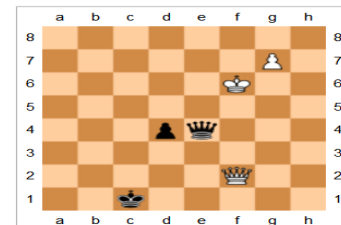


Collective Intelligence (CI) & Wisdom of Crowds (WoC)

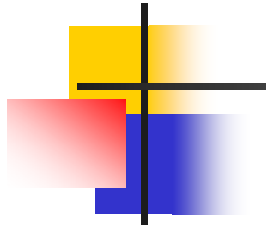


Kasparov versus the world (1999)

- A game of chess played in 1999 over the Internet
- Garry Kasparov played against the world team whose moves was decided by plurality vote
- On a typical move more than 5,000 people voted, and over the entire game 50,000 people from 75 countries voted
- After 62 moves of innovative chess, Kasparov won
- But he admitted he expended more energy on this one game than on any other in his career



"Intelligence" and "Collective"



Intelligence

the "capability of a system to adapt its behavior to meet its goals in a range of environments"

(Fogel, 1995, p. 22)

"the ability to solve hard problems"

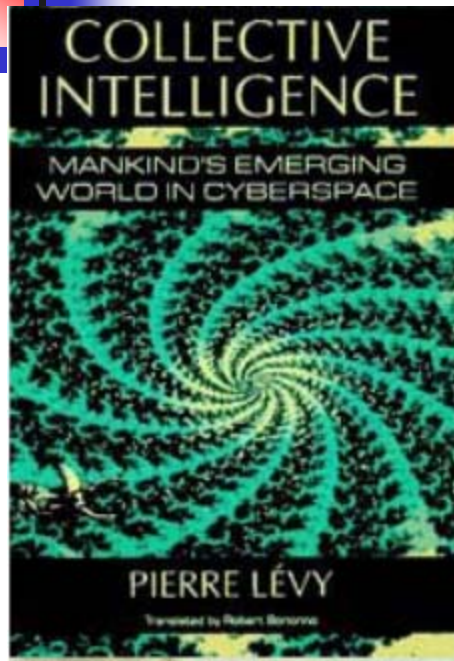
(Minsky, 1985)

Collective

defined as "of, relating to, characteristic of, or made by a number of people acting as a group"

(American Heritage Dictionary)

Collective Intelligence: Definitions



T58.5 .L38613 1997

“It is a form of universally **distributed intelligence**, constantly enhanced, **coordinated** in real time, and resulting in the effective mobilization of skills” --
Pierre Lévy, Canadian Research Chair of Collective Intelligence

“Collective intelligence is the capacity of **human community** to evolve towards higher order complexity of thought, problem solving and integration through **collaboration** and innovation”. --
George Pór (<http://www.community-intelligence.com/blogs/public>)

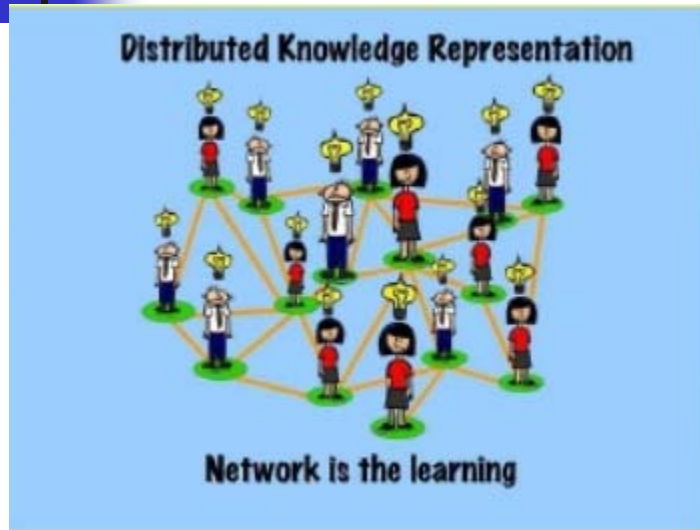


Collective Intelligence in Web 2.0 era

■ “**networked culture** gives rise to new structures of power which stem from the ability of **diverse groups** of people to pool knowledge, collaborate through research, debate interpretations and through such a collaborative process, refine their understanding of the world.” Henry Jenkins

- http://www.henryjenkins.org/2006/11/collective_intelligence_vs_the.html

Connectivism



- Centuries ago, it is possible for a single brilliant individual – an Aristotle or Leonardo – to surpass all others across many areas of knowledge
- But thanks to connectivity, collectively we now know far more than even the most brilliant individual. Because....
 - Knowledge is distributed/decentralized
 - Knowledge is interconnected
 - Knowledge is personal
 - Learning is a process of connecting specialized nodes or information sources

Why it works**

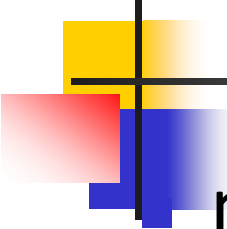
Harness latent microexpertise

- Collaboration routinely locates people with just the right microexpertise for the occasion
- The idea often spark ideas from others. The “Aha” moment.
- As creative collaboration is scaled up, the collaboration achieves a kind of “designed serendipity”*

* “chance that one idea will stimulate another new idea” By Jon Udell

** “Reinventing Discovery” by Michael Nielsen 2012

Characteristics of Collective Intelligence

- 
- nobody knows everything, everyone knows something, and what any given member knows is accessible to any other member
 - Key characteristics : Share information correct, evaluate each other's contributions, reach consensus

Identifiers of Collective Intelligence



a group of actors

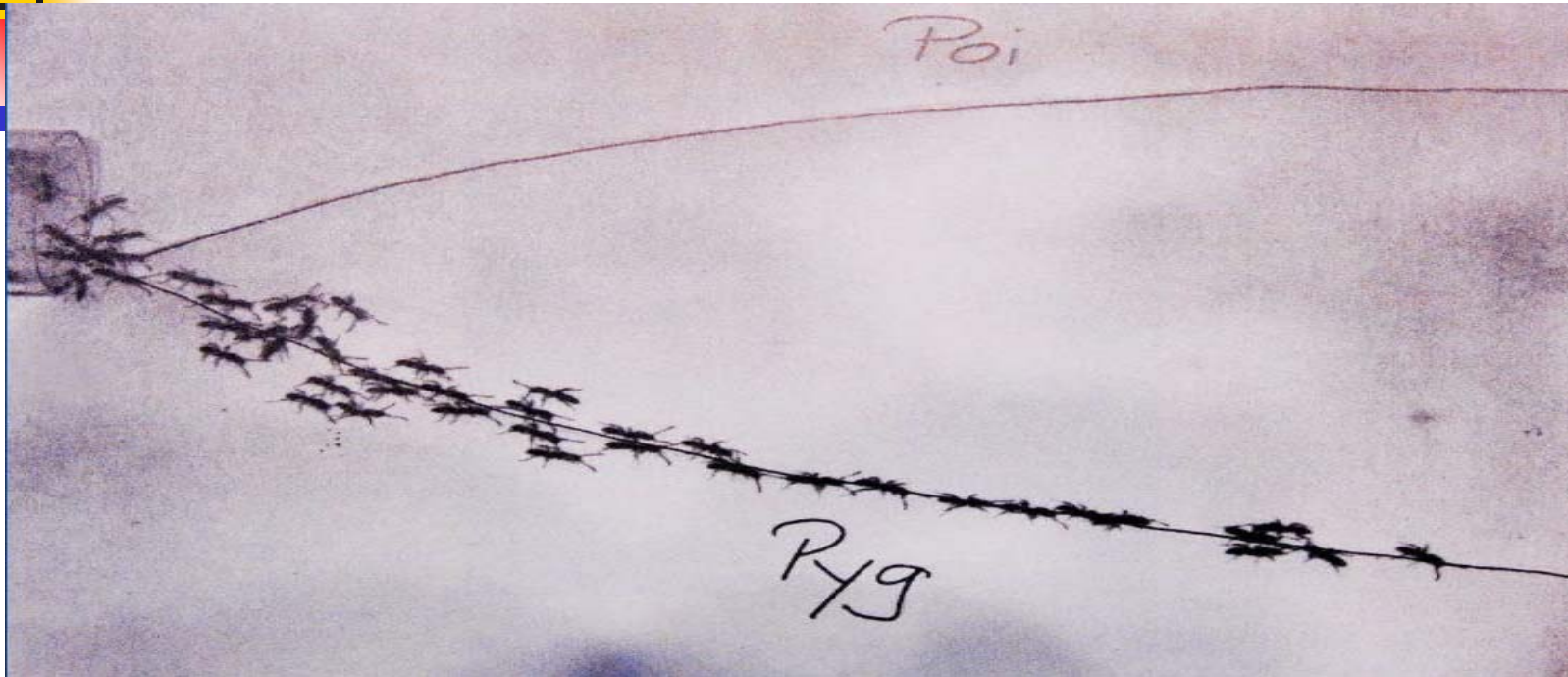
a set of resources available to those actors

a set of actions that the actors take

the collective results of the actions

a way of evaluating the result

Examples: Collective Behavior in Ant Colony

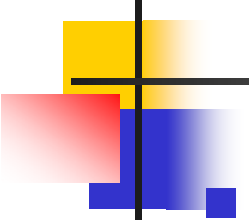


Can explore vast areas without global view of the ground

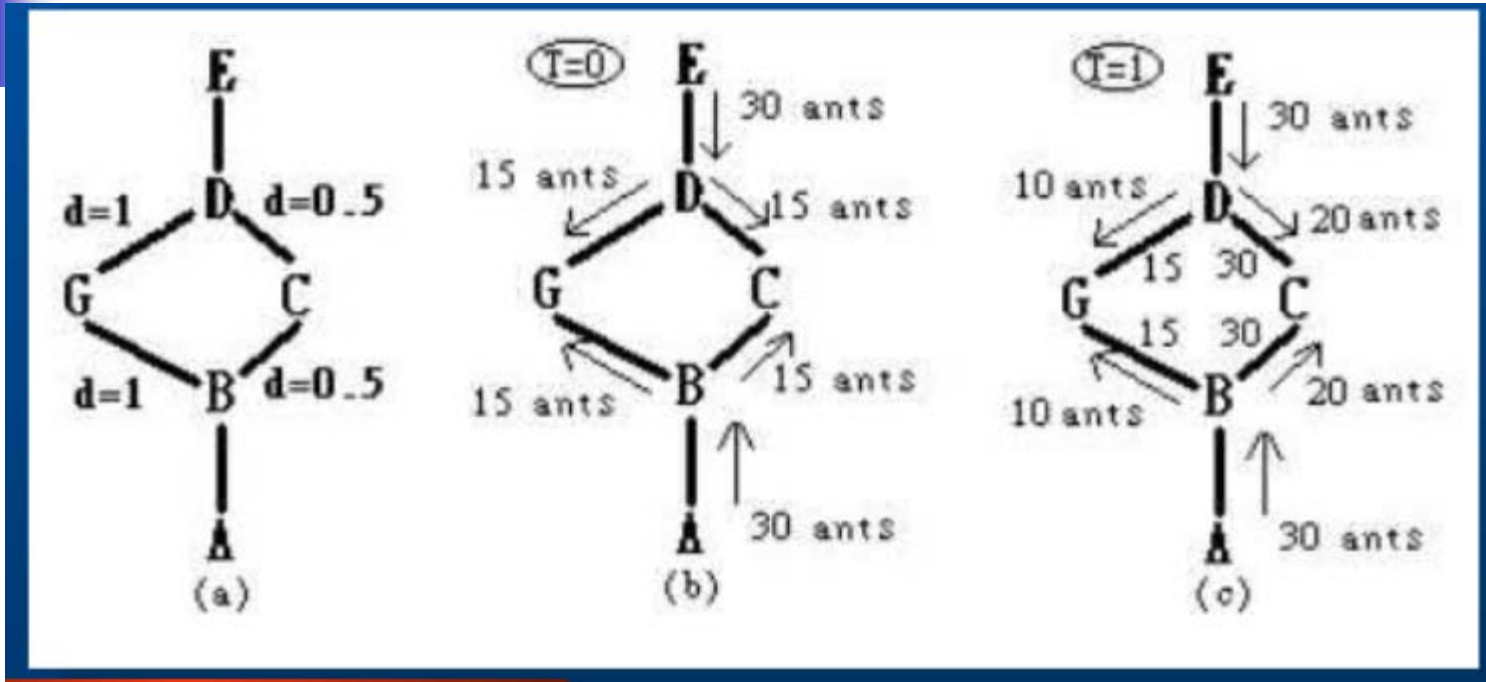
Can find the food and bring it back to the nest

Will converge to the shortest path

How can they manage such great tasks ?

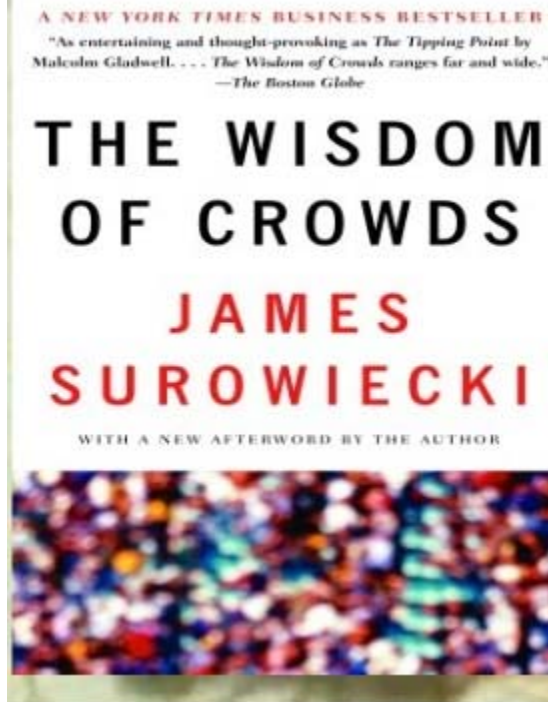
- 
- Ants search for food randomly around the nest
 - Leave “pheromones” behind them
 - Wherever they go, they let pheromones behind here, marking the area as explored and communicating to the other ants that the way is known
 - Other ants follow pheromone highways to food

Double Bridge Experiment



Ants choose randomly one of the two bridges
Some take the longer, some the shorter
Ants take the shorter bridge return earlier
Short bridge receive earlier pheromones and attracts earlier more ants
=> Ants find the shortest way to food

James Surowiecki



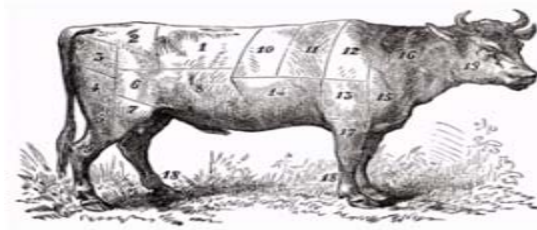
JC328.2 S87 2004

- Large groups of people are smarter than an elite few, no matter how brilliant—better at solving problems, fostering innovation, coming to wise decisions, even predicting the future



Examples in the book

- Guess the weight of a bull: 542.9 kg (543.4 kg)
- Guess the number of sweets in a jar: 871 (850)
- Find the way out of a maze:
 - First individual attempt avg 34.3 turns
 - Second individual attempt avg 12.8 turns
 - Majority turn decision avg 9 turns
 - Group decision is better than best individual



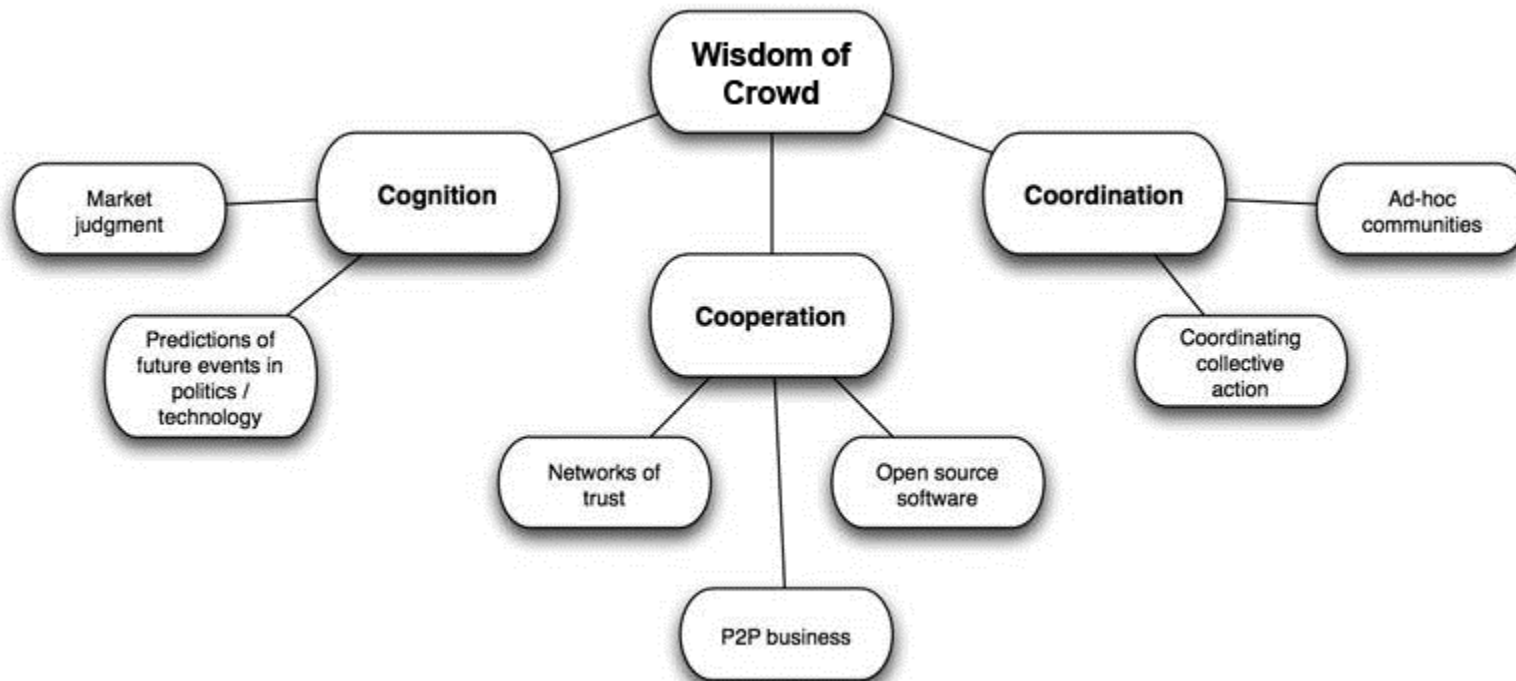
*average of 800 guesses = 1,197
actual weight of the ox = 1,198*

Ideas behind the book Wisdom of Crowd

- Groups are intelligent, often smarter than smartest people in them
- Groups don't need to be exceptionally intelligent people in them to be smart
 - Diversity beats ability



Types of problem



Cognition Problem – Who wants to be millionaire?

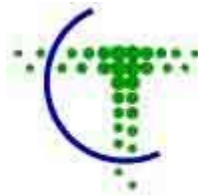
- Problems that have definite answer
- There may not be single answer, but some answers are certainly better than others
 - Morton Thiokol (Challenger disaster)



Rockwell International



Martin Marietta Materials




**Thiokol
Propulsion**

Challenger Disaster

- Rockwell's stock was down 6%,
- Lockheed's was down 5%,
- Martin Marietta's was down 3%,
- Morton Thiokol's stock was hit hardest of all, it was down 6%.
- By the end of the day, Morton Thiokol's decline had almost doubled, so that at market close, Thiokol's stock was down nearly 12%.
- By contrast, the stocks of the three other firms started to creep back up, and by the end of the day their value had fallen only around 3%.



Cognition - Newsfutures

 **Predictions**

0 open orders | 0 shares | [manon.gaucher@gmail.com](#) ▼

m\$ 23.00

[Sports](#) | [Politics](#) | [Economics](#) | [Entertainment](#) | [Science & Tech](#) | [Business](#)

Hillary Clinton to win US Presidential Election 2016



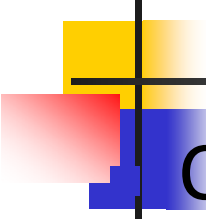
Buy at
5.80

Sell at
4.95

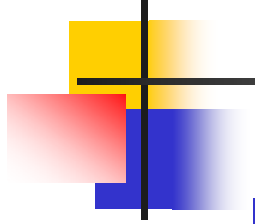
38 months left for trading this contract.

Trading start	Sunday, June 16, 2013 10:00:00 AM
Trading end	Friday, September 30, 2016 10:00:00 AM
Event date	Saturday, October 1, 2016 5:37:12 PM
Event	US Presidential Election 2016 Winner
Long shares	Long shares will be resolved at m\$ 10.00 if this statement occurs, m\$ 0.00 if it doesn't.
Short shares	Short shares will be resolved at m\$ 0.00 if this statement occurs, m\$ 10.00 if it doesn't.

Cooperation

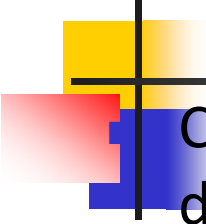
- 
- Collective efforts of people who associate voluntarily to achieve specified objectives
- Getting people to form networks of trust without a central system controlling their behavior or directly enforcing their compliance
 - It indicates merely the willingness of individuals to help each other

Cooperation - BitTorrent



- is that if you wish to download a file you draw separate sections of the file from other people in the world who have already downloaded it. This is called a Peer-To-Peer system. The collective intelligence of users means that files of all types and sizes can be accessed quickly and easily.

Coordination problem – Shall we dance ?

- 
- Coordination is much more inclusive, requiring more than the desire and willingness to cooperate of the participants
 - Less amenable to clear, definite solutions
 - To solve it, a person has to think not about what he believe is the right answer but also about what other people think the right answer is
 - It involves a deliberate and conscious effort to bring together the activities of various individuals in order to provide unity of action. It requires concurrence of purpose, harmony of effort and concerted action
 - Characteristics: Self organizing, fluid, dynamics, reconfigurable bottom up, converges over time
 - Meeting up
 - Queuing

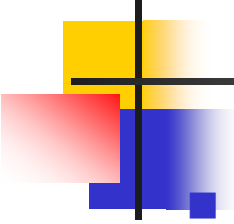


Can a crowd be wise?

Diversity of opinion/knowledge: each crowd member needs to have some form of private information about the matter at hand.

- **Independence:** individuals in the crowd need to draw their own conclusions without influence from the rest of the crowd.
- **Decentralization:** Crowd members can apply local knowledge and thinking to their solution to the problem – think specialization.
- **Aggregation:** Collating the above and getting to a sensible collective decision. Web 2.0 provide many tools for aggregation

Diversity of opinion/knowledge

- 
- People are bringing different perspectives to the table. Think multi-disciplinary approach
 - Each crowd member needs to have some form of private information (e.g concrete data plus analysis, interpretation or even intuition)
 - Diversity is more important in small group collaboration because large group guarantees a certain level of diversity

Diversity – Scott Page



HF5549.5.M5 P34 2007

Page reveals how groups that display a range of perspectives outperform groups of like-minded experts.

Page suggests that difference beats out homogeneity, whether you're talking about citizens in a democracy or scientists in the laboratory.

His conclusion: Diversity yields superior outcomes.

Diversity gives you a larger range of opinions to select from

To a man with a hammer, every problem looks like a nail.

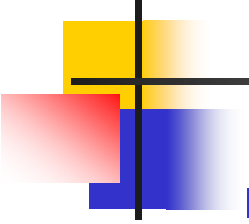
--- Mark Twain

Diversity

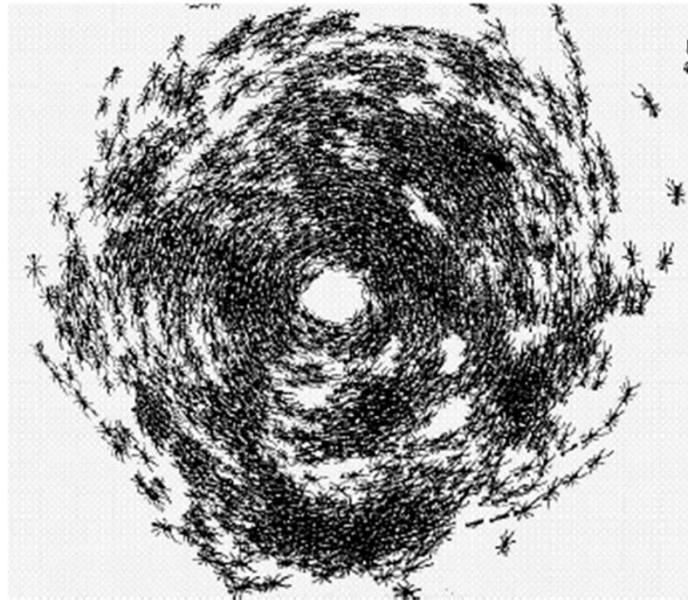
- To harness the power of the wisdom of crowds you really need diversity, the nay-sayers, the moaners and complainers, and the crazy optimists, the fools, the happy-go-lucky – you need the whole mix



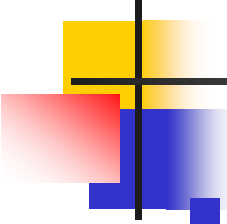
Independence

- 
- Relative freedom from the influence of others
 - Make decision based on our own judgment and is not determined by people around us
 - Crowd cannot act like crowd
 - Make sure decision are made simultaneously
 - Avoid the circular mill problem

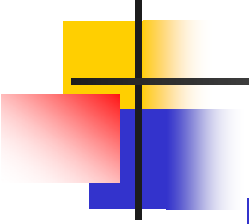
Circular Mill or Army Ant Death Spiral



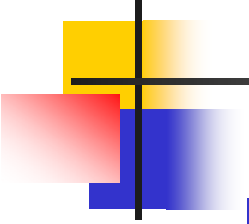
Decentralization

- 
- Power does not rest with one person or authority. No one at the top dictates the crowd's answer
 - Decision are made by individuals based on their own local and specific knowledge rather than a planner
 - Good example is the open source software development movement or Wikipedia

Aggregation

- 
- A mechanism for turning private judgment into a collective action
 - Summarizing people opinion into one collective verdict
 - Online discussion systems do not lead to wisdom on their own because there is no aggregation

Creativity

- 
- “To be creative requires divergent thinking (generating many unique ideas) and then convergent thinking (combining those ideas into the best result).” Newsweek [July 10, 2010]

Summary of keys to wise crowd

Participants

- Diverse group of participants
- Independent, decentralized participants

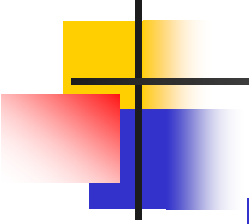


Market

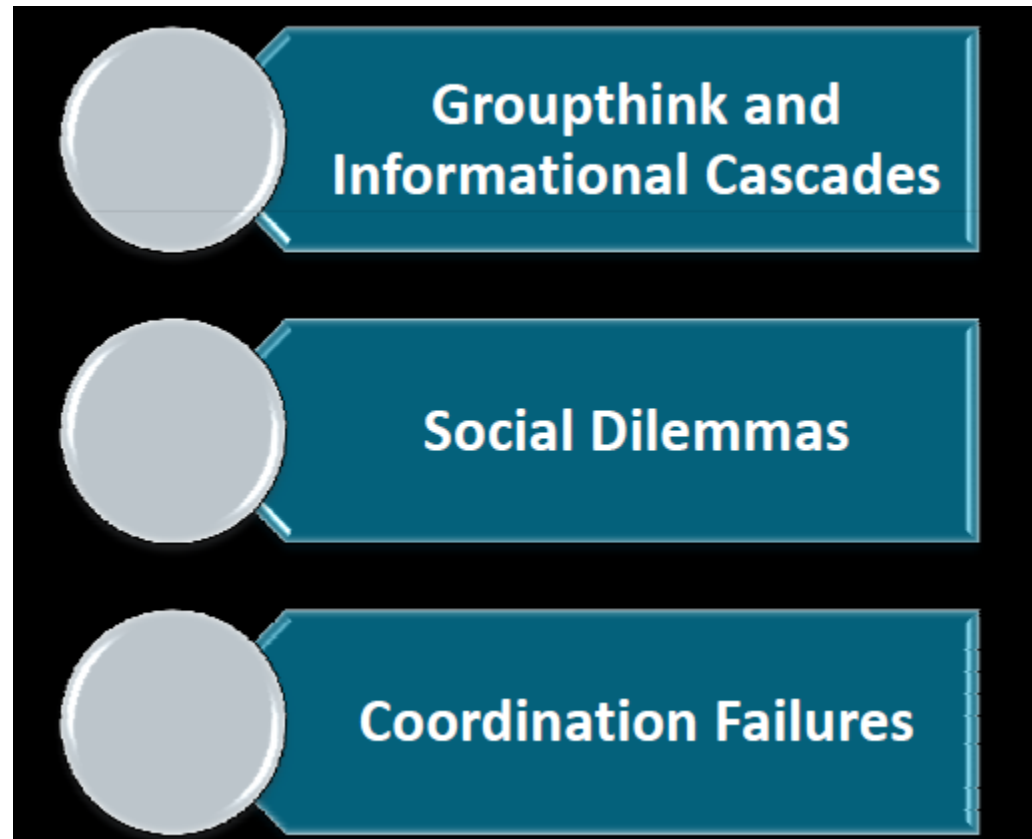
- Aggregated results
- Incentive mechanisms



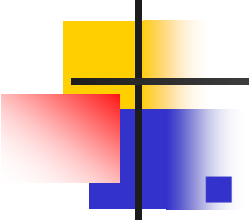
An offline example of wise crowd

- 
- Who is in charge of the supply of bread to the population of HK ?

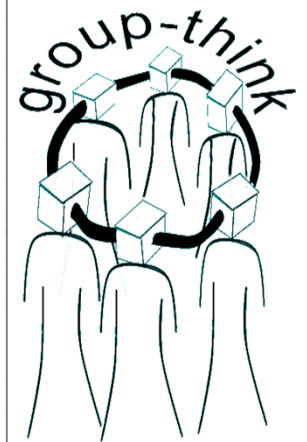
Factors inhibit collective intelligence



Groupthink and Informational Cascades

- 
- Whole turns to be less than the sum of the parts because only some are actually contributing while everyone else imitates or conforms
 - Herd behavior - “Extraordinary Popular Delusions and the Madness of Crowds” by Charles Mackay
 - Men, it has been well said, think in herds; it will be seen that they go mad in herds, while they only recover their senses slowly, one by one.
 - He also concluded that people are more prone to believe the “Wondrously False” than the “Wondrously True.”
 - *Remedy – mechanism that foster diversity and independence*

IMDB – July 2008



Top 250 movies as voted by our users

For this top 250, only votes from regular voters are considered.

Rank	Rating	Title	Votes
1.	9.3	The Dark Knight (2008)	146,180
2.	9.1	The Shawshank Redemption (1994)	347,115
3.	9.1	The Godfather (1972)	297,139
4.	9.0	The Godfather: Part II (1974)	169,394
5.	8.9	Buono, il brutto, il cattivo. II (1966)	99,074
6.	8.9	Pulp Fiction (1994)	297,236

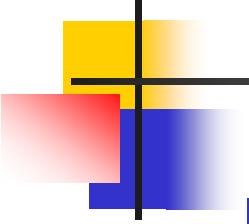
Social Dilemmas



Whole turns to be less than the sum of the parts because some parts contribute and the others slack off

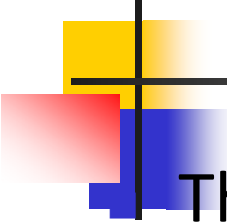
- Such situations arise when group faced with prioritizing either short-term selfish interests or the long-term interests (aka Tragedy of Commons)
- *Remedy – Incentives must be carefully structured to reward individual participation*

Coordination Failures

- 
- Whole turns to be less than the sum of the parts because the parts' contribution interfere with or cancel each other
 - *Remedy – evolving structures and practices that coordinate individual contribution**

** AL-HAKIM, L. & MEMMOLA, M. 2008. Business Web Strategy: Design, Alignment, and Application, Hershey, PA, USA, IGI Global.*

Good examples of 'Wise Crowds'

- 
- The Stock Market (mostly – bubbles and runs are what happens when the crowd stops working to the principles outlined before) – Note the stock market performs well over time
 - Open source software such as Firefox, Linux, Apache
 - Google's web index – powered by PageRank™ which is powered by... YOU
 - Cloudmark – a collaborative spam filtering system

Dumbness of crowd

If all the members of the Dog Lover Society got together to design a dog... what would you get?



Generic dog

OR



Frankendog

http://headrush.typepad.com/creating_passionate_users/2007/01/the_dumbness_of.html

Consensus does not always equal correctness.


Ants become smarter as the number of collaborators increases, humans become dumber.

The "Wisdom of Crowds" was never meant to mean "mobs", "groups acting as one",

"committees", "consensus"*

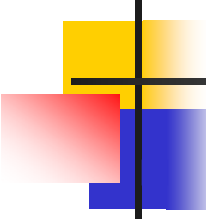
* James Surowiecki (Wisdom of Crowds):

"Collective Intelligence" vs. "Dumbness of Crowds"



Collective Intelligence	Dumbness of Crowds
A pile of people writing Amazon book <i>reviews</i>	A pile of people collaborating on a wiki to collectively author a <i>book</i> (e.g. <i>Million Penguins Project</i>)
All the photos on Flickr, <i>taken by individuals on their own</i> , and the new ideas created from that pool of photos (and the API).	Expecting a group of people to create and edit a photo <i>together</i> .
Getting <i>input</i> and ideas from many different people and perspectives.	Blindly averaging the input of many different people, and expecting a breakthrough. (It's not always the averaging that's the problem it's the <i>blindly</i> part)
The community on Threadless , voting and discussing t-shirts <i>designed by individuals</i> .	Expecting the Threadless community to actually <i>design</i> the t-shirts together as a group.

Differences between WoC & CI



WoC seeks to aggregate anonymously produced data, seeing the wisdom emerging when a large number of people each enter their own calculations without influencing each other's findings.

- CI focuses on the kinds of deliberative process that occurs in online communities as participants share information, correct and evaluate each other's findings, and arrive at a consensus understanding.
- The *Wisdom of Crowds* model focuses on isolated inputs: the *Collective Intelligence* model focuses on the process of knowledge production