Knowledge sharing and team cooperation

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A brief introduction of our department

- Department of Information Management of Peking University was founded in 1947, and it is one of departments that established library and information science (LIS) earliest in China. Now, bachelor, master and PhD degrees can be delivered, and postdoc stations are also included.
- Every year, the department accepts about 40 undergraduate students (20% of them are foreign students), 30 master candidates and 15 PhD candidates. About 20% students (including undergraduate students, master candidates and PhD candidates are sent abroad (U.S., Europe, Japan, HK, etc.) for academic exchange and study).
- There are 32 teachers in our department and most of them have study experience abroad or graduated from foreign universities.

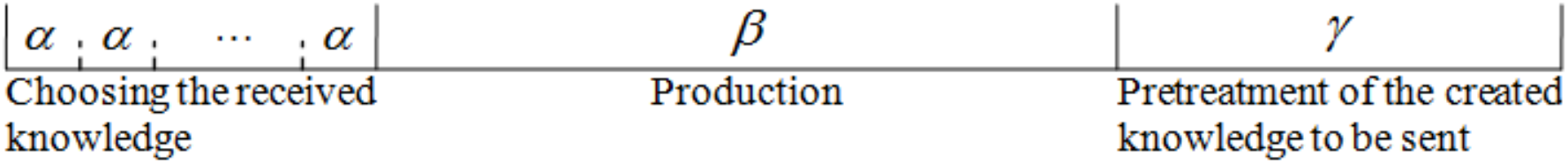
Introduction

- Knowledge should be shared to be valuable, so effective team cooperation is a crucial problem.
- Knowledge exchange and sharing are very important and helpful in coordinating actions of units. However, when “knowledge explosion” has brought much more knowledge to people than ever, it has also generated too much miscellaneous knowledge which people feel annoying and inconvenient when selecting and discriminating the knowledge received. As a result, a challenge in is to investigate the effects of cooperation and search for a “best cooperation degree”.

Two aspects

- When studying knowledge sharing, there are mainly two aspects to be considered
  - **Receiver's ability of acceptance**. This is the receiver's attribute, and this parameter describes the knowledge receiver's ability in understanding the knowledge, judging whether it is suitable to be considered in further processing activities.
  - **Expressing ability of knowledge**. This is the knowledge's attribute, determined by the knowledge provider. In knowledge sharing, it is supposed that there is a protocol which requires that for each piece of knowledge, a part should serve as a tag to express the information of the knowledge (such as the abstract of a paper)

Working time allocation



$$(\sum \alpha) + \beta + \gamma = 1$$

- Part 1: Choosing the received knowledge. This part makes the judgments about the suitability of the knowledge received
- Part 2: Production. This part is used for production and to yield outputs
- Part 3: Pretreatment of the created knowledge to be sent.

Modeling process - parameters and hypotheses

- Team size: the number of members in a team and is noted by n.
- Each unit of output is accompanied with one unit of knowledge generated
- α and the expressing ability of knowledge are inversely proportional.
- γ and the expressing ability of knowledge are directly proportional
- Team members are mutually dependent on one another
- One unit of production time yields one unit of output
- One unit of production time needs one unit of cost

Modeling process - derivation

1. $0 < \alpha, \beta, \gamma < 1$
2. $\alpha + g = \frac{m}{\gamma + g}$
3. $g^2 + g - m = 0$
4. $g = \frac{\sqrt{1+4m} - 1}{2}$
5. $\gamma = \frac{m}{\alpha + \frac{\sqrt{1+4m} - 1}{2}} - \frac{\sqrt{1+4m} - 1}{2}$
6. $(n-1)\beta$
7. $\alpha\beta(n-1)$
8. $1 - \alpha\beta(n-1) - \gamma$
9. $\beta = \frac{1-\gamma}{\alpha(n-1)+1}$
10. $P(n) = \frac{\frac{\sqrt{1+4m}+1}{2} - \frac{m}{\alpha + \frac{\sqrt{1+4m} - 1}{2}}}{\alpha(n-1)+1} * n$
11. $C(n) = k * n$

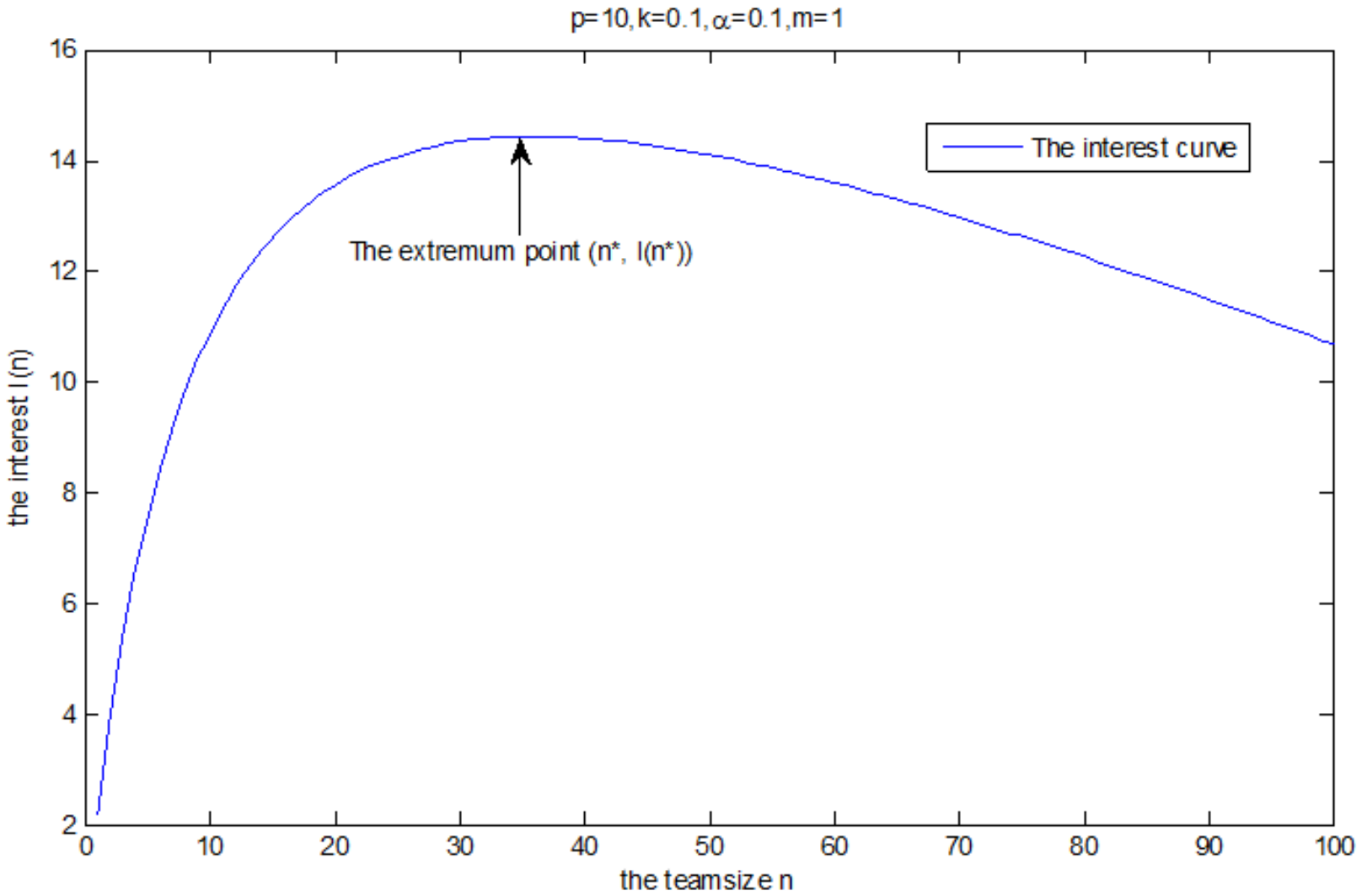
Modeling result

- The productivity interest is

$$I(n) = P(n) * p - C(n) = \frac{\frac{\sqrt{1+4m}+1}{2} - \frac{m}{\alpha + \frac{\sqrt{1+4m}-1}{2}}}{\alpha(n-1)+1} * n * p - k * n = I(n, \alpha, m)$$

- The final result of the modeling process and the productivity interest is determined by three parameters. By studying the relationship them, we can obtain some interesting conclusions, which can make knowledge sharing and teamwork cooperation more efficient in practice.

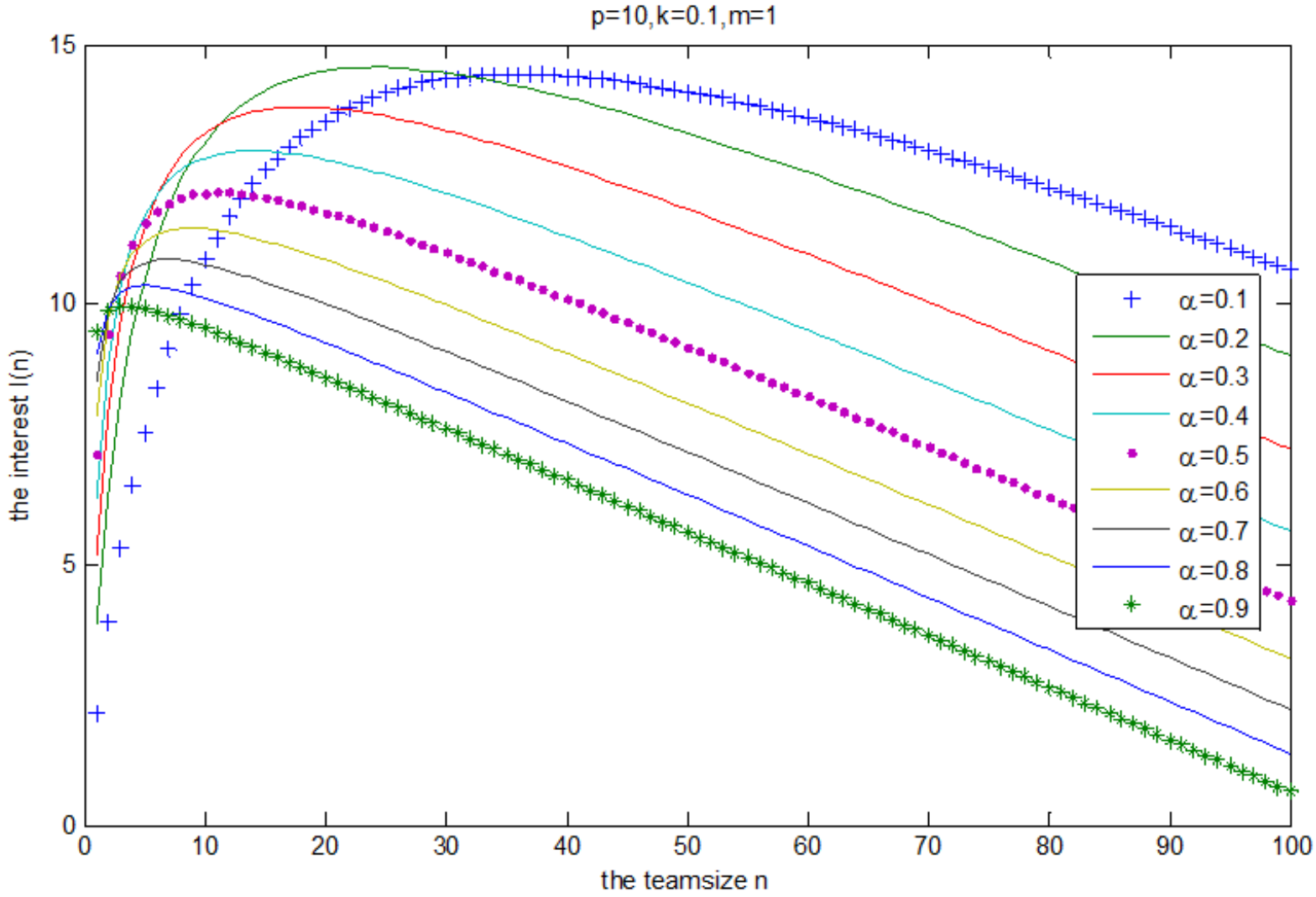
Sensitivity analysis I



Conclusion I

- When the team size is small, the productivity interest increases with the increment of working individuals, but when the team size is over a threshold, the interest decreases with the increment of working individuals.
- This implies that there is a single optimal team size in a cooperative task and increasing team size inadequately would cause some negative effects on the productivity effect.
- A rational explanation is that: when the quantity of knowledge increases greatly with the augmentation of the team size, the time allocated to choose the received knowledge takes a great part of the working time, resulting in the reduction of the production time. Such reduction makes the increment of the productivity interest insufficient to compensate the increment of the labor cost and results in the decrement of the productivity interest.

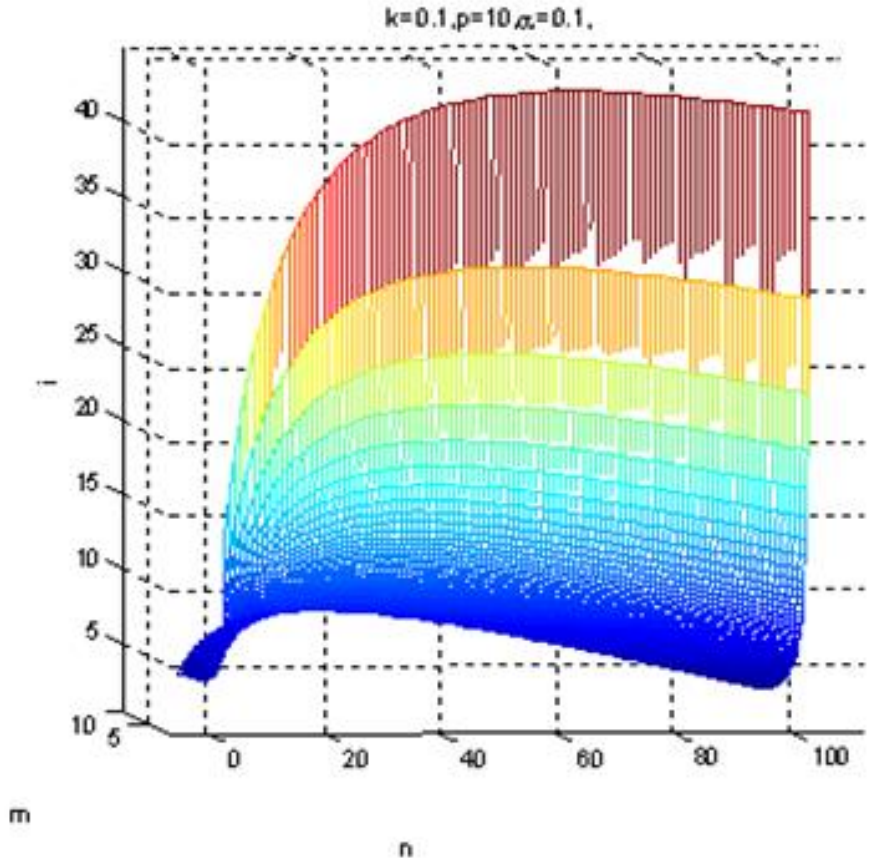
Sensitivity analysis II

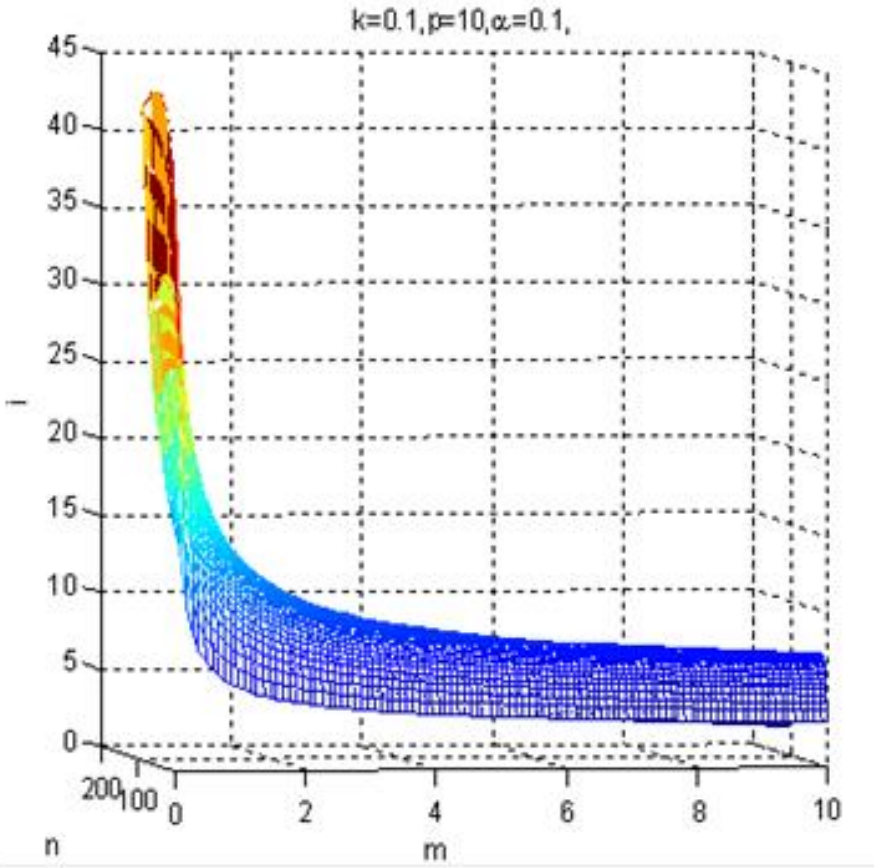


Conclusion II

- Inferred from these curves, every *I(n)* has an extreme point, and with the increment of α, the abscissa of the point $(n^*, I(n^*))$ diminishes.
- Such difference caused by the change of may be explained as follow: if an individual need more time to choose knowledge, the optimal size of such team will decrease so as to relieve the burden of knowledge filtration.

Sensitivity analysis III





Conclusion III

- In the same team size, I(m,n) increases when m decreases. In other words, improving the receiver's acceptance ability and knowledge expressing ability can increase the productivity interest, especially when m is small, the effect of improving choosing ability is remarkable.
- With a fixed m, there exists an optimal team size for the working group so the number of working individual should be controlled to get a maximum productivity interest.

Summary

- Increasing team size inadequately may affect the team performance in a negative way, in other words, team size should be controlled and kept thin to some extend.
- Improving the acceptance ability of individuals can increase the productivity interest. Generally, such ability might be strengthened by training and experience, or by the application of appropriate tools.
- If an individual needs more time in choosing knowledge, the optimal size of such team will decrease so as to relieve the burden of knowledge filtration. We may infer that in case that a team of a big size is needed, more efforts should be paid in enhancing knowledge management abilities, including the selection part and pretreatment part.
- When the knowledge choosing ability cannot be promoted, which usually exists in practice, an effective way to maximize productivity interest is to control team size.

THANK YOU !