

An Overview of Human Computation

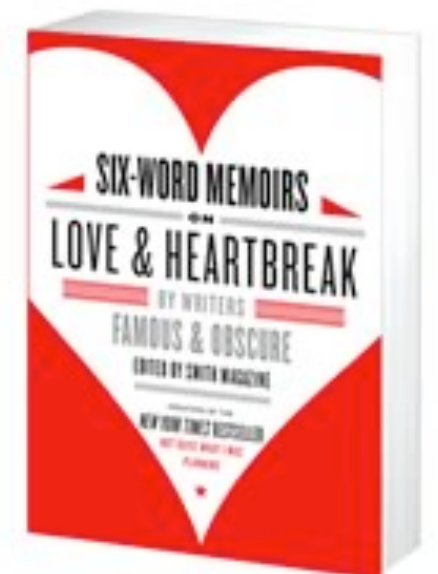


Dr. Ling-Jyh Chen (ccljj@iis.sinica.edu.tw)
Institute of Information Science, Academia Sinica



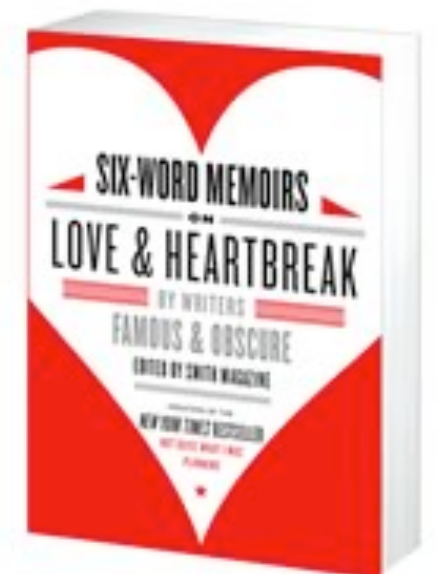
Dept. of Computer Science & Information Engineering,
National Taiwan Normal University

“Human Cycle”



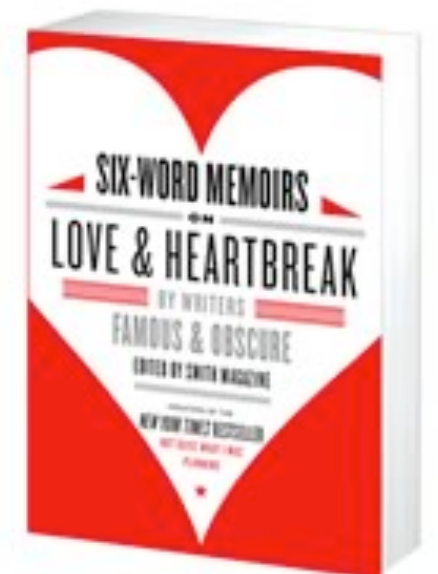
“Human Cycle”

- *A+ in Math. F- in Life.*



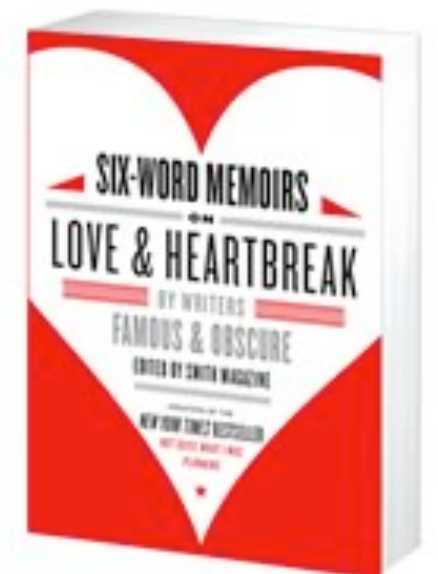
“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*



“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*
- *Only my dogs seem to understand.*



“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*
- *Only my dogs seem to understand.*
- *Happy talk happens over coffee.*



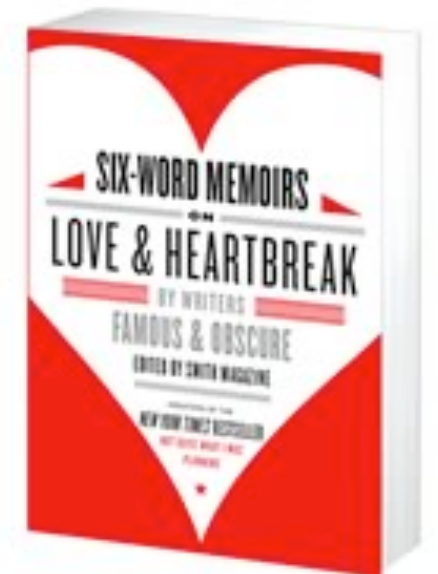
“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*
- *Only my dogs seem to understand.*
- *Happy talk happens over coffee.*
- *She kissed me and said yes.*



“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*
- *Only my dogs seem to understand.*
- *Happy talk happens over coffee.*
- *She kissed me and said yes.*
- *I accidentally said yes to forever.*



“Human Cycle”

- *A+ in Math. F- in Life.*
- *I'm 60. Look 40. Feel 20.*
- *Only my dogs seem to understand.*
- *Happy talk happens over coffee.*
- *She kissed me and said yes.*
- *I accidentally said yes to forever.*
- ...



Outline

- What is Human Computation?
- Human Computation Examples
- Human Computation Issues

What is HCOMP?

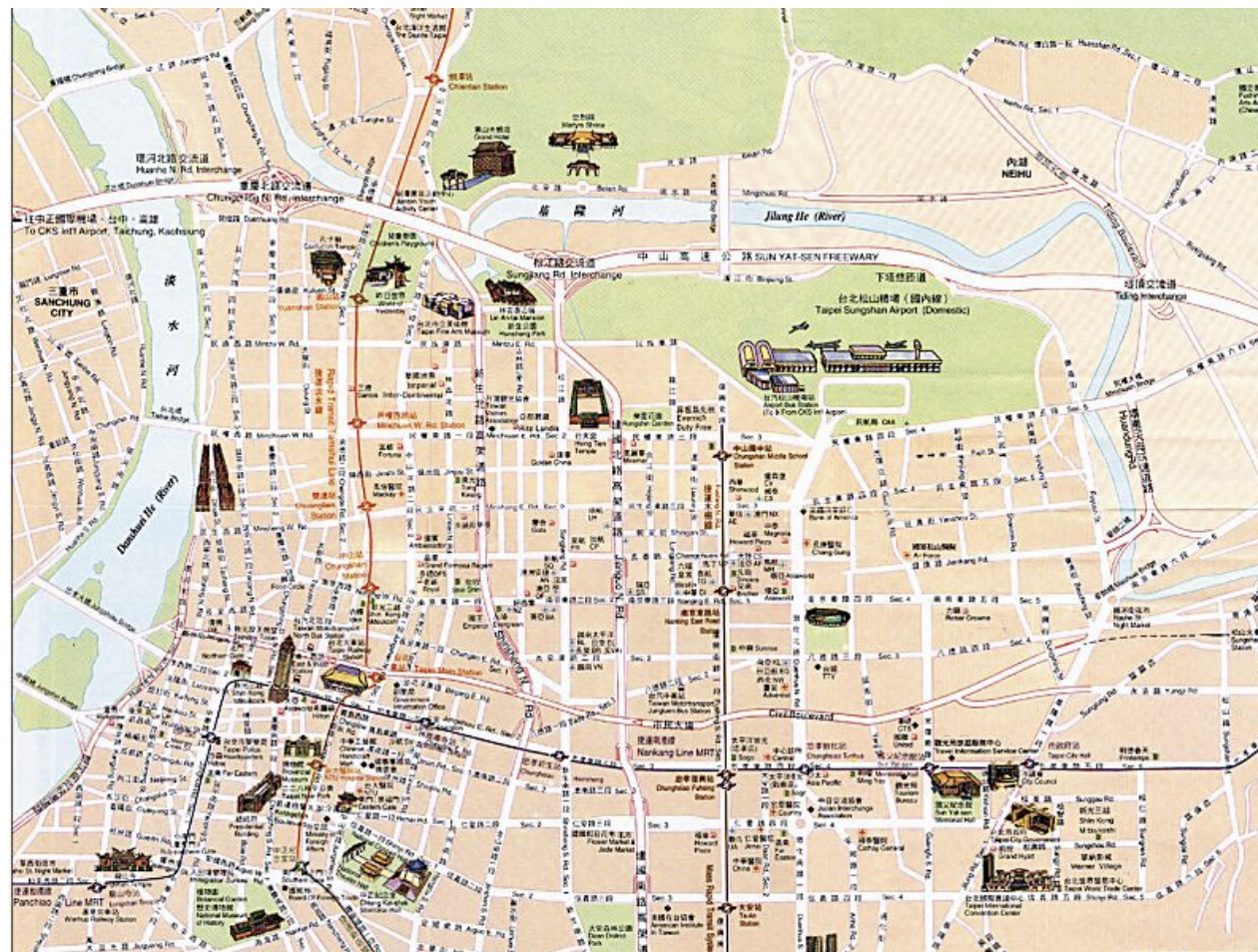
What is HCOMP?

- Many tasks are *trivial* for humans, but very *challenging* for computer programs.

What is HCOMP?

- Many tasks are *trivial* for humans, but very *challenging* for computer programs.

“What is the fastest way to get to the airport from Taipei downtown in rush hour?”



HCOMP

- If computer technologies can not do it well,
why don't we help?

You can do it!
We can help!

HCOMP

- If computer technologies can not do it well, why don't we help?

**You can do it!
We can help!**

- The basic ideas of HCOMP:

1. Let everyone do what they are good at!

2. Exploit “human cycles”!

HCOMP

- If computer technologies can not do it well, why don't we help?

**You can do it!
We can help!**

- The basic ideas of HCOMP:

1. Let everyone do what they are good at!

2. Exploit “human cycles”!

- It is a type of *collaborative intelligence* and *crowdsourcing*.



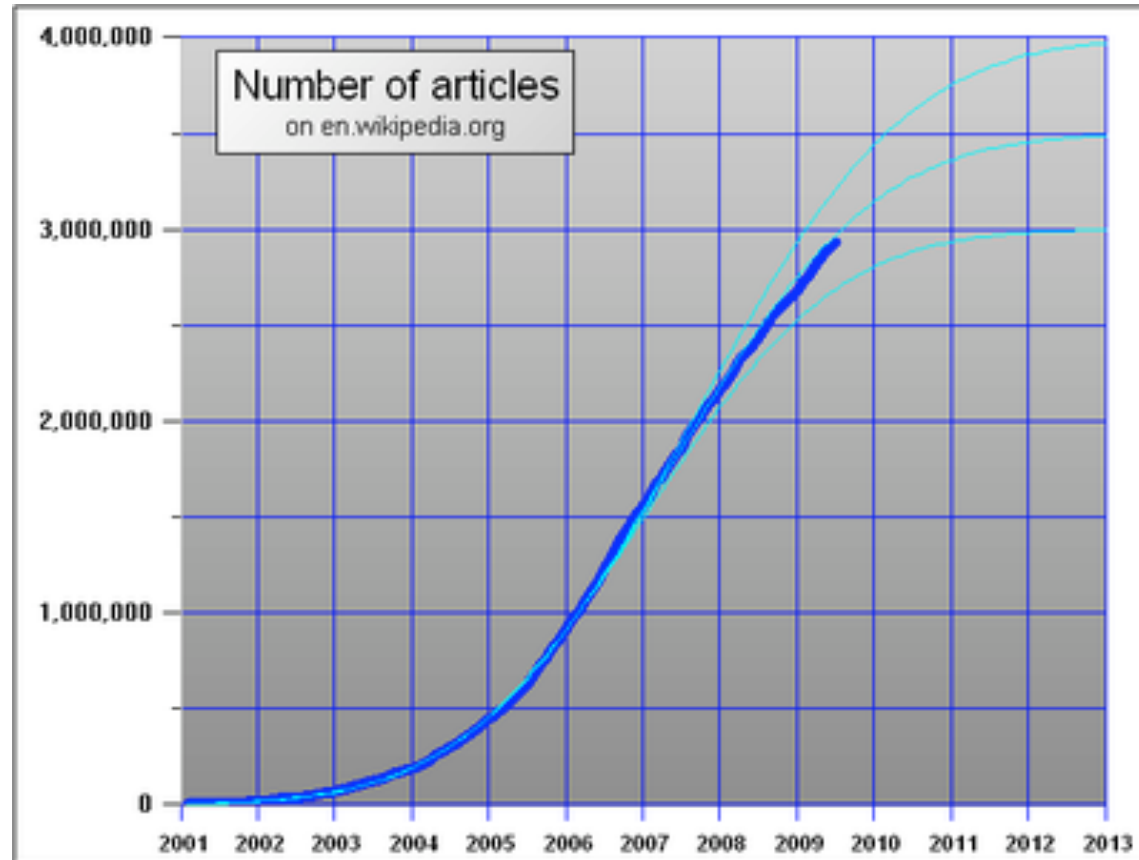
HCOMP examples

- There are four types of HCOMP systems
 - Voluntary
 - Open Source Software; Wikipedia
 - Incentive by money
 - Amazon Mechanical Turk
 - Incentive by fun
 - Games with a Purpose
 - You have no other choices ...
 - CAPTCHA/reCAPTCHA

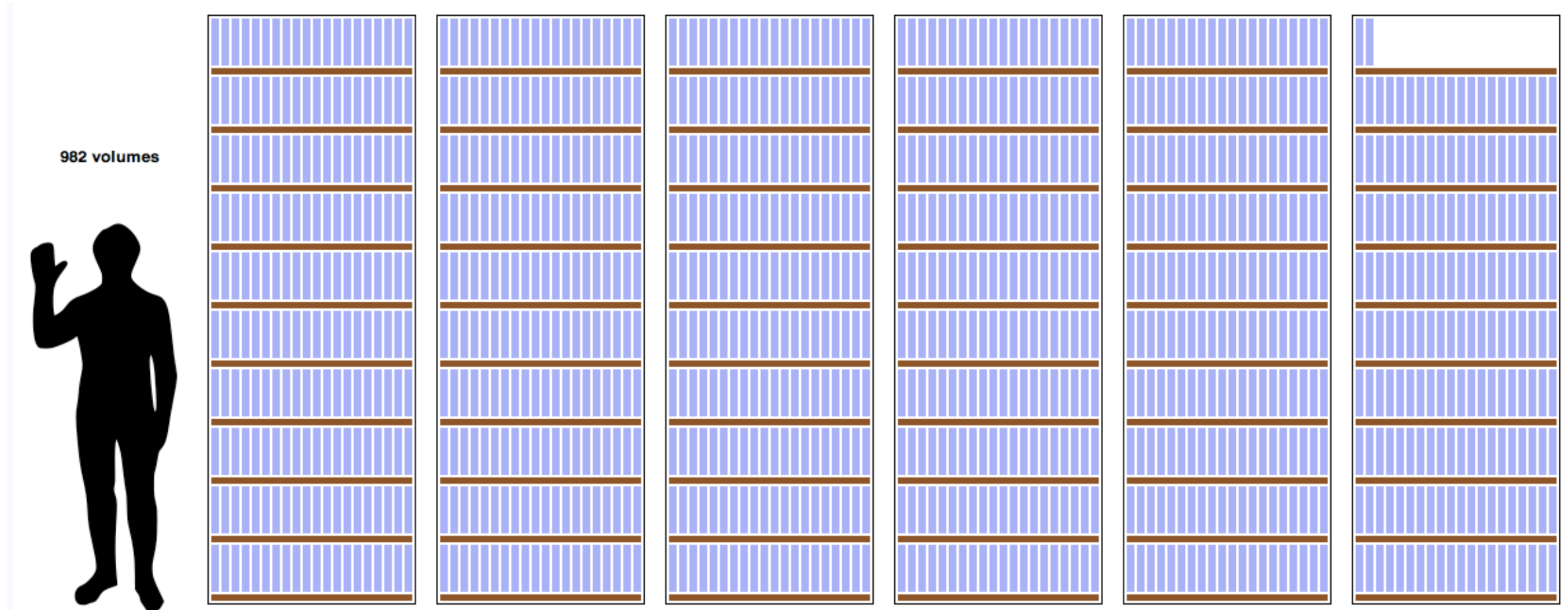
Wikipedia



- A free encyclopedia that everyone can change
 - 271 languages
 - 13,733,046 Articles
 - 752,382,630 Edits
 - 19,005,452 Users



- If the English-language Wikipedia is printed and bound in book form. (Each volume 25cm tall, 5cm thick, and containing 1,600,000 words or 8,000,000 characters.)



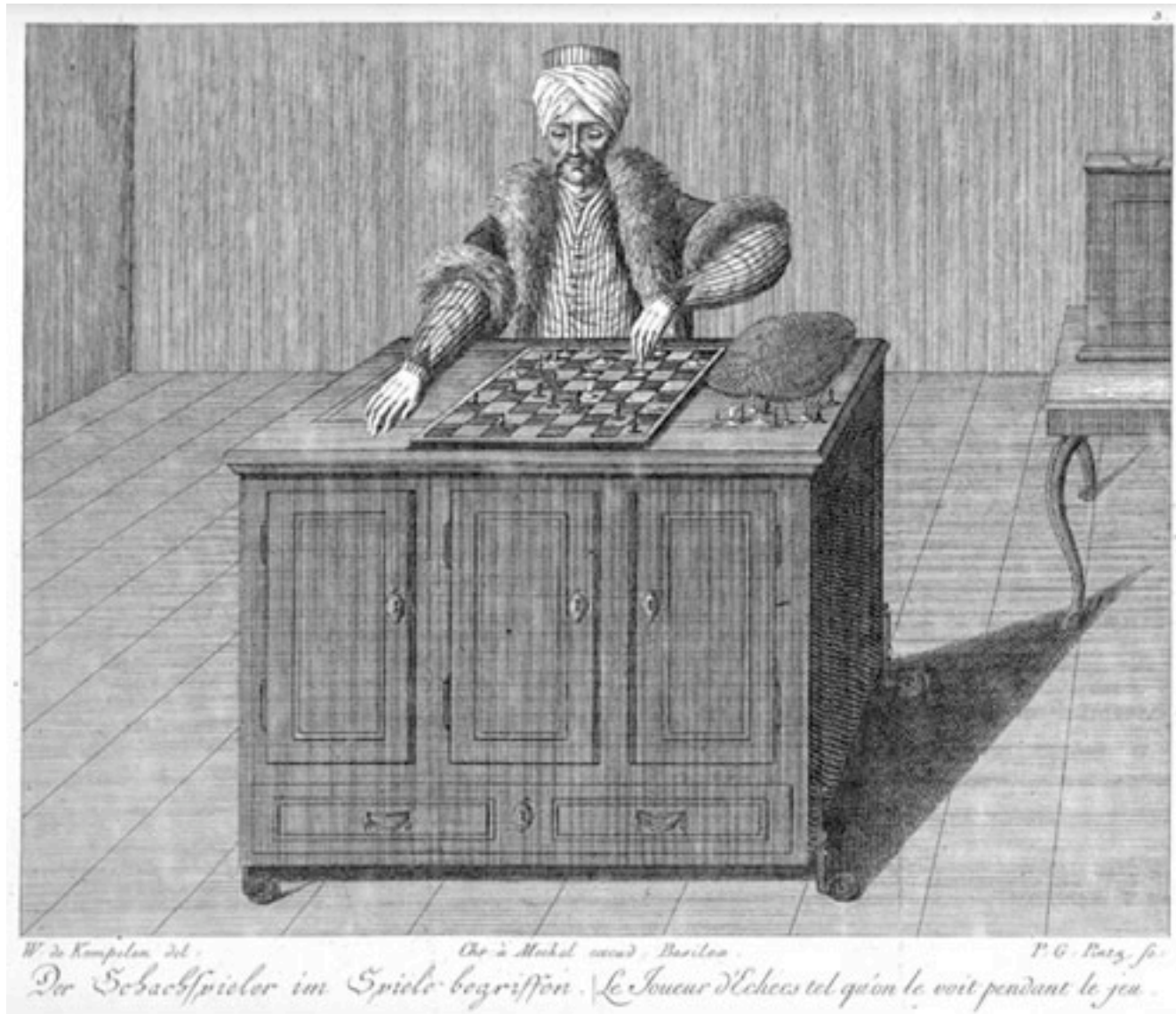
- Wikipedia is a type of collaborative intelligence
- Knowledge is accumulated, published, and accessible freely

- Wikipedia is a type of collaborative intelligence
- Knowledge is accumulated, published, and accessible freely
- *But, be careful...*

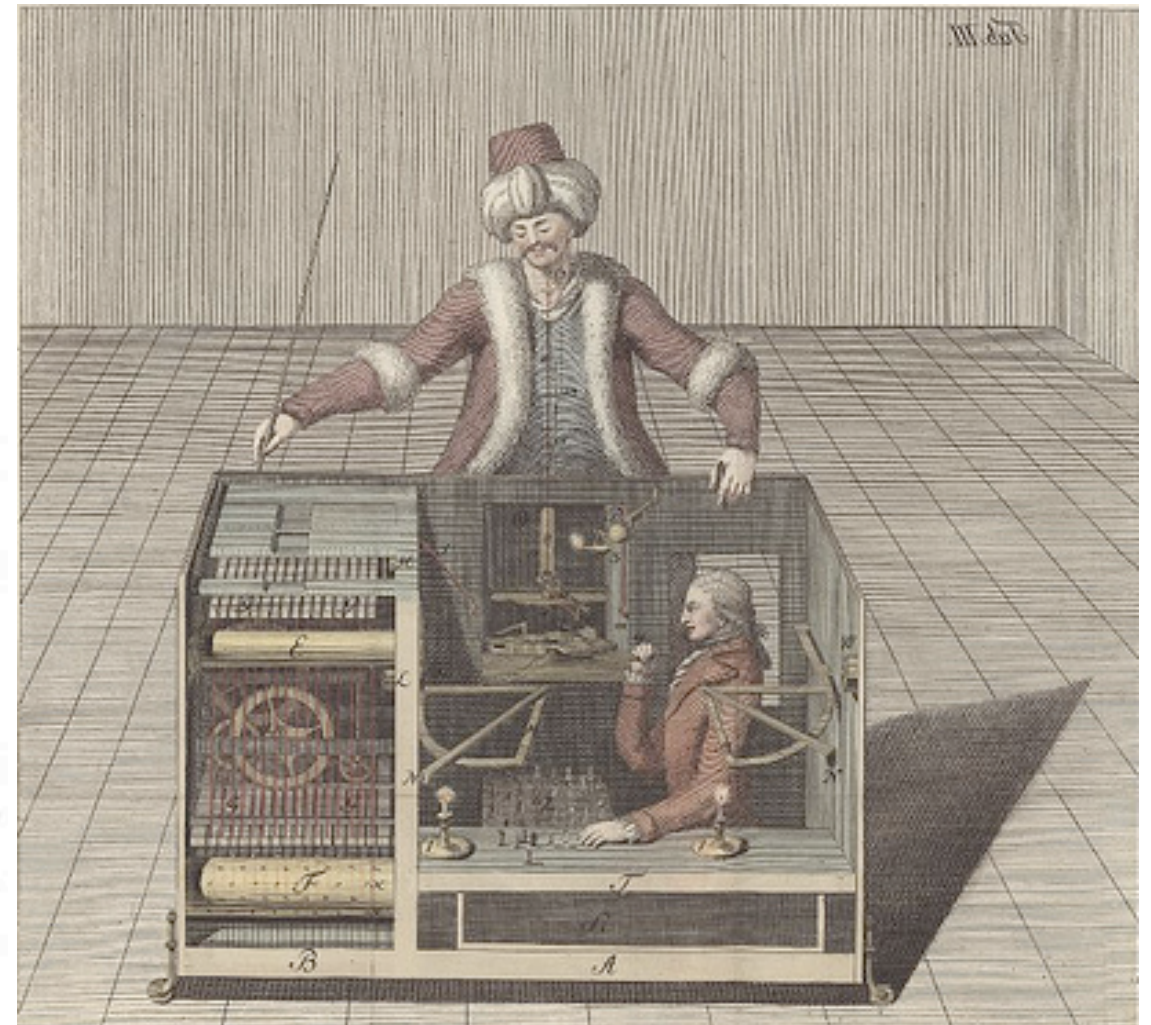
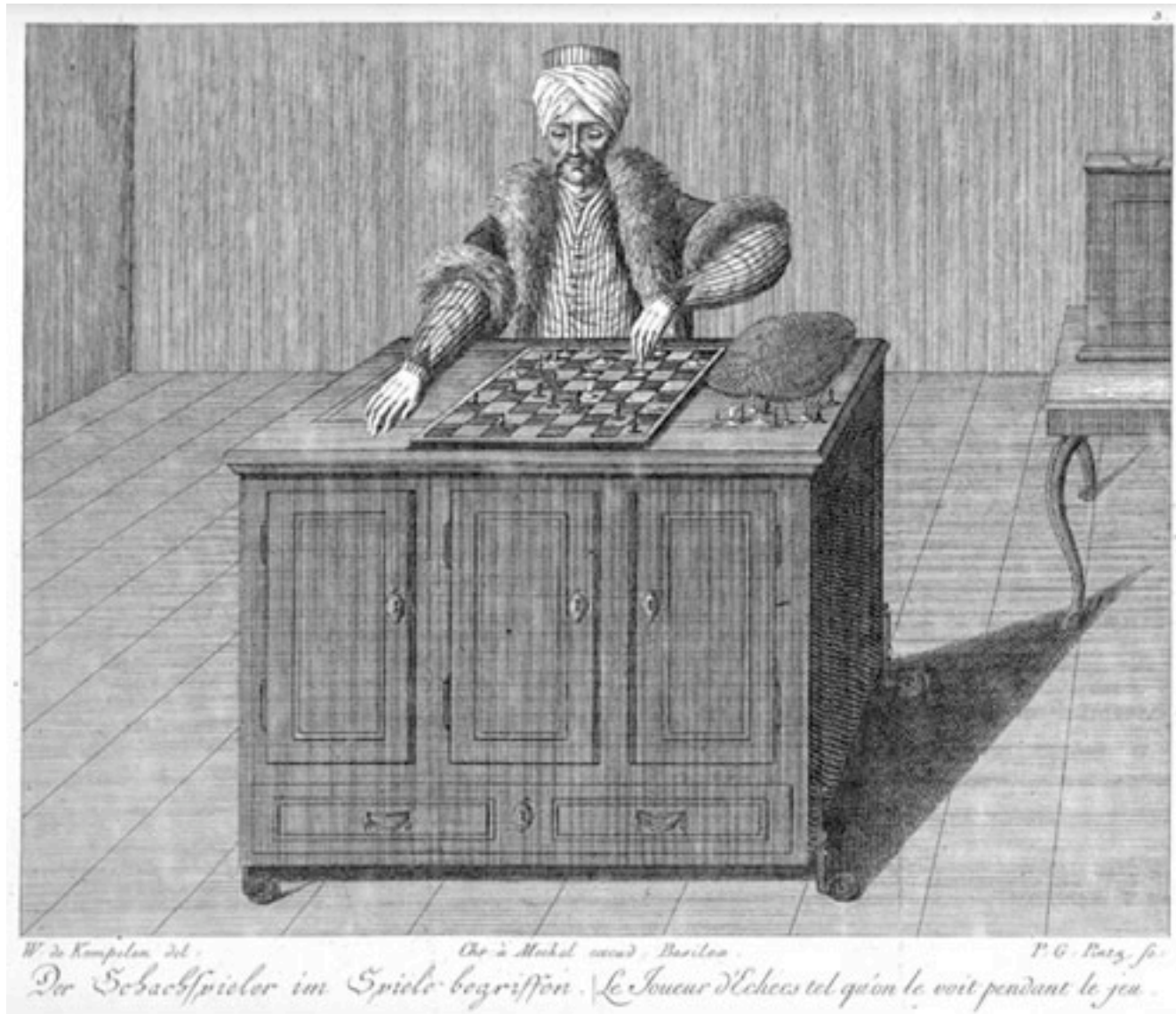


Mechanical Turk

- Automaton Chess Player



- Automaton Chess Player



Wikipedia | Mechanical Turk | Games with a Purpose | CAPTCHA

The screenshot shows the Amazon Mechanical Turk website. The browser window title is "Amazon Mechanical Turk - Welcome". The address bar shows "https://www.mturk.com/mturk/welcome". The search bar contains "amazon mechanical turk". The page features the Amazon Mechanical Turk logo with the tagline "Artificial Artificial Intelligence". Navigation links include "Your Account", "HITs", and "Qualifications". A top right link says "Already have an account? Sign in as a Worker | Requester". A main banner states "Mechanical Turk is a marketplace for work." and "We give businesses and developers access to an on-demand, scalable workforce. Workers select from thousands of tasks and work whenever it's convenient." It also mentions "88,388 HITs available. View them now." Below this, there are two main sections: "Make Money by working on HITs" and "Get Results from Mechanical Turk Workers". The "Make Money" section describes HITs as individual tasks and lists benefits for workers: "Can work from home", "Choose your own work hours", and "Get paid for doing good work". It includes a flow diagram: "Find an interesting task" (represented by a gear icon) -> "Work" (represented by a gear icon) -> "Earn money" (represented by a dollar sign icon). A "Find HITs Now" button is present. The "Get Results" section describes how to use Mechanical Turk and lists benefits for requesters: "Have access to a global, on-demand, 24 x 7 workforce", "Get thousands of HITs completed in minutes", and "Pay only when you're satisfied with the results". It includes a flow diagram: "Fund your account" (represented by a plus sign icon) -> "Load your tasks" (represented by a document icon) -> "Get results" (represented by a star icon). A "Get Started" button is present. Both sections have links to "learn more about being a Worker" or "learn more about being a Requester". The footer contains links for "FAQ", "Contact Us", "Careers at Amazon", "Developers", "Press", and "Policies", along with copyright information "©2005-2009 Amazon.com, Inc. or its Affiliates" and the text "An amazon.com company".

Amazon Mechanical Turk - Welcome

https://www.mturk.com/mturk/welcome

amazon mechanical turk

amazon mechanical turk
Artificial Artificial Intelligence

Your Account HITs Qualifications

Introduction | Dashboard | Status | Account Settings

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.

88,388 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 an interesting task **Work** **Earn money**

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

Fund your account **Load your tasks** **Get results**

Get Started

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

FAQ | Contact Us | Careers at Amazon | Developers | Press | Policies

©2005-2009 Amazon.com, Inc. or its Affiliates

An amazon.com company

● Amazon Mechanical Turk Examples

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!

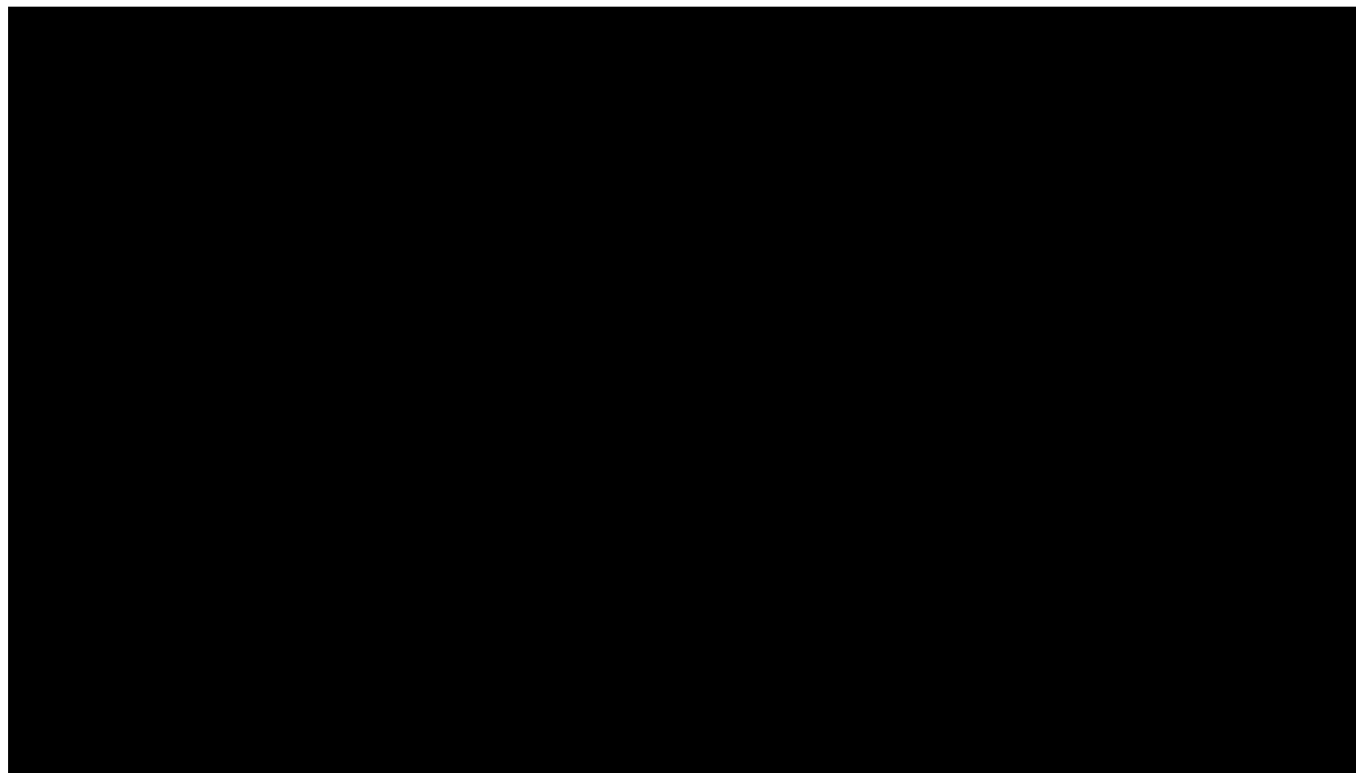
Submit

NOISE TO SIGNAL
Rob Cottingham



Games with a Purpose

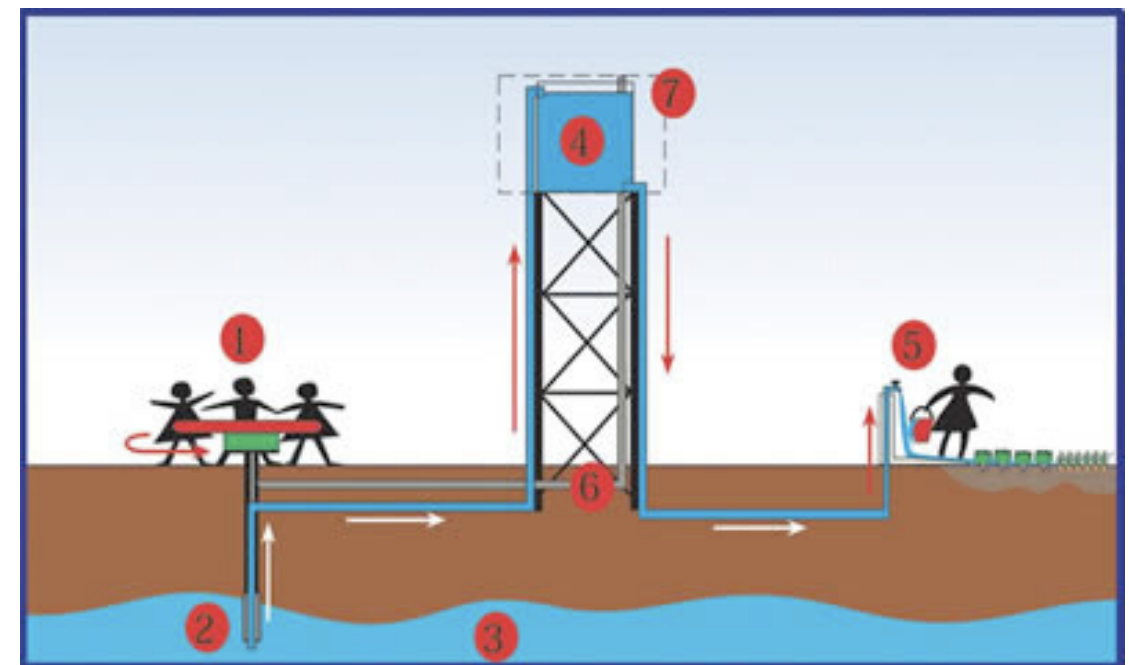
Games with a Purpose



- PlayPumps



- PlayPumps



● PlayPumps

"It is wonderful to see the children having so much fun on these roundabouts (PlayPumps) while at the same time bringing an essential service to the community."

Hennie Wesseling, TNT Director

"I witnessed how a simple water pump can transform a village and give its children a chance to thrive."

Jay-Z, Def Jam Records CEO and rap artist

"Water is intimately linked with education and gender equality. Girls who have to spend time gathering water for the family tend not to be in school. And where schools have sanitation, attendance is higher; especially for girls."

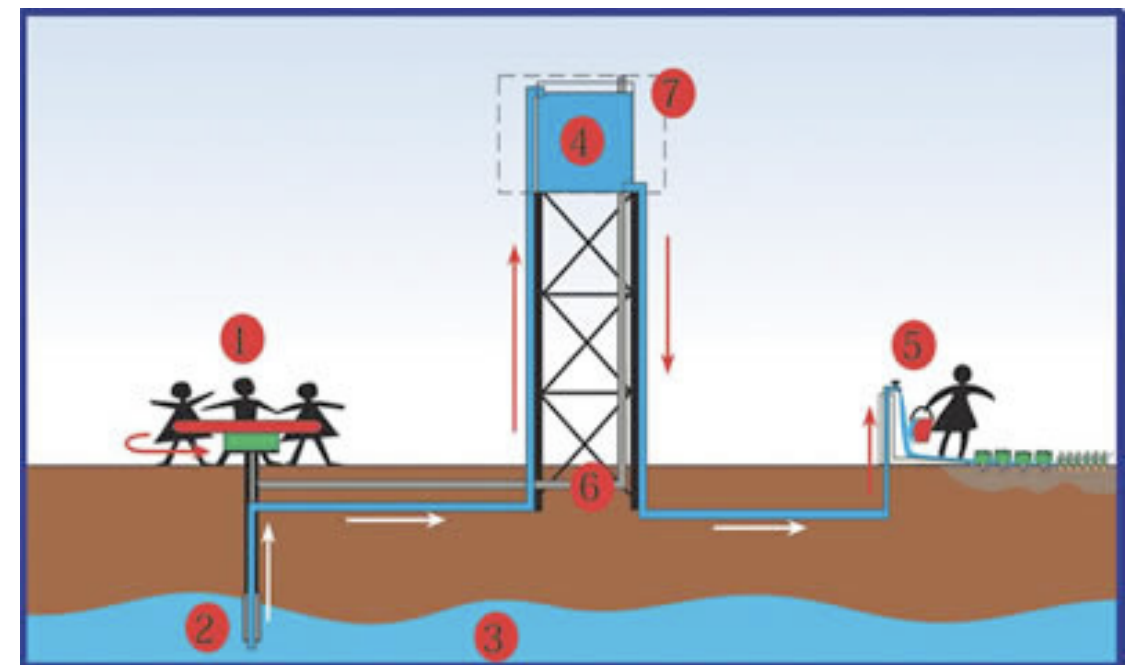
Kofi Annan, United Nations Secretary General

"Water is essential to life and we are committed to finding solutions that help alleviate its scarcity in some of our neediest communities. The PlayPump concept offers communities and schools an excellent way to access fresh water."

Dave Govender, Environmental Affairs Manager, Coca-Cola Southern and East Africa

"Partnerships are essential if we are to help Mozambique's education and culture sector, as well as the sector of water and sanitation, to get back on their feet after so many years of devastating war."

Angela Van Rynbach, Country Director, United Nations World Food Programme



- GWAP players perform **basic tasks** that cannot be automated.
- While being **entertained**, people produce useful data as a **side effect**.
- Pioneered by *Dr. Luis von Ahn (CMU)* who created the **ESP** game.



Wikipedia | Mechanical Turk | Games with a Purpose | CAPTCHA

- GWAP applications
 - Image/sound/video annotation
 - Speech/gesture/emotion recognition
 - Natural language understanding
 - Commonsense reasoning
 - Geospatial tagging
 - and more...

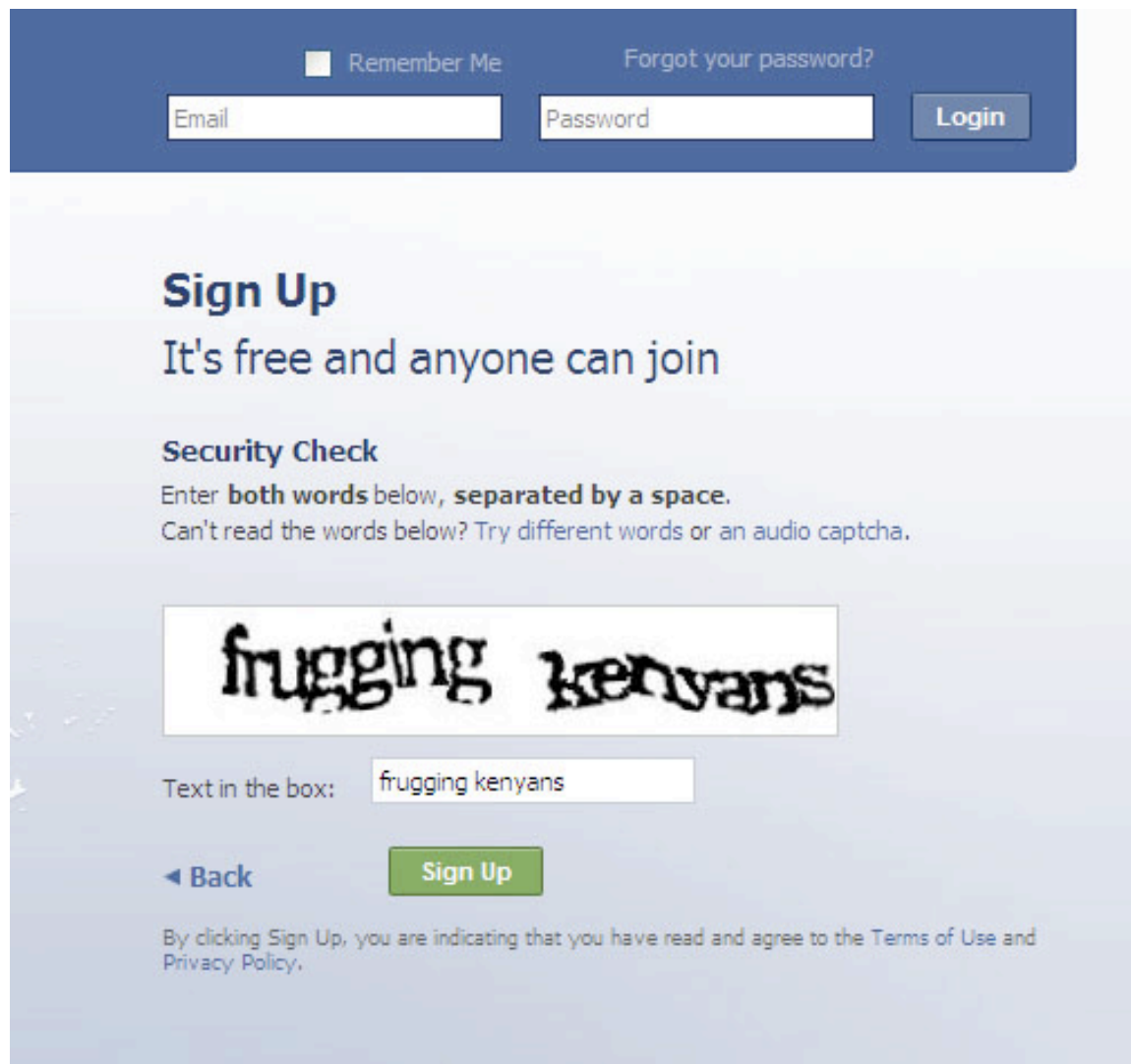
- GWAP applications
 - Image/sound/video annotation
 - Speech/gesture/emotion recognition
 - Natural language understanding
 - Commonsense reasoning
 - Geospatial tagging
 - and more...



CAPTCHA



- **CAPTCHA: Completely Automated Public Turing test to tell Computers and Humans Apart**



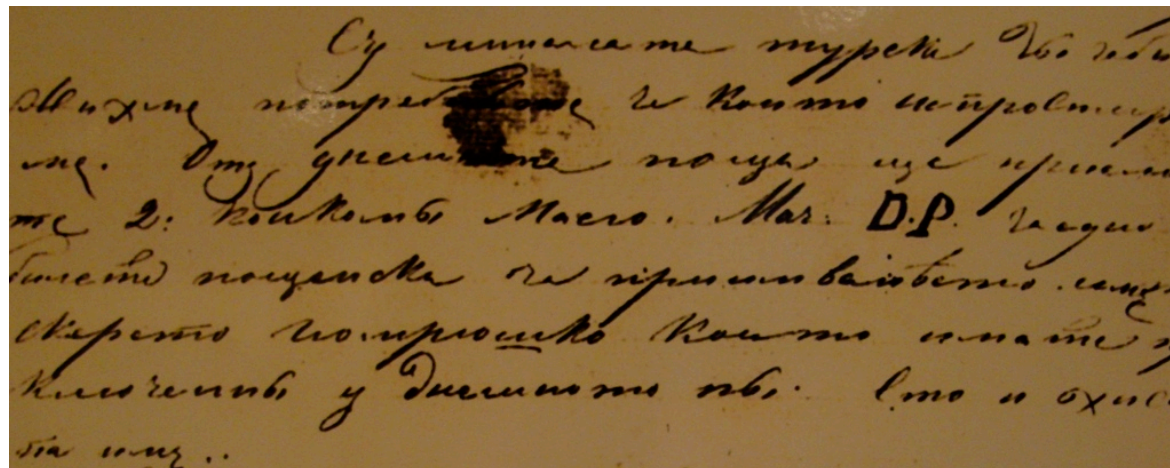
The image shows the Facebook 'Sign Up' page. At the top, there is a login section with fields for 'Email' and 'Password', a 'Remember Me' checkbox, and a 'Forgot your password?' link. Below this is the 'Sign Up' section with the text 'It's free and anyone can join'. A 'Security Check' section follows, instructing users to 'Enter both words below, separated by a space' and providing a link to 'Try different words or an audio captcha'. The CAPTCHA image displays the words 'frugging' and 'kenyans' in a distorted font. Below the image is a text input field containing 'frugging kenyans'. At the bottom, there are 'Back' and 'Sign Up' buttons, and a disclaimer: 'By clicking Sign Up, you are indicating that you have read and agree to the Terms of Use and Privacy Policy.'



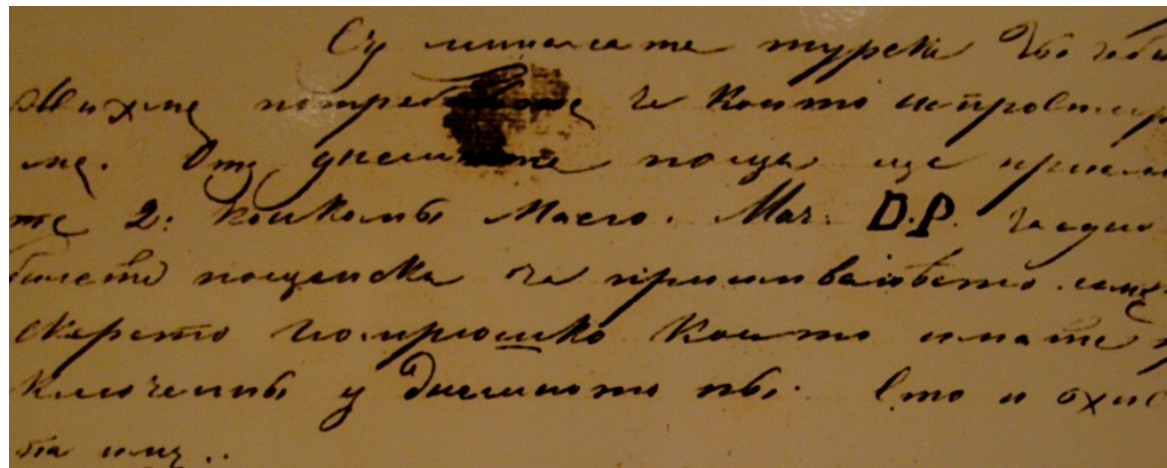
The image shows the Twitter 'Create a Free Twitter Account' page. It includes fields for 'Username' (darcylogan), 'Password' (masked), and 'Email Address' (d@rainbowforeverbrowsers.com). A 'Humanness' CAPTCHA is present, showing the words 'Sunday' and 'tired' in a distorted font. Below the CAPTCHA is a text input field containing 'Sunday tired'. At the bottom, there is a checkbox for 'I want the inside scoop—please send me email updates' and a 'Create my account' button.



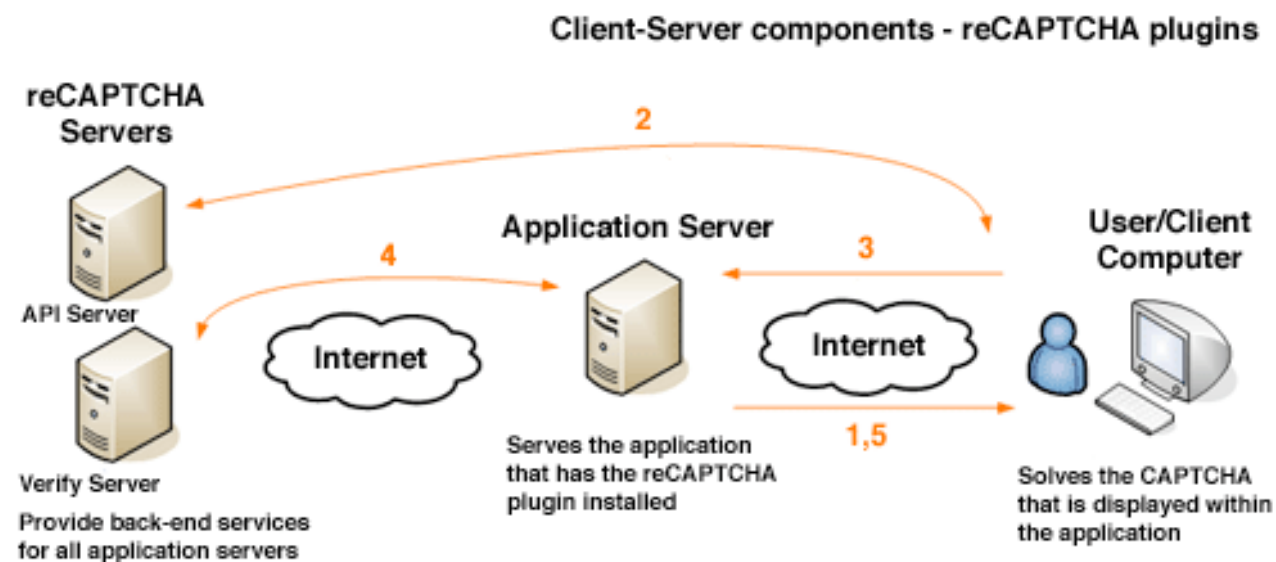
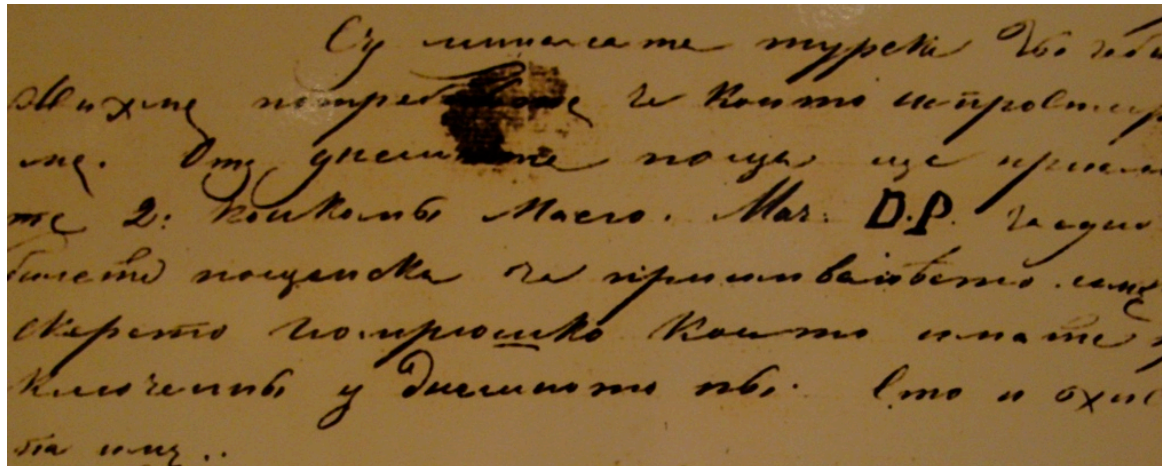
- reCAPTCHA: exploit HCOMP to real problems



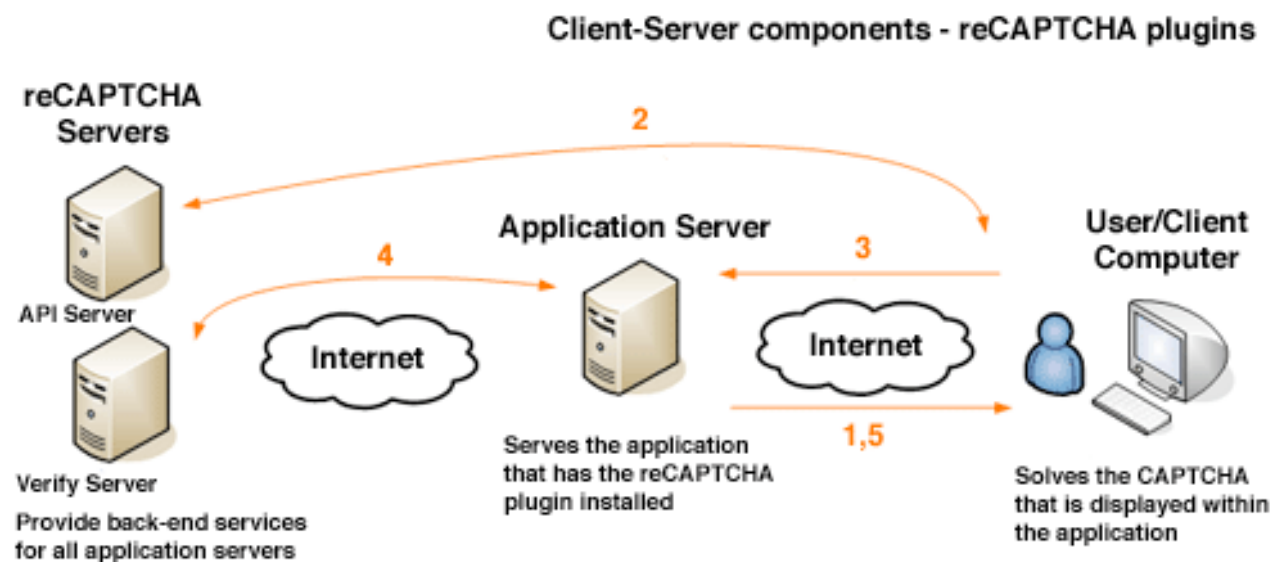
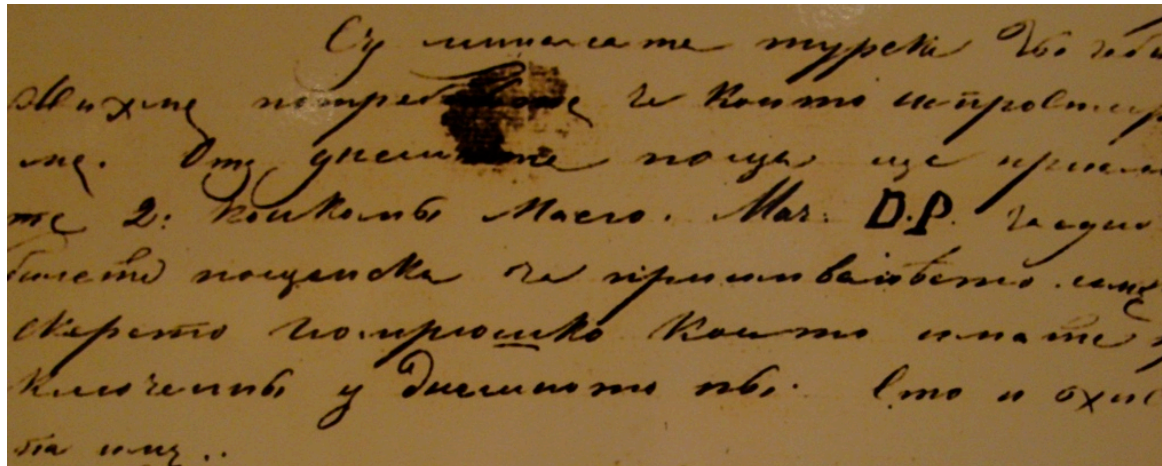
- **reCAPTCHA**: exploit HCOMP to real problems



- **reCAPTCHA**: exploit HCOMP to real problems



- **reCAPTCHA**: exploit HCOMP to real problems



- Google acquired reCAPTCHA in Sept. 2009!!

Wikipedia | Mechanical Turk | Games with a Purpose | CAPTCHA

- Optical Character Recognition (OCR) and/or Human Character Recognition (HCR):
complementary, not *competitive*!

- Optical Character Recognition (OCR) and/or Human Character Recognition (HCR):
complementary, not *competitive*!

- Optical Character Recognition (OCR) and/or Human Character Recognition (HCR):
complementary, not *competitive*!
- Human-aided OCR: using Computer-aided HCR to help OCR

- Optical Character Recognition (OCR) and/or Human Character Recognition (HCR):
complementary, not *competitive*!
- Human-aided OCR: using Computer-aided HCR to help OCR

- Optical Character Recognition (OCR) and/or Human Character Recognition (HCR):
complementary, not *competitive*!
- Human-aided OCR: using Computer-aided HCR to help OCR
- Well, how about *Chinese* characters?

Open Issues of HCOMP

- System benchmark

Open Issues of HCOMP

- System benchmark

Quantity	Quality
<ul style="list-style-type: none"># of outcomes / time# of new outcomes / timequeueing time / puzzleresponse time / puzzleprocessing time / puzzle..	<ul style="list-style-type: none">correctnessfidelityusabilityapplicabilityextensibility..

Open Issues of HCOMP

Open Issues of HCOMP

- System design issues
 - *centralized* vs *distributed* system
 - *single* vs *multiple* players per round
 - *single* vs *multiple* outcomes per round
 - *pure* vs *computer-aided* HCOMP
 - *stationary* vs *mobile* players
 - *'just enough'* incentives
 - not *yet another HCOMP system*

Where are we now?

- Play GWAP with Strategies

- We propose an *analysis* and design a set of *playing strategies* for the ESP game
- We implement a quasi ESP game, called *ESP Lite*, and evaluate the proposed strategies in real world.

- Social Mobile Game

- We investigate GWAP-based *geospatial tagging* systems.
- The *implementation* and real-world *experiments* are undergoing.

- HCOMP API

- We develop the *HCOMP API* to facilitate future HCOMP researches.
- HCOMP API will become a *SourceForge* project soon.

Summary

Summary

- HCOMP outsources certain steps of the computational process to humans.
- It has shown promise in solving a variety of problems that computer computation cannot currently resolve completely.

Let everyone do what they are good at!

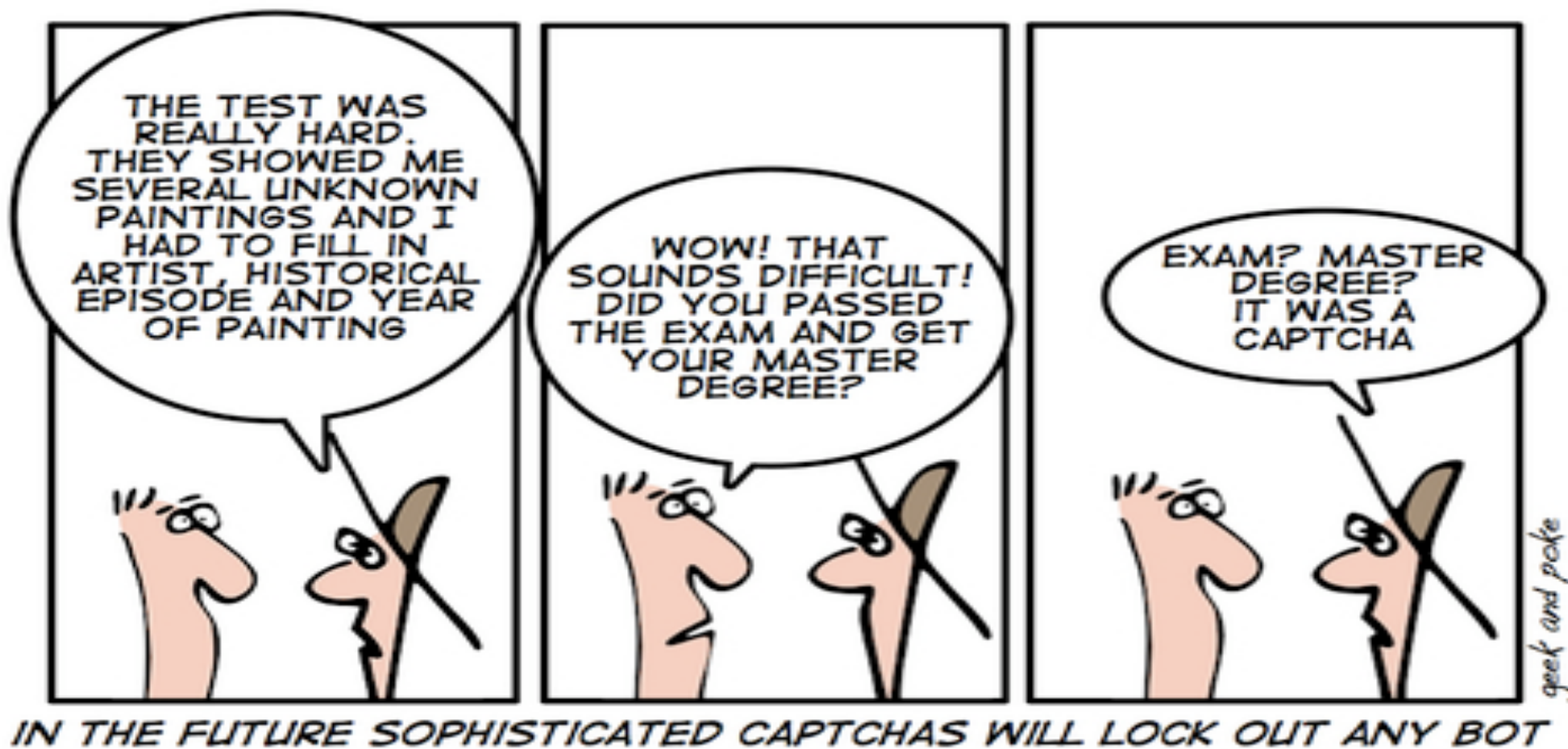
- HCOMP is an emerging area/application with lots of opportunities.

Make good use of your brain power!

Only great minds can read this!

fi yuo cna raed tihs, yuo hvae a sgtrane mnid too.
I cdnuolt blveiee taht I cluod aulacly uesdnatnrd
waht I was rdanieg. The phaonmneal pweor of the
hmuan mnid, aoccdrnig to a rscheearch at
Cmabrigde Uinervtisy, it dseno't mtaetr in waht oerdr
the ltteres in a wrod are, the olny iproamtnt tihng is
taht the frsit and lsat ltteer be in the rghit pclae. The
rset can be a taotl mses and you can sitll raed it
whotuit a pboerlm. Tihs is bcuseae the huamn mnid
deos not raed ervey lteter by istlef, but the wrod as a
wlohe. Azanmig huh? Yaeh and I awlyas tghuhot
slpeling was ipmorantt! If you can raed tihs forwrad it.

Don't misuse it !



Thanks

<http://nrl.iis.sinica.edu.tw/>
<http://nrl.iis.sinica.edu.tw/GWAP/>



中央研究院

資訊科學研究所

助研究員

陳 伶 志 博士

地 址：臺北市南港區研究院路2段128號 電話：(02)2788-3799 ext.1702
中央研究院資訊科學研究所 傳真：(02)2782-4814
電子信箱：ccljj@iis.sinica.edu.tw
網 址：http://www.iis.sinica.edu.tw/~ccljj/



Academia Sinica
Institute of Information Science

Ling-Jyh Chen Ph.D.
Assistant Research Fellow

128, Section 2, Academia Road Tel: +886-2-2788-3799 ext.1702
Institute of Information Science Fax: +886-2-2782-4814
Nankang, Taipei 115 E-mail: ccljj@iis.sinica.edu.tw
Taiwan, R.O.C. http://www.iis.sinica.edu.tw/~ccljj/