

Crowd Computing

Leverage Collective Intelligence, Creativity,
and Resources

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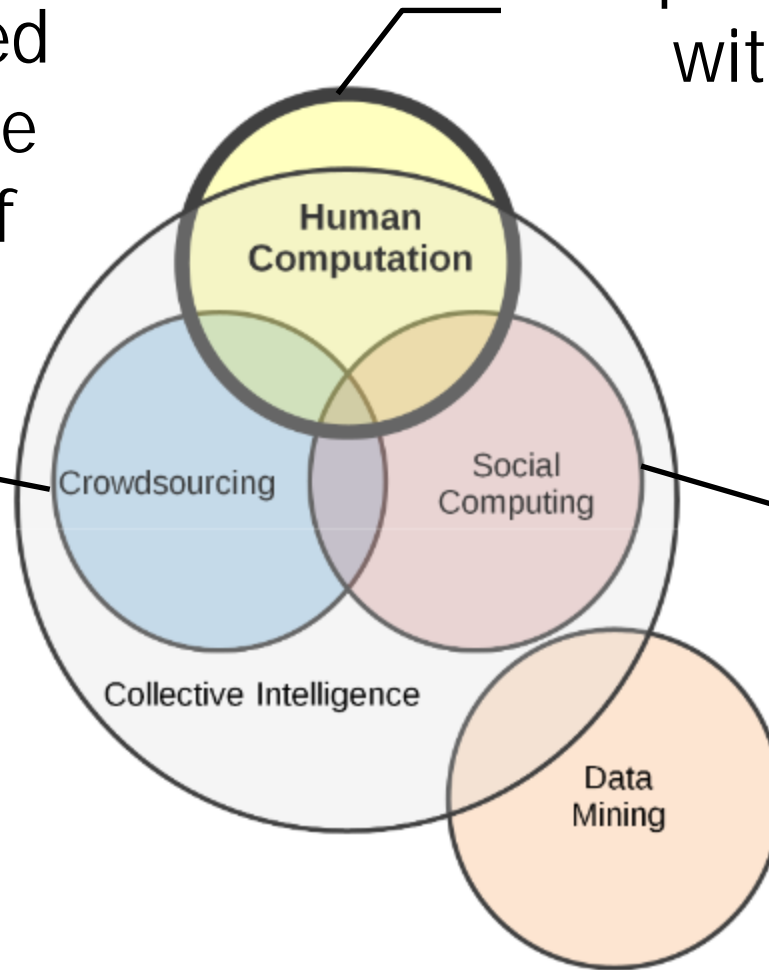
Definitions

- Crowd Computing
 - Harness the power of people online to do tasks that are hard for individuals or computers to do alone
- Other arguments
 - Crowd computing = (human + machine) computing
 - Crowd computing = (social + cloud) computing



Replace designated agents / employee with members of the public

Replace computers with humans



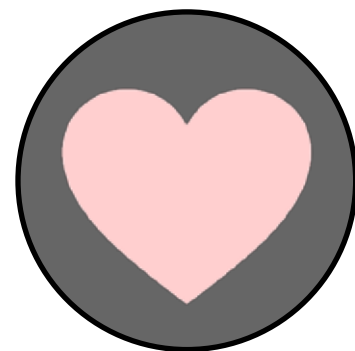
Create and recreate social behaviors, conventions, contexts online

(Quinn & Bederson, 2011)



Human Computation

- Paradigm for utilizing human processing power to solve problems that computers cannot yet solve
 - von Ahn's 2005 dissertation titled *Human Computation*
 - Eventually able to be done by computers
 - Without monetary compensation



(Von Ahn, 2005)



HCOMP I: Game with a Purpose (GWAP)

- Use game for human computation, e.g.
 - ESP Game (later Google Labeler)



(Von Ahn, 2006; Von Ahn & Dabbish 2008)



Common GWAP Tasks

- Image / sound / video annotation
- Gesture / emotion / speech recognition
- Natural language understanding / translation
- Commonsense reasoning
- Geospatial tagging
- ...

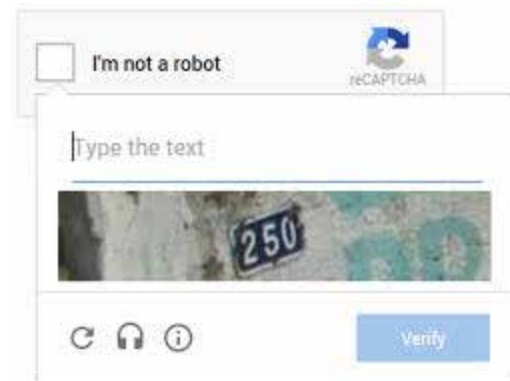
Fort McMoney: Adventure of a Canadian Oil Company





HCOMP II: Service for Data

- Implicitly exchange data service, e.g.
 - reCAPTCHA



(Von Ahn et al. 2008)

Image verification code in 12306

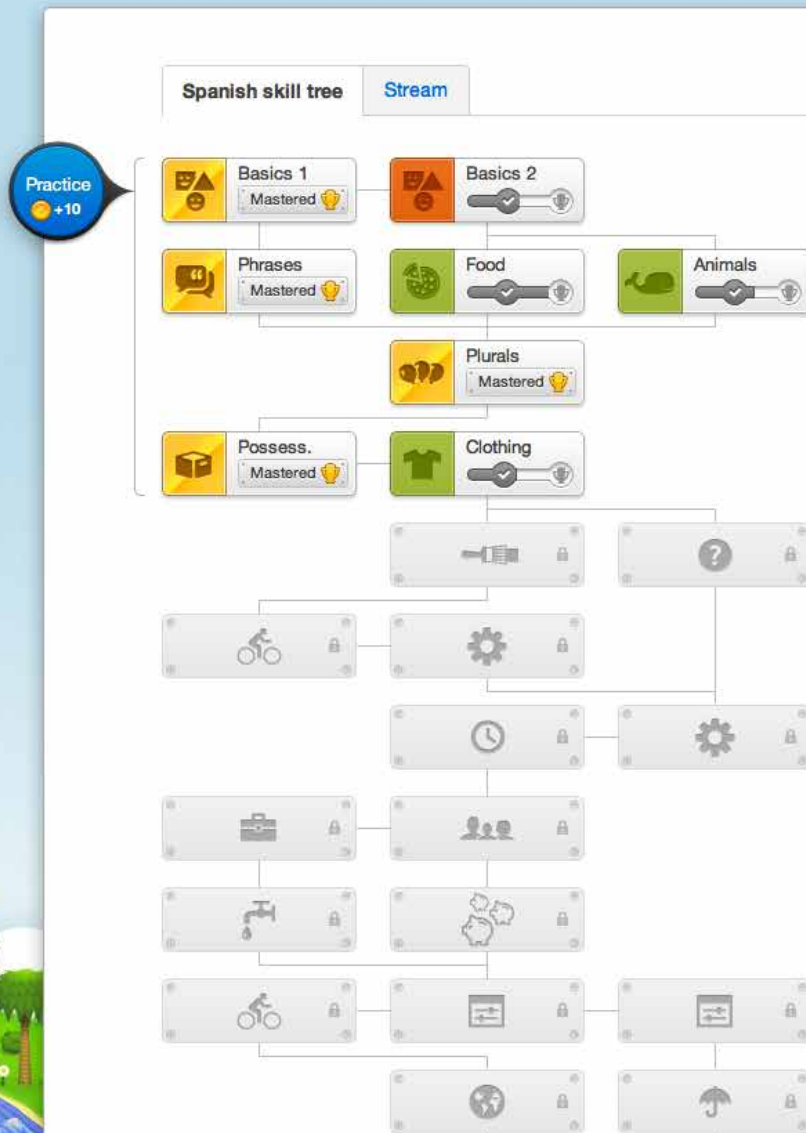


Duolingo: Language Learning for Multi-lingual Translation

duolingo

Home Translations Questions Follow people

Mygrapefruit is learning Spanish



Mygrapefruit

Sanna Nynäshamn
Brushing up my high school Spanish, trying to learn French & German (and any other language that pops up) while waiting for Japanese :D! :D!

137 Following 104 Followers

Spanish progress



1201 Skill points Rank 33rd/74
98 Sentences translated Rank 18th/74

Daily progress



Get skill points every day for best results

☐ Send me a daily reminder email

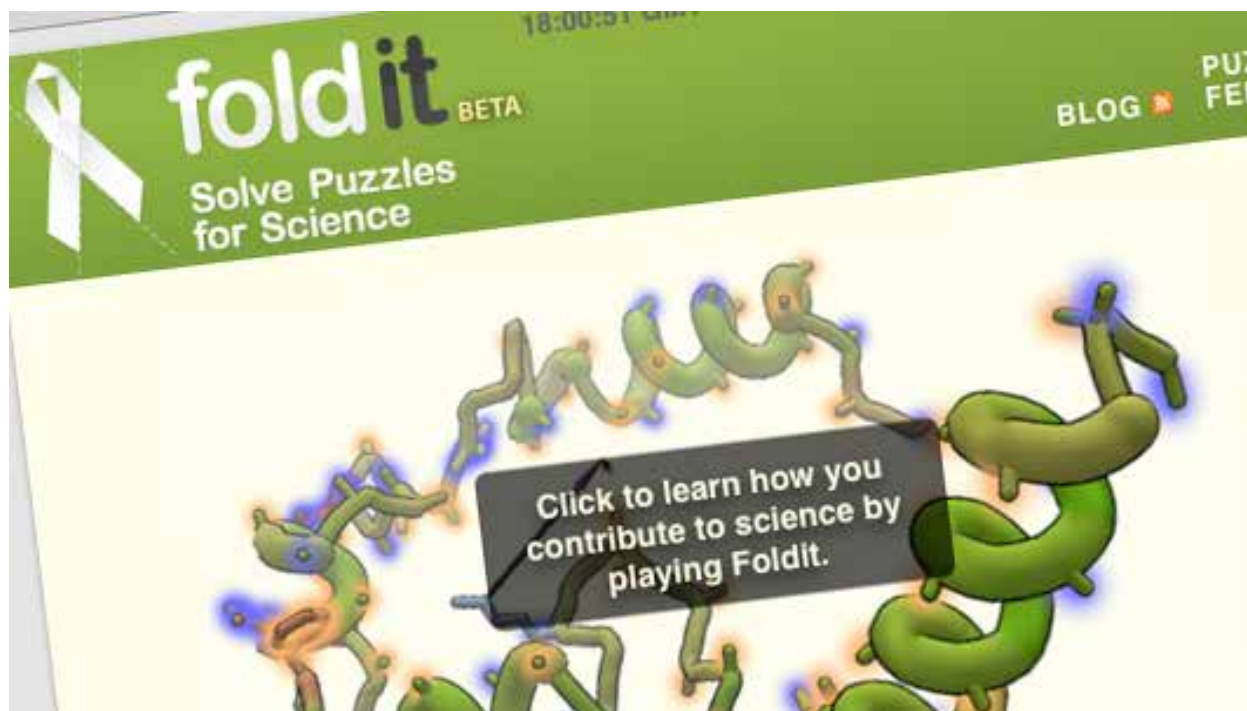
Feedback

<https://www.duolingo.com/>



HCOMP III: Citizen Science

- Scientific research conducted, in whole or in part, by amateur or nonprofessional scientists, e.g.
 - Foldit



(Cook et al., 2010)

<http://www.nature.com/news/2010/100804/full/466685a.html>

NASA's Be a Martian Initiative



<http://blogs.discovermagazine.com/citizen-science-salon/2014/04/02/help-map-red-planet-nasas-martian-citizen-science-initiative/#.VeFtiPkxtg9>



HCOMP IV: Community Sourcing

- Building and maintaining a community of volunteers



(Hu et al., 2011)





Twitch Plays Pokemon

- 1.1 million active users, peak of 121,000 viewers
- Issuing 122+ million commands
- Completed Pokemon Red in 16:07:45:30
- 9 million unique onlookers



Maintaining community engagement
Massive volume of input
Lag between chat and video
Trolls

https://en.wikipedia.org/wiki/Twitch_Plays_Pok%C3%A9mon



Crowdsourcing

- Outsourcing to the online crowd
 - Coined by Jeff Howe in 2006 in Wired magazine
 - Often with monetary compensations





Crowdsourcing Platforms

- General purpose platform

- Amazon's Mechanical Turk

<http://mturk.com/>



- Domain-specific platform

- UpWork (professionals)

<https://www.upwork.com/>



- Media-specific platform

- Mindswarm (video)

<http://www.mindswarms.com/>

- Umati (physical kiosk)



- ...

Berkeley Umati Physical Kiosk



2 Vend Tasks Exit Field Toggles

Question Professor Student

Indicate the outcome of executing the following (one of 'compilation error', 'runtime error', or 'whatever is printed') and briefly justify your answer:

```
string s = 'Hello';  
String s2 = s;  
s = s + ' there';  
if (s == s2)  
    System.out.println("equal");  
else  
    System.out.println("not equal");
```

'not equal' - the addition creates a new string, so s and s2 point to different things.

Grading Rubric

Student Answer

Grading Slider

0 Submit



(Heimerl et al. 2012)

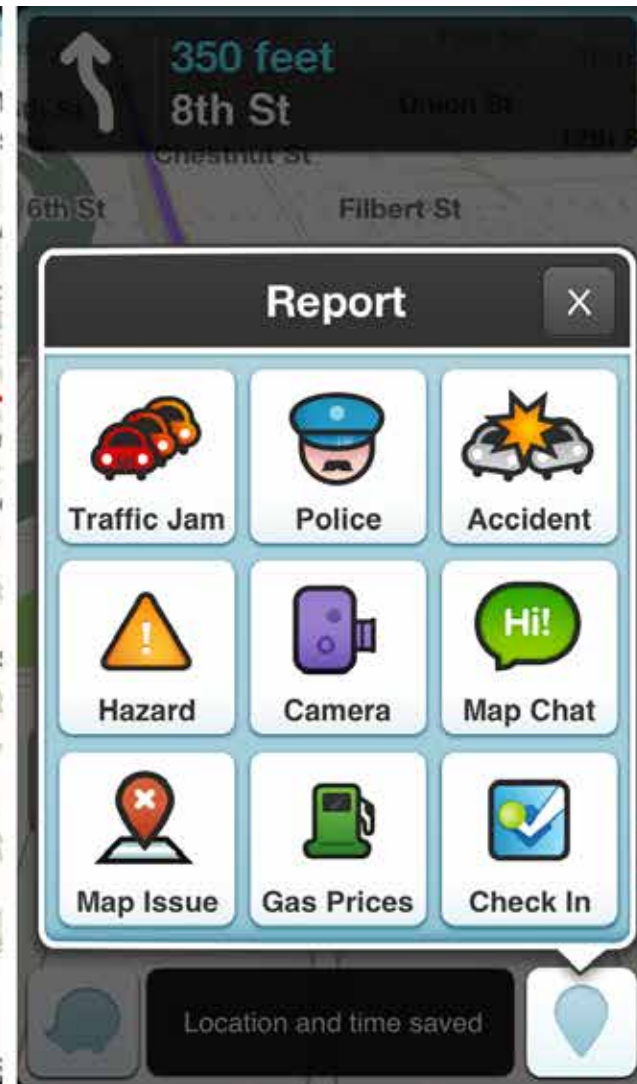
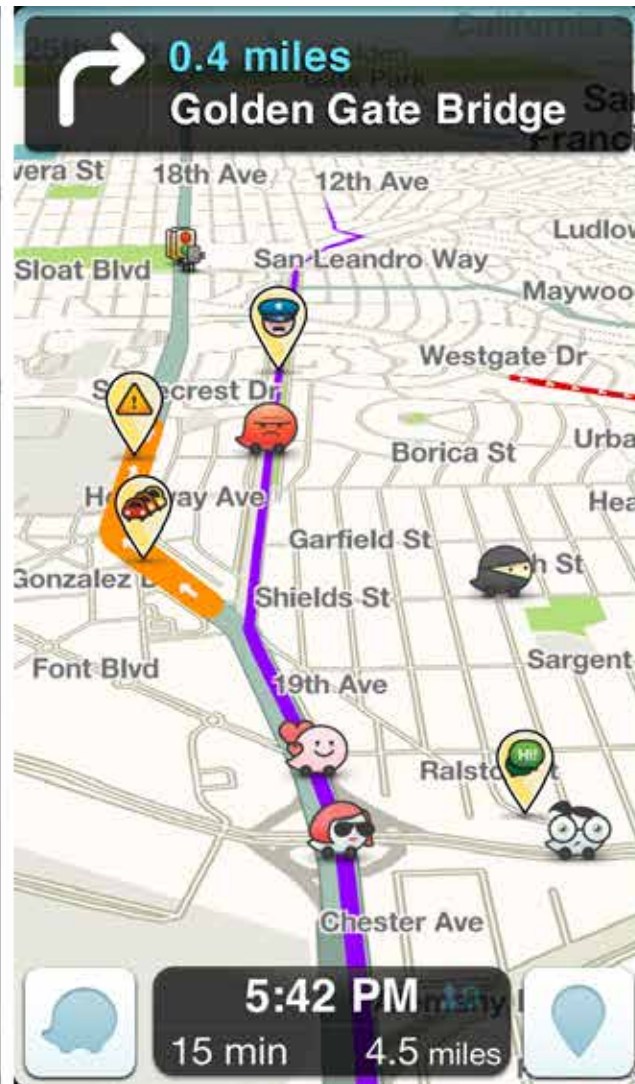


Crowdsourcing Tasks

- Similar to the HCOMP tasks
- Crowd sensing



Waze



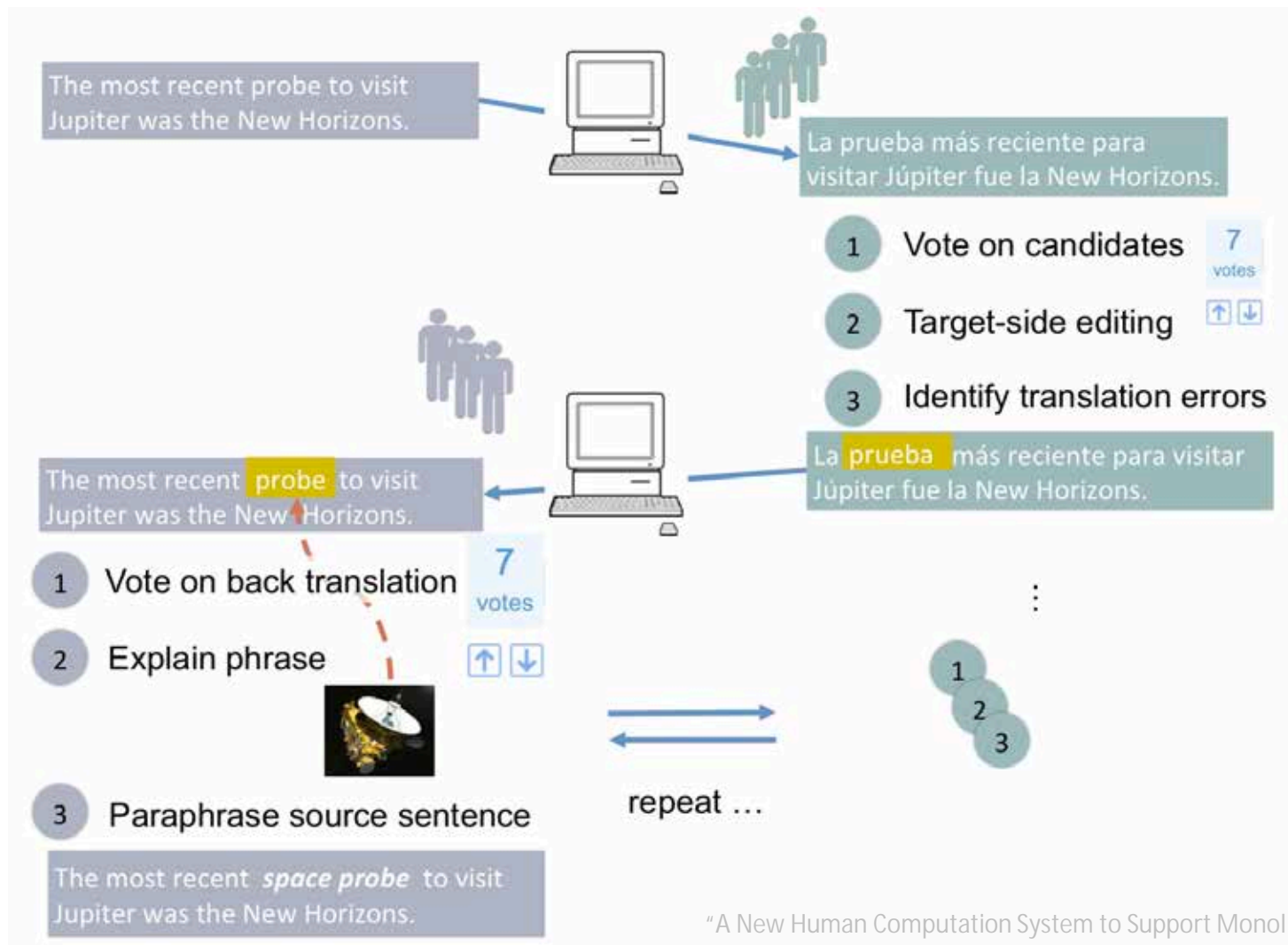


Knowledge Aggregation Process

- One time
 - E.g., parallel
- Complementary iteration (Hu et al., 2011)
 - E.g., monolingual workers for multilingual translation
- Constructive iteration (Yu et al. 2014)
 - E.g., example-schema-evaluation
- Evolutionary iteration (Yu & Nickerson 2011)
 - Generic algorithm: crossover-mutation



Mono Trans 2



"A New Human Computation System to Support Monolingual Translation"



Quality Control Mechanisms

- | | |
|-------------------------|-----------------|
| • Output agreement | ESP Game |
| • Input agreement | Tag-a-tune |
| • Economic models | |
| • Defensive task design | |
| • Redundancy | reCAPTCHA |
| • Statistical filtering | |
| • Multilevel review | Soylent |
| • Automatic check | fold.it |
| • Reputation system | Mechanical Turk |

(Quinn & Bederson, 2011)

ImageNet

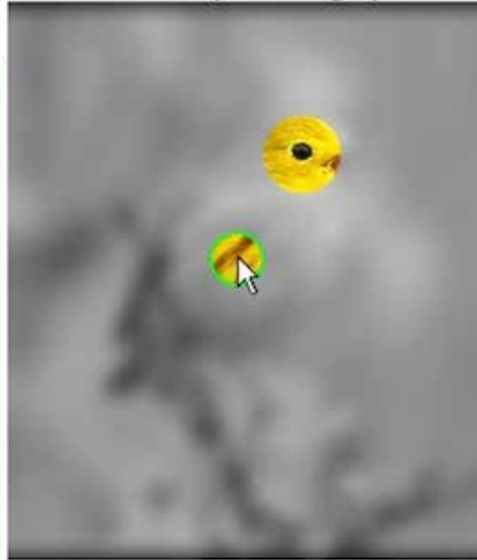


Click Me or Press 1

[Prairie Warbler \(wikipedia\)](#)



Draw and identify the category.



Bubble: Smaller
(Press - or 's')

Bigger
(Press + or 'w')

Bubble cost: 11

Points for correct identification: 65

Total score: 0

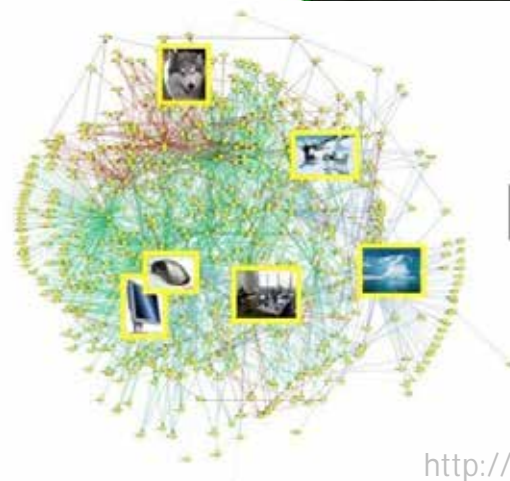


Click Me or Press 2

[Yellow Warbler \(wikipedia\)](#)



ImageNet Large Scale Visual Recognition Challenges



IMAGENET

<http://web.eecs.umich.edu/~jiadeng/>



Crowd Creativity

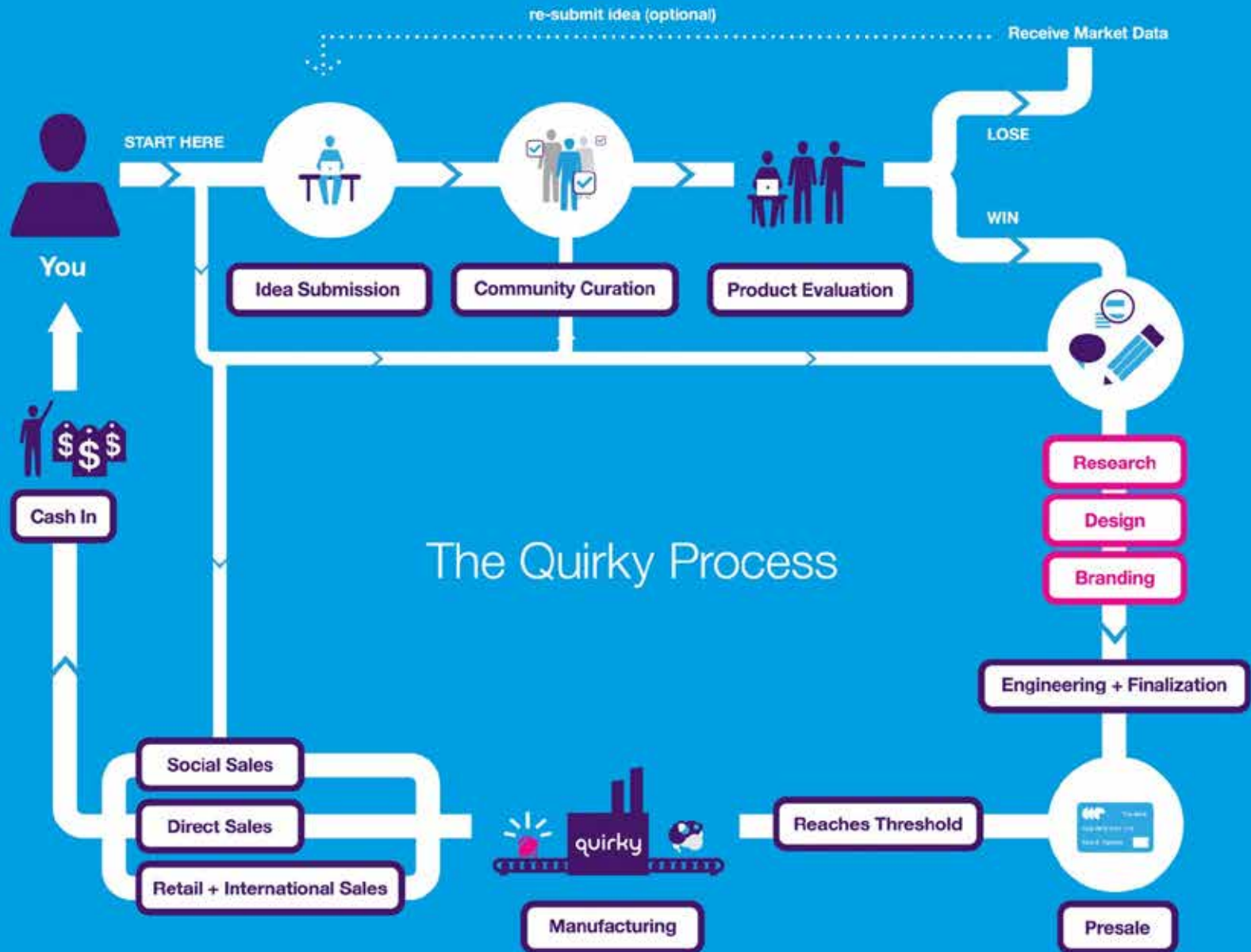
- Tapping of creative talent pools to design and develop original art, media or content
 - Contest
 - Vote
 - Bid



<http://crowdsourcingweek.com/five-predictions-for-crowdsourcing-in-2014/>



<http://crowdsourcingweek.com/five-predictions-for-crowdsourcing-in-2014/>





Crowdfunding

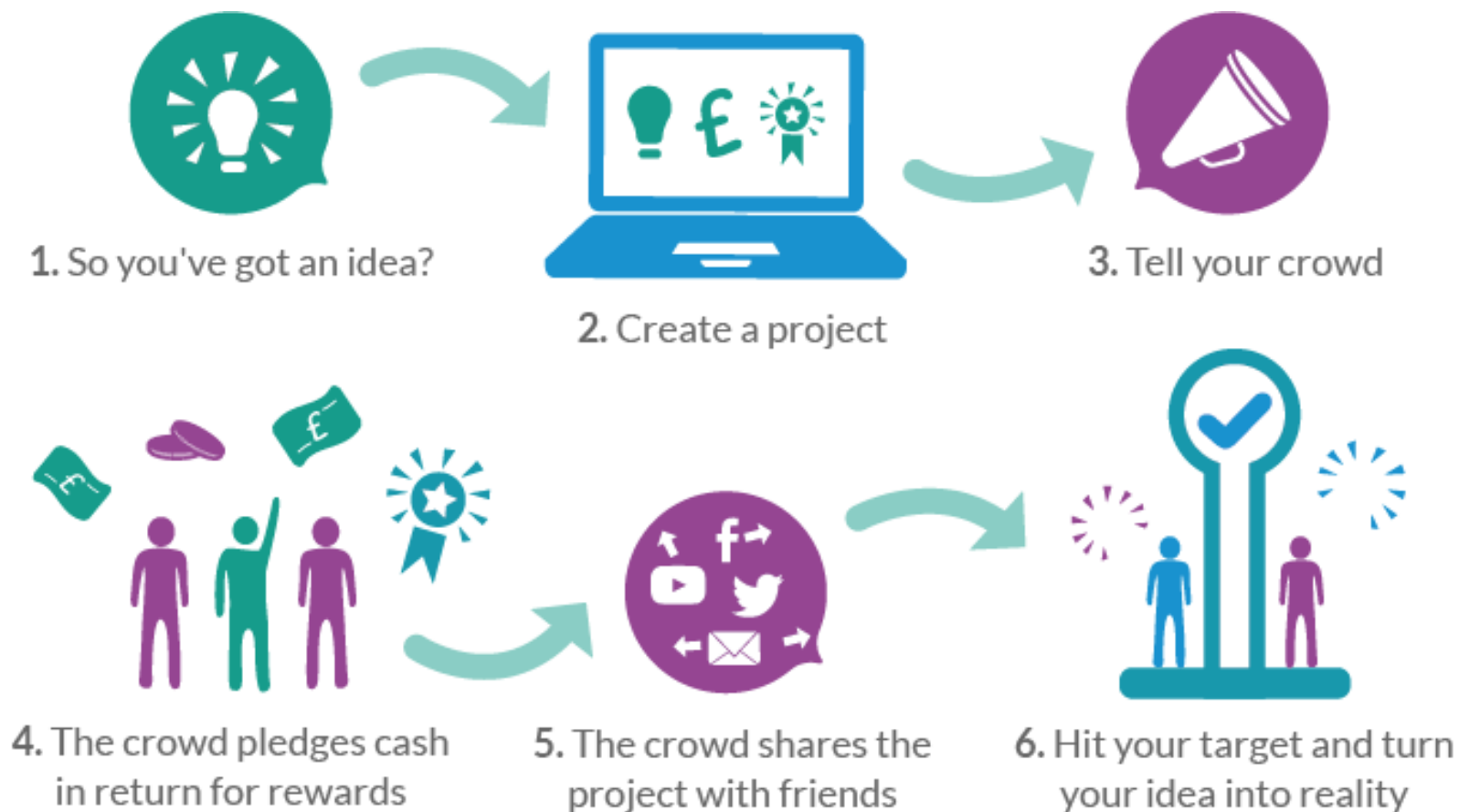
- Raising monetary contributions from a large number of people online
 - Eye-catching
 - Heart-touching
 - Feasibility
 - Affordability



<http://www.crowdmapped.com/is-your-crowdfunding-company-getting-good-reviews/>



Crowdfunding Process



Kickstarter Oculus Rift

[Home](#)[Updates](#) 51[Backers](#) 9,522[Comments](#) 2,075

📍 Long Beach, CA

🔧 Technology

Funded! This project was successfully funded on Sep 1, 2012.

**9,522**

backers

\$2,437,429

pledged of \$250,000 goal

0

seconds to go

Oculus

Project by

Oculus
Long Beach, CA[Contact me](#)

📅 First created · 24 backed

👤 Has not connected Facebook

🌐 [oculusvr.com](#)[See full bio](#)[f Share](#)

259

[🐦 Tweet](#)[↔ Embed](#)

Developer kit for the Oculus Rift - the first truly immersive virtual reality headset for video games.

<https://www.kickstarter.com/>

Kickstarter “The Veronica Mars Movie Project”

veronica **MARS**

IN SELECT THEATERS
MARCH 14, 2014

CHECK BACK TO FIND
A LOCATION NEAR YOU

Raised: \$5,702,153 (285 percent of goal)
From: 91,585 people
Funded: April 12, 2013

<https://www.kickstarter.com/>

Chinese Crowdfunding “Monkey King: Hero is Back”





Challenges in Crowd Computing

- Insufficient knowledge of the crowd
 - How to motivate
 - What task to assign
 - Which result to accept
 - How much to pay
- Maintenance of the crowd
 - Timely tasks
 - Repeated tasks
 - Unpopular tasks



<http://www.americanbusinessmag.com/wp-content/uploads/crowdsourcing.jpg>

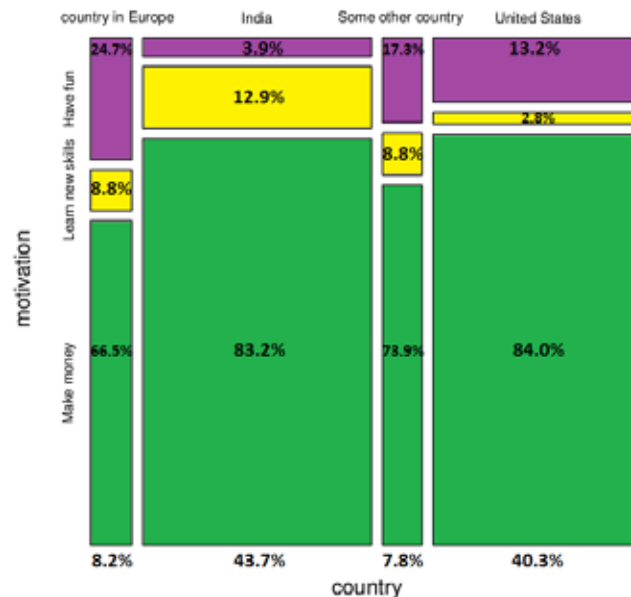
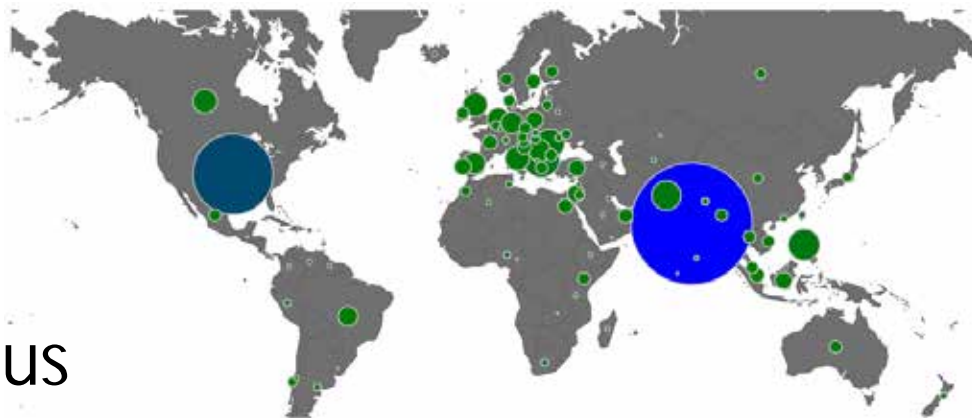


https://researchimpact.files.wordpress.com/2013/01/sl_n_logo_final_aug2011.png



Challenges in Crowd Computing

- Sample Bias
 - Culture
 - Age
 - Social-economic status
- Cheating
- Advertising
 - Visibility
 - Incentive
 - Branding



<http://www.mturkgrind.com/threads/demographics-of-mechanical-turk.26341>



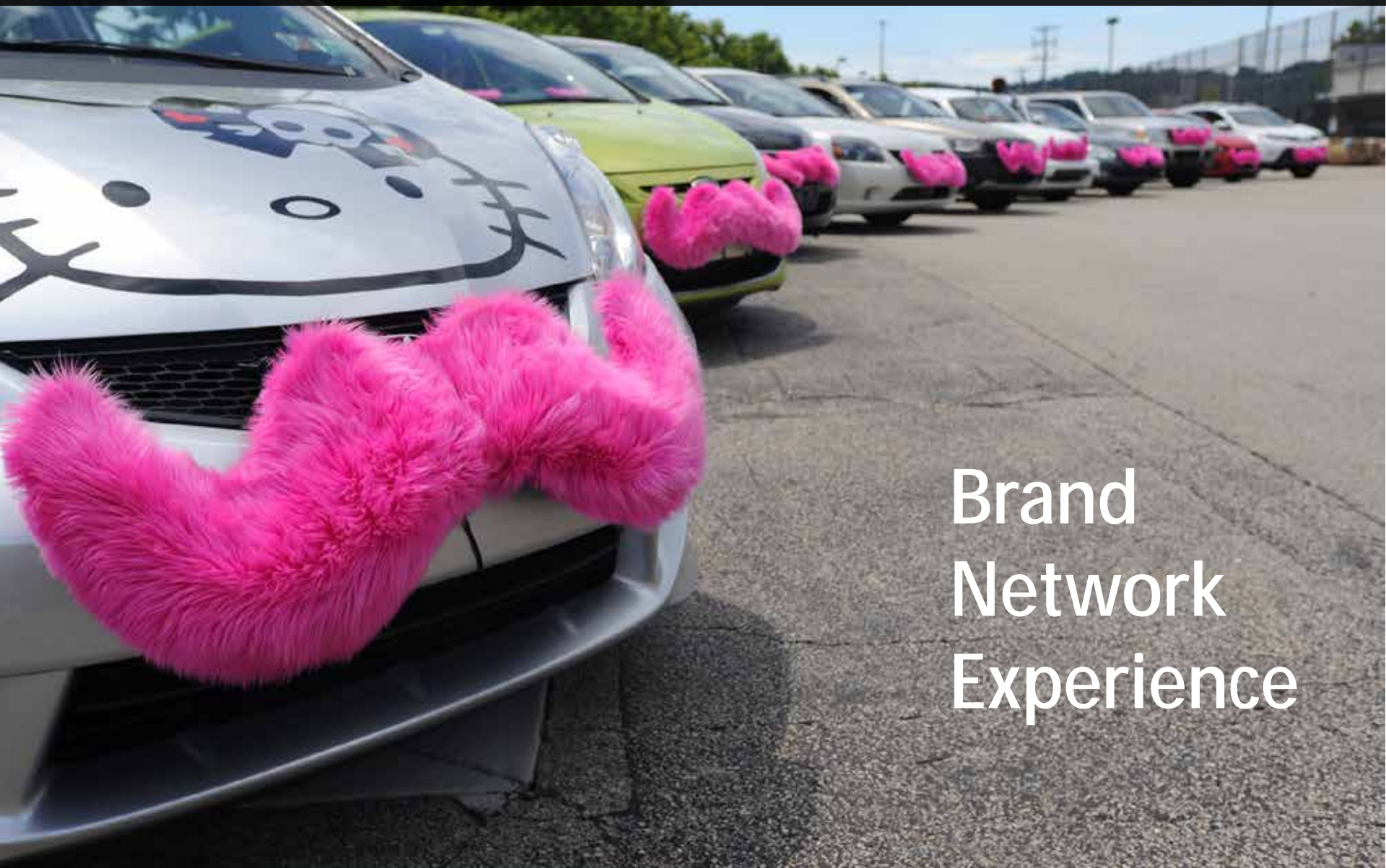
Sharing Economy

- Business built on the sharing of resources – accessing goods without ownership



<http://www.montrealgazette.com/business/sharing+economy/9674465/story.html>

US Presidential Campaign



Brand
Network
Experience

<http://www.post-gazette.com/opinion/Op-Ed/2014/07/13/Republicans-should-love-Uber-Shared-services/stories/201407130050>



Why it is Good ...

- Save money
- Good for the environment
- Provide flexibility
- Practical





Or not ...

- Damage the item / place
- Not trust the others
- Compromise privacy
- Not worth the effort
- Not good enough quality
- ...





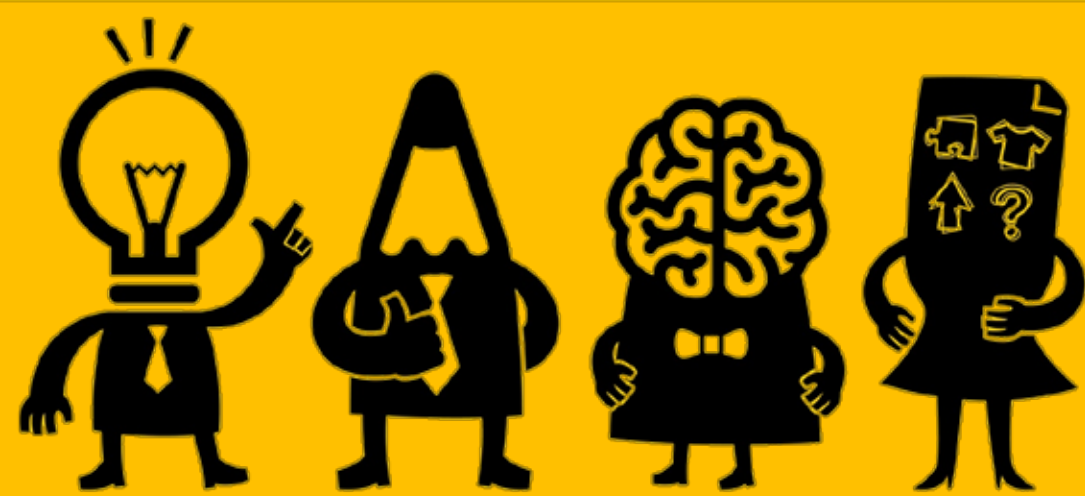
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Thank you J

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