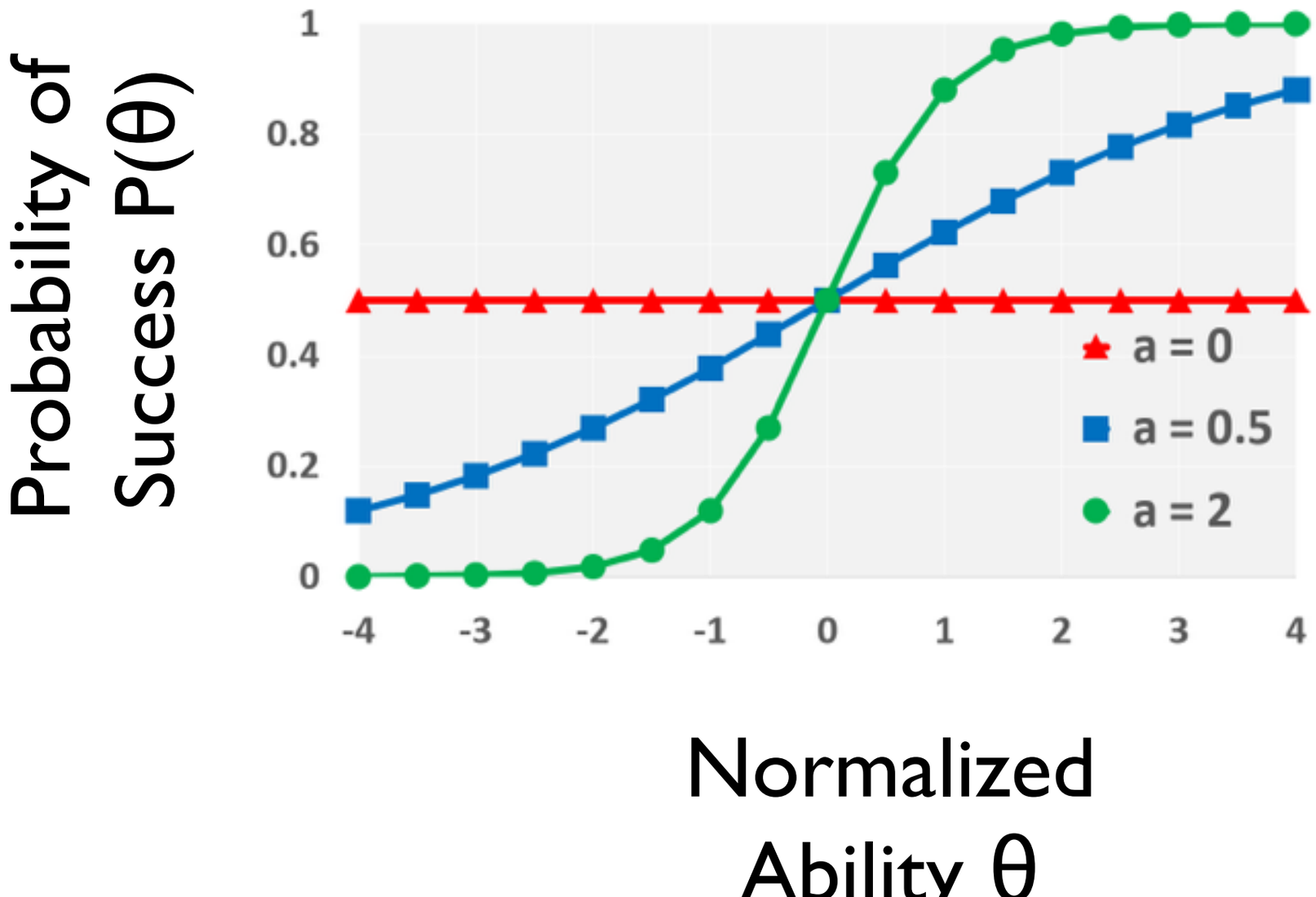


Item Response Theory

- Test takers have a single ability parameter θ
- Questions are modeled by **Item Characteristic Curve:**
  - α: discrimination of the question
  - β: difficulty of the question

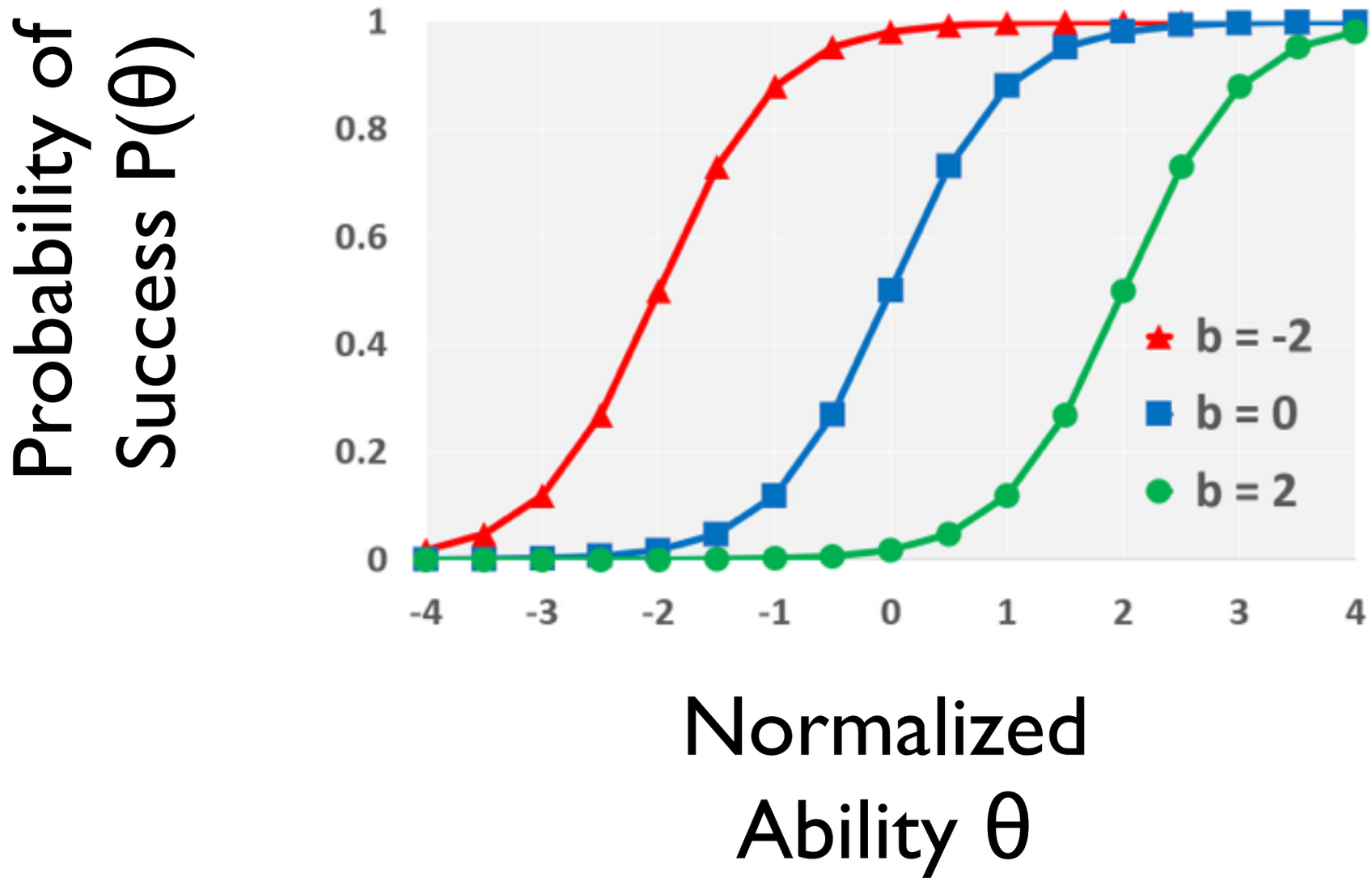
Item Response Theory

α: discrimination of the question



Item Response Theory

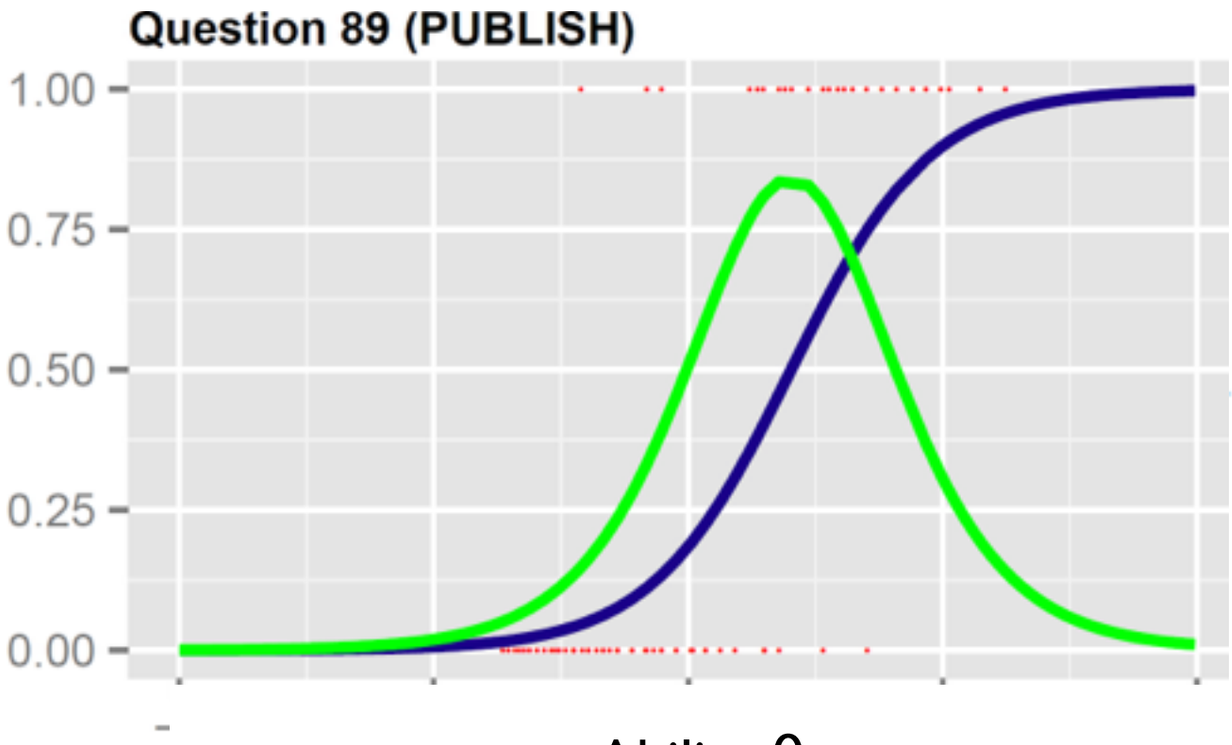
β: difficulty of the question



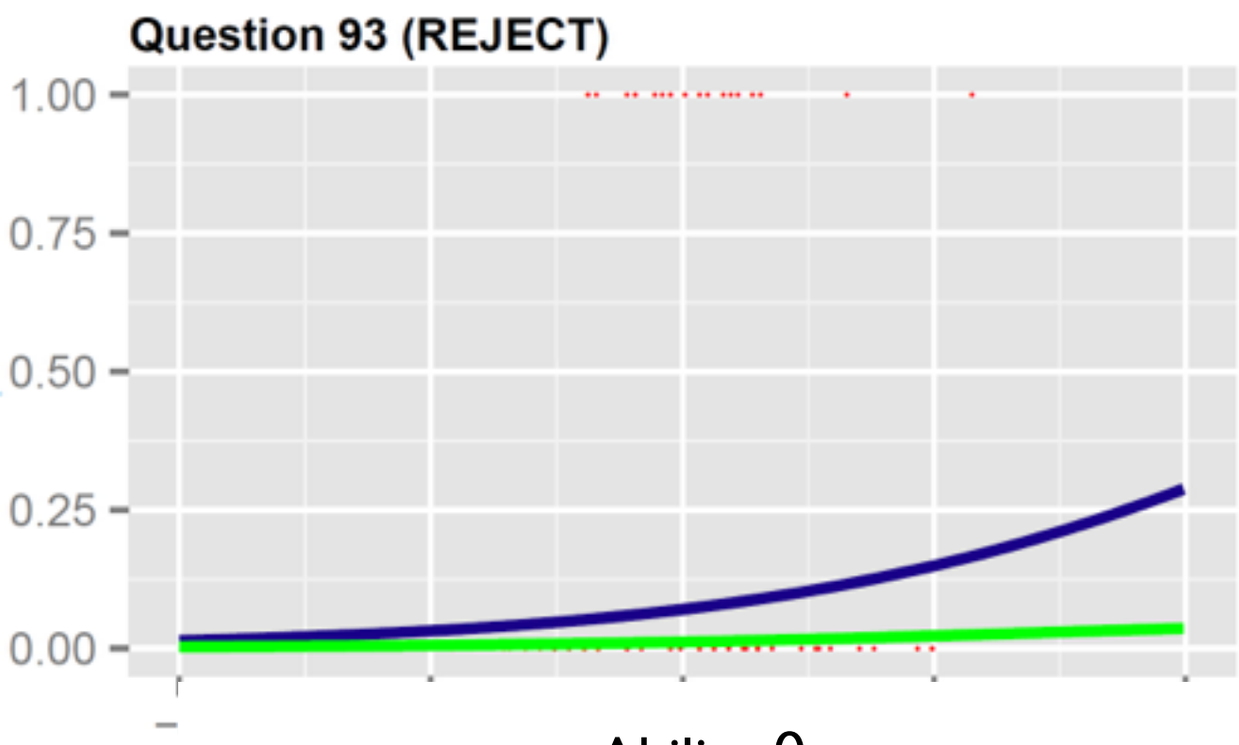
Question Quality Evaluation

I(θ): information gain

P(θ): probability of success



Discrimination=1.83
Difficulty=0.81



Discrimination=0.45
Difficulty=6.14

Ability measures

- Endogenous measures
  - $\theta(u)$: Test score of candidate u
    - Fit the function using logistic regression
    - Derive discrimination and difficulty values for each question

Ability measures

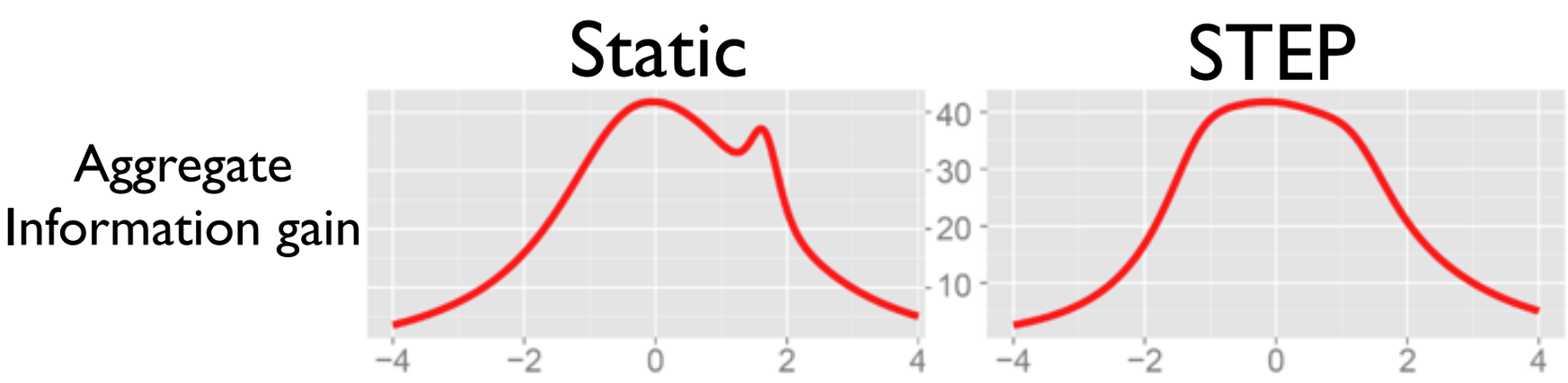
- Exogenous measures
  - $\theta(u)$: Hourly wage of candidate u after taking the test
    - Use wage data from ODesk
    - More robust to cheating
    - Evaluates importance of skills in the marketplace

STEP cost

- Using oDesk data
- Question cost
  - Static question bank licensing: $10 per question
  - STEP: $4 per question
  - Create question “from scratch” (IKM data): $25 per question

STEP performance

- Question quality (Java test example)
  - Static Question Bank: 87% acceptance rate
  - STEP generated questions: 89% acceptance rate



STEP

- System that continuously generates new questions
- Makes tests more cheating-proof
- Assesses test quality with real-market performance data
- Identify potential errors or ambiguities
- Is of equal or higher quality with existing tests
- Cheaper to generate questions than licensing

What would the ability to find and engage experts allow you to do?