

Can Intellectual Property Rights Promote Innovation?

Teramoto, Shinto
Kyushu University, Faculty of Law : Professor

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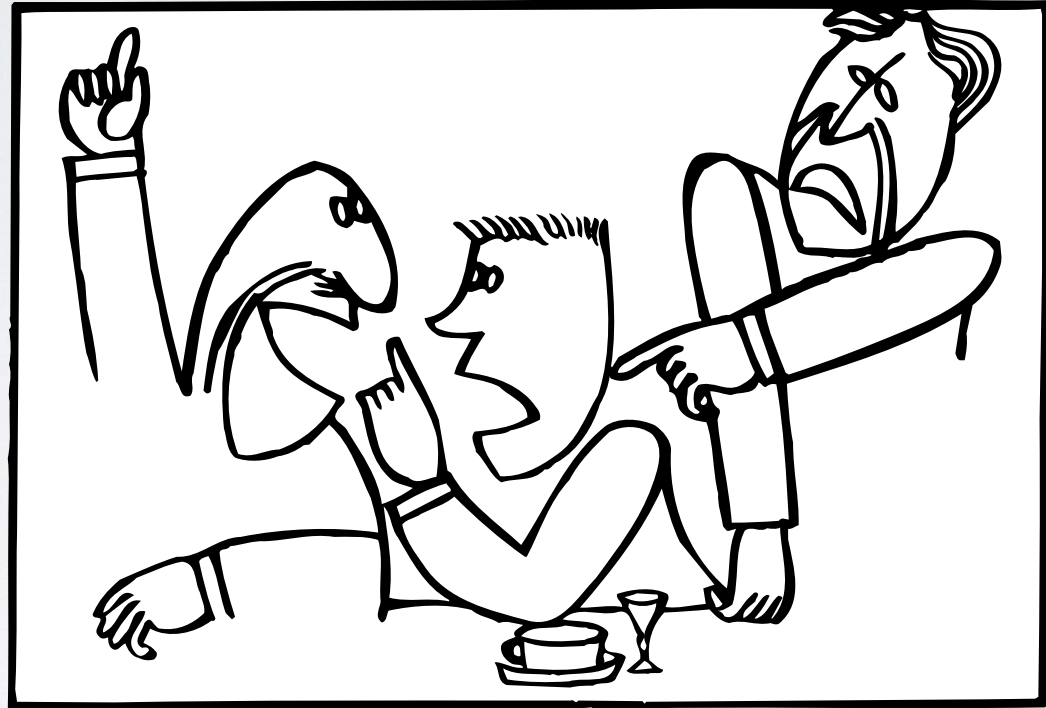
Can Intellectual Property Rights Promote Innovation?

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The Secrets to Building Innovation Ecosystems
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Shinto Teramoto

Professor, Kyushu University
jshin768@gmail.com

Debates on the function of IPRs



- For stronger protection of intellectual property?
- Or, for weaker protection of intellectual property?

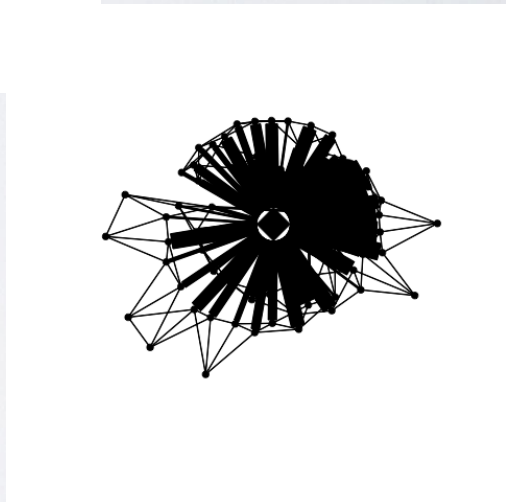
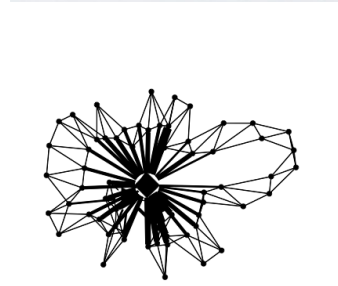
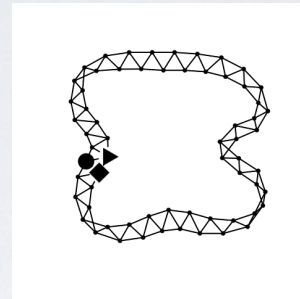
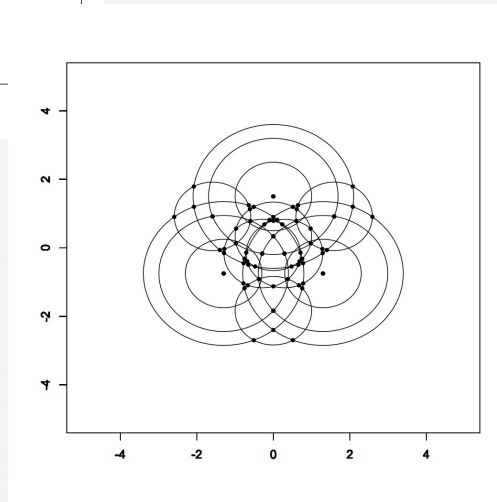
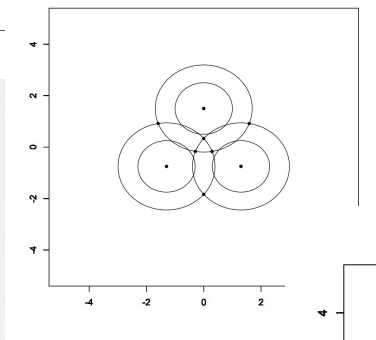
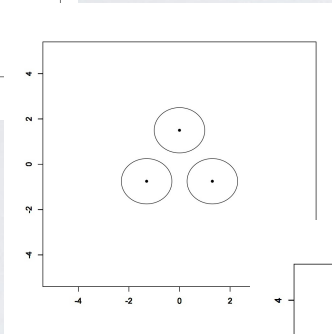
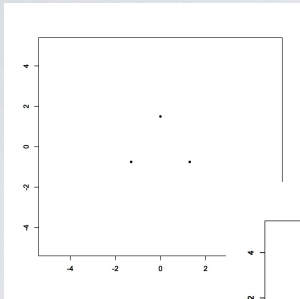
Can IPRs promote diffusion of products and services?



Can IPRs promote the continuous generation of innovations?

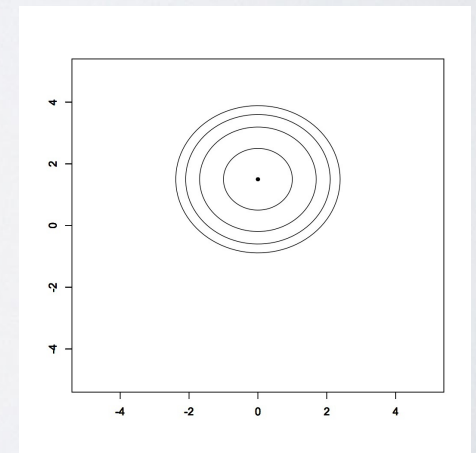
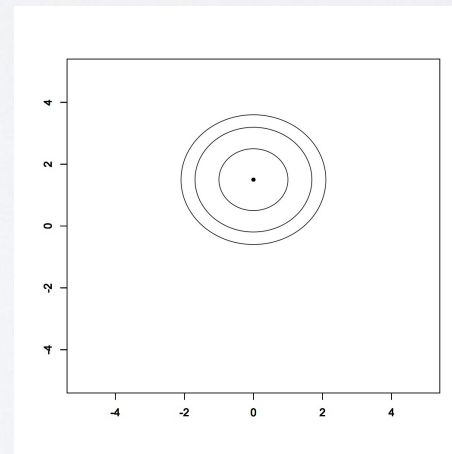
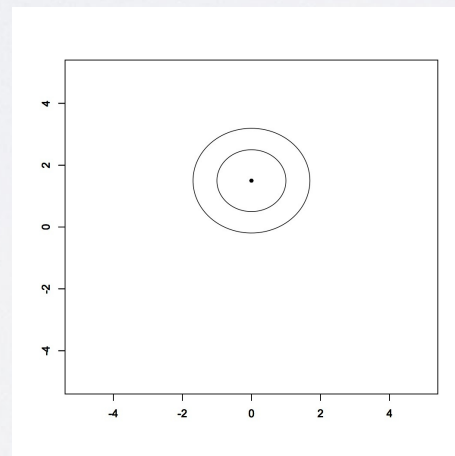
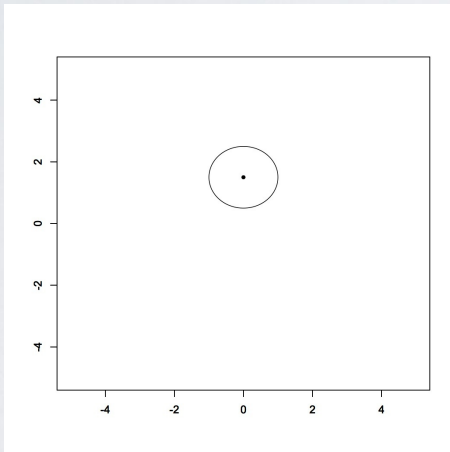


Simple Models to Assess the Pros and Cons of IPRs



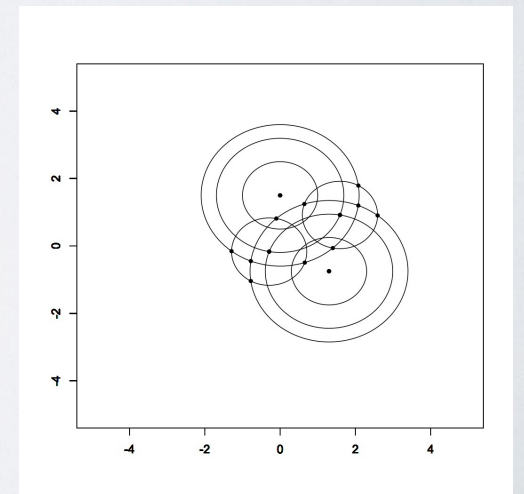
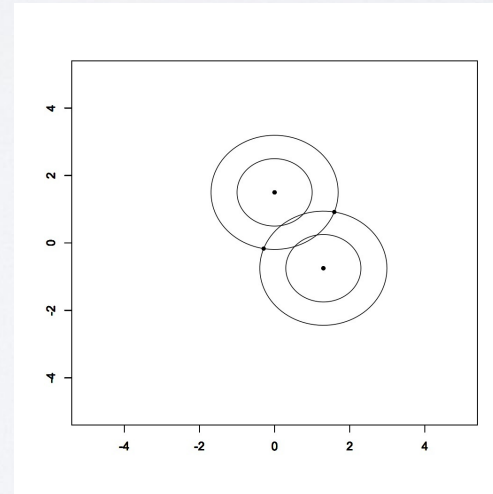
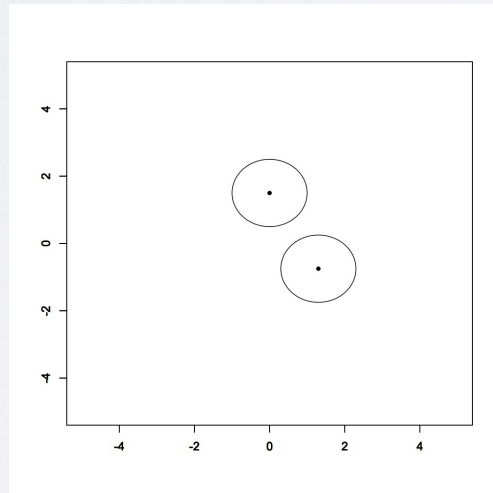
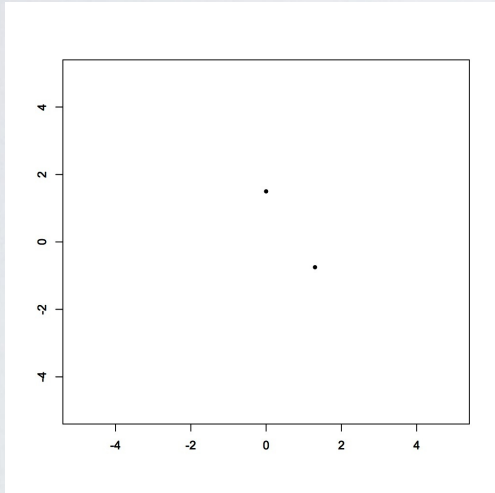
Simple models to assess the viability of IPRs in promoting generations of innovations

- One node denotes one innovation.
- The expanding radius of a circle having one node as its center denotes the effect of the innovation denoted by the said node.

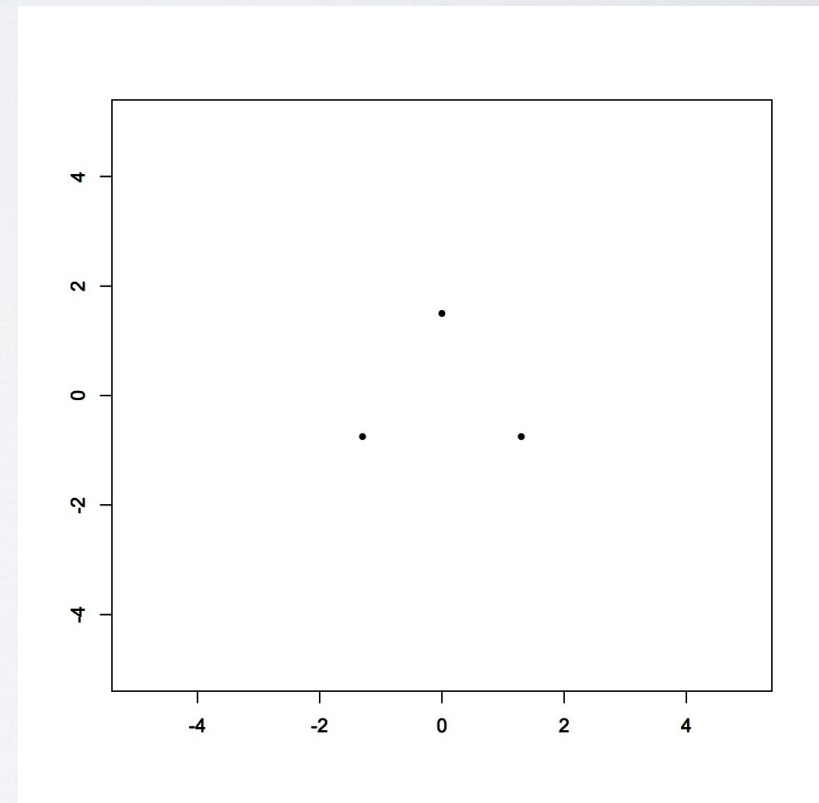


- The radius denoting the impact of an innovation gradually increases as time passes.
- In the model, the growth of the radius (“ r ”) is regulated by the following formula:
 - $r = \max(\log((t-g)/\tau) + 1, 0)$
 - t : the number of the relevant trial
 - g : the number of the trial when the relevant vertex was generated
 - $\tau, \tau > 0$: a constant that regulates the growth of r

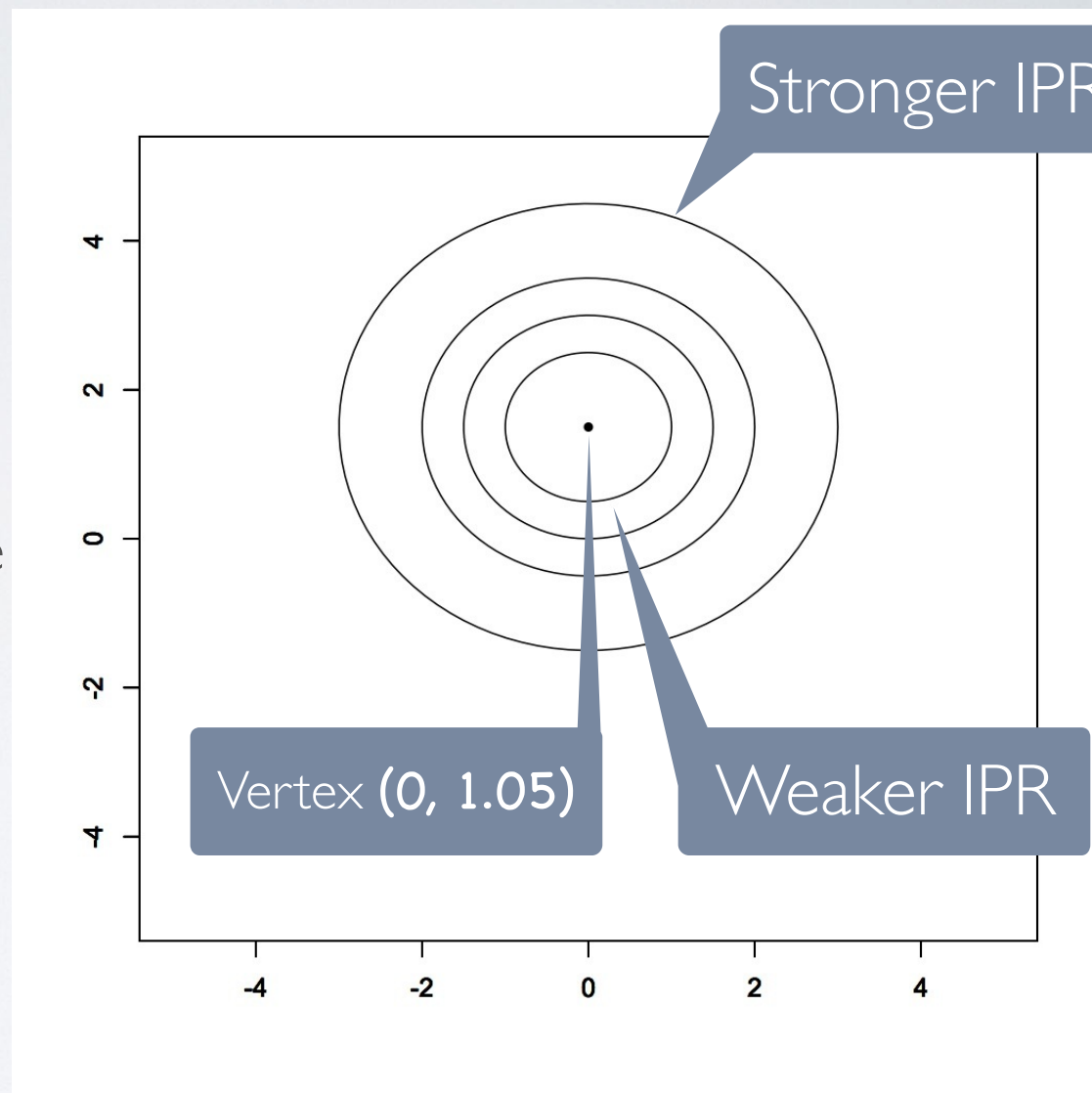
- New innovations may be generated under the effects of past innovation A (denoted by node A) and innovation B (node B).
- The intersections of the circle, having node A as its center, and the circle, having node B as its center, denote such new innovations.



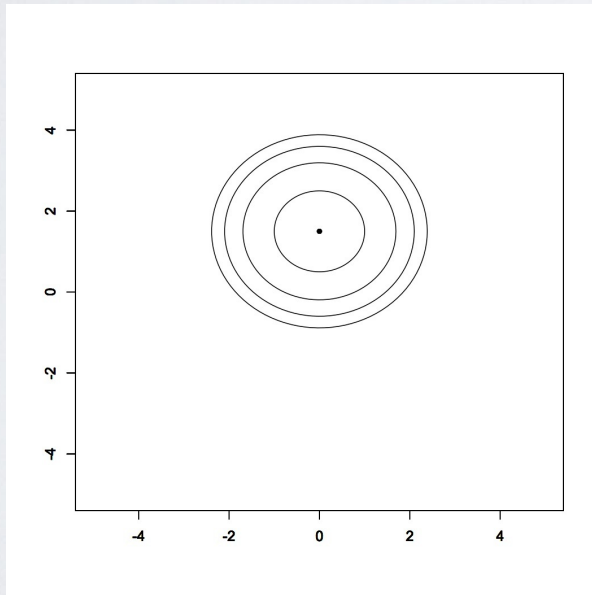
- The simulation starts from the conditions in which three past innovations exist.
- The simulation conducted here does not give specific meaning to the geodesic position of each node.
- The geodesic positions of the said respective nodes are arbitrarily determined as follows:
 - $(0, 1.5)$
 - $(1.5 \times \cos(\pi/6), -1.5 \times \sin(\pi/6))$
 - $(-1.5 \times \cos(\pi/6), -1.5 \times \sin(\pi/6))$



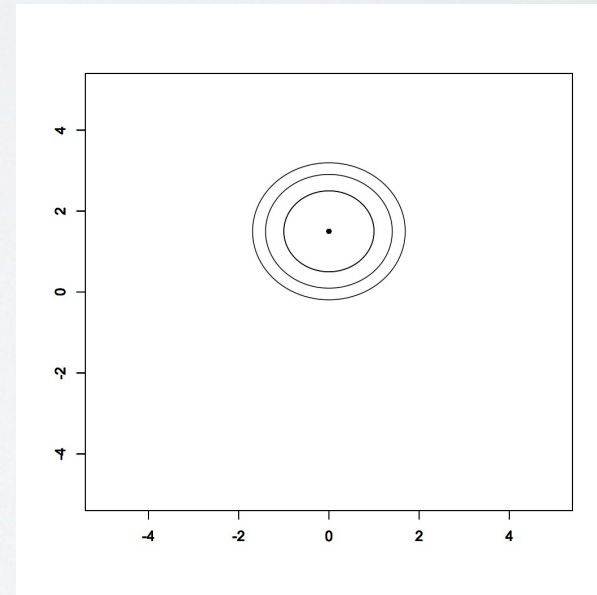
- A past innovation may be protected by an IPR (patent, copyright, etc.).
- In the simulation, for the purpose of simplicity, only the vertex $(0, 1.5)$, which denotes one of the past innovations, is given IPR.
- The impact of the IPR is denoted by the area in the circle which has the vertex $(0, 1.5)$ as its center.
- The radius (r) is longer to denote a stronger IPR, and it is shorter to denote a weaker IPR.



- An IPR can suspend the dissemination of the products and services embodying a new innovation, which fall within the scope of the IPR.
- Thereby, the increase of the effect of such new innovation is obstructed.
- This phenomenon can be denoted by the restricted or delayed increase of the radius of the circle which represents the effect of the said new innovation.

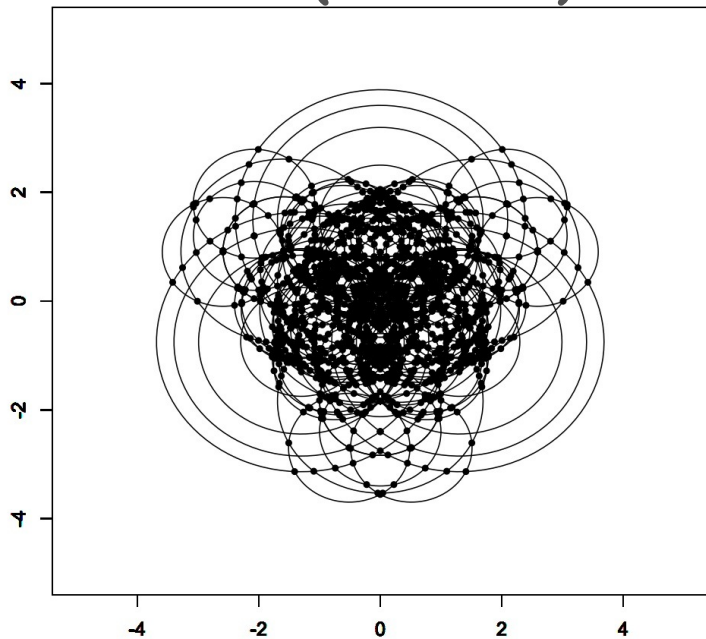


$\tau = 1$ (The increase of the effect of a new innovation is not restricted)



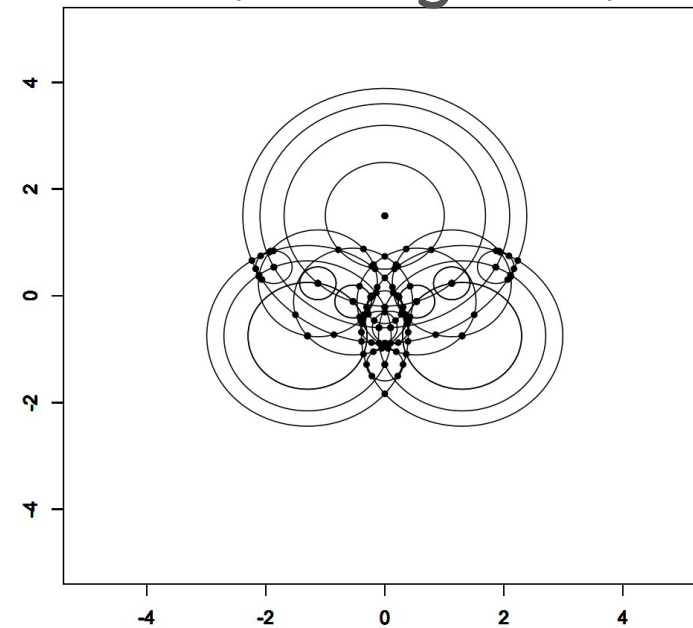
$\tau = 2$ (The increase of the effect of a new innovation is restricted by an IPR)

$r=0$ (no IPR)

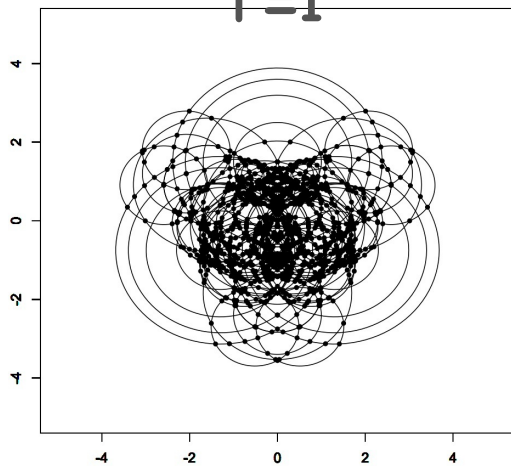


- r denotes the strength of the IPR given to the past innovation represented by node $(0, 1.5)$.

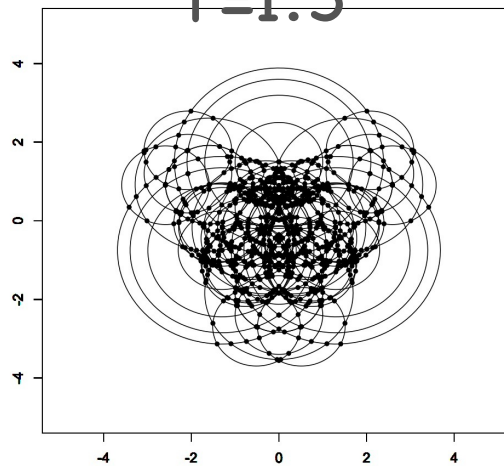
$r=3$ (strong IPR)



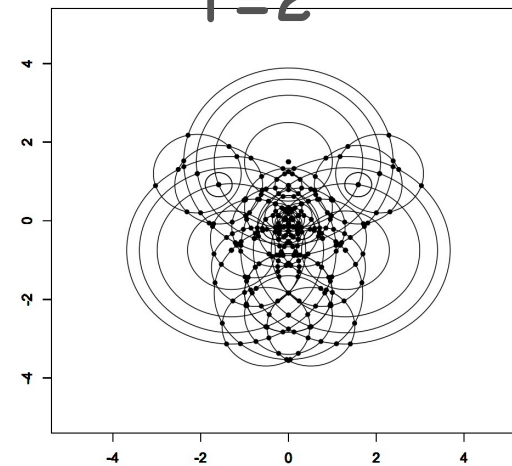
$r=1$



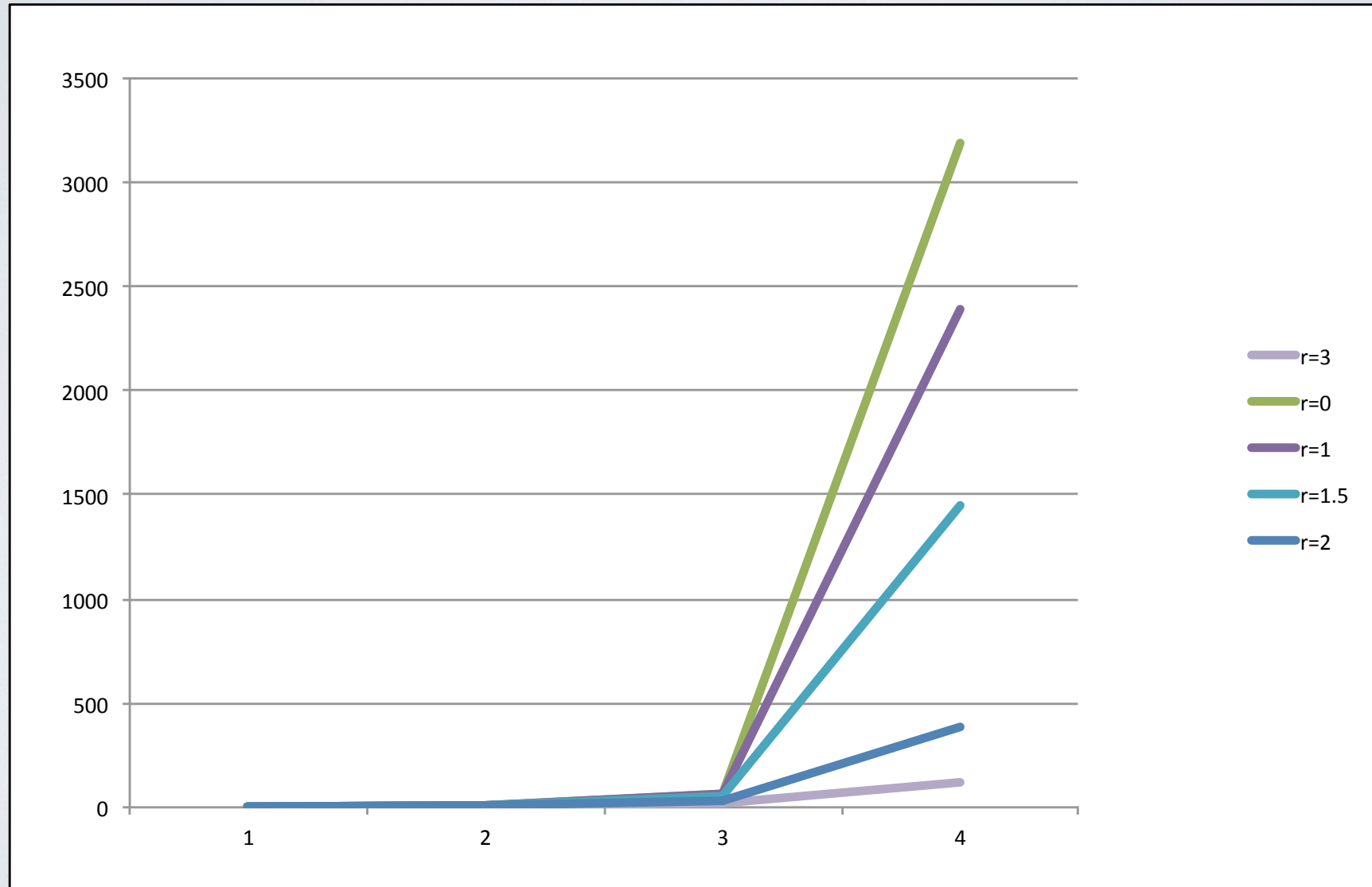
$r=1.5$



$r=2$



The increase of intersections (denoting new innovations) is deterred by a stronger IPR.

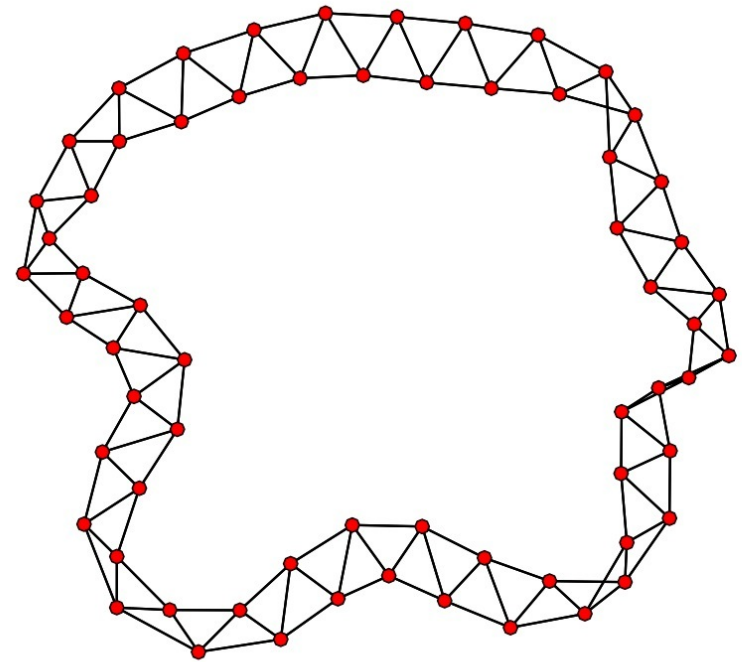


The Suggestion of the Simulation

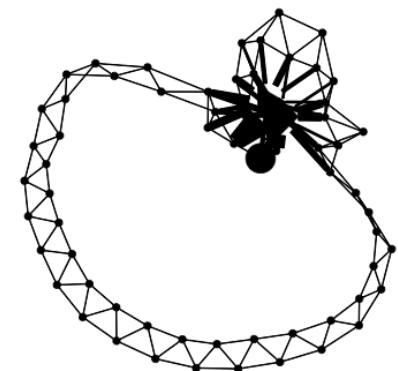
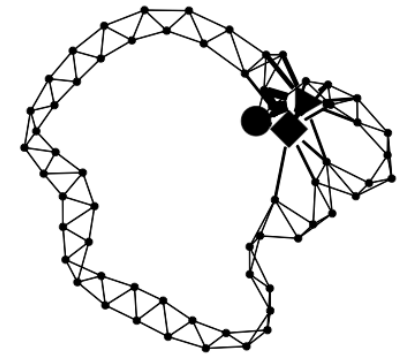
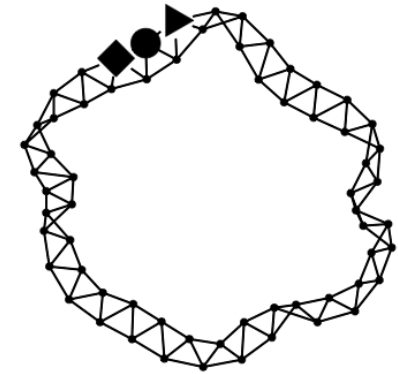
- IPR can give an innovator an advantage by obstructing the emergence of innovations, some of which may make his/her innovation obsolete.
 - This may promote entrepreneur's investments in new innovations if they expect that they can secure IPRs for their innovations.
- On the other hand, the exercise of IPRs may suffocate the growth of innovations which may promote the continued use of past innovations.
 - Open source employs the strategy of letting new innovations grow freely, hoping that they can promote the continued use of past innovations.

Simple models to assess the viability of IPRs in promoting diffusion of products or services embodying innovations

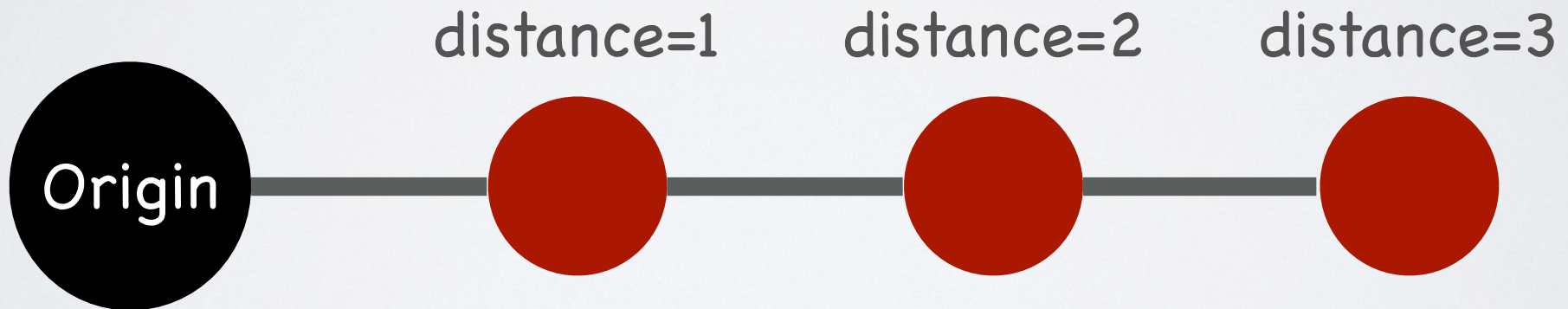
- Each of multiple nodes (in the simulation, 64 nodes) denotes each actor in a market.
- A line connecting **node_i** and **node_j** denotes the ties or relationship of a certain degree of strength between the actor denoted by **node_i** and another actor denoted by **node_j**.
- Each actor is likely to have ties with a limited number of other actors from the beginning through friendship, business, etc.
- The simulation assumes that every actor has ties with four other actors in its neighborhood.



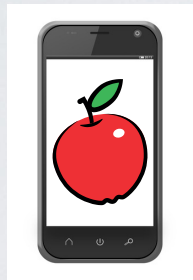
- One node (“**Origin**” ●) denotes the originator of a past innovation.
- Two of the nodes having a direct tie with **Origin** denote the commercial distributors (“**S_f**” ▲ and “**S_s**” ■) of products or services embodying the said past innovation.
- Successful sale of such products or services to a consumer by **S_f** or **S_s** is denoted by the establishment of a line connecting **S_f** or **S_s** and the node representing the consumer.



- The model assumes that the probability of S_f 's (or S_s 's) successful sale of products or services to a consumer gradually decreases according to the increase in the distance between **Origin** and the node denoting the relevant consumer.



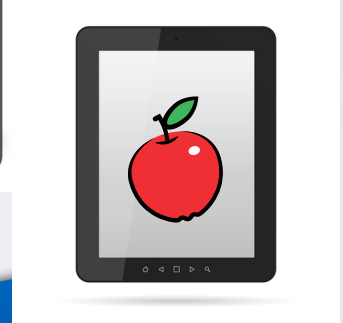
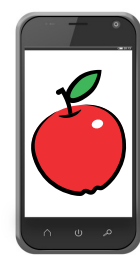
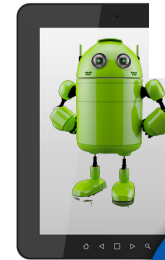
- The model assumes that one consumer may purchase multiple products or services of the same kind from either or both of S_f and S_s .



Consumer_a



Consumer_b



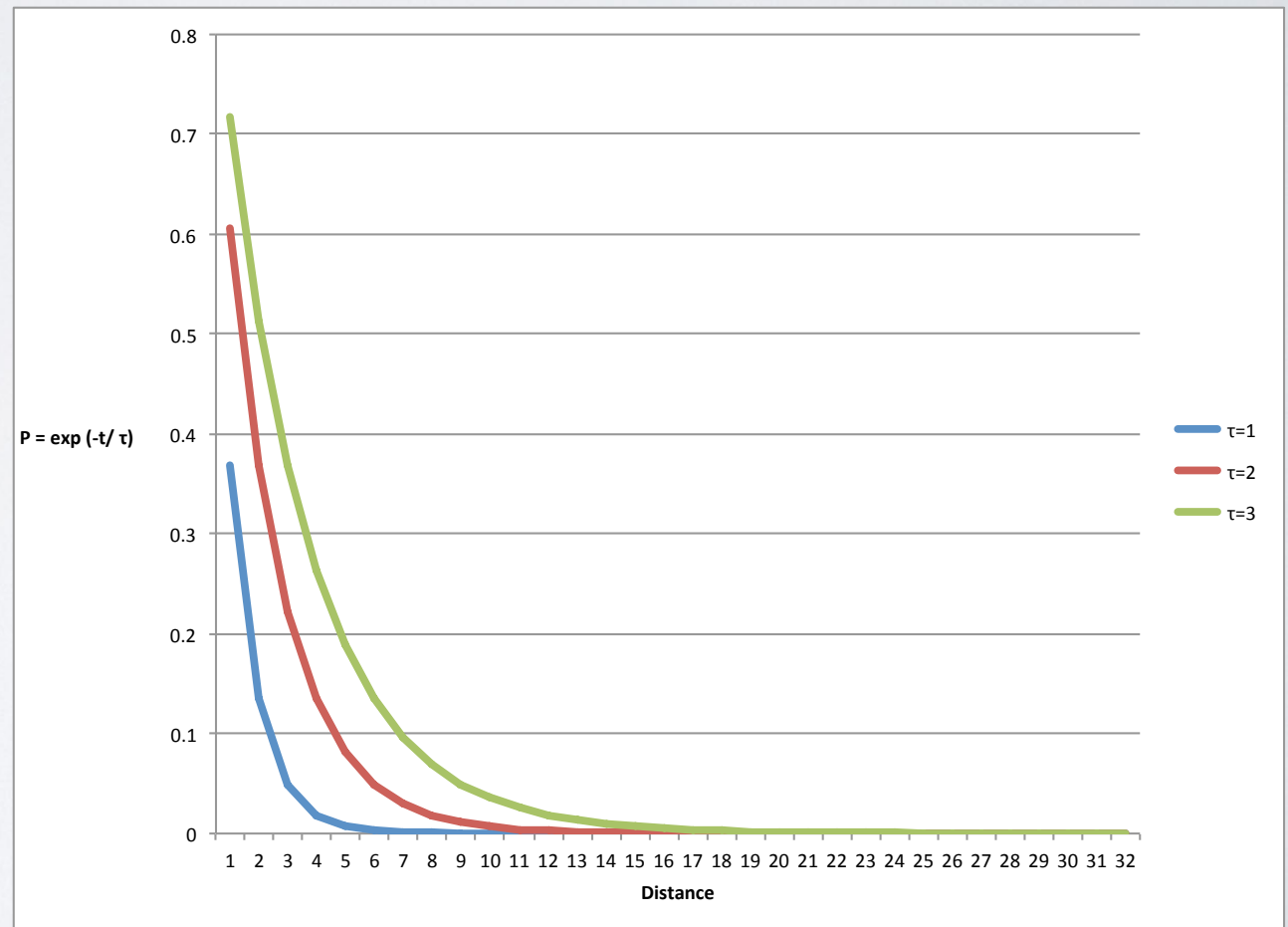
Consumer_c

- In the model, the probability of successful sales (P) is regulated by the formula, below.
- The larger τ represents the stronger sales capabilities of S_f (or, S_s), and the smaller τ represents the weaker sales capabilities.

- t : the distance between Origin and the relevant potential consumer

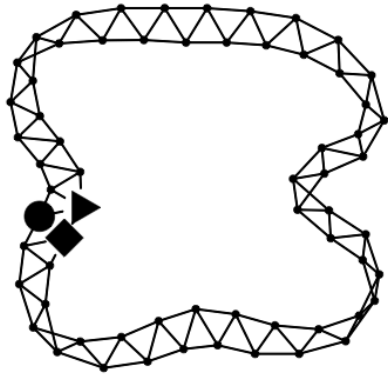
- $\tau, \tau > 0$: a variable prefixed for each of S_f and S_s

- $P = \exp(-t/\tau)$ represents the strength of the supplier's sales capabilities.

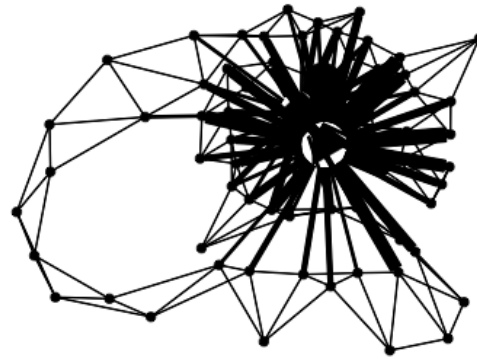


- In the model, an IPR is given to \mathbf{S}_f .
- \mathbf{S}_f can obstruct \mathbf{S}_s 's sales of products or services by using \mathbf{S}_f 's IPR.
 - This is denoted by the cutoff of \mathbf{S}_s 's ties with other nodes.
 - This cutoff happens at a certain probability (“**fForce**”).
 - A greater **fForce** denotes a stronger IPR, while a smaller **fForce** denotes a weaker IPR.

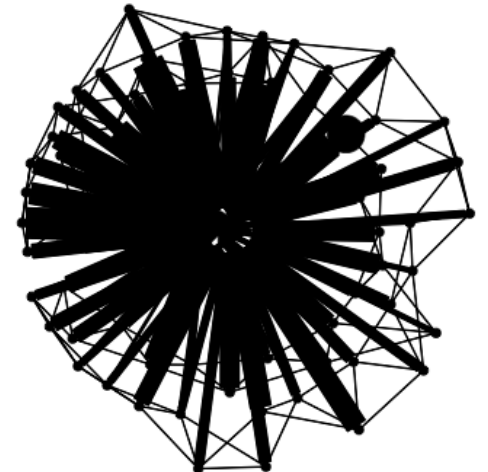
- At each trial:
 - Each of \mathbf{S}_f and \mathbf{S}_s connects itself with other nodes at a given probability. This denotes the sales activities of \mathbf{S}_f and \mathbf{S}_s .
 - Then, the ties between \mathbf{S}_s and each of the other nodes are cut off at a given probability. This denotes the exercise of IPR by \mathbf{S}_f .



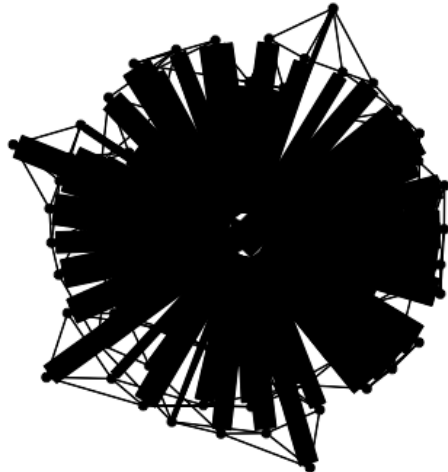
Default



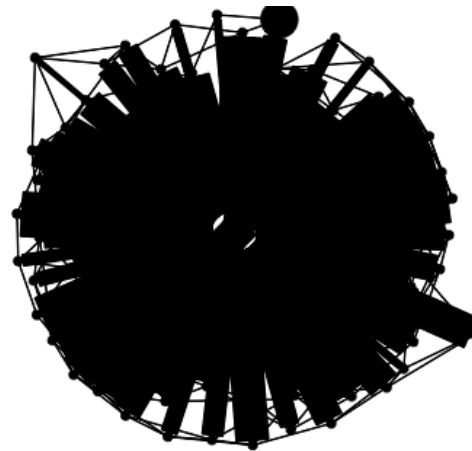
Trial 10



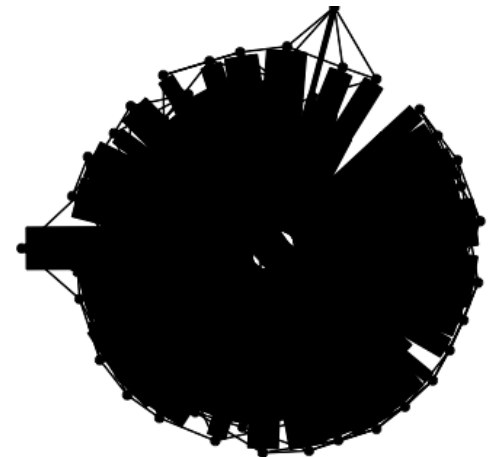
Trial 20



Trial 30

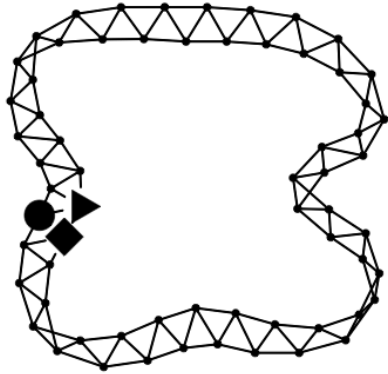


Trial 40

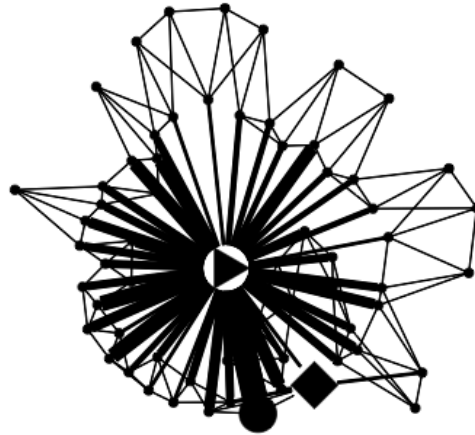


Trial 50

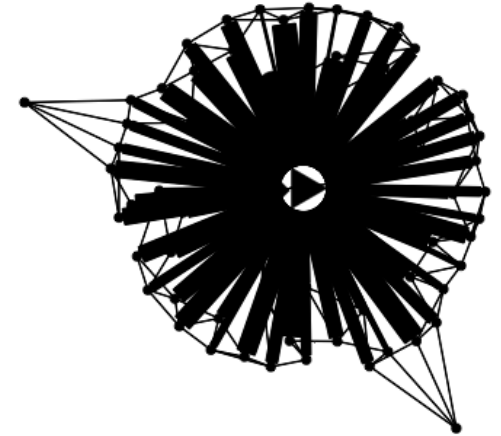
The development of a network when neither S_f nor S_s enforces IPR.
 S_f has stronger sales capabilities ($\tau = 2$), and S_s has weaker sales capabilities ($\tau = 1$).



Default



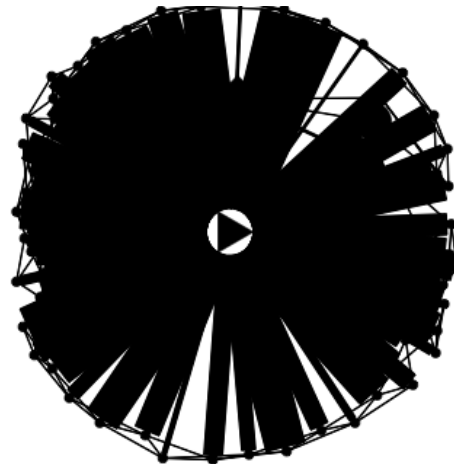
Trial 10



Trial 20



Trial 30

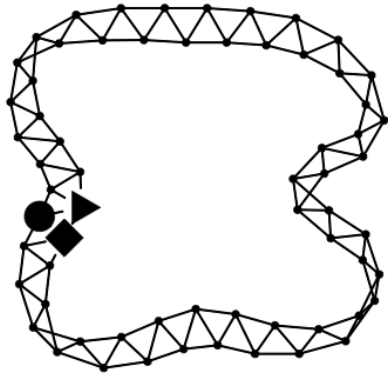


Trial 40



Trial 50

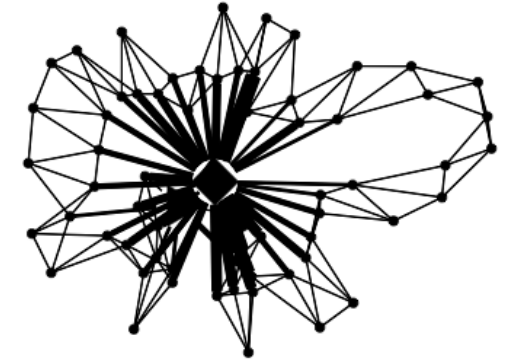
The development of a network when S_f (having stronger sales capabilities) enforces IPR against S_s (having weaker sales capabilities).



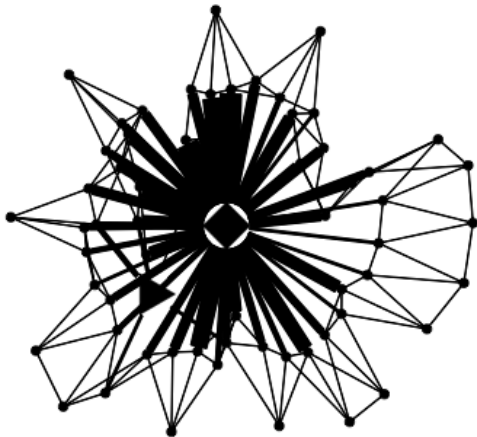
Default



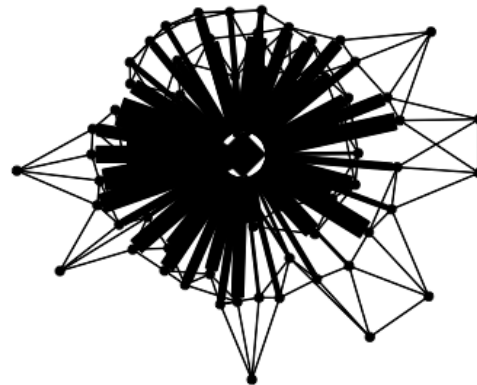
Trial 10



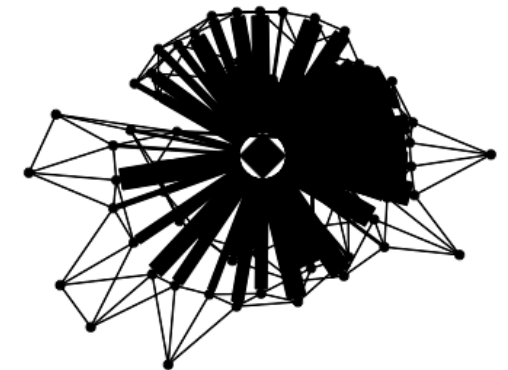
Trial 20



Trial 30

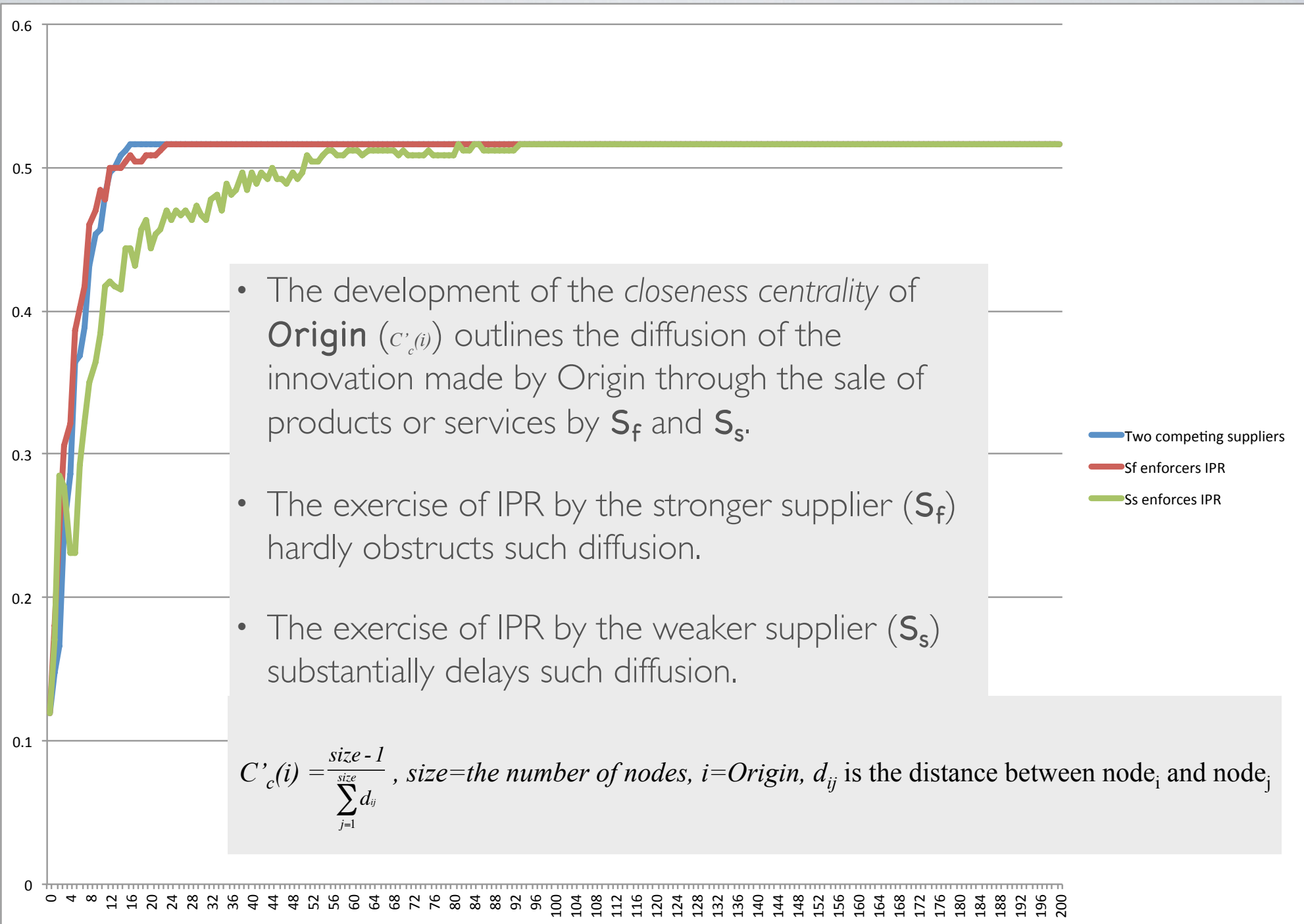


Trial 40



Trial 50

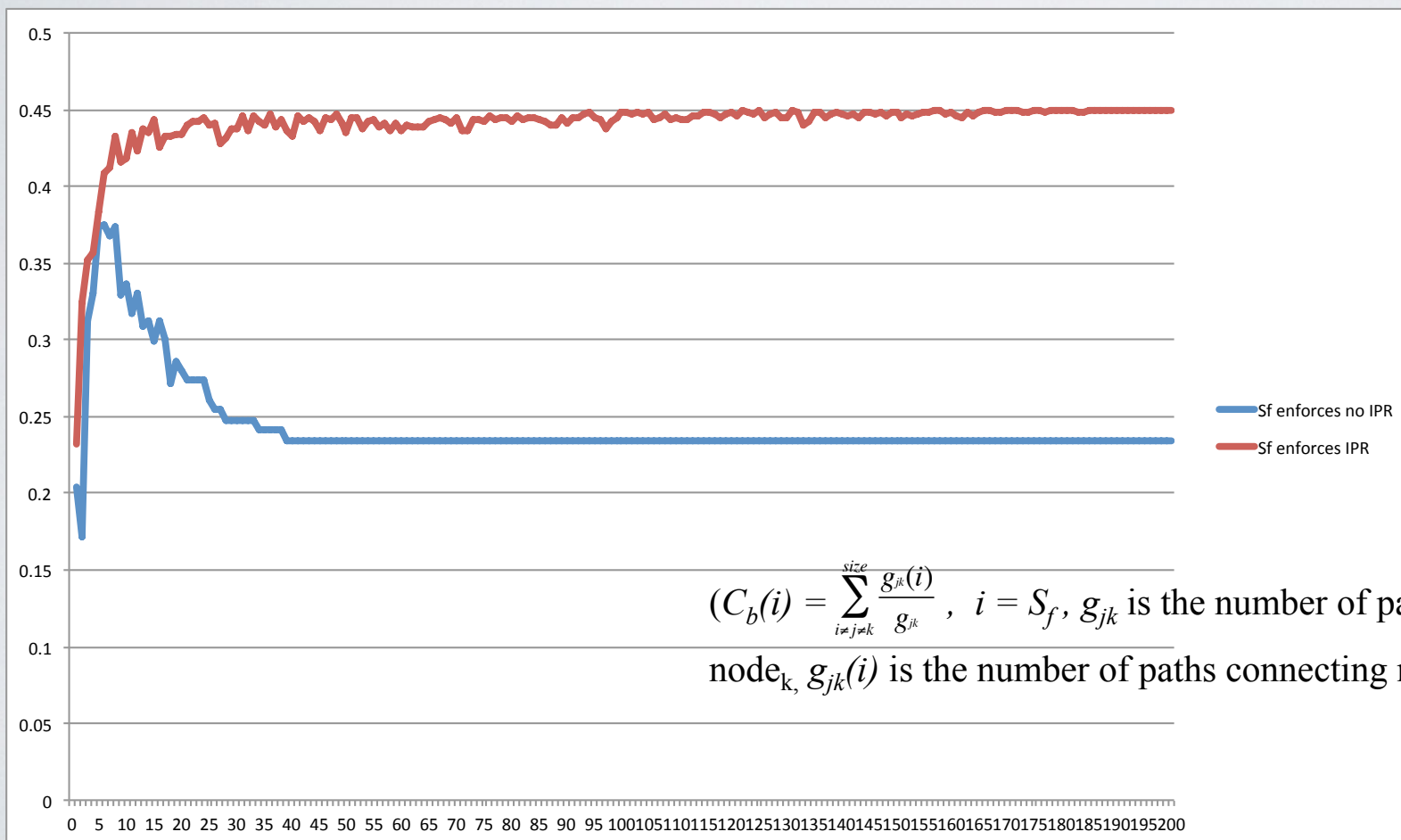
The development of a network when \mathbf{S}_s (having weaker sales capabilities) enforces IPR against \mathbf{S}_f (having stronger sales capabilities).



- The development of the *closeness centrality* of **Origin** ($C'_c(i)$) outlines the diffusion of the innovation made by Origin through the sale of products or services by S_f and S_s .
- The exercise of IPR by the stronger supplier (S_f) hardly obstructs such diffusion.
- The exercise of IPR by the weaker supplier (S_s) substantially delays such diffusion.

$$C'_c(i) = \frac{size - 1}{\sum_{j=1}^{size} d_{ij}}, \text{ size} = \text{the number of nodes}, i = \text{Origin}, d_{ij} \text{ is the distance between node}_i \text{ and node}_j$$

- Obviously, S_f can prominently increase S_f 's *betweenness centrality* (an index that shows how often S_f lies between a pair of other nodes) by enforcing its IPR.
- Obviously, S_f becomes more likely to maintain an advantageous position in the competitive market by exercising its IPR.



The Suggestion of the Simulation

- Exercise of IPR by the weaker supplier against the stronger supplier may obstruct the wider and quicker diffusion of products or services embodying innovations.
- Exercise of IPR by the stronger supplier against the weaker supplier may have little effect on the diffusion of innovations.

IPRs are double-edged



- IPRs have both advantages and disadvantages in the promotion of the generation and diffusion of innovations.

Suggestion to the players in innovation ecosystems



- Entrepreneurs
- Managers
- Researchers
- Engineers
- Attorneys
- Governments , etc.

- Every player has to maintain its flexibility in choosing its own IPR strategies, whether it be -
 - whether it be to enforce IPRs aggressively:
 - to cooperate with potential or actual competitors through cross-license arrangements, patent pools or Standard Setting Organizations (SSOs);
 - to employ open source strategies: or
 - otherwise.



- However, it leaves little doubt that entrepreneurs have to accumulate as many as IPRs as they can, so that they can maintain the discretion to choose the most suitable strategy.



Thank you

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