

## Assessing the Role of Intellectual Property Laws from a Social Network Perspective

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1

A serious conflict between the **goal** of and the **means** employed by IP laws has provoked intense debate over the viability of IP laws



Wider and quicker dissemination of information is the **goal**.



Entitling the IP right holder to prevent others from disseminating information is the **means**.

2

The **goal** is to promote establishing edges between vertices, while the **means** is to cut out edges



**Goal**



**Means**

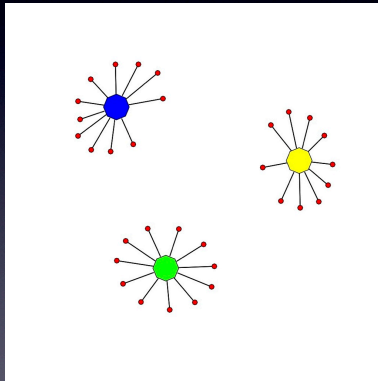
3

## Conventional justification of IP laws

- An IP right warrants the monopoly of the right holder;
- The monopoly warrants greater profit for the right holder;
- The IP right holder is incentivized to enter the relevant market to disseminate new and creative information (or, goods or services embodying it) and/or to further originate such information; and
- IP law promotes wider and quicker dissemination of new and creative information.

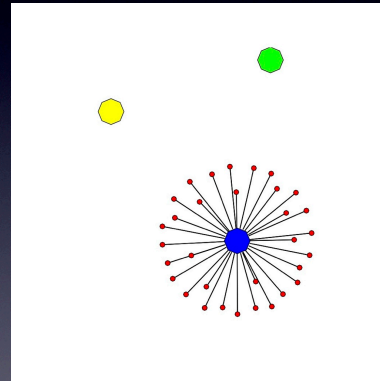
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The conventional justification of IP laws implicitly assumes a market with a limited amount of demands in which none of the competing suppliers can gain satisfactory profit if free competition prevails.



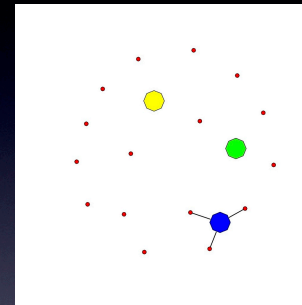
free competition

5

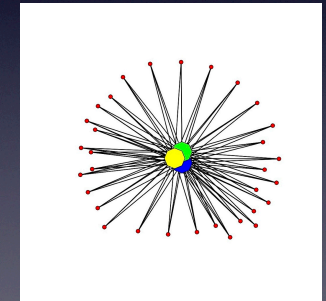


monopoly

The conventional justification overestimates monopoly and underestimates free competition.



A monopolistic supplier may reach a very tiny portion of potential demands.



Competing suppliers may reach a satisfactory amount of demands.

6

Only partial or anecdotal criticisms have been raised

- A study from the perspective of “Law and Economics” has pointed out that the impact of IP rights to increase the supply by the right holder will finally reach its limitation at a certain degree of strength of IP protection, and that it is harmful to strengthen IP protection beyond such degree (Landes & Posner (1989)).
- Criticisms of IP rights with an anecdotal or empirical approach are found quite often.

7

However, legal studies have failed to answer the fundamental questions.

- Under what conditions do IP rights promote a wider and quicker diffusion of information, and under what conditions do they not?

8



The simulation proposed here tries to develop a new methodology to assess the viability of IP law by:

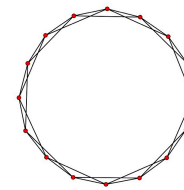
- 1) explicitly implementing the impact of consumers network that increases the probability that suppliers successfully reach consumers; and
- 2) rejecting the implicit assumption that the market necessarily constitutes a zero-sum game.

9

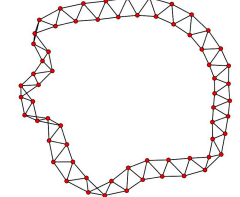
## Implementing a consumers network in the model

- The simulation here assumes that the actors in the market are connected with one another to a certain degree from the beginning.
- Just for the purpose of simplicity, the simulation here starts from a regular graph.
- The simulation here has not yet implemented the dynamic development of a consumers network.

4-regular graph with 16 vertices



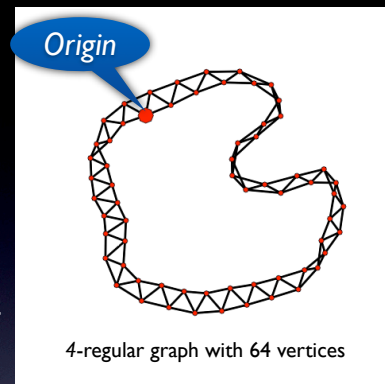
4-regular graph with 64 vertices



10

The default condition of the market is defined by:

- the size of the market represented by the number of vertices;
- the degree of the regular graph that represents the default condition of the market; and
- one vertex arbitrarily chosen from all the vertices ("*Origin*"), which represents the initial transmitter (author, inventor, etc.) of new and/or creative information.



11

## Rejecting the implicit assumption that the market necessarily constitutes a zero-sum game



- The simulation here sets the maximum possible number of products or services embodying the same *Information* (the "*Products*") purchased by one consumer.
- The size of demand of each consumer is represented by the maximum number of edges that a vertex can receive from suppliers, and such number is chosen randomly from among the integer not less than 1 and not greater than the said maximum possible number.

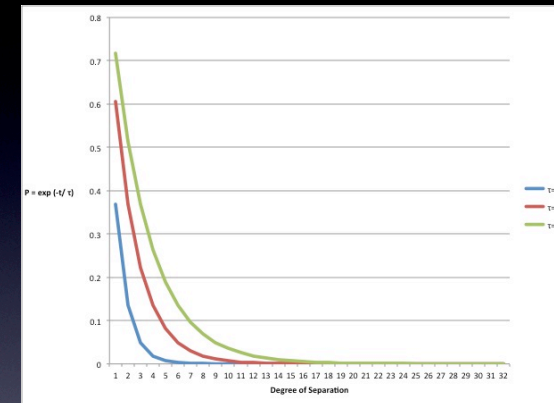
12

## Implementing the impact of a consumers network in the model

- $t$ : the degree of separation between a certain consumer and the *Origin*.
- $P$ : the probability that the supplier is successful in selling the said good or service to the said consumer.
- The simulation here assumes that  $P$  gradually decreases as  $t$  increases.
- In order to represent this assumption in a simpler way, the simulation here applies the concept of “time constant” ( $\tau$ ).
- $P = \exp(-t / \tau)$

13

$\tau$  represents the strength of the sales capability of a supplier



- A greater sales capability of a supplier, which can reach a more distant vertex, is represented by a larger  $\tau$ .
- A weaker sales capability of a supplier is represented by a smaller  $\tau$ .

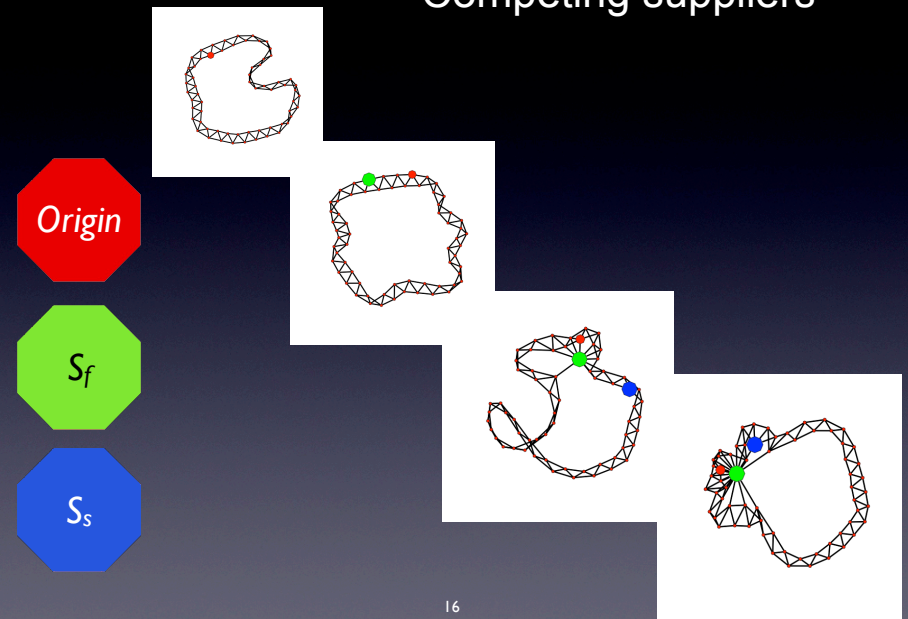
14

## Competing suppliers

- Within a certain degree (“5” in the graphs following) from the *Origin* at the default condition of the market, one vertex is arbitrarily chosen and becomes the first supplier (“ $S_f$ ”) of the *Products*.
  - ▶ The sales capability of  $S_f$  is defined by certain degree of  $\tau$  (“ $\tau_f$ ”).
- Within a certain degree (“5” in the graphs following) from the *Origin* just after the  $S_f$ ’s first trial of selling *Products*, one vertex is arbitrarily chosen and becomes the second supplier (“ $S_s$ ”) of the *Products*.
  - ▶ The sales capability of  $S_s$  is defined by certain degree of  $\tau$  (“ $\tau_s$ ”).
- $S_f$  and  $S_s$  distribute the *Products* independently.
  - ▶ The purchase of one *Product* by one consumer (a vertex) from  $S_f$  (or  $S_s$ ) is represented by one edge established between such vertex and  $S_f$  (or  $S_s$ ).

15

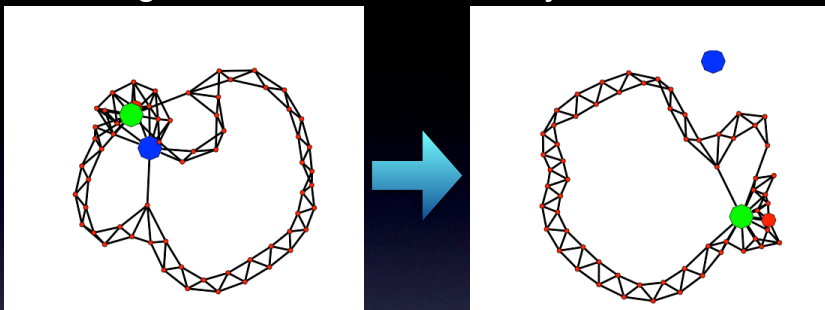
## Competing suppliers



16



## IP rights held and enforced by $S_f$ and/or $S_s$



- The successful enforcement of IP rights held by  $S_f$  (or,  $S_s$ ) is represented by the cut out of the edges connecting  $S_s$  (or,  $S_f$ ) and other vertices.
- The strength of such IP rights is represented by the probability that such respective edges are cut out.
- Such probability is a value between 0 and 1 (or, 0% and 100%).
- A probability of 0 means no IP rights.

17

## Decision not to enter the market

- The simulation here assumes that respective suppliers expect to reach a certain sales performance within a certain number of trials.
- If the supplier enters the market irrespective of its forecast of sales performance, the threshold is set as 0.
- The simulation here starts assuming that both  $S_f$  and  $S_s$  enters the market.
- If it is found that either of the suppliers cannot reach its threshold, the simulation is re-started assuming that such supplier had not entered the market.

18

## Measuring the impact of IP rights

- If the diffusion of the Information (or, Products) within the society is accelerated and/or reaches a higher degree by giving IP rights to either or both of  $S_f$  and  $S_s$ , we can estimate that IP rights are viable for promoting quicker and/or wider dissemination of innovation and/or cultural development.
- If not, the viability of IP rights is doubtful.
- The degree of the diffusion of the Information can be approximately estimated by the *closeness centrality* of the *Origin* (here, even if two or more edges connect a supplier and another vertex, it is assumed that there is only one edge between them).

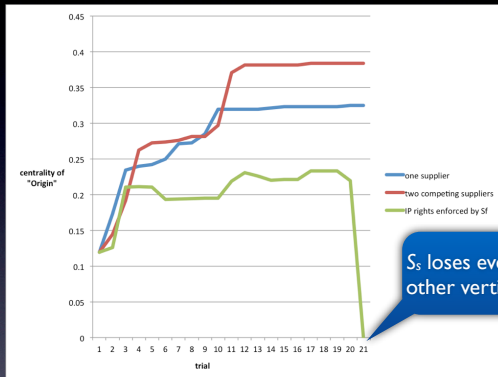
19

## The parameters used in the simulation

- *size*: the number of vertices in the market.
- *paraRegular*: the degree of the regular graph representing the default conditions of the market.
- *cCapa*: the maximum possible number of *Products* purchased by one consumer.
- *fDegree*: the degree from the *Origin*, from which scope  $S_f$  comes.
- *sDegree*: the degree from the *Origin*, from which scope  $S_s$  comes.
- *fr*: the degree of strength of sales capability of  $S_f$ .
- *sr*: the degree of strength of sales capability of  $S_s$ .
- *fForce*: the degree of strength of IP rights of  $S_f$ .
- *sForce*: the degree of strength of IP rights of  $S_s$ .
- *fminC* and *fmaxTrial*:  $S_f$  does not enter the market unless it attains the minimum sales performance (*fminC*, represented by the percentage against the possible maximum number of edges sent by  $S_f$ ) within a prefixed number of trials (*fmaxTrial*).
- *sminC* and *smaxTrial*:  $S_s$  does not enter the market unless it attains the minimum sales performance (*sminC*, represented by the possible maximum number of edges sent by  $S_s$ ) within a prefixed number of trials (*smaxTrial*).

20

Simulation - Multiple suppliers may reach one consumer simultaneously,  $S_f$  and  $S_s$  with weak sales capabilities, no threshold for entrance



$S_s$  loses every tie with other vertices.

	$cCapa$	$fT$	$sT$	$fminC$	$sminC$	$fForce$	$sForce$
Substantially one supplier	4	2	0.001	0	0	0	0
Two competing suppliers	4	2	2	0	0	0	0
$S_f$ enforces IP rights against $S_s$	4	2	2	0	0	50	0

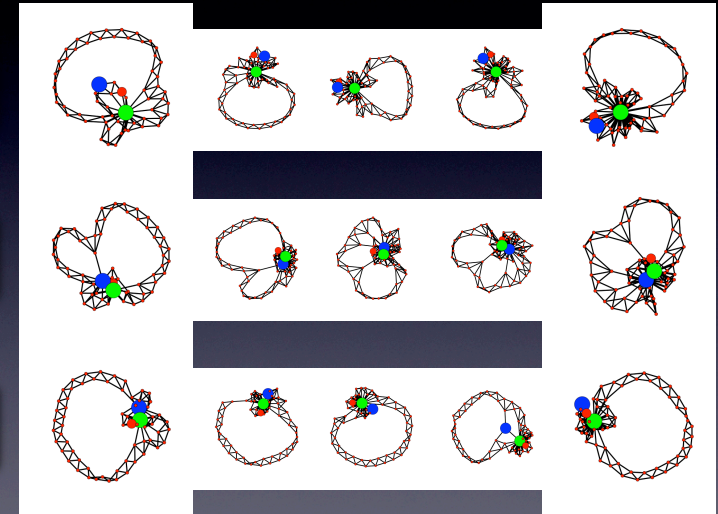
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- ✓ IP rights cannot promote diffusion of information.
- ✓ Two competing suppliers without IP rights is most effective in promoting wider and quicker diffusion of information.

Substantially one supplier

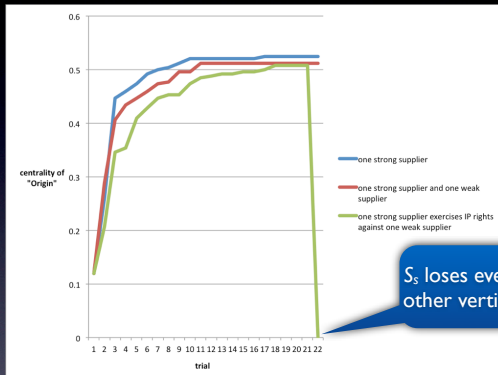
Two competing suppliers

$S_f$  enforces IP rights against  $S_s$



22

Simulation - Multiple suppliers may reach one consumer simultaneously,  $S_f$  with strong sales capability,  $S_s$  with weak sales capability, no threshold for entrance



$S_s$  loses every tie with other vertices.

	$cCapa$	$fT$	$sT$	$fminC$	$sminC$	$fForce$	$sForce$
Substantially one supplier	4	4	0.001	0	0	0	0
Two competing suppliers	4	4	2	0	0	0	0
$S_f$ enforces IP rights against $S_s$	4	4	2	0	0	50	0

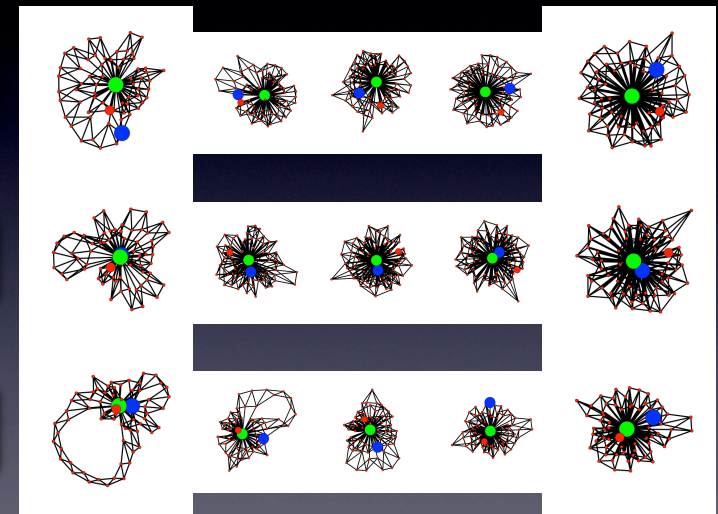
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- ✓ IP rights cannot promote diffusion of information.
- ✓ Little difference is found among three simulations.

Substantially one supplier

Two competing suppliers

$S_f$  enforces IP rights against  $S_s$

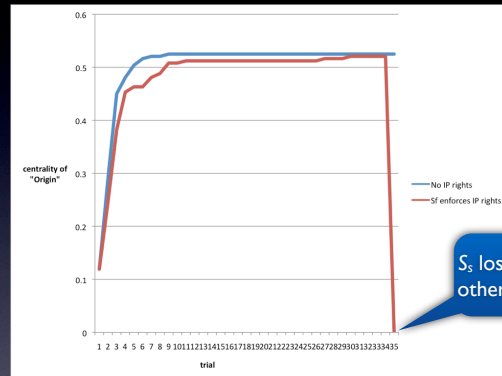


24



Simulation - Multiple suppliers may reach one consumer simultaneously,  $S_f$  with strong sales capability and a high threshold for entrance,  $S_s$  with weak sales capability

✓ IP rights cannot promote diffusion of information.



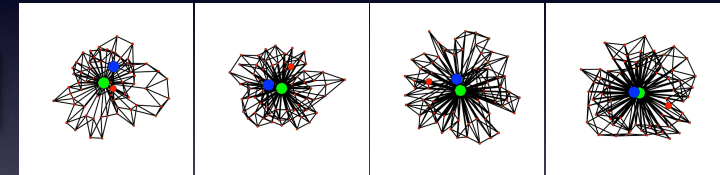
	cCapa	fT	sT	fminC	fmaxTrial	sminC	fForce	sForce
Two competing suppliers	4	4	2	0.7	13	0	0	0
$S_f$ enforces IP rights against $S_s$	4	4	2	0.7	13	0	50	0

25

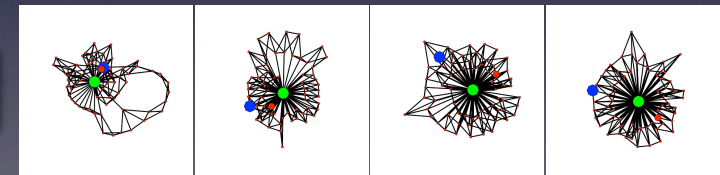
Simulation - Multiple suppliers may reach one consumer simultaneously,  $S_f$  with strong sales capability and a high threshold for entrance,  $S_s$  with weak sales capability

✓ Even without IP rights,  $S_f$  may enter the market.  
✓ Little difference is found between two simulations.

Two competing suppliers



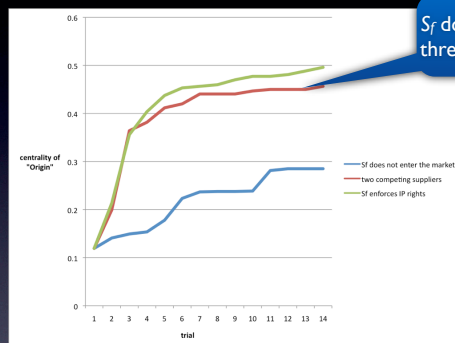
$S_f$  enforces IP rights against  $S_s$



26

Simulation - Only one of the two suppliers may reach one consumer (a zero-sum game),  $S_f$  with strong sales capability and a high threshold for entrance,  $S_s$  with weak sales capability

✓ IP rights possibly promote diffusion of information.

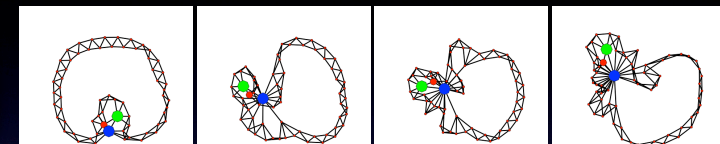


	cCapa	fT	sT	fminC	fmaxTrial	sminC	fForce	sForce
Substantially one supplier	1	0.001	2	0	0	0	0	0
Two competing suppliers	1	4	2	0.7	13	0	0	0
$S_f$ enforces IP rights against $S_s$	1	4	2	0.7	13	0	50	0

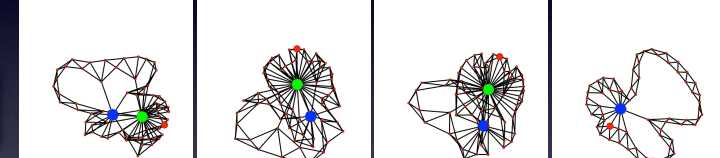
27

Simulation - Only one of the two suppliers may reach one consumer (a zero-sum game),  $S_f$  with strong sales capability and a high threshold for entrance,  $S_s$  with weak sales capability

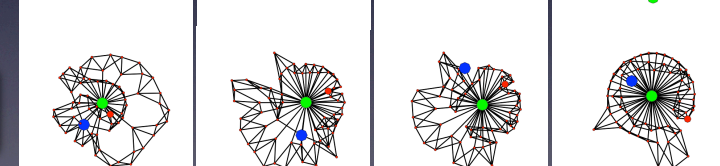
$S_f$  does not enter the market



Two competing suppliers



$S_f$  enforces IP rights against  $S_s$



28



Simulation - Only one of the two suppliers may reach one consumer (a zero-sum game),  $S_f$  with strong sales capability and a high threshold for entrance,  $S_s$  with weak sales capability

- Without IP rights,  $S_f$  is estimated not to be able to reach the threshold to enter the market, and  $S_f$  will not enter the market.
- IP rights possibly warrant  $S_f$ 's reach to the threshold, and incentivize it to enter the market.
- This has the impact of promoting the diffusion of information.

29

## Discussion

- The simulation here is very simple and reflects only limited aspects of reality.
- However, although a theoretical proof has not yet been prepared, the conditions where IP rights can promote diffusion of information is obviously limited.

30

- Interestingly, such conditions (a zero-sum game, a highly limited number of suppliers each with a strong sales capability, and a high threshold to enter the market) correspond to the business conditions of a conventional manufacturing industry and media industry.
- Such conditions also correspond to those of a conventional film industry in which players often demand strong IP protection.
- However, it is also well known that modern open source business and “free culture” are developing in clearly distinguishable conditions in which IP rights play a less important role.

31

## Conclusion and Future Development

- The simulation here is very simple and primitive.
- However, obviously, the intrinsic assumption that IP rights promote diffusion of innovation and/or cultural development should be abandoned.
- Restructuring IP laws through the collaboration of social network analysis specialists and lawyers is required.

32

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## Thank you

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