

# Human Computation in Social Computing

Irwin King

Department of Computer Science and Engineering  
The Chinese University of Hong Kong

[king@cse.cuhk.edu.hk](mailto:king@cse.cuhk.edu.hk)

<http://www.cse.cuhk.edu.hk/~king>

©2009 Irwin King. All rights reserved.



# Topics in Social Computing

- Social Network Theory and analysis
- Large graph algorithms/  
graph mining/link analysis
- Learning to rank/  
personalized search
- Recommender systems/  
collaborative filtering
- Social media, e.g., YouTube,  
Flickr, wiki, blogs, etc.
- Virtual communities, e.g.,  
Second Life, wikipedia, etc.
- Social monetization/  
computational advertising
- Policy, privacy, and security
- Opinion mining/sentiment  
analysis
- Human computation/social  
games/crowdsourcing

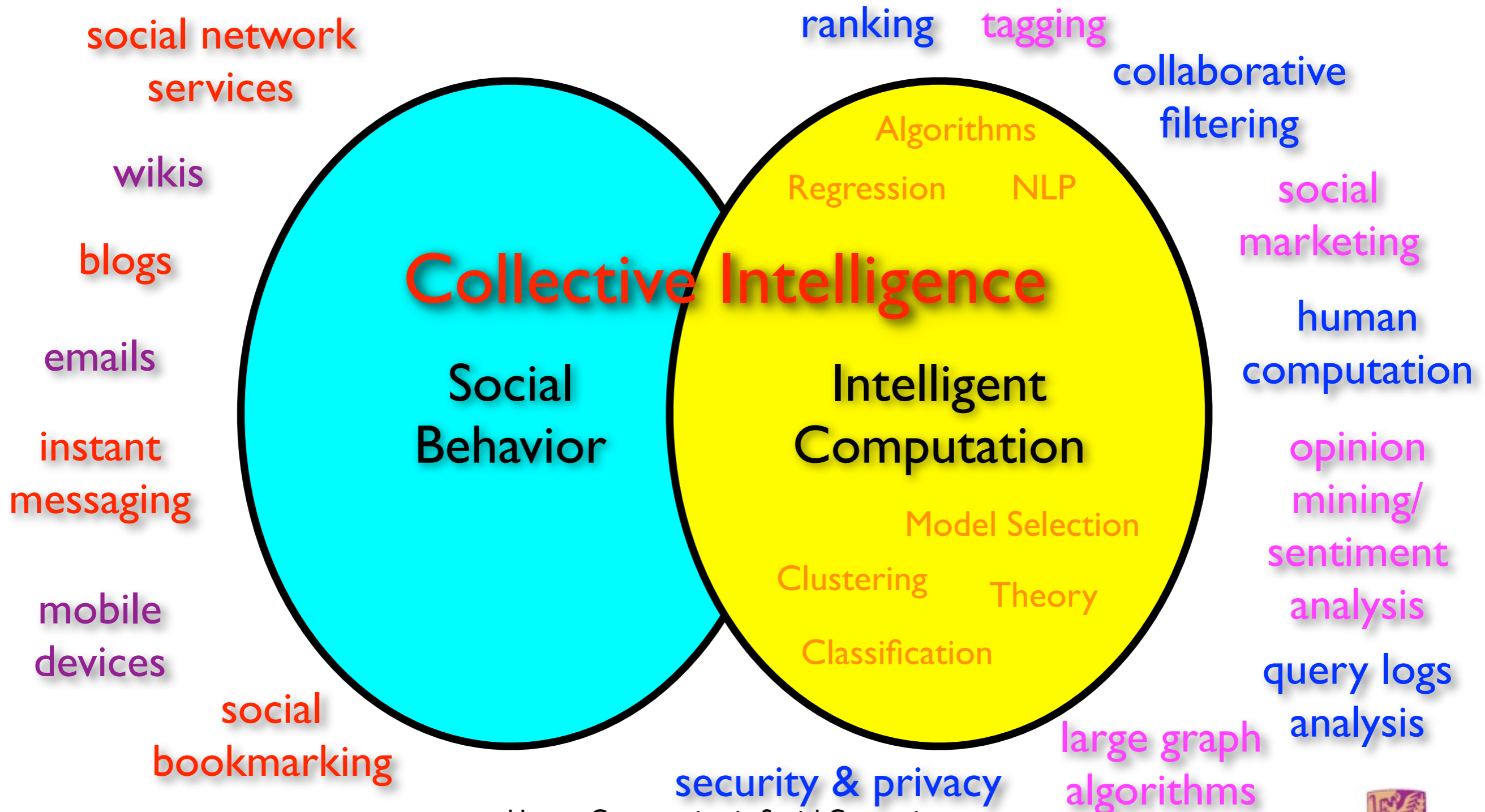


# Social Relations

presence  
identity  
social role  
reputation  
expertise  
trust  
ownership  
accountability  
knowledge  
crew  
teams  
populations  
binary  
cardinal  
integer  
real  
squad  
organizations  
cohort  
markets  
communities  
partners  
groups



# Social Computing



Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# Playing/Having Fun Work/Computation

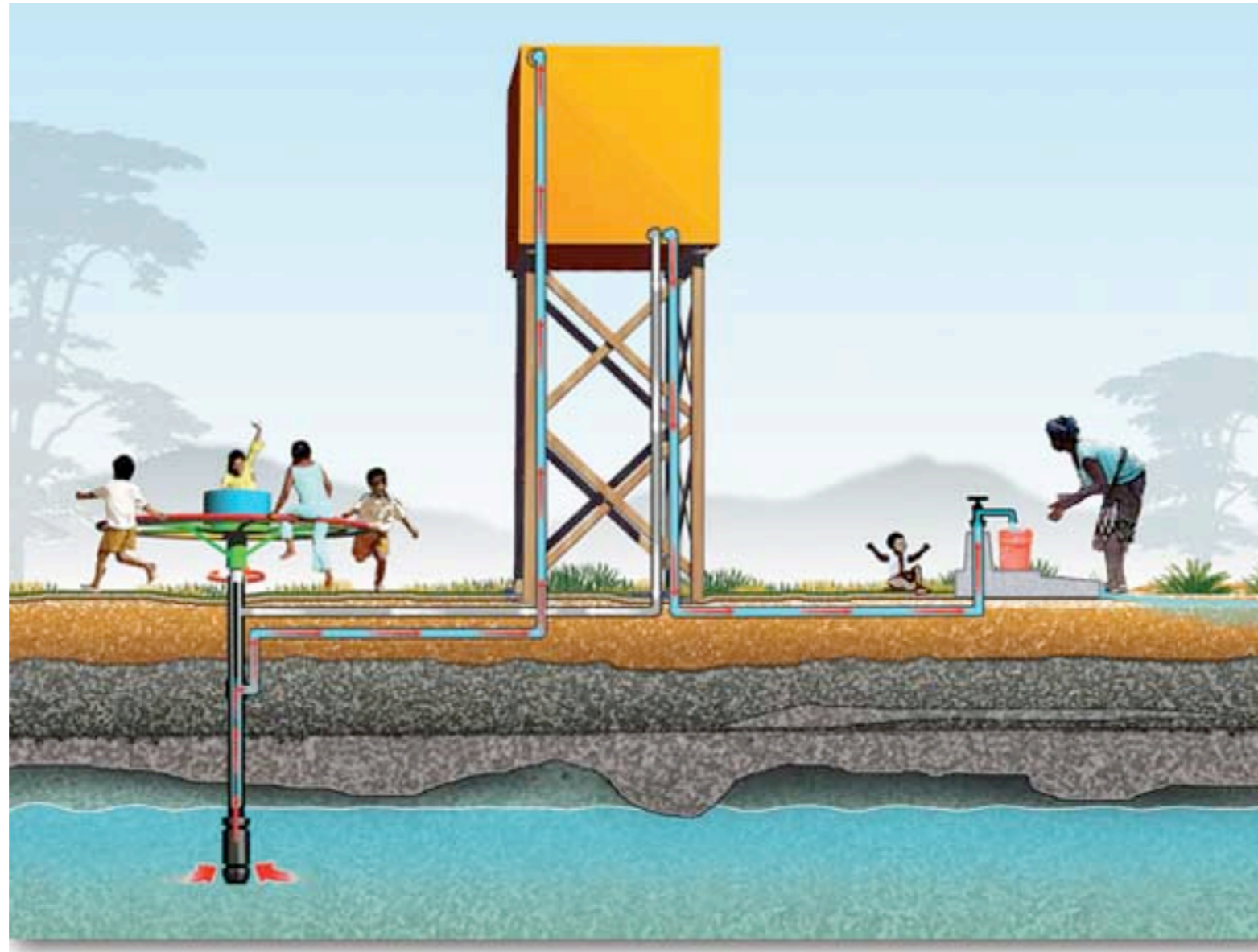


Human Computation in Social Computing  
Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# Idea of Human Computation



- Take advantage of people's desire to be entertained and perform useful tasks as a side effect

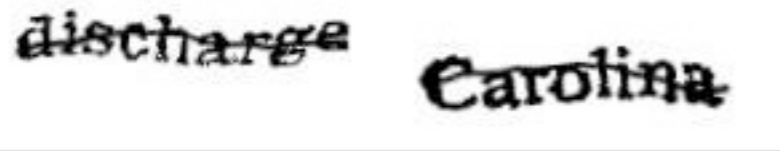
Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Social/Human Computation

Security Check: Enter both words below, separated by a space. What's This?  
Can't read this? Try another.  
[Try an audio captcha](#)



Text in the box:

I have read and agree to the [Terms of Use and Privacy Policy](#)

[Sign Up](#)

[Problems signing up? Check out our help pages](#)

Security Check: Enter both words below, separated by a space. What's This?  
Can't read this? Try another.  
[Try an audio captcha](#)



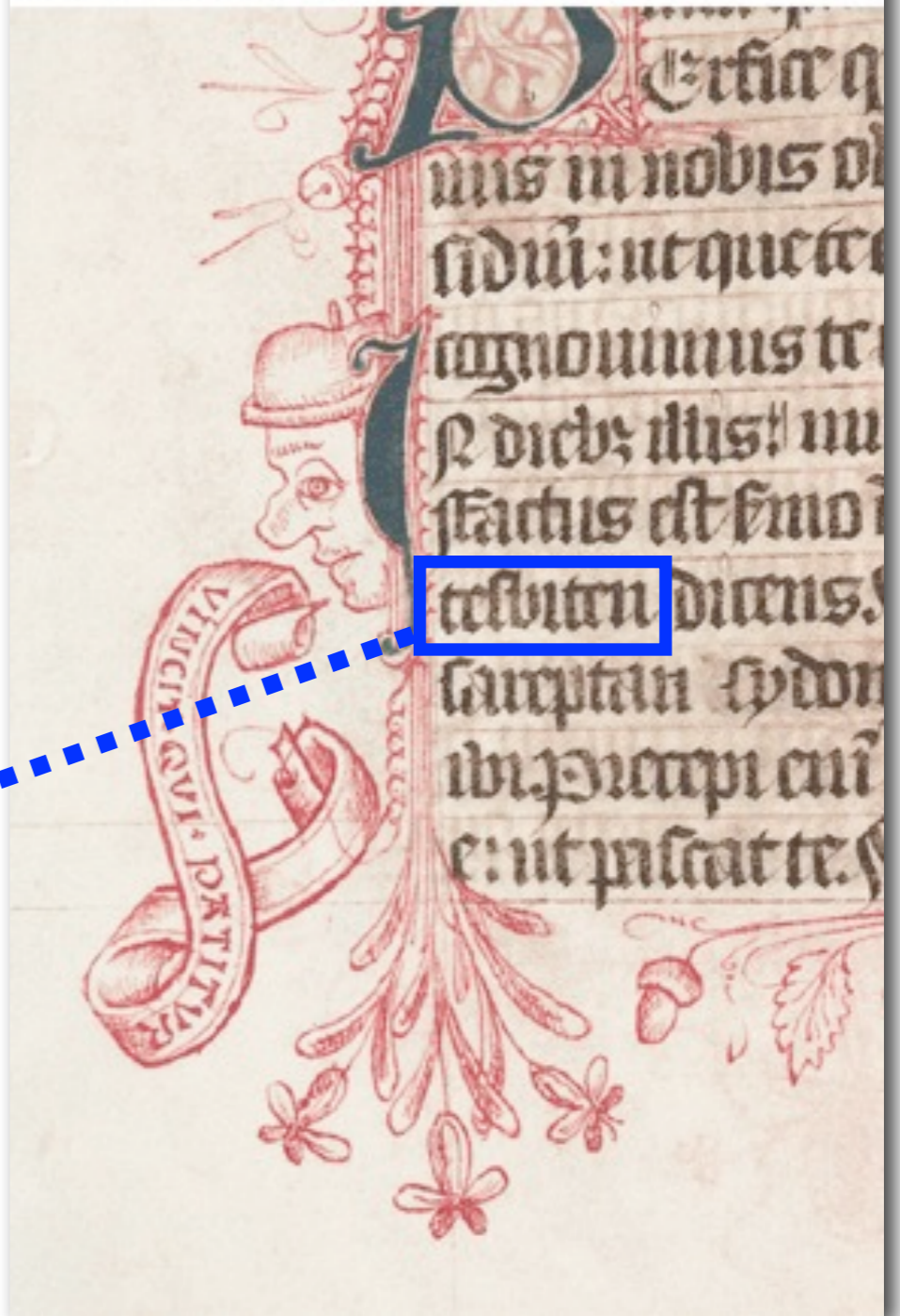
Text in the box:

I have read and agree to the [Terms of Use and Privacy Policy](#)

[Sign Up](#)

[Problems signing up? Check out our help pages](#)

MS. Don. b. 6, fol. 48v (detail) © Bodleian Library, University of Oxford



[Problems signing up? Check out our help pages](#)

[Sign Up](#)





# Human Computation

The screenshot shows the Google Image Labeler interface. At the top left is the Google logo with 'Image Labeler BETA' and 'Google Image Labeler' text. On the top right are links for 'Help' and 'Sign In'. On the left side, there is a scorecard with 'time left' at 01:17, 'score' at 0, and 'passes' at 0. In the center, there is a text input field with a 'label' button and a 'pass' button. Below the input field, it says 'Your partner has suggested 10 labels.' A large image of a lake and mountains is displayed in the center. Below the image is a 'zoom out' button. On the right side, there are two sections: 'off-limits' with labels 'sky', 'water', 'blue', 'lake', and 'mountain', and 'my labels' which is currently empty. Red starburst shapes are overlaid on the interface, highlighting the input field, the scorecard, the 'off-limits' list, and the 'my labels' section.

Google Image Labeler BETA

Help | Sign In

time left  
01:17

score  
0

passes  
0

label pass

Your partner has suggested 10 labels.

zoom out

off-limits

sky  
water  
blue  
lake  
mountain

my labels

[Privacy Policy](#) - [Terms of Use](#) - [Return to Google Image Search](#)  
© 2007 Google





# Why Is It Important?

- Some statistics (July 2008)
  - 200,000+ players have contributed 50+ million labels.
  - Each player plays for a total of 91 minutes.
  - The throughput is about 233 labels/player/hour (i.e., one label every 15 seconds)
- Idea behind
  - Solve some problems which are difficult to be solved by computers.
  - Take advantage of people's desire to be entertained.
  - Produce useful metadata as a by-product.



# Games With A Purpose



- **Matchin**
  - Image search by aesthetic value
- **Babble**
  - Translate foreign language into English
- **InTune**
  - Tags songs with description text
- **Squigl**
  - Image segmentation
- **Verbosity**
  - Database of common knowledge description



# Background

- Human Computation Systems (**HCS**) aim to solve Artificial Intelligence (AI) problems through the human human interactions
- In order to ensure the collected information to be useful, we have to:
  1. guarantee the **quality** of collected information
  2. attract **more people** to contribute information





# Types of HCS

- The categories of the human computation systems are:
  1. Initiatory Human Computation
  2. Distributed Human Computation
  3. Social Game-based Human Computation with volunteers or paid engineers
  4. Social Game-based Human Computation with online players



# Initiatory Human Computation (I)

- Objective: To complete some tasks that are **natural for humans but difficult for computers** even computation power increased rapid recently
- Example (I): CAPTCHA
  - A computer generated challenge-response test
  - Objective: To **distinguish humans from computers** using a common sense problem



The Yahoo! CAPTCHA.

Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Initiatory Human Computation (2)

- Example (2): reCAPTCHA
  - Objective: To produce valuable common sense knowledge to **improve the OCR** quality in digitizing books
  - Combining two words: **one identified word; and one unidentified word**
  - If a user recognizes the identified word, the answer to the unidentified word is assumed to be correct





# Initiatory Human Computation (3)

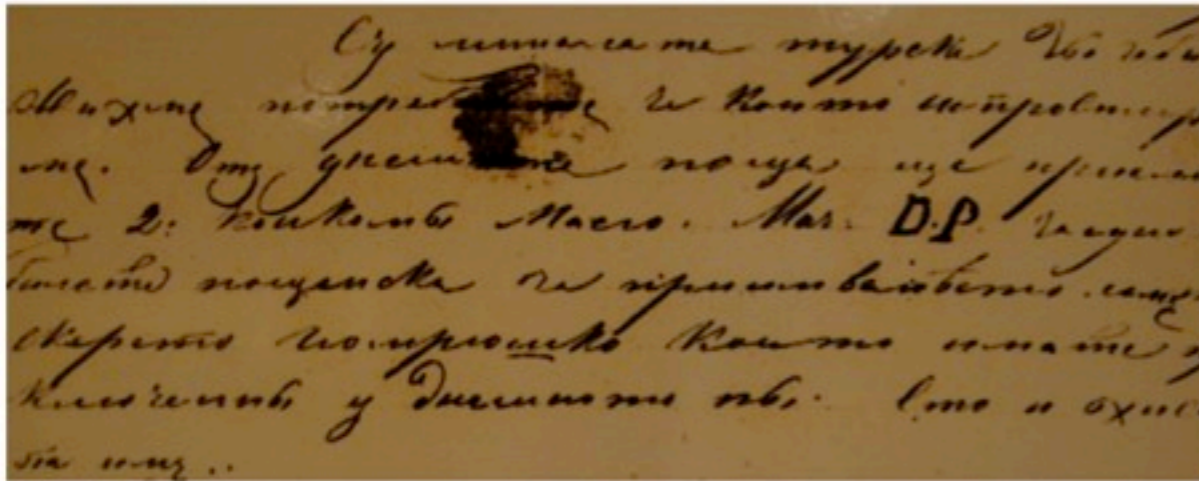
- Example (2): reCAPTCHA

The Norwich line steamboat train, from New-London for Boston, this **morning** ran off the track seven miles north of New-London.

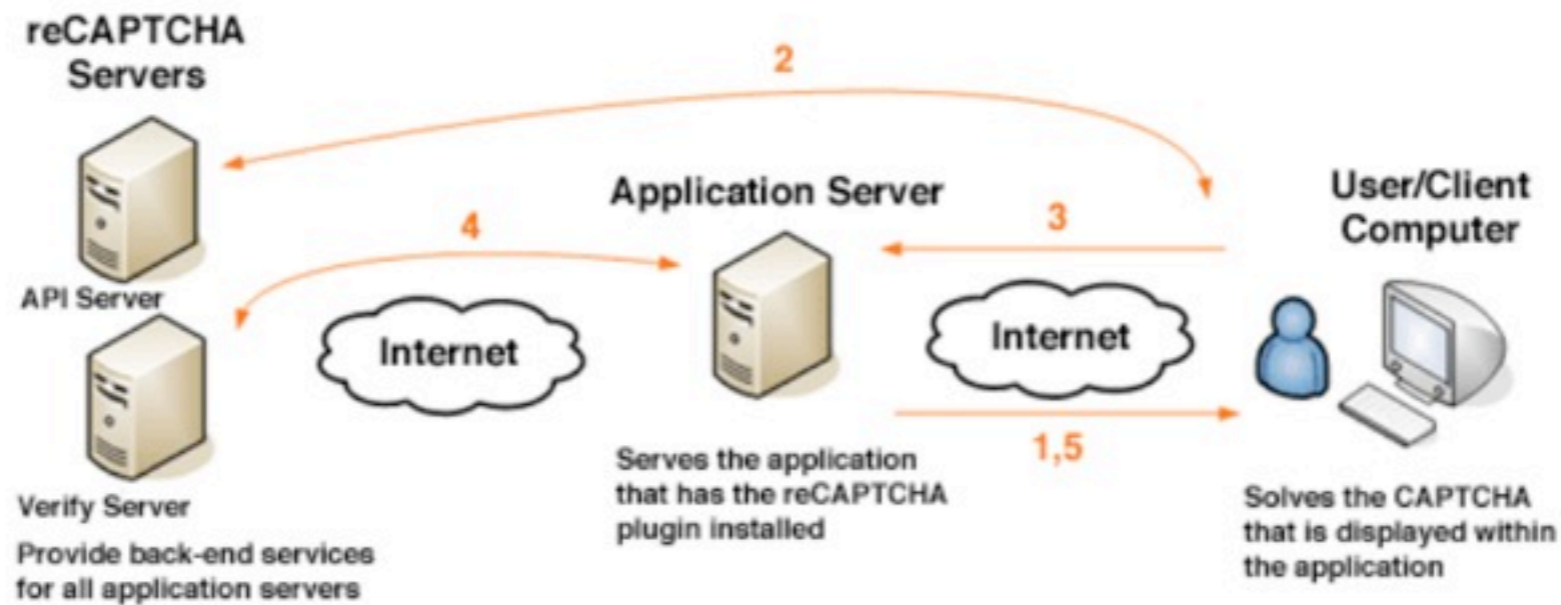
morning



# reCAPTCHA

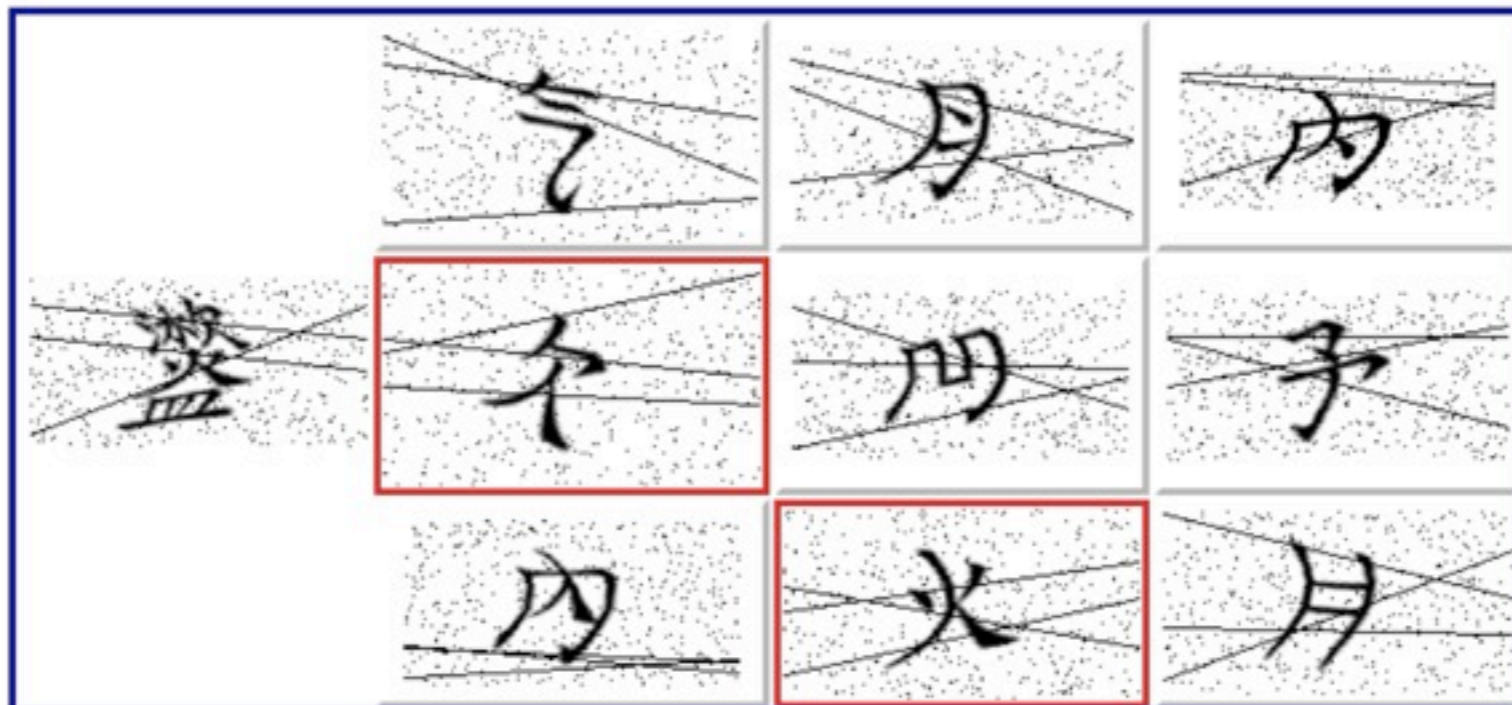
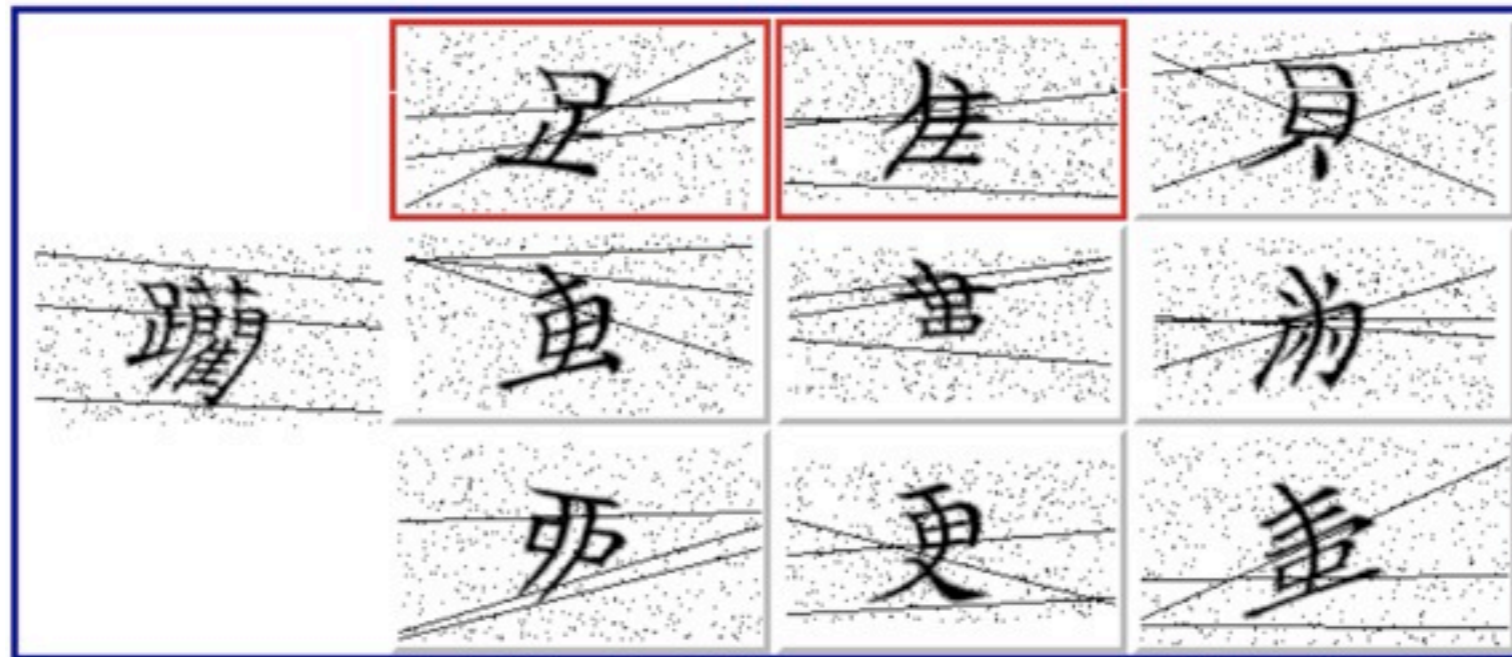


Client-Server components - reCAPTCHA plugins



# Chinese CAPTCHA

Ling-Jyh Chen, Institute of Information Science, Academia Sinica, Taipei, Taiwan



INTERNATIONAL CONFERENCE ON COMPUTATIONAL INTELLIGENCE IN SOCIAL COMPUTING

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# Distributed Human Computation (I)

- Objective: To encourage a **huge population of Internet users** to contribute to solve the difficult AI problems
- Example (1): **Razor**
  - To use human votes to determine if a given email is spam (anti-spam mechanism)
- Example (2): **Proofreader**
  - To give a (small) portion of the image file and corresponding text (generated by OCR) side-by-side to a human proofreader



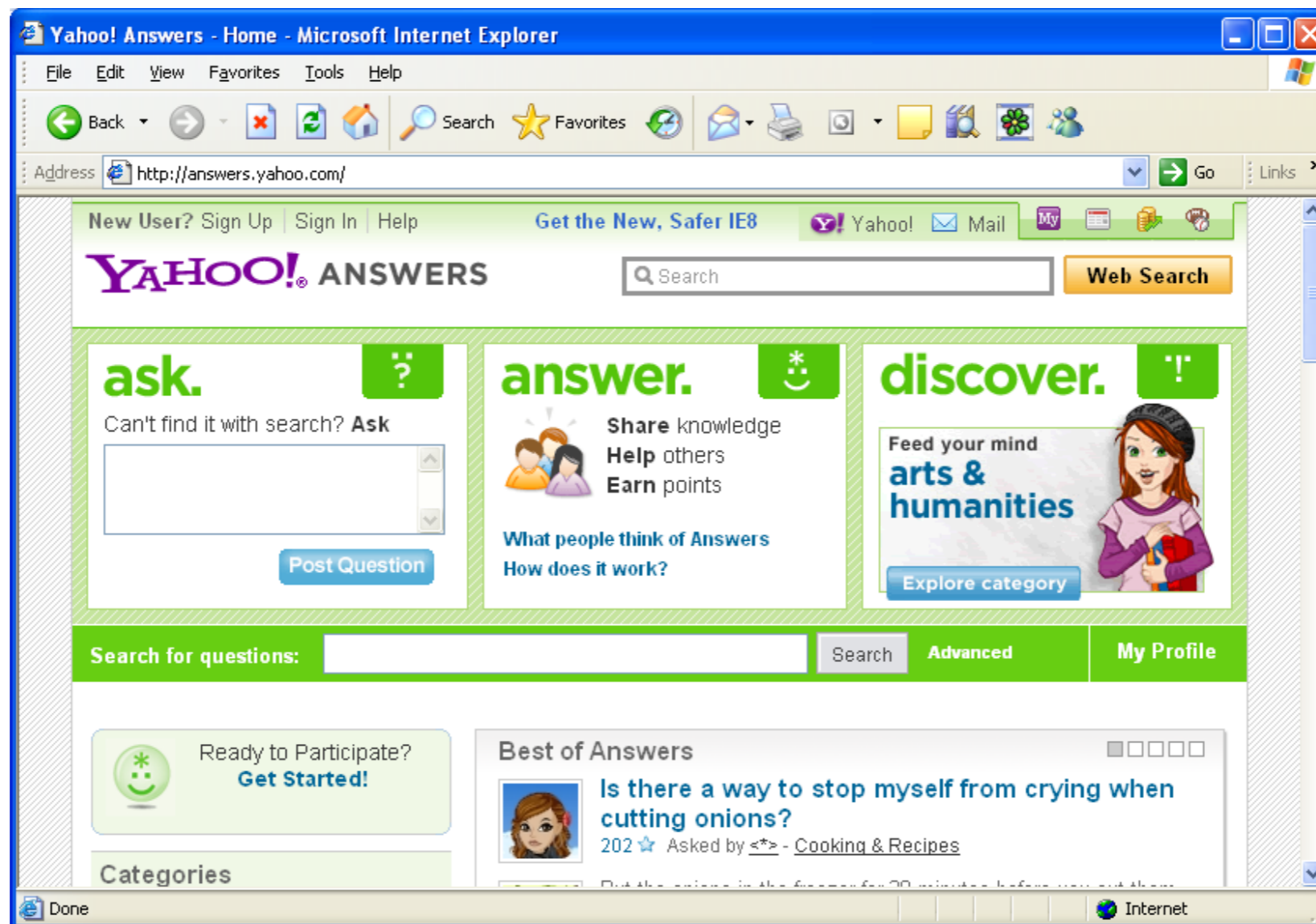
# Distributed Human Computation (2)

- Example (3): **Wikipedia**
- The collective knowledge is distributed in that essentially almost anyone can contribute to the Wiki



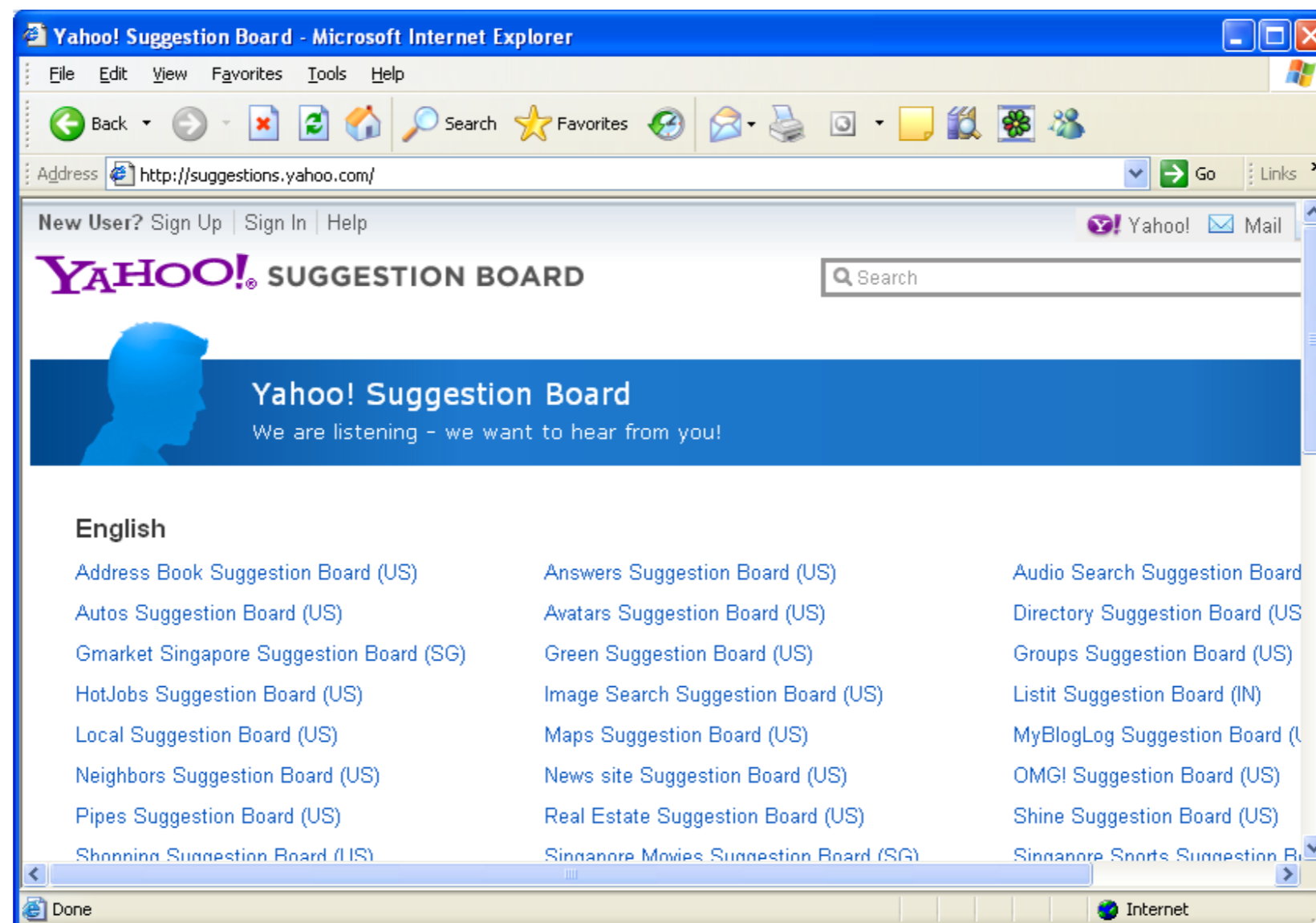
# Distributed Human Computation (3)

- Example (4): **Yahoo! Answers**
- To provide automated collection of human reviewed data at Internet-scale



# Distributed Human Computation (4)

- Example (5): **Yahoo! Suggestion Board**
- An Internet-scale feedback and suggestion system



Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# Distributed Human Computation (5)

- Example (6): **Amazon Mechanical Turk**
  - It provides monetary rewards for tasks
- Example (7): **LabelMe**
  - A web-based tool for image annotation
  - Anybody can annotate image using it. You can only have access to the database once you have annotated a certain number of images.
- Example (8): **43Things**
  - To collect goals from users and help them to find other users who have similar goals
- Example 9: **MajorMiner**
  - Music annotation game



# Amazon Mechanical Turk

## Mechanical Turk is a marketplace for work.

We give businesses and developers access to an on-demand, scalable workforce. Workers select from thousands of tasks and work whenever it's convenient.

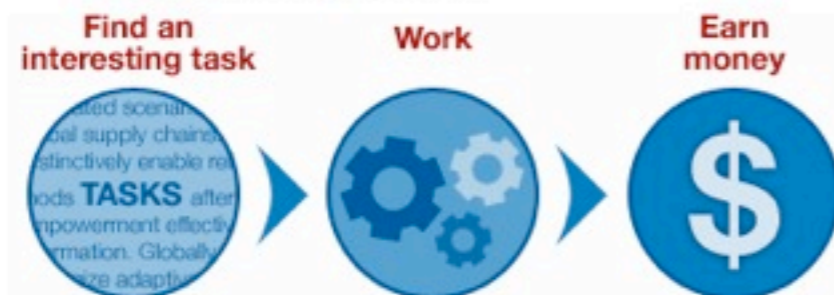
**26,113 HITs** available. [View them now.](#)

## Make Money by working on HITs

HITs - *Human Intelligence Tasks* - are individual tasks that you work on. [Find HITs now.](#)

### As a Mechanical Turk Worker you:

- Can work from home
- Choose your own work hours
- Get paid for doing good work



[Find HITs Now](#)

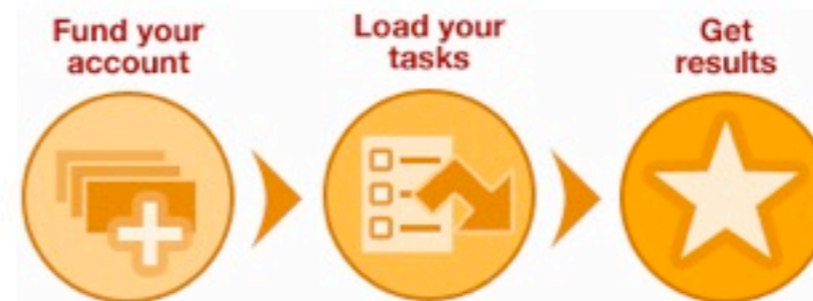
or [learn more about being a Worker](#)

## Get Results from Mechanical Turk Workers

Ask workers to complete HITs - *Human Intelligence Tasks* - and get results using Mechanical Turk. [Register Now](#)

### As a Mechanical Turk Requester you:

- Have access to a global, on-demand, 24 x 7 workforce
- Get thousands of HITs completed in minutes
- Pay only when you're satisfied with the results



[Get Started](#)

or [learn more about being a Requester](#)



# Example of Mechanical Turk

## Answer a short survey

1. What is your gender?

- Male  
 Female

2. What is your age?

3. Which of the following best describes your highest achieved education level?

Some High School

4. What is the total income of your household?

- Less than \$12,500   
\$12,500 - \$24,999   
\$25,000 - \$37,499   
\$37,500 - \$49,999

5. What is your favorite type of TV Show? (select all that apply)

- Sports  
 Situational Comedies  
 Drama  
 News  
 Music Videos

## Find the Website Address for this Restaurant

- For this restaurant below, enter the website address for the official website of the restaurant
- Include the full address, e.g. <http://www.thecheesecakefactory.com>
- Do not include URLs to city guides and listings like Citysearch.

Restaurant Name: **\$(name)**

Address: **\$(address)**

Phone Number: **\$(phone)**

Website:

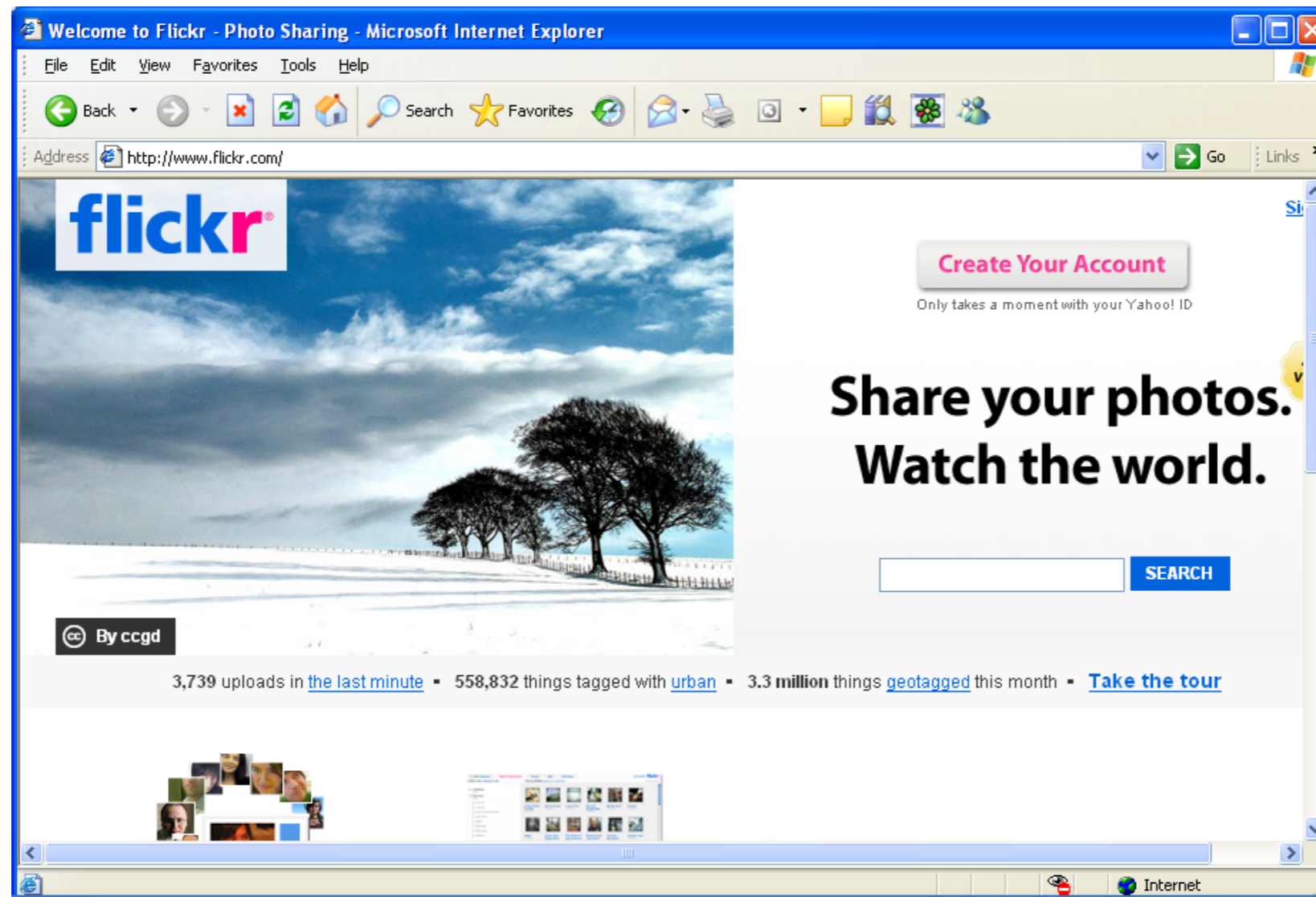
Please provide any comments you may have below, we appreciate your input!





# Distributed Human Computation (6)

- Example (10): **Yahoo's flickr**
- It is a photo-sharing site with captions being used as photo tags



Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# Social Game-based Human Computation with Volunteers or Paid Engineers (I)

- Recently social games were proposed to **collect accurate information** from players as a side effect of their playing
- The players are **volunteers** or **paid engineers**
- Disadvantages:
  - Rely on **online volunteers** or **paid engineers** to enter information explicitly
  - **Unable to scale up** the system due to high cost
  - **No validation mechanism** to guarantee that the information collected is accurate



# Social Game-based Human Computation with Volunteers or Paid Engineers (2)

- Most of the games at early stage aimed to collect commonsense knowledge.
- Example (1): **Cyc**
  - To collect information from the input by **paid knowledge engineers**
- Example (2): **Open Mind**
  - To collect **common sense knowledge** from people to develop intelligent software
  - Shortcoming: was too reliant on the **unpaid volunteers** to donate their time to contribute information



# Social Game-based Human Computation with Volunteers or Paid Engineers (3)

- Example (2): **Open Mind**



# Social Game-based Human Computation with Volunteers or Paid Engineers (4)

- Example (3): **Mindpixel**
  - Reward those Internet users who consistently **validate a fact** inline with the other users
  - Shortcoming: the cost is high!
- Example (4): **Wildfire wally**
  - To solve the **maximum clique problem**
  - Shortcoming: rely on unpaid volunteers to donate their time to contribute information





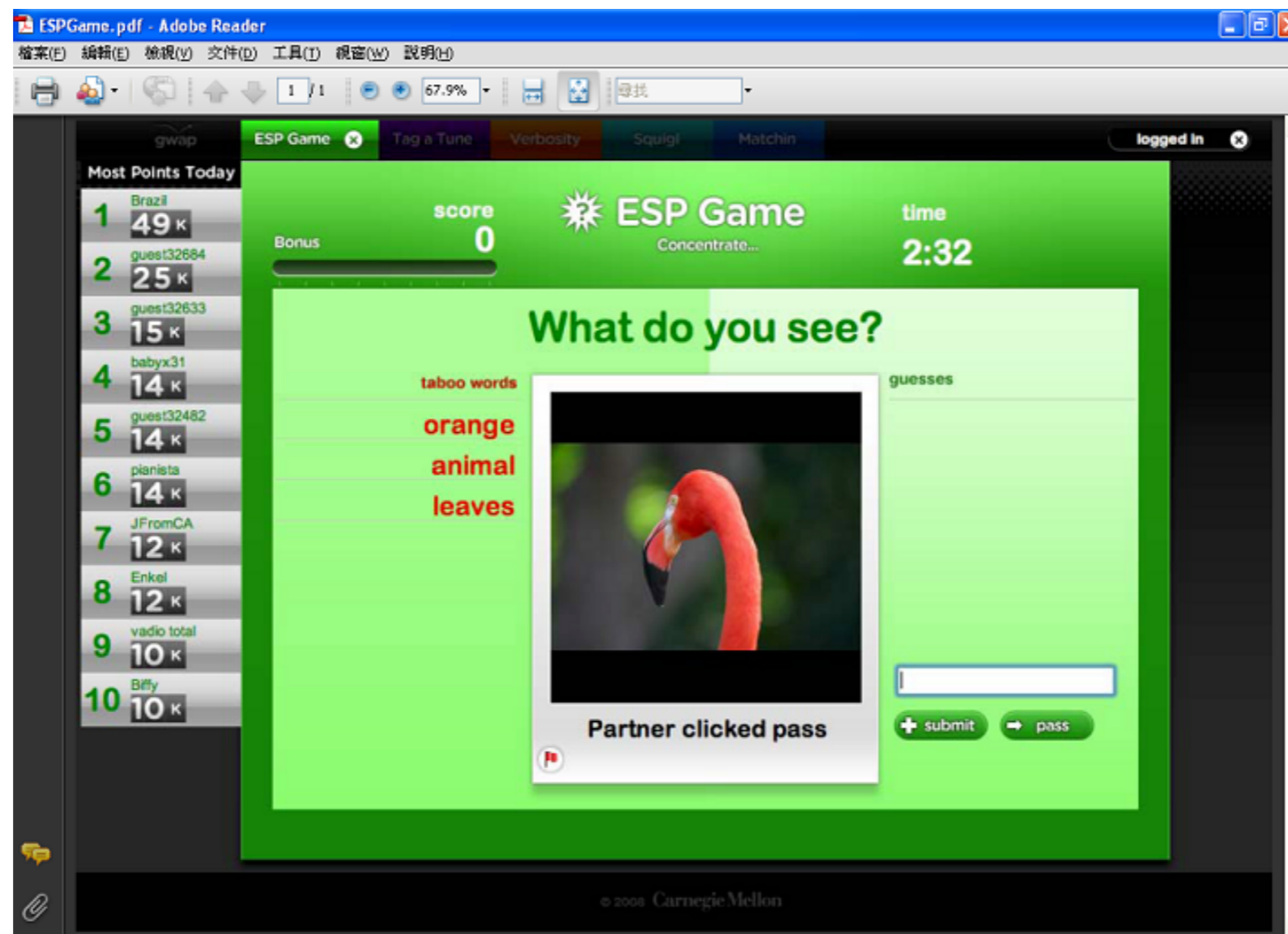
# Social Game-based Human Computation with Online Players (I)

- Later, social games were proposed to **collect information** from the players as a **side effect** of their playing
- Advantage:
  - It **encouraged more Internet users** to contribute information to solve the AI problems because of the **increasingly popularity of online game**
- TWO important factors for collecting information effectively from players through a social game:
  - Guarantee the **quality** of collected information
  - Maintain the **enjoyment** of players in the game



# Social Game-based Human Computation with Online Players (2)

- To collect text information from images
  - Examples (1): **ESP game**



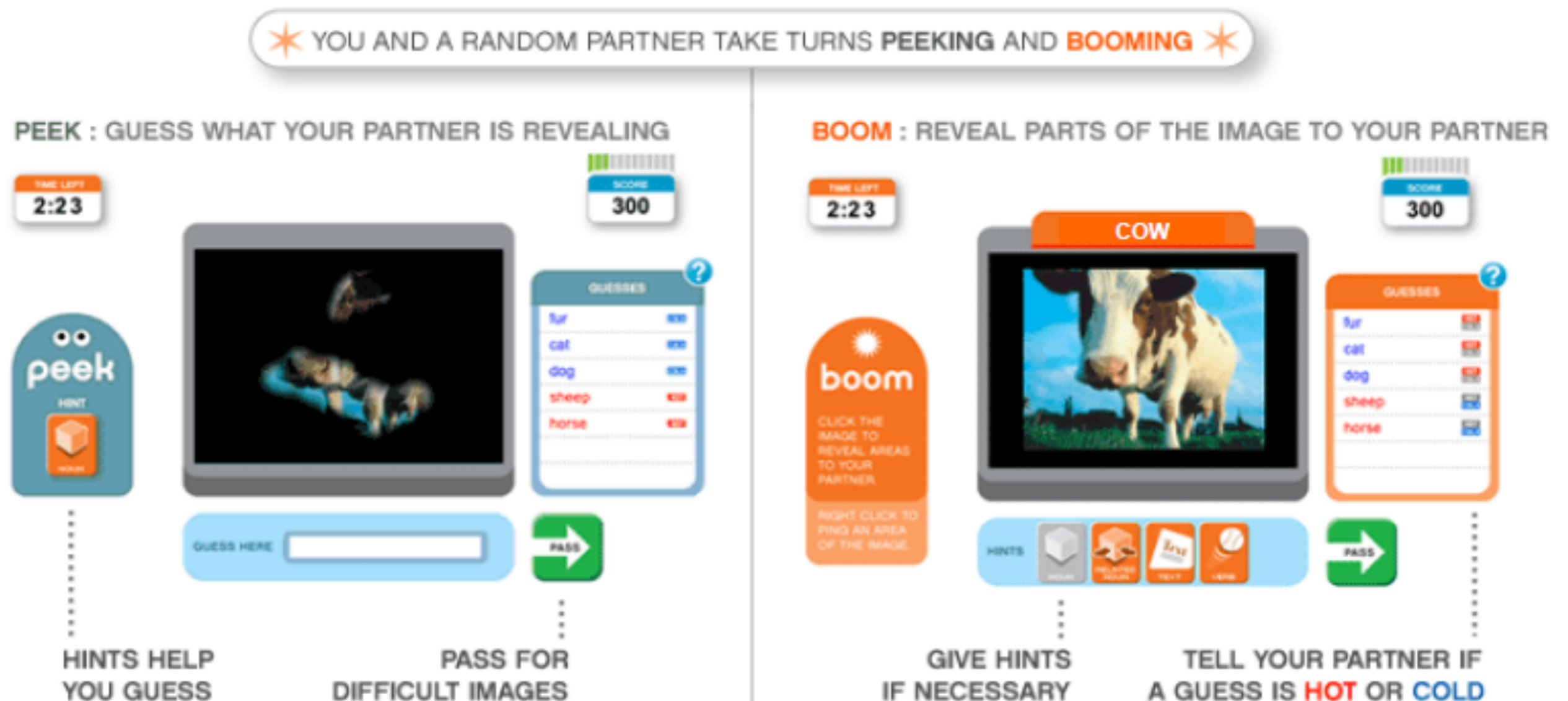
Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Social Game-based Human Computation with Online Players (3)

- To collect text information for images:
  - Examples (2): **Peekaboom**



# Social Game-based Human Computation with Online Players (4)

- To collect commonsense knowledge:
  - Examples (3): **Verbosity**



Figure 1. Part of the Narrator's screen.





# Social Game-based Human Computation with Online Players (5)

- To collect subjective descriptions of sounds and music:
  - Example (4): **Tagatune**

**Most Points Today**

|    |             |       |
|----|-------------|-------|
| 1  | sunshine    | 173 k |
| 2  | quest40692  | 86 k  |
| 3  | WhigleyFive | 50 k  |
| 4  | occam       | 24 k  |
| 5  | ScottParade | 20 k  |
| 6  | haim        | 17 k  |
| 7  | missy420    | 16 k  |
| 8  | adaman      | 12 k  |
| 9  | Amro        | 10 k  |
| 10 | tomkiddo    | 9,850 |

Score: 80  
Timer: 1:41  
Tag a Tune  
Hear Here

Describe the tune ...  
0:10

Listening to the same tune?  
same different 1 in a row

your descriptions  
male vocal  
medieval music  
quartet  
two females

your partner's descriptions  
guitar  
solo  
no vocals

You Correct Partner  
60 points

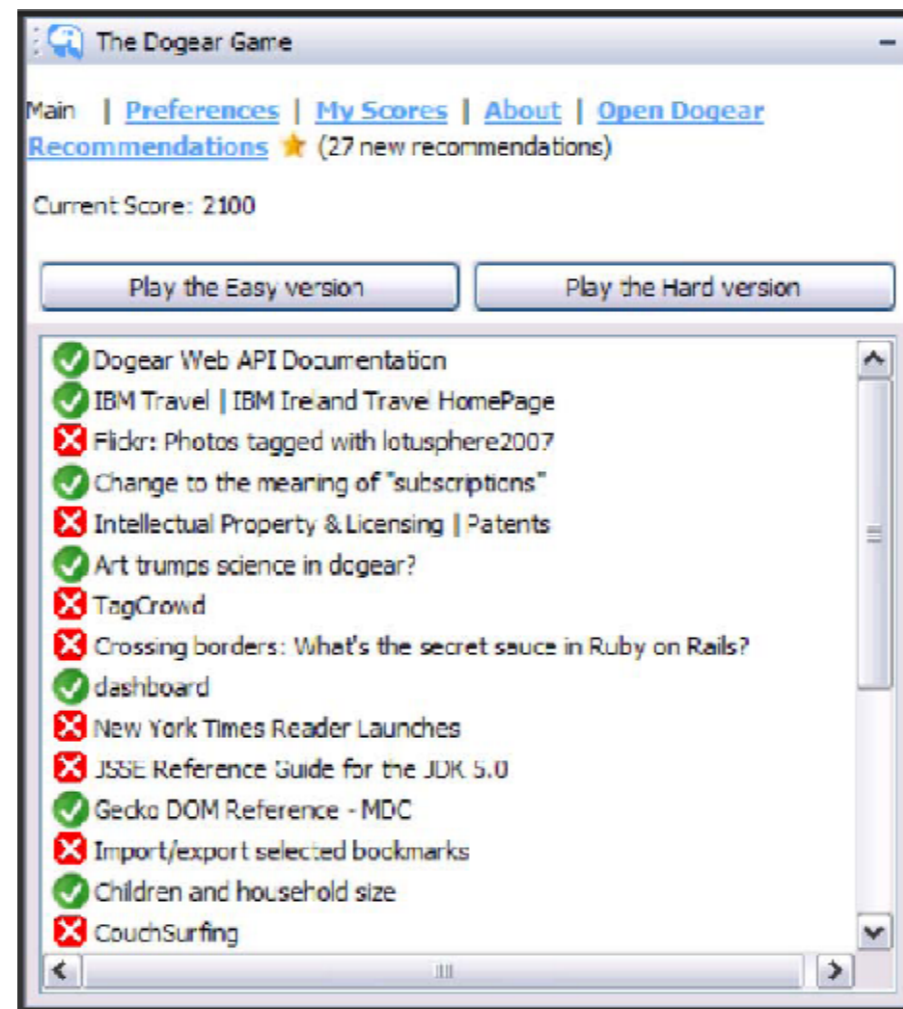
submit pass

Your partner has chosen.



# Social Game-based Human Computation with Online Players (6)

- To learn colleagues' bookmarks in an organizational goal:
- Example (5): **Dogear Game**



# Social Game-based Human Computation with Online Players (7)

- To tag locations in the real world through gameplay in mobile social games:
  - Example (6): **Gopher guessing game**

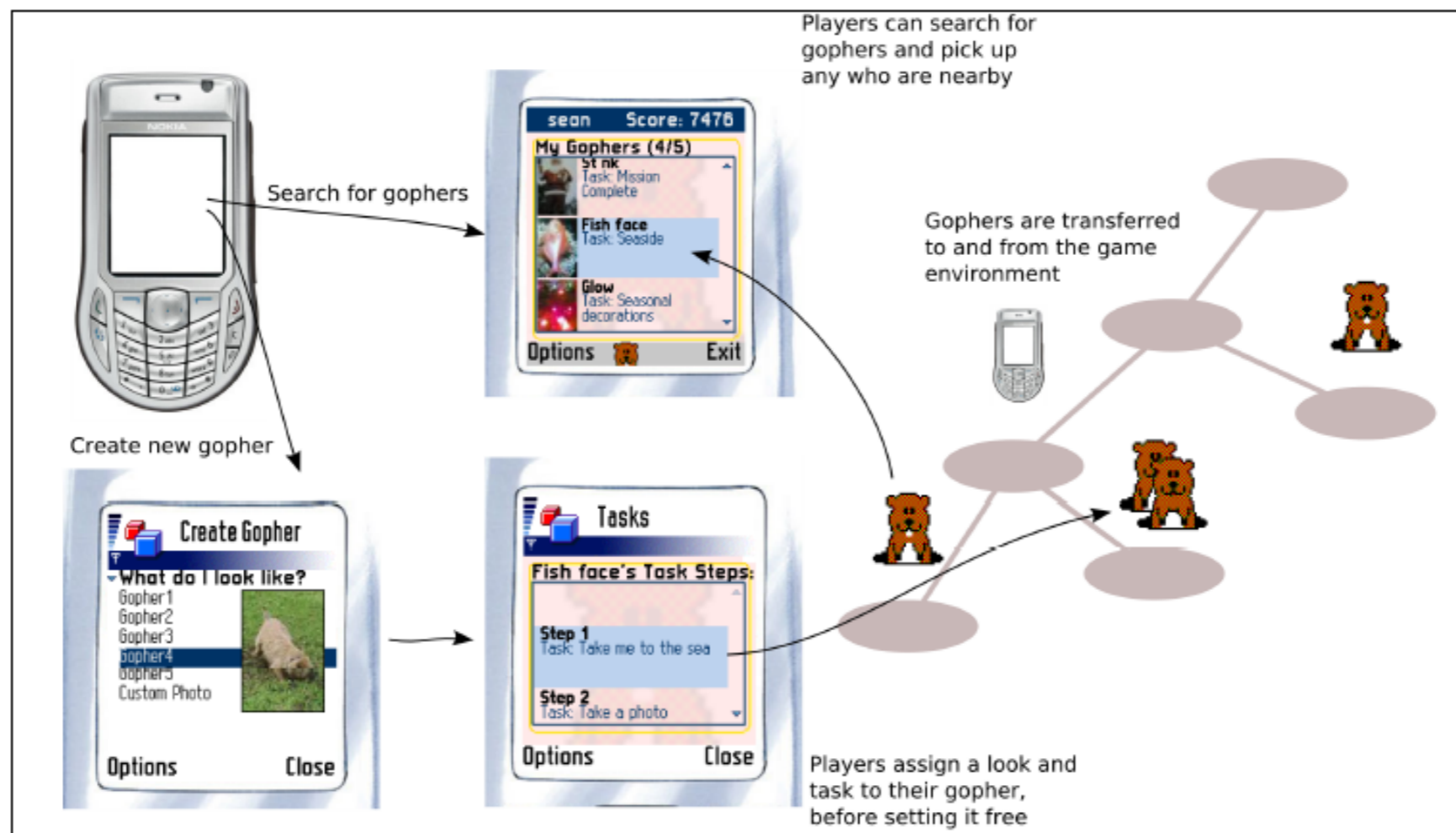


Figure 1. Real world experience, acquiring gophers

Human Computation in Social Computing



# Social Game-based Human Computation with Online Players (8)

- To tag locations in the real world through gameplay in mobile social games:
- Example (7): **Gopher guessing game**

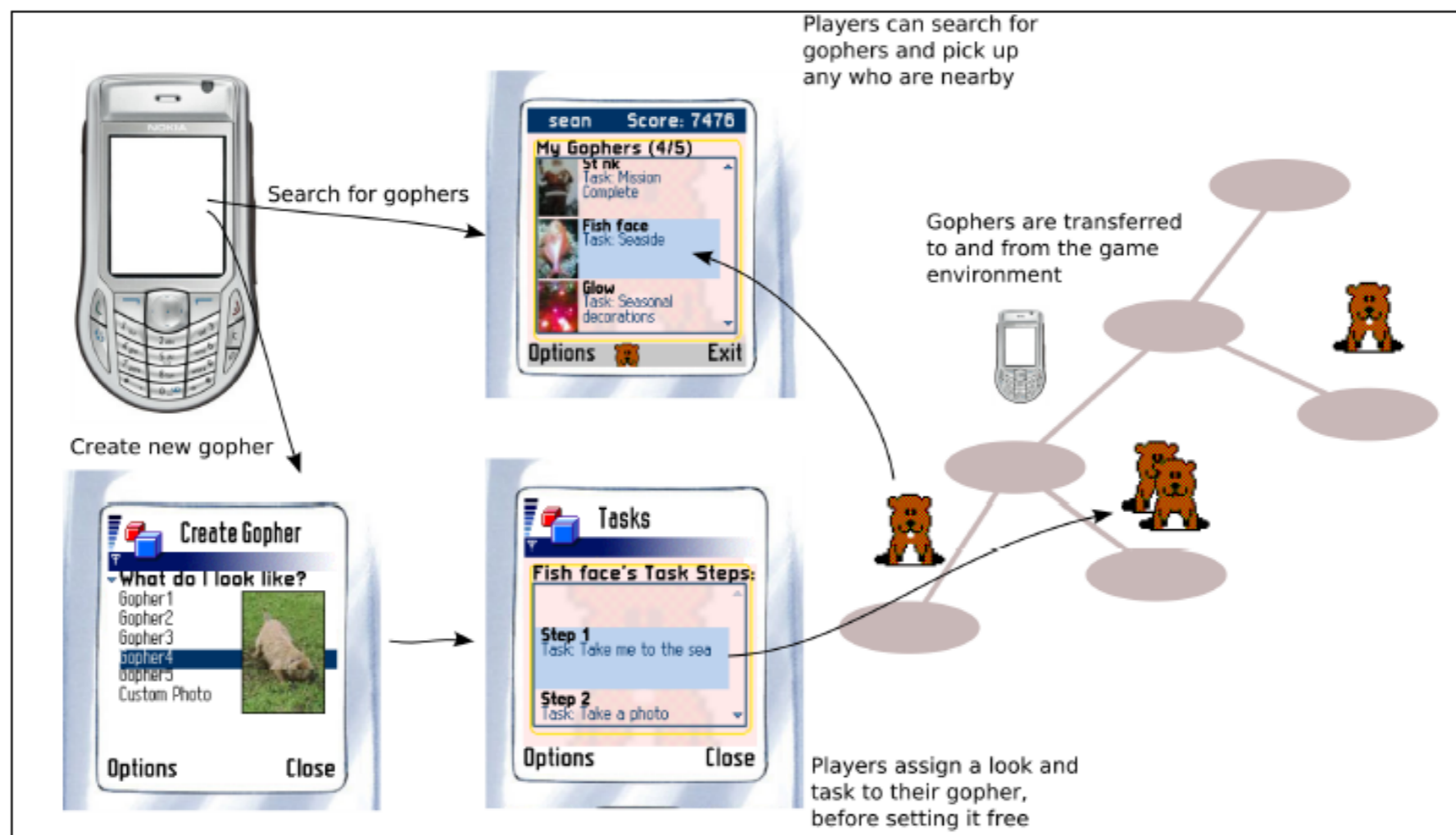
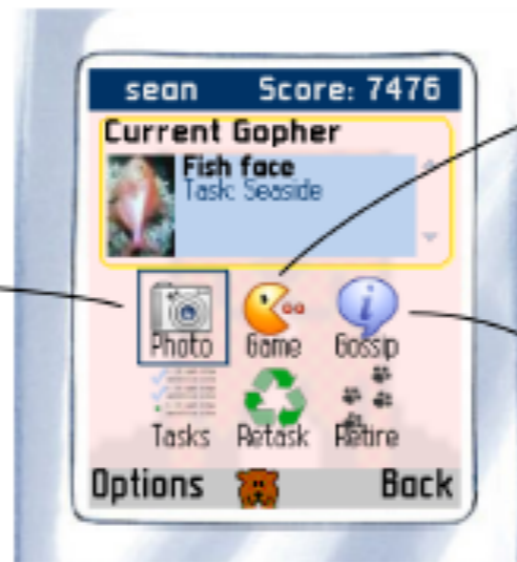


Figure 1. Real world experience, acquiring gophers  
Human Computation in Social Computing

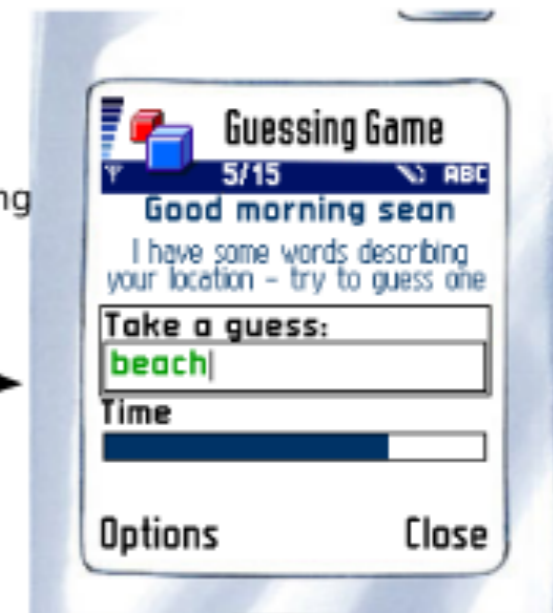




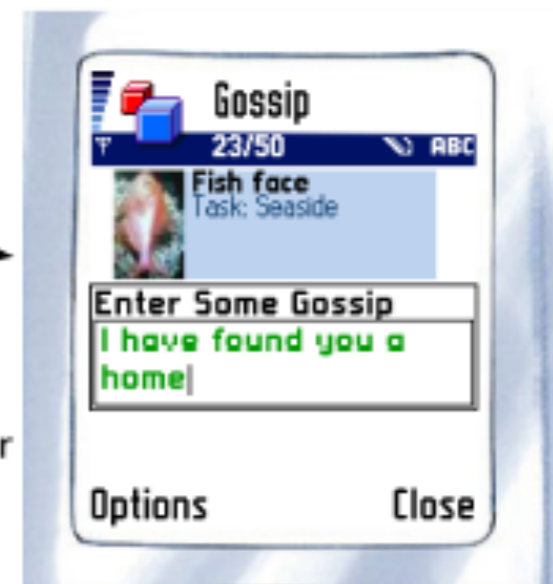
Visual feedback can be provided in the form of camera phone images - players photograph their current location and supply this to the gopher. The gopher responds with an image from its history, taken at a spatially nearby location.



Gophers can participate in a word guessing game, based on their real-world location. Players supply semantic descriptions relative to their current whereabouts. They are awarded points depending on the accuracy of their guesses.



Players can provide text information by exchanging some gossip with the gopher - a player supplies textual information to the gopher. The gopher responds with some gossip from it's history, taken at a nearby location.



**Figure 2. Real world experience, interacting with gophers**



# Entertainment Shopping

The screenshot shows the top of the Swoopo website. On the left is the Swoopo logo. To its right, it says "Swoopo in the news" with a newspaper icon and "Entertainment Shopping". On the far right, it says "Swoopo international:" followed by flags for Germany, UK, Spain, USA, and Canada. Below this is a navigation bar with "Home | My Swoopo | Help | Register". A login bar contains a "Username" field, a password field with dots, and a "LOGIN" button. Below the login bar is a "All categories" dropdown menu. The main banner features a kitchen scene with a stand mixer and knives. A red starburst says "Starting NOW". Large red text reads "CALPHALON, HENCKELS & KITCHENAID". A dark blue box on the right says "REGISTER NOW FOR FREE" and "BUY BIDS AND BID WITHOUT RISK!". A red arrow points to "Browse Kitchenware".

The screenshot shows a section titled "Bid now - these auctions are about to end". It contains five auction cards, each with a red "64 Auction" banner in the top left corner. Each card displays the item name, a timer, the current bid amount, and the bidder's name, with a green "BID" button at the bottom.

| Item   | Timer    | Current Bid | Bidder    |
|--|----------|-------------|-----------|
| 300 Bids Voucher                             | 00:00:18 | \$117.90    | Nirajzala |
| MySims Agents (Nintendo DS)                  | 00:02:05 | \$0.24      | Bb4kids   |
| Samsung UN46B6000 46-Inch 1080p LED HDTV     | 00:00:15 | \$102.00    | Julia30   |
| Wii   Nintendo Console + Wii Sports          | 00:00:15 | \$32.04     | Bearboy66 |
| Apple MacBook Pro MB991LL/A 13.3-Inch Laptop | 00:45:27 | \$12.42     | Jamesham  |



# Categorization of Social Games

TABLE I  
CATEGORIZATION OF SOCIAL GAMES

| Game Structure      | Verification Method     | Game Mechanism                         |
|---------------------|-------------------------|--|
| Output-agreement    | Symmetric               | Collaborative or Hybrid                |
| Input-agreement     | Symmetric               | Collaborative or Hybrid                |
| Inversion-problem   | Asymmetric              | Collaborative or Competitive or Hybrid |
| Output-optimization | Symmetric or Asymmetric | Collaborative or Competitive or Hybrid |





# Summary

TABLE II  
CATEGORIZATION OF SOCIAL GAMES WITH EXAMPLES

| Game Structure      | Verification Method | Game Mechanism | Player Requirement |              | Examples                        |
|---------------------|---------------------|----------------|--------------------|--------------|---------------------------------|
|                     |                     |                | Num of Player      | Game Play    |                                 |
| Output-agreement    | Symmetric           | Collaborative  | 2                  | Synchronous  | ESP, Matchi, Squigl, OntoGame   |
|                     |                     | Hybrid         | Multi-players      | Synchronous  | Common Consensus, Social Heroes |
|                     |                     | Hybrid         | Multi-players      | Asynchronous | Gopher Game                     |
| Input-agreement     | Symmetric           | Collaborative  | 2                  | Synchronous  | TagATune                        |
|                     |                     | Hybrid         | N/A                | N/A          | N/A                             |
| Inversion-problem   | Asymmetric          | Collaborative  | 1 or 2             | Synchronous  | Peckaboom, Verbosity            |
|                     |                     | Competitive    | 2                  | Asynchronous | Dogear, CyPRESS, CARS           |
|                     |                     | Hybrid         | 1 or Multi-players | Synchronous  | Phetch                          |
| Output-optimization | Symmetric           | Collaborative  | 2                  | Synchronous  | Restaurant Game                 |
|                     |                     | Competitive    | N/A                | N/A          | N/A                             |
|                     |                     | Hybrid         | Multi-players      | Synchronous  | Diplomacy                       |





# Crowdsourcing

Sheng-Wei (Kuan-Ta) Chen, Institute of Information Science, Academia Sinica, Taipei, Taiwan

- Crowdsourcing = Crowd + Outsourcing
- Soliciting solutions via open calls to large-scale communities

- INNOCENTIVE



- oDesk



- Amazon Mechanical Turk - Marketplace for work

- Yahoo! Answers

- Wikipedia



# What Are Crowdsourcable?

- Software development - USD \$25,000 per job
- Data entry - USD \$4.4 per hour
- Image tagging - USD \$0.04 per image
- General questions - points on Yahoo! Answers
- Image understanding - USD \$0.01 to \$0.02 per task
- Human action recognition - USD \$0.01 per task
- Linguistic annotations (word similarity) - USD \$0.2 per 30 word pairs



# Multimedia QoE Assessment

- Quality of Experience (QoE) = User's subjective satisfaction about a service (multimedia content)
- To provide end-user experience, we measure the QoE of multimedia content, e.g, image, voice, video, etc.
  - Efficiency vs. Reliability
  - Objective evaluation approach
  - Subjective evaluation approach



# Evaluation Approaches

- Objective Evaluation
  - Cannot capture all the QoE dimensions that may affect users' experiences
  - Cannot include external factors, e.g., quality of headsets, distance between the viewer and the display
- Subjective Evaluation
  - Opinions, e.g., 1=bad, 2=poor, 3=fair, 4=good, and 5=excellent
  - Difficult to define the ordinal scales concisely
  - Difficult to verify users' scoring results





# Drawbacks of Subjective Evaluation

- High economic cost
  - Participant payment
- High labor cost
  - Supervision labor
- Physical space/time requirements
  - Transportation cost
  - Laboratory space
  - Difficult to find motivated participants



# Crowdsourcing Challenges

- Not every Internet user is trustworthy
  - Experiments without supervision so no quality assurance
  - Increased variance and bias
  - Need to find a way to detect problematic inputs!



# Paired Comparison Test



Stimulus A



Stimulus B



Which one is better?

Vote



Stimulus A

Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Features of Paired Comparison

- Generalizable across a variety of multimedia applications
- Simple comparative judgement
- Interval scale QoE scores can be calculated
- Verifiable users' feedback





# Verification of Users' Inputs

- Transitivity property
  - If  $A > B$  and  $B > C$  then  $A$  should be  $> C$
- Transitivity Satisfaction Rate (TSR)

$$\frac{\# \text{ of triples satisfy the transitivity rule}}{\# \text{ of triples the transitivity rule may apply to}}$$

- Detect inconsistent judgements from problematic users
  - $\text{TSR} = 1 \Rightarrow$  perfect consistency
  - $\text{TSR} \geq 0.8 \Rightarrow$  generally consistent
  - $\text{TSR} < 0.8 \Rightarrow$  judgement are consistent

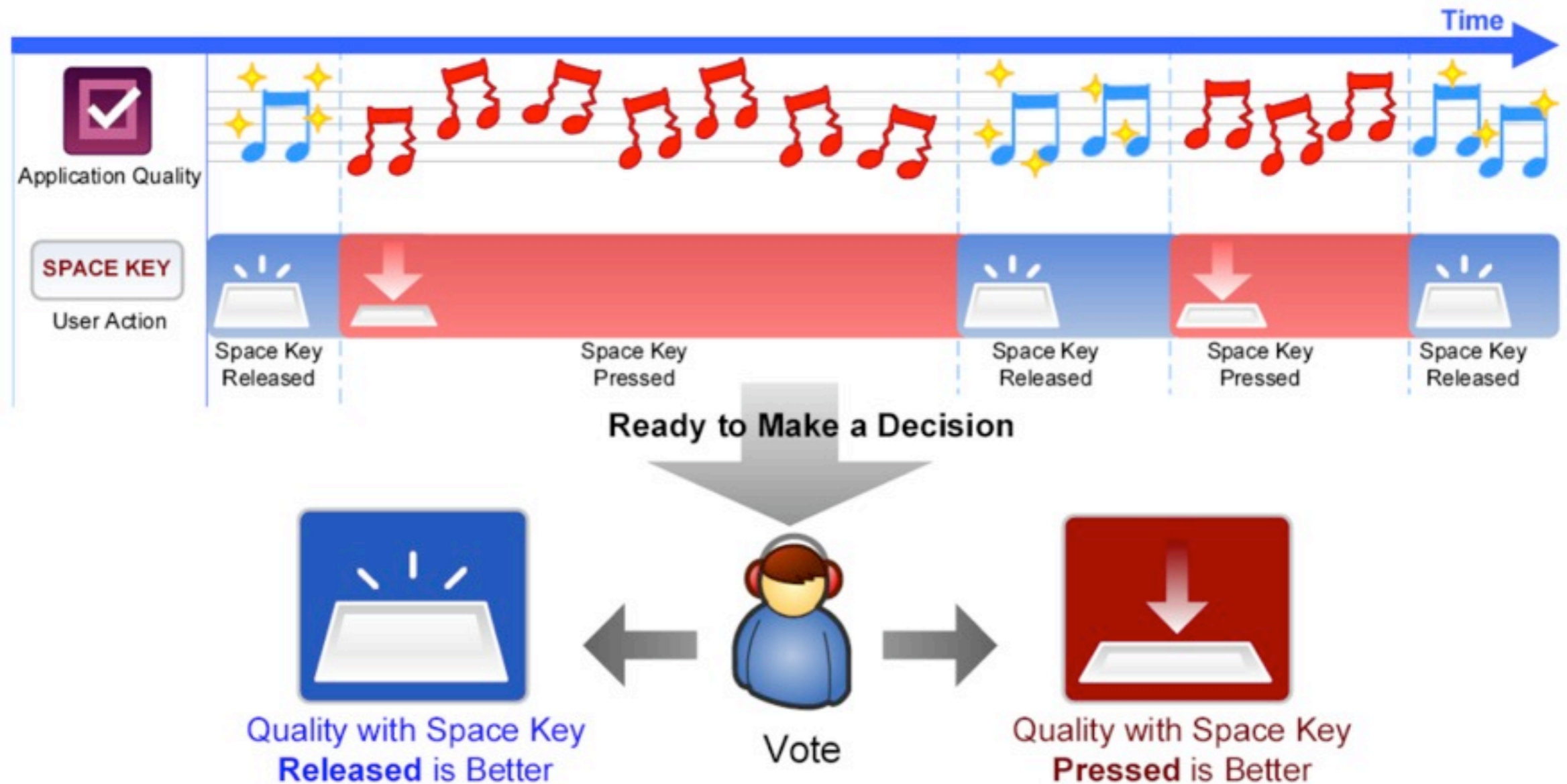


# Experiment Design

- Suppose our task is to evaluate the effect of  $n$  audio processing algorithms, e.g., audio encoding
  - Select an audio clip (source clip) as the evaluation target
  - Apply the  $n$  algorithms to the source clip and generate  $n$  different versions of the clip (test clips)
  - Create an Adobe Flash-based system for users to evaluate the  $n$  test clips
  - A user need to perform 2 out of  $n$  paired comparison



# Concept Flow of Acoustic QoE Evaluation



# Which One is Better?





# Participant Source

- Laboratory
  - Recruit part-time workers at an hourly rate of USD \$8
- MTurk
  - Post experiments on the Mechanical Turk web site
  - Pay the participant USD \$0.15 for each qualified experiment
- Community
  - Seek participants on the website of Internet community with 1.5 million members
  - Pay the participant an amount of virtual currency that was equivalent to USD \$0.01 for each qualified experiment



# Evaluation of the Framework

- Three participant sources
  - Laboratory
  - Amazon Mechanical Turk
  - Community
- Each with different cost structure
- Compare the cost required by each participant and the data quality produced



- The first **crowdsourcable** QoE evaluation framework
- Users' inputs can be **verified**
  - the transitivity property:  $A > B$  and  $B > C \rightarrow A > C$
  - detect inconsistent judgements from problematic users
- Experiments can thus be outsourced to Internet crowd
  - **lower monetary cost**
  - **wider participant diversity**
  - **maintaining the evaluation results' quality**

| Case Study   | Experimenter Source | Total Cost (dollar) | # Rounds | # Person | Qualified Rate | Cost / Round (cent) | Time / Round (sec) | Avg. TSR |
|--------------|---------------------|---------------------|----------|----------|----------------|---------------------|--------------------|----------|
| MP3 Bit Rate | Laboratory          | 50.97               | 1440     | 10       | 67%            | 3.54                | 16                 | 0.96     |
|              | MTurk               | 7.50                | 750      | 24       | 47%            | 1.00                | 9                  | 0.96     |
|              | Community           | 1.03                | 1,470    | 93       | 54%            | 0.07                | 25                 | 0.96     |

Chen et al, "A Crowdsourcable QoE Evaluation Framework for Multimedia Content," *Proceedings of ACM Multimedia 2009*.



# Summary

- Human computation is **useful** can be **effective** in performing **intelligent tasks** where computers cannot
- Crowdsourcing provides a **new paradigm** and a new platform for scientific research
- **New applications, new methodologies, and new businesses** are emerging with the aid of human computing/crowdsourcing





# On-Going Research

## Machine Learning

- Heavy-Tailed Symmetric Stochastic Neighbor Embedding (NIPS'09)
- Adaptive Regularization for Transductive Support Vector Machine (NIPS'09)
- Direct Zero-norm Optimization for Feature Selection (ICDM'08)
- Semi-supervised Learning from General Unlabeled Data (ICDM'08)
- Learning with Consistency between Inductive Functions and Kernels (NIPS'08)
- An Extended Level Method for Efficient Multiple Kernel Learning (NIPS'08)
- Semi-supervised Text Categorization by Active Search (CIKM'08)
- Transductive Support Vector Machine (NIPS'07)
- Global and local learning (ICML'04, JMLR'04)



# On-Going Research

## Web Intelligence/Information Retrieval

- A Generalized Co-HITS Algorithm and Its Application to Bipartite Graphs (KDD'09)
- Entropy-biased Models for Query Representation on the Click Graph (SIRIR'09)
- Effective Latent Space Graph-based Re-ranking Model with Global Consistency (WSDM'09)
- Formal Models for Expert Finding on DBLP Bibliography Data (ICDM'08)
- Learning Latent Semantic Relations from Query Logs for Query Suggestion (CIKM'08)
- RATE: a Review of Reviewers in a Manuscript Review Process (WI'08)
- MatchSim: link-based web page similarity measurements (WI'07)
- Diffusion rank: Ranking web pages based on heat diffusion equations (SIGIR'07)
- Web text classification (WWW'07)



# On-Going Research

## Recommender Systems/Collaborative Filtering

- Learning to Recommend with Social Trust Ensemble (SIRIR'09)
- Semi-Nonnegative Matrix Factorization with Global Statistical Consistency in Collaborative Filtering (CIKM'09)
- Recommender system: accurate recommendation based on sparse matrix (SIGIR'07)
- SoRec: Social Recommendation Using Probabilistic Matrix Factorization (CIKM'08)

## Human Computation

- A Survey of Human Computation Systems (SCA2009)
- Mathematical Modeling of Social Games (SIAG2009)
- An Analytical Study of Puzzle Selection Strategies for the ESP Game (WI'08)
- An Analytical Approach to Optimizing The Utility of ESP Games (WI'08)

Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Acknowledgments

- **Prof. Michael Lyu**
- Mr. Patrick Lau
- Mr. Lam Cho Fung
- Mr. Simon Mok
- Mr. Ivan Yau
- Hongbo Deng (Ph.D.)
- Baichuan Li (M.Phil.)
- Zhenjiang Lin (Ph.D.)
- Hao Ma (Ph.D.)
- Mingzhe Mo (M.Phil.)
- Dingyan Wang (M.Phil.)
- Wei Wang (M.Phil.)
- Haiqin Yang (Ph.D.)
- Connie Yuen (Ph.D.)
- Xin Xin (Ph.D.)
- Chao Zhou (Ph.D.)
- Yi Zhu (Ph.D.)
- CUHK Grant #6902498 from Microsoft





Irwin King  
Ricardo Baeza-Yates (Eds.)

King · Baeza-Yates (Eds.)

King · Baeza-Yates (Eds.)

## Weaving Services and People on the World Wide Web

Ever since its inception, the Web has changed the landscape of human experiences on how we interact with one another and data through service infrastructures via various computing devices. This interweaving environment is now becoming ever more embedded into devices and systems that integrate seamlessly on how we live, both in our working or leisure time.

For this volume, King and Baeza-Yates selected some pioneering and cutting-edge research work that is pointing to the future of the Web. Based on the Workshop Track of the 17th International World Wide Web Conference (WWW2008) in Beijing, they selected the top contributions and asked the authors to resubmit their work with a minimum of one third of additional material from their original workshop manuscripts to be considered for this volume. After a second-round of reviews and selection, 16 contributions were finally accepted.

The work within this volume represents the tip of an iceberg of the many exciting advancements on the WWW. It covers topics like semantic web services, location-based and mobile applications, personalized and context-dependent user interfaces, social networks, and folksonomies.

The presentations aim at researchers in academia and industry by showcasing latest research findings. Overall they deliver an excellent picture of the current state-of-the-art, and will also serve as the basis for ongoing research discussions and point to new directions.



Weaving Services and People  
on the World Wide Web

# Weaving Services and People on the World Wide Web

ISBN 978-3-642-00569-5



9 783642 005695

springer.com

 Springer

springer.com

Human Computation in Social Computing

ՀԱՅԿԱՅԻՆ  
ԳԻՏԱԿԱՆ ԳՐԱՐԱՆ

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009





# VeriGuide

- **Similarity text** detection system
- Developed at **CUHK**
- Promote and uphold academic **honesty, integrity, and quality**
- Support **English, Traditional** and **Simplified Chinese**
- Handle **.doc, .txt, .pdf, .html,** etc. file formats
- Generate detailed **originality report** including **readability**





# VeriGuide Free Trial



**IRWIN KING @ WEB INTELLIGENCE & SOCIAL COMPUTING LAB**

Trace: > [confs](#) > [record2008](#) > [home](#)

You are here: [home](#)

### NAVIGATION

- [Home](#)
- [Profile](#)
- [Research Interests & Projects](#)

### ABOUT US

- [News | Newsletter](#)
- [Research Group | Presentations](#)
- [Collaborators](#)
- [Contact Us](#)

### PUBLICATIONS

1. [Conference Papers 2005-Now](#)
2. [Journal Articles](#)
3. [Books, Edited Books & Proceedings](#)
4. [Book Chapters](#)
5. [Conference Papers 2000-2004](#)
6. [Conference Papers 1994-1999](#)
7. [Theses](#)
8. [Presentations](#)

### PROFESSIONAL ACTIVITIES

1. [Professional Achievements](#)
2. [Awards](#)
3. [Grants](#)
4. [Teaching](#)
5. [Education Excellence](#)
6. [Demos & Software](#)
  - I. [Finding Experts Demo](#)
  - II. [MEMPM Matlab Toolbox](#)
7. [Conference Activities](#)

### Irwin King (金國慶), WISC Lab

Associate Professor, B.Sc. (Caltech), M.Sc., Ph.D. (USC)  
SMIEEE (CIS), MACM, MINNS, APNNA

Department of Computer Science and Engineering  
The Chinese University of Hong Kong, Shatin, NT, Hong Kong  
**Phone:** +(852) 2609 8398; **Fax:** +(852) 2603 5024  
**Email:** king [ at ] cse [ dot ] cuhk [ dot ] edu [ dot ] hk

- Associate Editor of IEEE Transactions on Neural Networks (IEEE TNN)
- Associate Editor of IEEE Computational Intelligence Magazine (IEEE CIM)
- Vice-President and Board Member of Asia Pacific Neural Network Assembly (APNNA)
- Chair, Task Force on the Future Directions of Neural Networks (IEEE CIS)
- Chair, SIG and Regional Chapters Committee for Asia and the Pacific, (INNS)
- Director of International Programmes, Faculty of Engineering (ERGIP)
- Member of RGC Engineering Panel, The Hong Kong SAR Government
- Co-Founder, Co-Principal Investigator and Chief Technologist, The VeriGuide Project
- General Co-Chair, Workshop on Social Computing in Education (WSCE2009), in conjunction with SocialComp'09
- General Co-Chair, Workshop on Social Web Search and Mining, in conjunction with CIKM2009
- Program Co-Chair, The first SIGMM Workshop on Social Media (WSM2009) in conjunction with ACM Multimedia 2009 (ACM MM'09), October 19-24, 2009, Beijing China

**Research interests:** Machine learning, social computing, web intelligence, information retrieval, multimedia information processing

*Caltech's motto, "...the truth shall set you free."*

### News

- **Keynote, Invited Talk, Advisory Committee, Technical Program Committee Member, Reviewer, Panel Chair, Panelist, or Tutorial Speaker at** [ICONIP'09](#), [CollaborateCom2009](#), [CIKM2009](#), [ACML'09](#), [ICCCI'09](#), [APSIPA ASC 2009](#), [WI'09](#), [SocialCom-09](#), [SIGIR2009](#), [IJCAI-09](#), [CASoN2009](#), [IWSSIP2009](#), [IJCNN2009](#), [FAW2009](#),

<http://www.cse.cuhk.edu.hk/~king>

Human Computation in Social Computing

Irwin King, First ACM Forum on Cyberspace and Social Computing (CyberSocialCom2009), November 9, 2009



# Q & A

