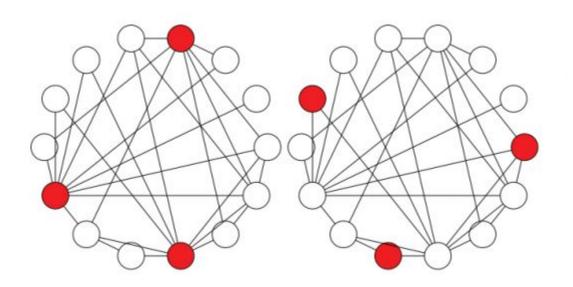
Discrete Ideas

Information Diffusion, Epidemics and Emergence of Knowledge in Networks

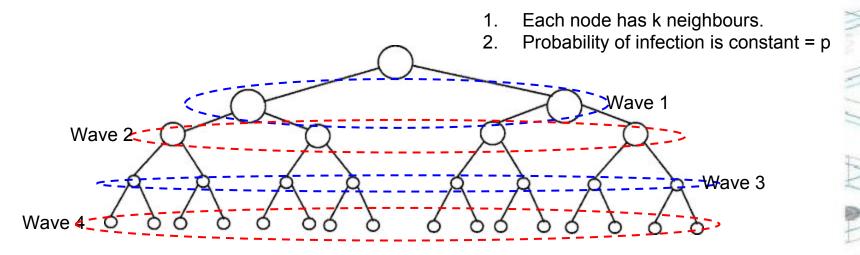
S. R. Sudarshan Iyengar CSE department IIT Ropar

The Majority Illusion



The majority illusion in Social Networks, Kristina et al., PloS one, Vol 11, Issue 2, 17/Feb/2016

The Branching Model

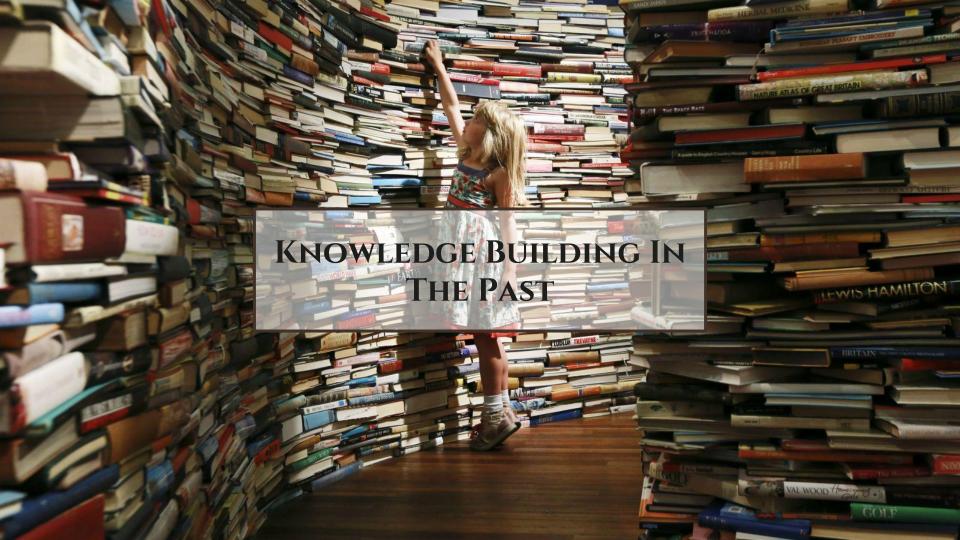


- 1. Expected number of neighbours each person infects = k . p
- 2. The process stops when none of the nodes in a wave is infected.
- 3. The value k.p has a cutting edge significance. What happens when k.p < 0, when k.p>0 and when k.p ~ 0?

Emergence of Knowledge:

9

Epidemic or Information Diffusion?



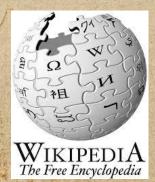
ता व्यापालीक वर्तीयात स्वारत्वी वित्त ज्यांका की जाता व्यापाली है हो प्रत्य पर्व में मानविव्य वित्त व्यापाली and the and after any along much by admits handers agree that the there is a second of The state of the s prepala (the horse he was felomore and) alepage mus compo grant after the traps of the standard con The course of was as mind there ad pupos a Complete Stom was been better in the gradus of one of the part of S ordered to the transmission indices off agript on coff tite on a time regards transport oni established being sent of the sent or PROGRAMAS OF SED ON an entire and tramata THE A R. P. WHELE WAS TAKEN 4 3008 5 W. 10 and where the same state and the same the same to the are wearen a proper a proper pays and a real payor and the same of city of a security of ווא יקניים אבר mayo on a polar manufall to me all a los as a polar or parties per Jumpalen weak districted with high was for health a father in the form that the second of the s MA A CONTRACTOR MAIN A MATTER ON CHEST MIT AND CHAPTER constructed for a committee and friends of the same same area antiques states while of well aires angulated and which expectly after

Crowdsourcing= Crowd + Outsourcing













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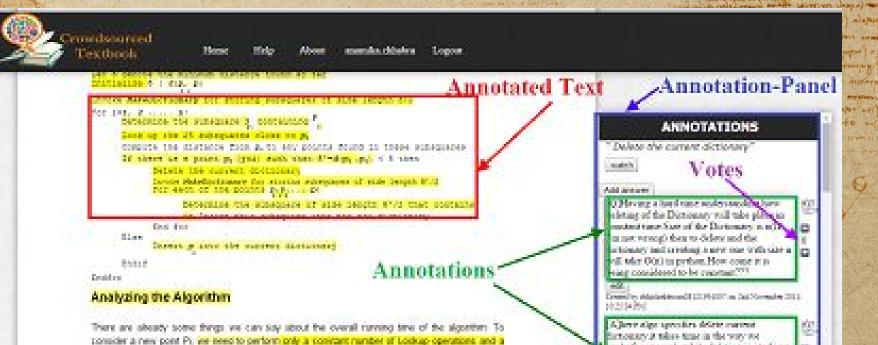


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Section 2.

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Crowdsourced Textbook

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- Questions
- Answers

Pointers







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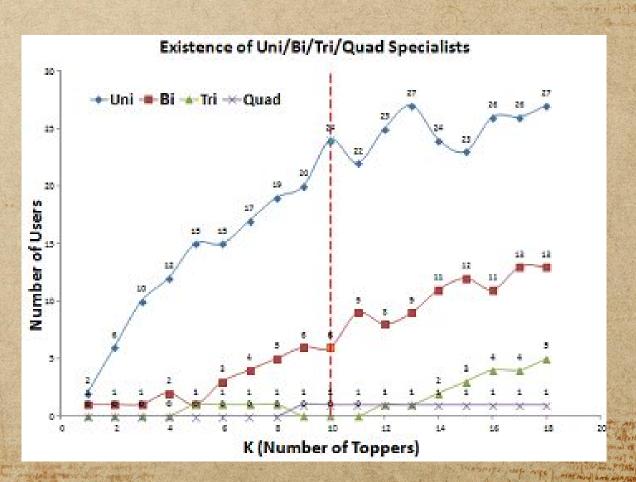
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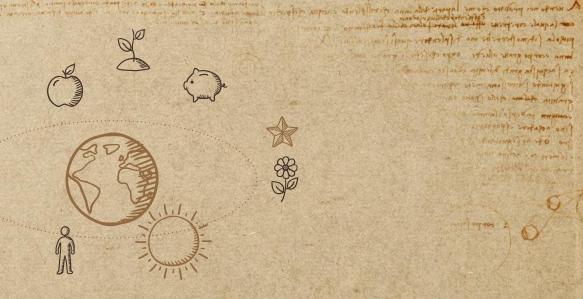


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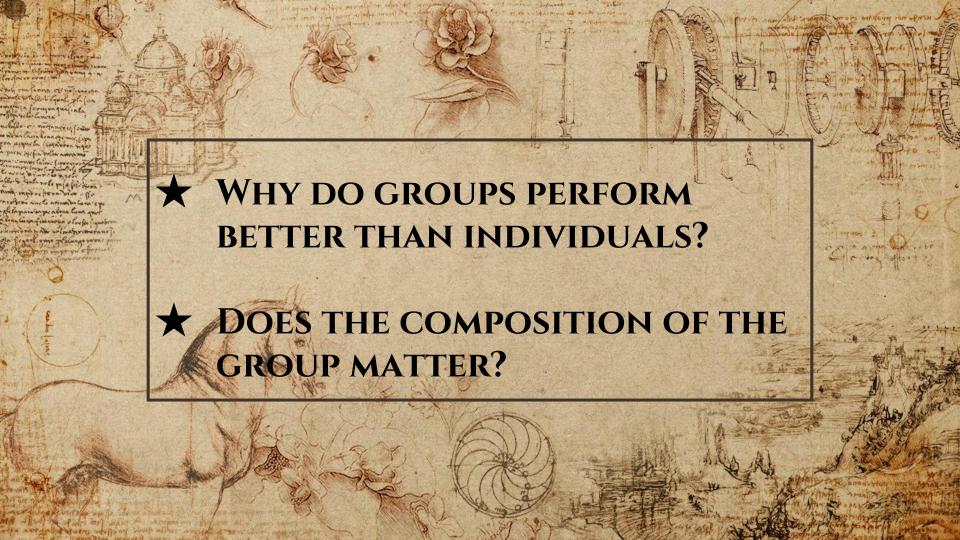


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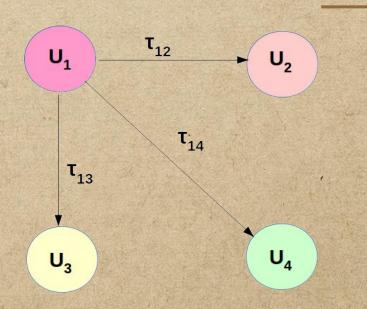
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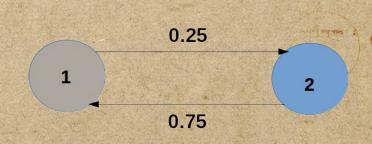
ECOSYSTEM

There are categories of users in any Collaborative Knowledge Building System, which leads to an ECOSYSTEM.



THE APPLE HITTING PHENOMENON...





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The Triggering Phenomenon

ELEMENTARY THEORIES ON TRIGGERING

- Luhmann's Theory [1]
 - Social System and Cognitive System
 - Irritations
 - Structural Coupling
- * Piaget's Model of Equilibration [2]
 - Incongruency leads to Cognitive Conflicts
 - Equilibration
- Information Processing Theory [3]
 - Knowledge Frames related by various conditions

[1] Seidl, David. "Luhmanns theory of autopoietic social systems." Ludwig-Maximilians-Universitt Mnchen-Munich School of Management (2004).

[2] Piaget, Jean. Piagets theory. Springer Berlin Heidelberg, 1976.

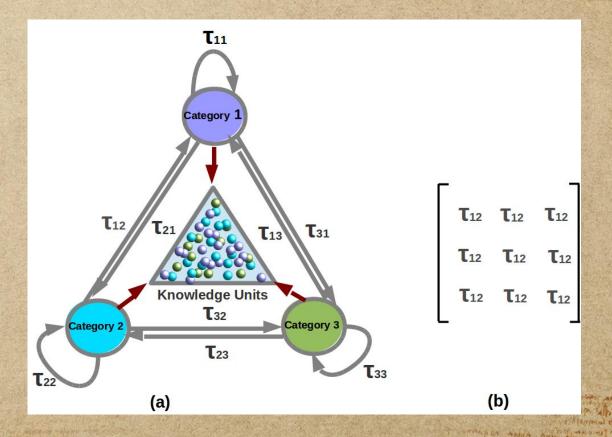
[3] Minsky, Marvin. "Frame-system theory." Thinking: Readings in cognitive science (1977): 355-376

THE TRIGGERING PHENOMENON IN CATEGORIES

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KU'S AT A GIVEN TIME

KUs of a category that get added at time t are dependent on:

- ★ The number of KUs of all the categories that get added to the system at time (t-1).
- The triggering factors from all other categories to the considered category.
- ★ The number of users in the considered category.
- ★ The internal knowledge of the users of the considered category.

THE PROBLEM STATEMENT

Comment of the state of the second of the se

simply with one

Given the:

- * Number of users,
- + Categories and
- * The triggering among the categories,

Find the ideal number of users for each category to build maximum amount of knowledge

SOURCES OF KNOWLEDGE UNITS IN A KNOWLEDGE BUILDING SYSTEM

Internal Knowledge

* Triggered Knowledge

TERMINOLOGY

n; = the number of users in category 'i', such that

$$\sum_{i=1}^m n_i = n$$

m = the number of categories,

 \mathbf{r}_{i} = the internal knowledge contribution of a user of category \mathbf{i} .

 $\mathbf{r}_{i}(\mathbf{t})$ = the internal knowledge contribution of a user of category 'i' at time 't', such that, $\sum_{i=1}^{\infty} r_{i}(t) = r_{i}$

τ_{ij} = the number of knowledge units (KUs) of type 'i' that get triggered due to one KU of type 'j'.

KU'S AT A GIVEN TIME CONTD..

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KUs of a category 'i' that get added at time 't' is given by:

$$k_i(t) = n_i(\tau_{i1}k_1(t-1) + \tau_{i2}k_2(t-1) + \cdots + \tau_{im}k_m(t-1)) + n_ir_i(t)$$

i.e.,

$$k_i(t) = n_i \left(\sum_{j=1}^m \tau_{ij} k_j(t-1) + r_i(t) \right)$$

THE MATRICES USED...

K(t) = The column vector consisting of the knowledge generated by various categories at time 't'.

T = The triggering matrix

N = Matrix storing the number of users in each category

R(t) = the column matrix storing the function by which each category users add their internal knowledge to the system.

$$K(t) = \begin{bmatrix} k_1(t) \\ k_2(t) \\ \vdots \\ k_m(t) \end{bmatrix}$$

$$T = egin{bmatrix} au_{11} & au_{12} & \cdots & au_{1m} \ au_{21} & au_{22} & \cdots & au_{2m} \ dots & & dots \ au_{m1} & \cdots & \cdots & au_{mm} \end{bmatrix}$$

$$R(t) = \begin{bmatrix} r_1(t) \\ r_2(t) \\ \vdots \\ r_m(t) \end{bmatrix}$$

KU'S AT A GIVEN TIME CONTD...

The knowledge generated by various categories at time 't' can be represented as:

THE R. L. WHELL WATER

$$K(t) = N(TK(t-1) + R(t))$$

TOTAL KNOWLEDGE AT TIME 'T

Lemma The total knowledge generated in the system at time t is given by:

$$K(t) = \sum_{i=0}^{t} (NT)^{i} NR(t-i)$$

NET KNOWLEDGE IN THE SYSTEM

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Theorem Given the matrices N, T and R, the net knowledge in the system at the end of the Knowledge building process is given by:

$$K = (I - NT)^{-1}NR$$

when

$$\rho(NT) < 1$$

where I is an Identity Matrix of the order $m \times m$ and ρ is the spectral radius.

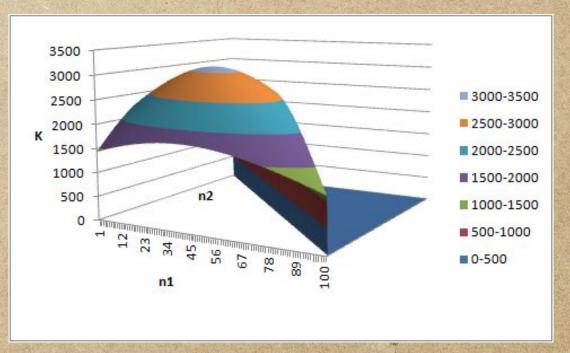
$$R = \begin{bmatrix} r_1 \\ r_2 \\ \vdots \\ r_m \end{bmatrix}$$

$$K = \begin{bmatrix} k_1 \\ k_2 \\ \vdots \\ k_m \end{bmatrix}$$

IDEAL DISTRIBUTION OF USERS

THE SURFACE PLOT

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HILL CLIMBING ALGORITHM

Algorithm 1 Hill Climbing Algorithm For Perfect Skill set Distribution

- ① Pick a random distribution $D = [n_1, n_2, ..., n_m]$ of users across different categories, such that $\sum_{i=1}^{m} n_i = n$
- 2 Consider all the $2*\binom{m}{2}=m(m-1)$ neighboring distributions(N) of D, defined as: N=[

for i = 1: m

for j = 1 : m

If $i \neq j$:

N.append((D[1], D[2], ..., D[i] - 1, ..., D[j] + 1, ..., D[m]))

3 Calculate $K_{N[j]} \forall \ 1 \leq j \leq m(m-1)$ based on the following formula:

$$K = (I - \delta)R$$

where $K_{N[j]}$ represents the net knowledge in the system with the distribution N[j] Choose i such that $K_{N[i]} = \max_j K_{N[j]}$

• If $K_{N[i]} > K_D$ then D = N[i] and we repeat steps 2 to 4 else: return D //The perfect skill set distribution agus unhanos miga valuesto in opinistolisto, il villator y valuesto le odino, vum

CONCLUSION

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★ Right mix of users leads to acceleration in the knowledge building process.

It should not necessarily be a group of experts, even the presence of non-experts helps.

"The sum of some is greater than parts!"

