



# The Evolutionary Path to Innovation and Creativity

Xavier Llorà

*Illinois Genetic Algorithms Lab  
University of Illinois at Urbana-Champaign*

[xllora@illigal.ge.uiuc.edu](mailto:xllora@illigal.ge.uiuc.edu)



# So, not a GA talk?

## 🔷 This is not a talk about

- Genetic algorithms
- Genetic programming
- Estimation of distribution algorithms
- Genetic-based machine learning
- ...

## 🔷 This is a talk about

- Creativity and innovation support
- The role of genetic algorithms and evolutionary computation
- How fast interaction and visual analytics improve collaboration?
- The social aspects of communication in innovation processes



# An Hypothetical Real-World Scenario

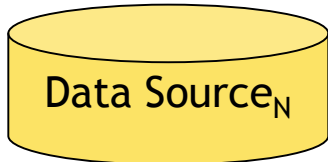
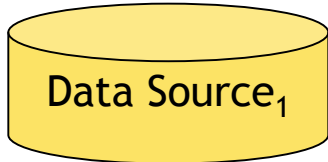
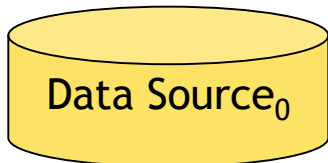
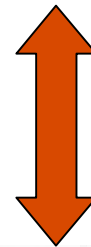
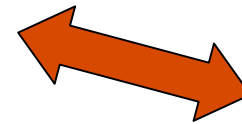
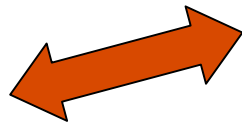
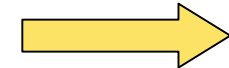
- ▶ Creativity processes are leaded by collectivities
  - Design groups are becoming inherently multidisciplinary
  - Groups are no longer staying on a common location
- ▶ Computers have become mediators of collaborations
  - Email, chat rooms, blogs, wikis...
  - A flood of available information
  - Different modes of communication
- ▶ The question:  
*“Could it be possible to take advantage of computer-mediated communication nature to support human innovation and creativity processes?”*



# Elements Involved



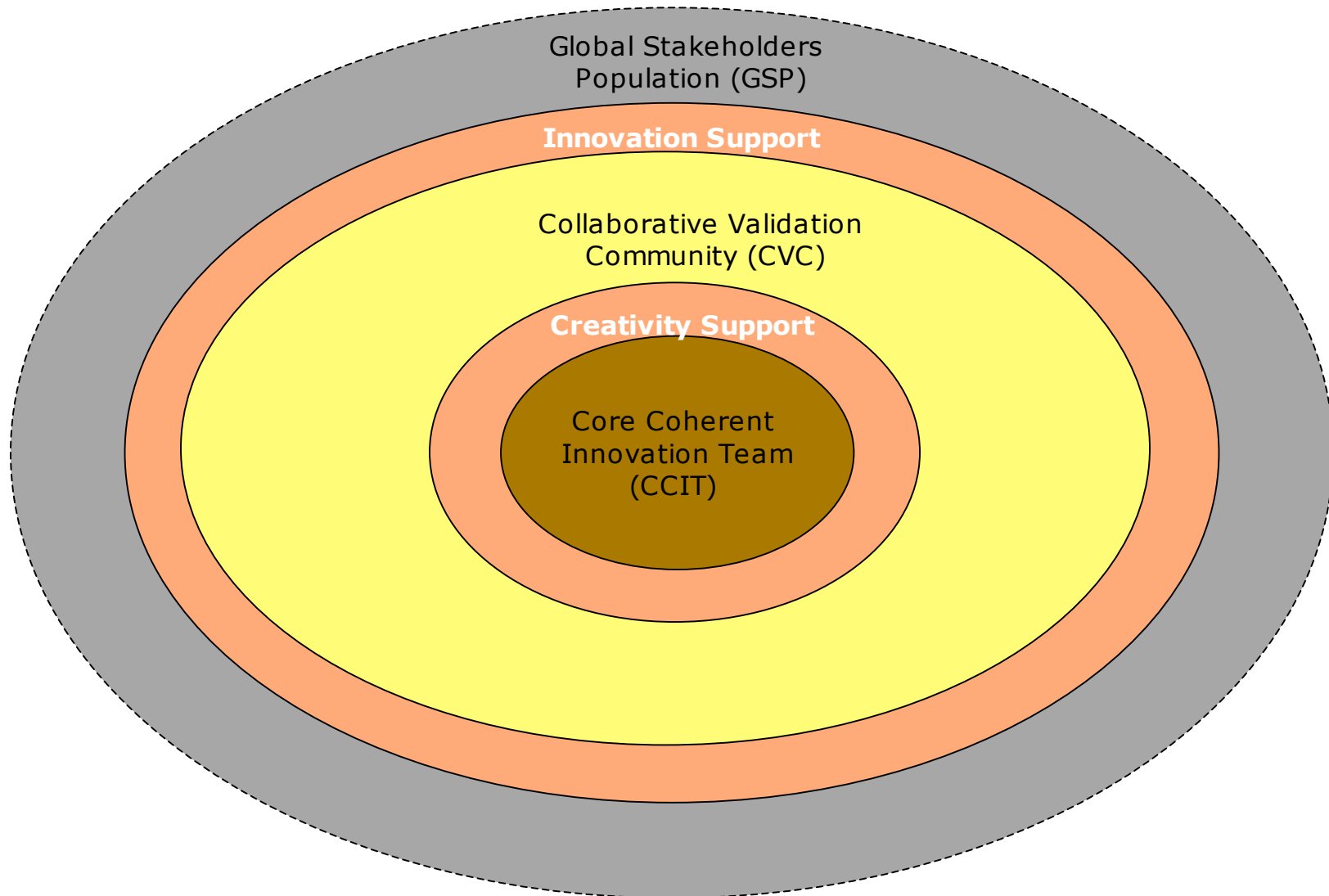
Innovation and Creativity Support?







# A Simple Conceptual Model





# Innovation, Creativity, and GAs?





# Human and Social Aspects of GAs (I/II)

<b>Recombination agent</b>	<i>computational</i>	<b>Standard Genetic Algorithms</b>	<b>Interactive Genetic Algorithms</b>
	<i>human</i>	<b>Computer Aided Design (CAD)</b>	<b>Human-Based Genetic Algorithms</b>
		<i>computational</i>	<i>human</i>

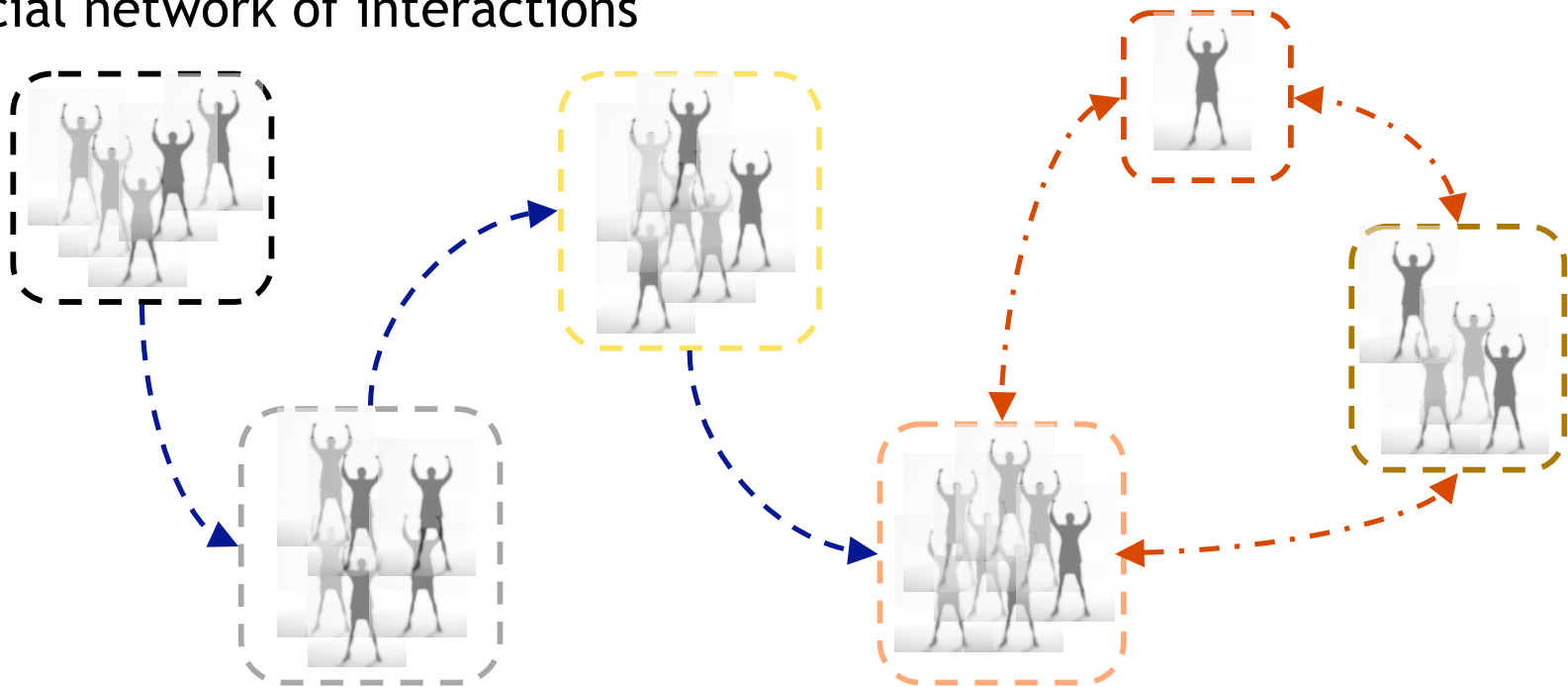
**Selection agent**

(Kosorukoff & Goldberg, 2002)



# Human and Social Aspects of GAs (II/II)

- Population-based method
- Parallel genetic algorithms
  - Groups of working units
  - Communication between groups for a common goal
  - Models for collaborative work
- Social network of interactions





# Innovation Requires Chance Discovery

- Successful innovation and creativity need the proper recombination of relevant salient fortuitous events
- Relevant scenario *building blocks* need to be identified
- A **chance** here means an event or a situation with significant impact on human decision making
- A **chance** can be conceived either as an opportunity or as a risk for a recombination event of scenarios. Some examples

*“Which is going to next big thing to take over the cell phone market?”*

- Not an easy answer



# Chance Discovery for Innovation

- Chances are hidden in **future** scenarios (chance discovery is not data mining)
- Hypothetical scenarios can be made, but the next big one is unexpected
- Future scenarios are a recombination of existing ones
- The **discovery** of a chance is to become aware of and to explain the significance of a chance, especially if the chance is rare and its significance has been unnoticed.
- The combination of chance discovery and human-based genetic algorithms provide a sound working model to the creation of innovation-support systems



# And The Group

- 🔷 The identification of chances is a social activity
- 🔷 Groups work together to
  - Create scenarios
  - Identify relevant chances
- 🔷 Participants
  - Interact to each other
  - Influence others opinions
  - Play different roles in the group
- 🔷 Influence dynamics and social network aspects are key elements
  - “What conditions need to be met to make it creative?”*





What Do You Envision Then?



# The Vision (I/II)

## 🔗 Computers have become mediators of collaborations

- Email, chat rooms, blogs, wikis...
- A flood of available information
- Different modes of communication

## 🔗 Let's take advantage of such information

- Logs of conversations
- Archive of documents (email attachments, blogs, personal web pages...)
- Human-computer interactions
- Social aspect of the communication and collaboration



# The Vision (II/II)

➤ Create a system to supports innovation and creativity

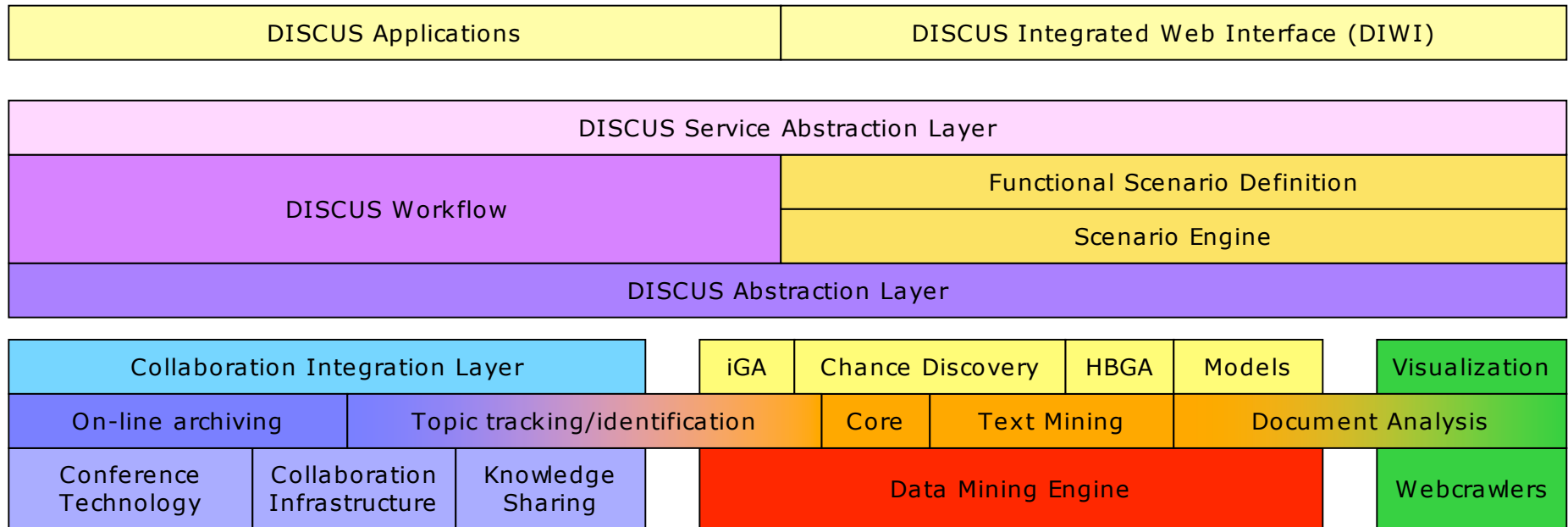
**DISCUS:** *Distributed Innovation and Scalable Collaboration in Uncertain Settings*

➤ The tools available

- Web portals
- Collaboration tools (message boards, chats, blogs...)
- Genetic algorithm (Interactive, Human-based, and Parallel GAs)
- Chance discovery (KeyGraphs and Influence Diffusion Models)
- Data and text mining
- Information retrieval

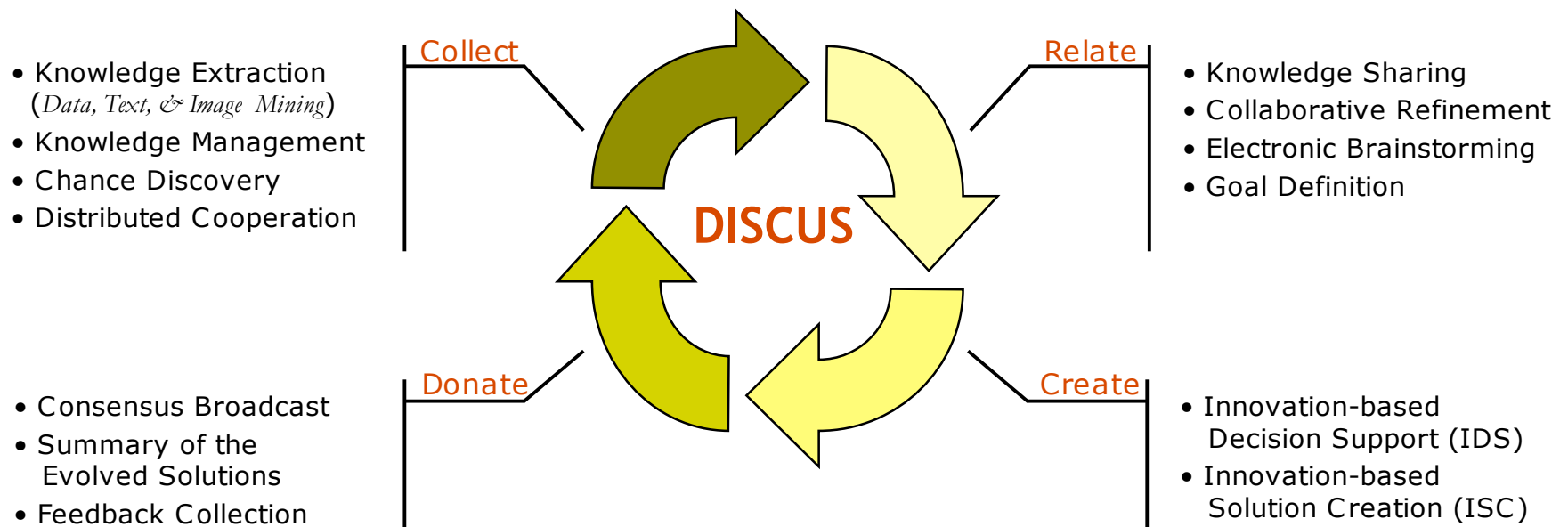


# The Web as a Playground





# Innovation and Creativity as a Process





# What About The Pieces?



# Relevant, Salient, and Fortuitous Events

🔗 Innovation requires to identify relevant events

🔗 On-line communication:

- tend to be superficial
- take the form of scenarios
- logs of the communication may be available

🔗 KeyGraphs are:

- a tool for scenario visualization
- a method for chance identification
- computation embodiments
- a tool for externalization and discussion



# What is a KeyGraph? (I/II)

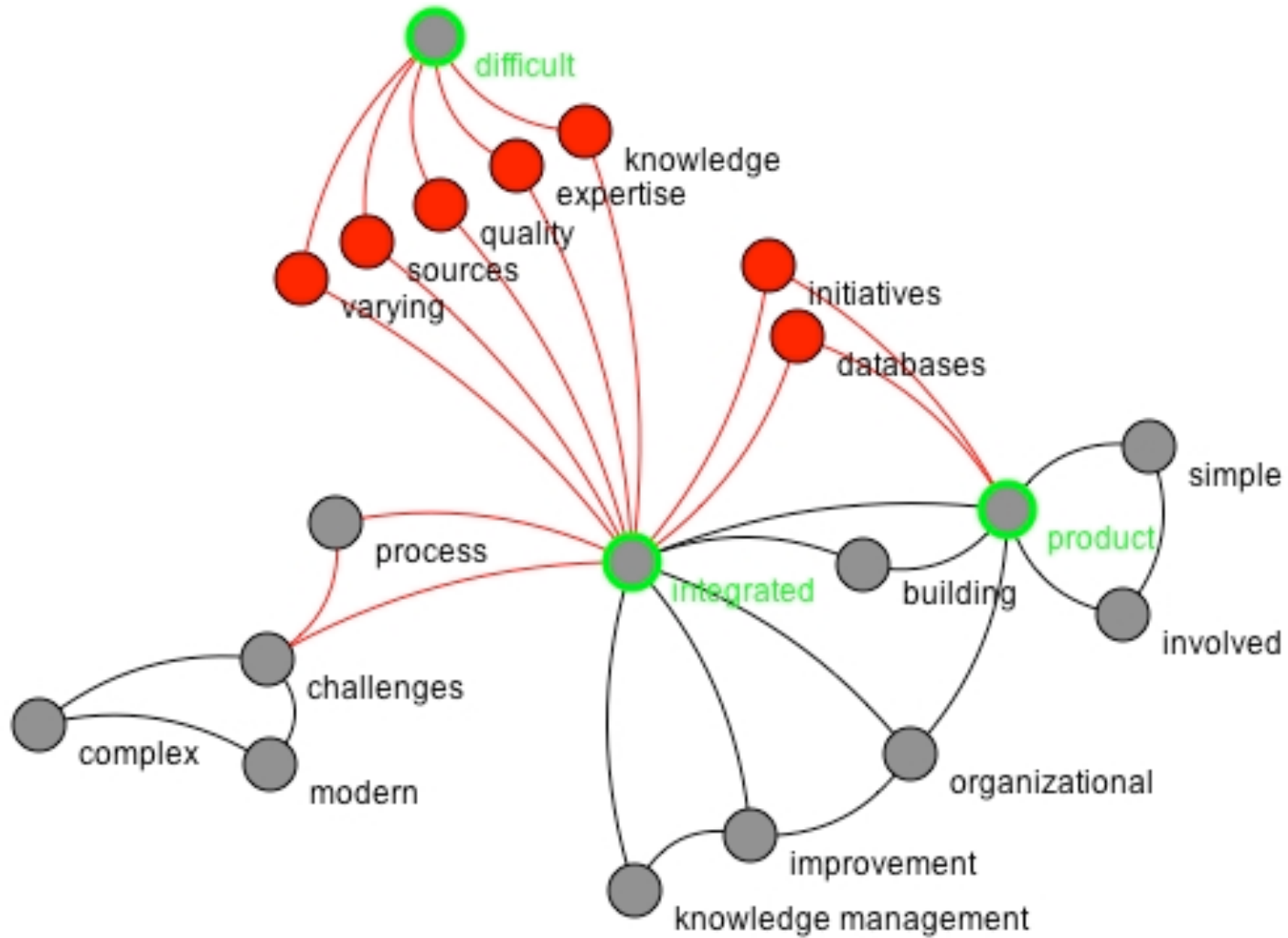
- Given a set of sequences of events
  - $D = \{ [e_0, e_1, e_2, \dots e_{n_0}], [e_0, e_1, e_2, \dots e_{n_1}], \dots [e_0, e_1, e_2, \dots e_{n_k}] \}$
- The goal is to identify low frequency events (chances) that co-occur with high frequency events.
- A set of events may be generated by
  - Mail exchanges
  - Shopping carts
  - Conversation logs
  - ...
- A document, or conversation,  $D$  contain sets of events (phrases) and events (words)





# What is a KeyGraph? (II/II)

<http://www-discus.ge.uiuc.edu>



— High frequency  
  — Low frequency  
  Keyword



# A DISCUS and KeyGraphs

Resources

[- Knowledge Center Mining](#) - [- Google Search](#) - [- Solution center](#) - [- KeyGraph Analysis](#)

Discussion Board

## Houses

| [Start new thread](#) | [Show all bodies](#) | [Hide all bodies](#) |

Pages: < 1 2

+ **Air conditioner** · Portercircle · replies: 11 📅 May 26, 2004 - 7:21 PM

+ **Transcontinental influence** · xllora · replies: 8 📅 May 26, 2004 - 7:43 PM  
 | [Post Reply](#)

In late 18XX and early 19XX there was a strong japanese influence in western culture. For instance, impresionist were fascinated with japanese prints. They even reproduce some of the prints in their pictures. The samne think can be seen in some architectes, such as Frank Lloyd Wrihth. He was greatly influenced by japanes house, and that was clearly reflected in some of k influences still remain in US : the main reason for not havin

*Keywords:*  
house influence clear

**Attachment(s):**  
[frank-loyd-wright-home-stud](#)  
[frank-loyd-wright-robie-exte](#)  
[frank-loyd-wright-robie-living](#)

+ **The global KeyGraph?** ·

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Discussion

- ◆ Houses
- ◆ Resources

User Information

Xavier Llorà (xllora)  
DISCUS administrator

[Close window]

Logged Users

+ Online Members  
+ My DISCUSsions (14)

Solution Center

+ Housing  
 Air conditioning is a must.



# How Can I Compute a KeyGraph?

## Document Processing (D')

- Document compactation (stop-word removal and word stemming)
- Phrase construction (most frequent work combinations)

## Extraction of high-frequency terms ( $N_{hf} \subset D'$ )

## Extracting links for all $N_{hf} \subset D'$ (top ranking association)

$$key(w) = 1 - \prod_{g \subset G} \left[ 1 - \frac{based(w, g)}{neighbors(g)} \right] \quad based(w, g) = \sum_{s \in D'} |w|_s \cdot |g - w|_s,$$

$$neighbors(w) = \sum_{s \in D'} \sum_{w \in s} |w|_s \cdot |g - w|_s,$$

- Extracting key links among  $N_{hf}$  and  $N_{hf}$  using the *assoc* metric
- Keyword identify useful bridges among clusters ( $N_{hf} \cup N_{hf}$ )



But, Aren't We Talking About A Group Activity?



# Influence Diffusion Models

## 🔷 Influence Diffusion Model (IDM)

- Analyze the influence factors in a communication
- Two main influence factors:
  - Turning point messages
  - Role play identification

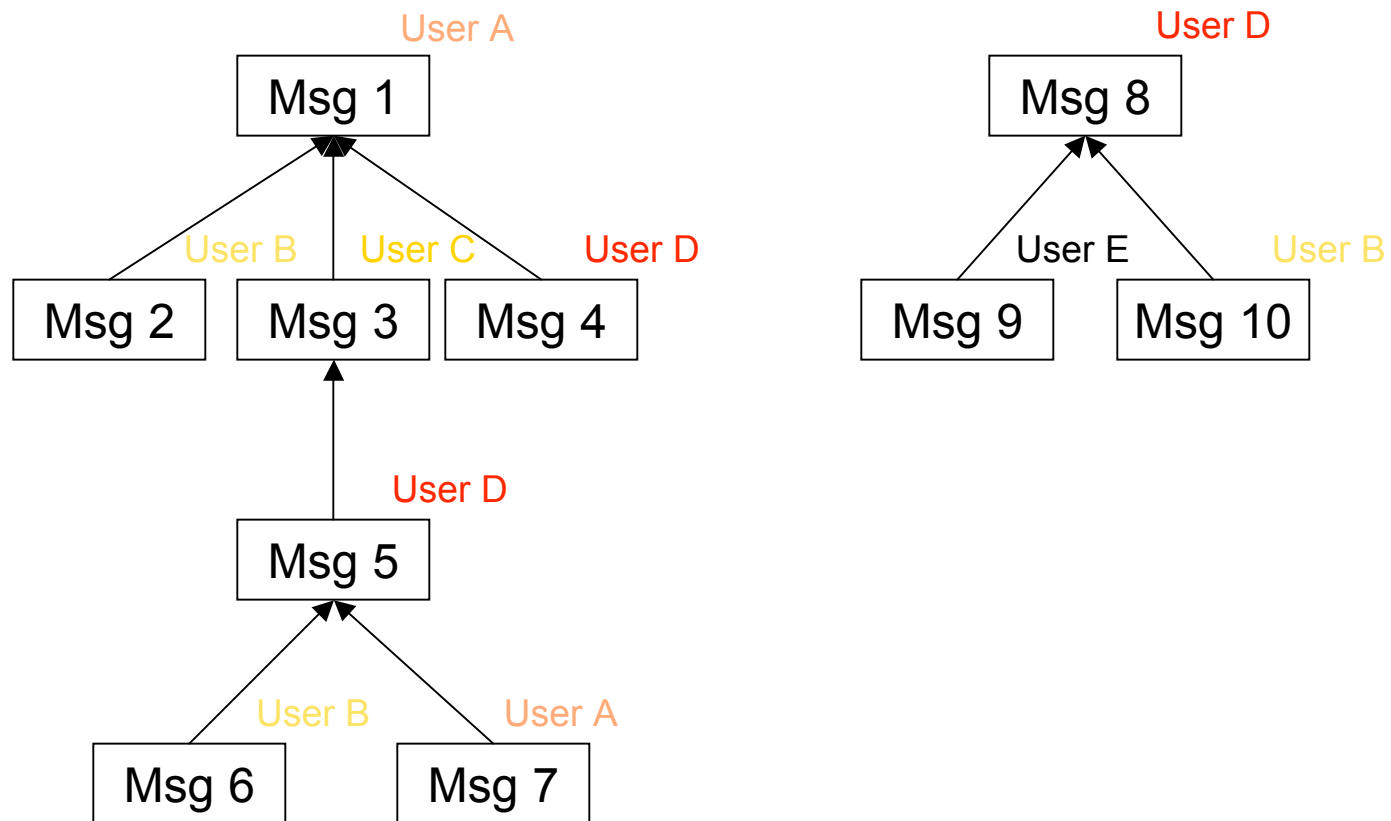
## 🔷 Help identify communication roles and blocks

- Strong opinion leaders (trend creators)
- Communication facilitators (trend publishers)
- Critical mass for a blossom communication (early adopters)
- Communication dumper (slow adopters)
- Disruptors (rejecters)



# Structure on an On-line Communication

## IDM and structured bulletin boards





# Some Details on IDM

🔷 Influence from a message  $x$  on a reply  $y$

$$i_{x,y} = |w_x \cap w_y| / |w_y|$$

🔷 Influence chain of a message  $x$  on a reply  $z$  to a reply  $y$

$$i_{x,z} = |w_x \cap w_y \cap w_z| / |w_z| \times i_{x,y}$$

🔷 Messages can be ranked by their influence  $i_k$

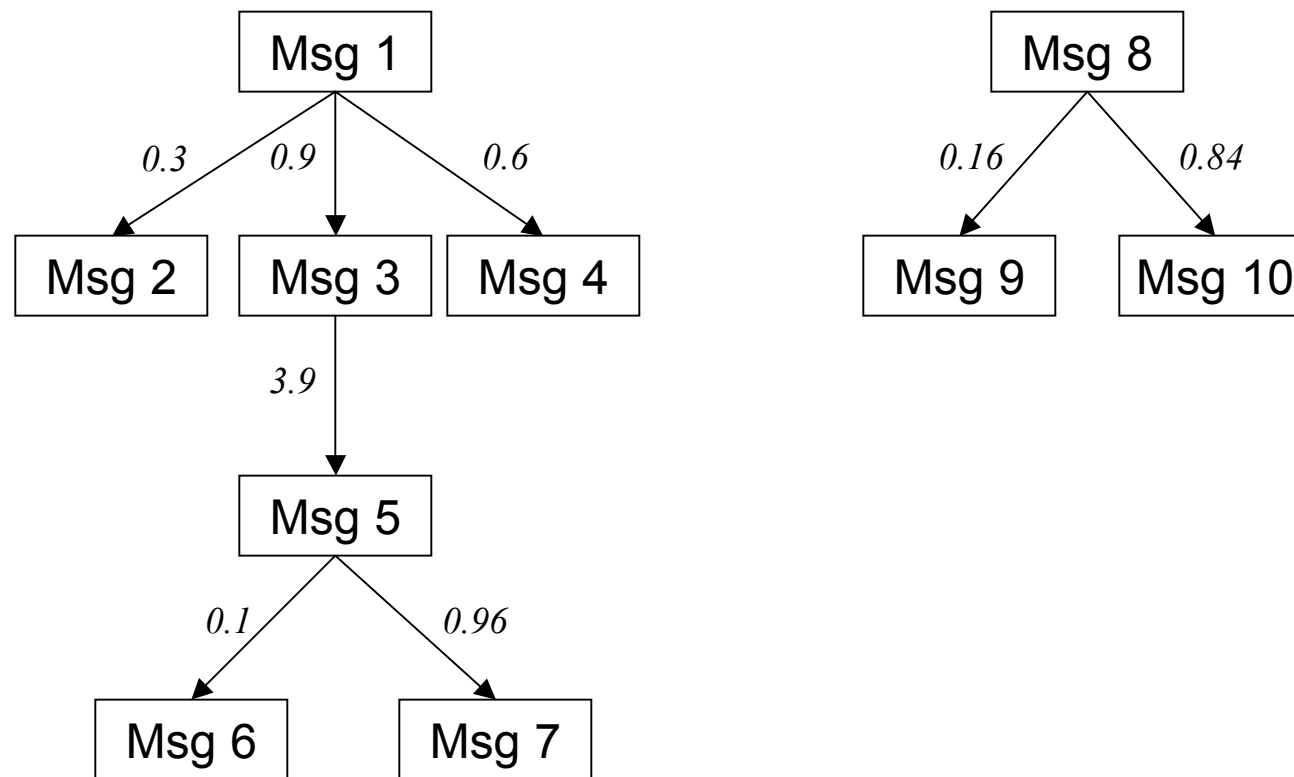
🔷 Participants

- can be ranked by the influence of their messages
- form a social network of influence



# Influence on an On-line Communication

## IDM and structured bulletin boards

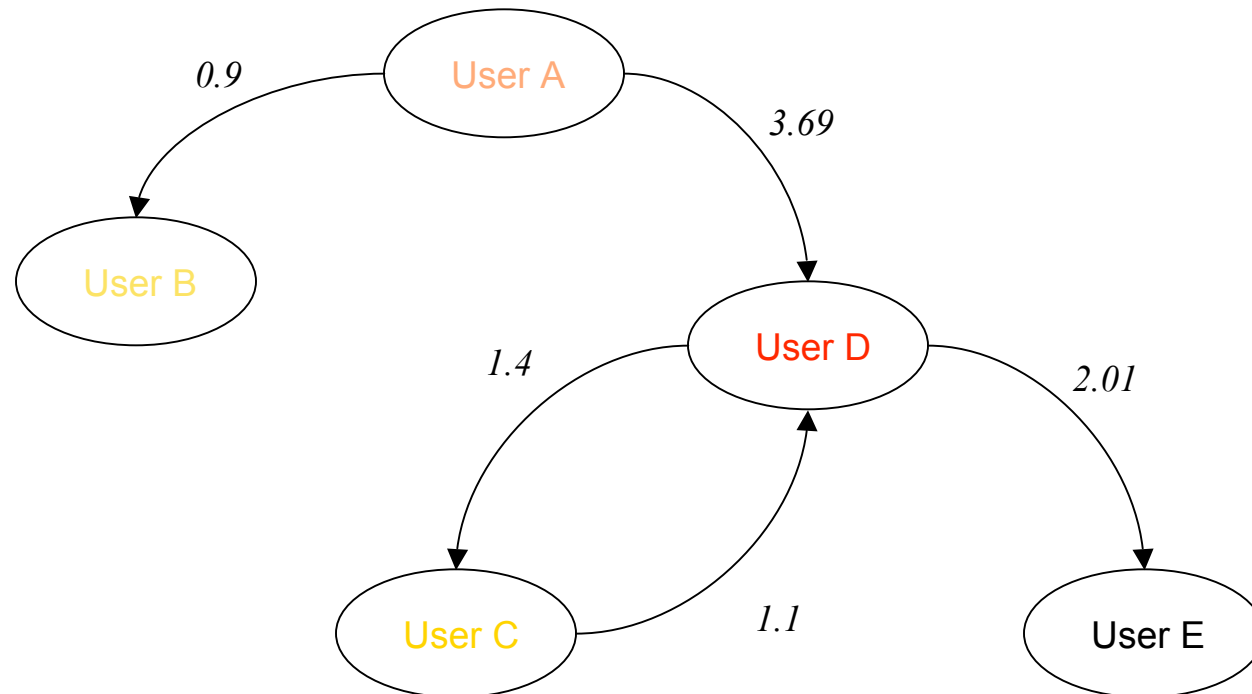







# Influence on an On-line Communication

## IDM and Social Network of Influence





# A Real Prototype



Resources
- Knowledge Center Mining - Google Search - Solution center - KeyGraph Analysis

Discussion Board


## Houses

| [Start new thread](#) | [Show all bodies](#) | [Hide all bodies](#) |

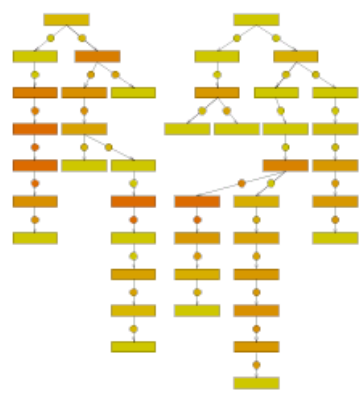
Pages: [«](#) [1](#) [2](#)

+ Air conditioner · Portercircle · replies: 11
May 26, 2004 - 7:21 PM


+ Transcontinental influence · xllora · replies: 8
May 26, 2004 - 7:43 PM


[Post Reply](#)

In late 18XX and early 19XX there was a strong japanese influence in western culture. For instance, impresionist were fascinated with japanese prints. They even reproduce some of the prints in their pictures. The samne think can be seen in some architectes, such as Frank Lloyd Wriigth. He was greatly influenced by japanes house, and that was



) Some of this of space in Japan is one?

ted 

29733 bytes  
 33530 bytes  
 25080 bytes

May 26, 2004 - 7:33 PM

Discussion

- ◆ Houses
- ◆ Resources

User Information

Xavier Llorà (xllora)  
DISCUS administrator

[Close window]

Logged Users

Online Members

- + My DISCUSsions (14)

[Launch](#)

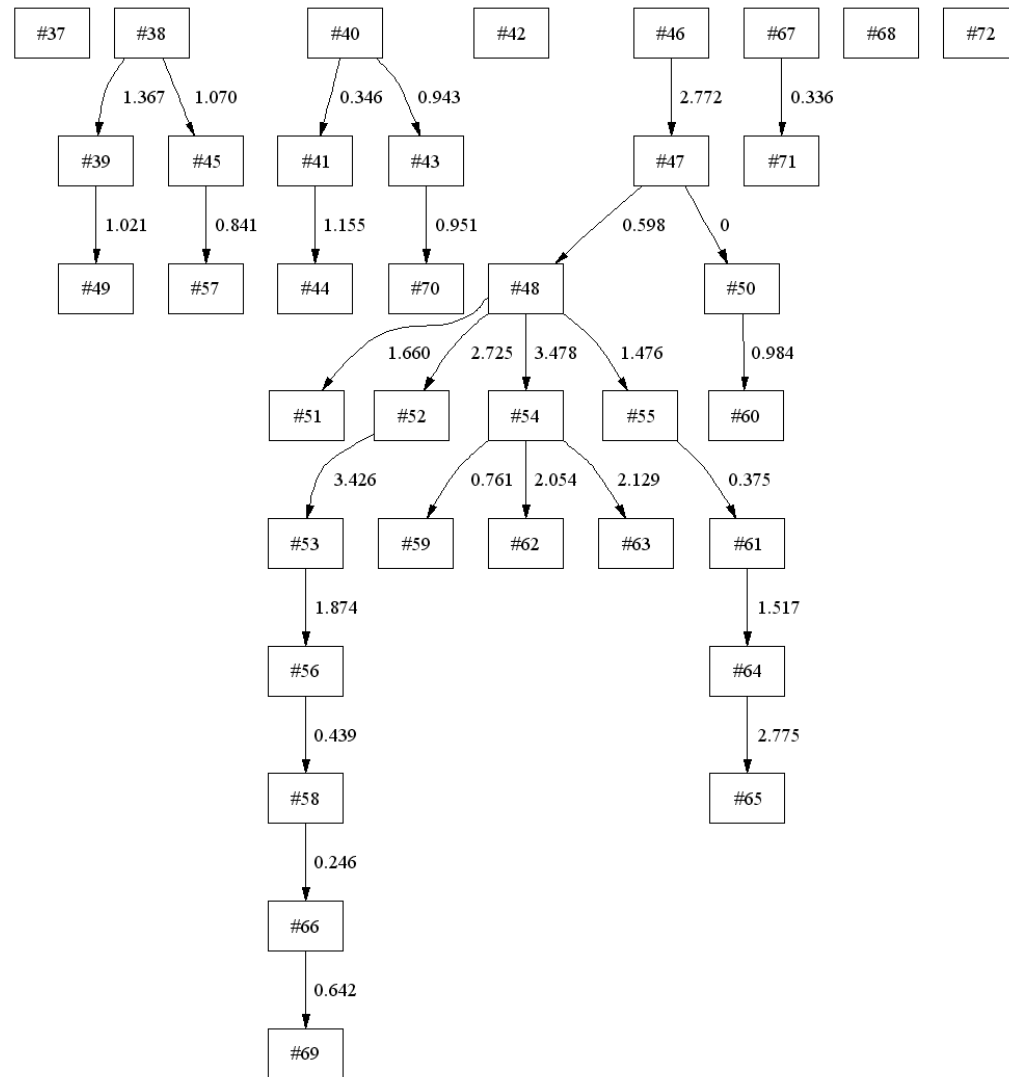
Solution Center

- + Housing
  - Air conditioning is a must.

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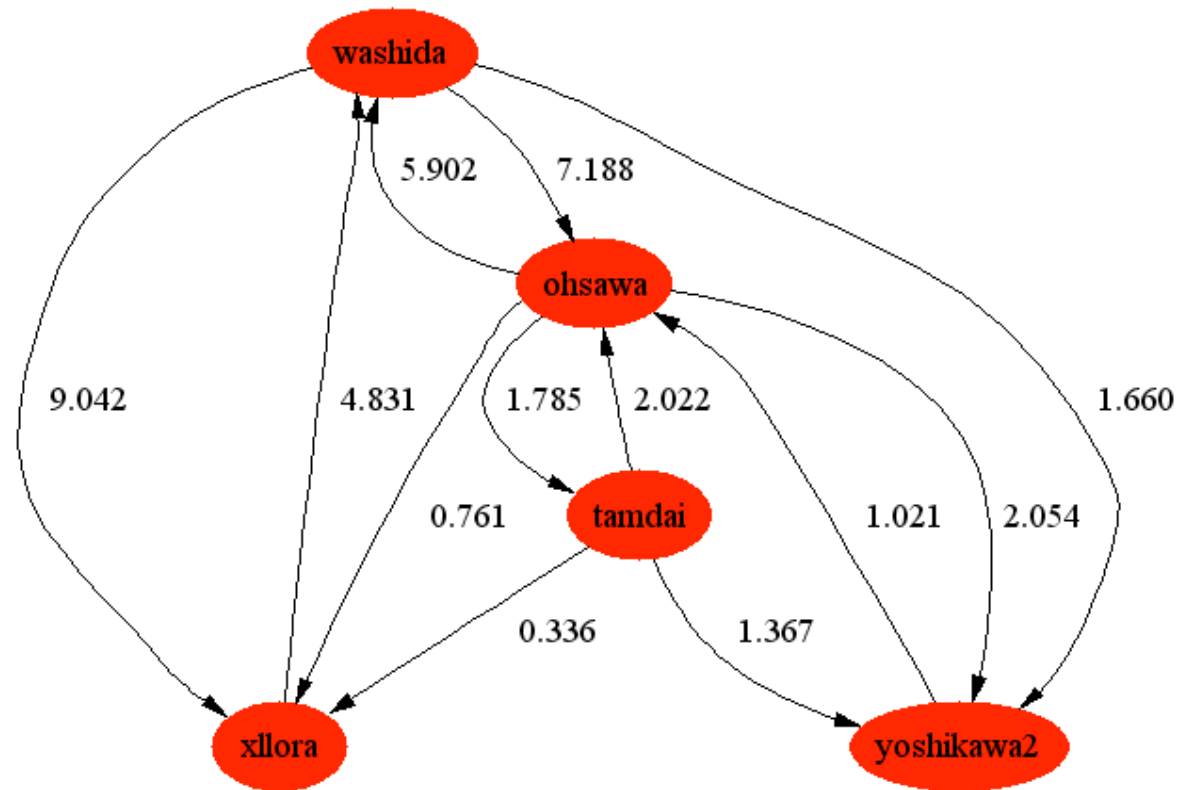


# A Real Marketing DISCUSSION





# A Real Marketing DISCUSSION





And Where is The GA?




# Human-Based Genetic Algorithms

- ▶ A simple collaborative effort (*Kosorukoff & Goldberg, 2002*)
- ▶ A pool of possible future scenarios and chances
- ▶ Two activities: selection and scenario creation
- ▶ Scenarios and chances are generated by participant
  - Free form creation
  - Recombine previous scenarios
  - Guided process supported by chance discovery techniques
- ▶ Group activity
  - One or more groups
  - Sequential or parallel activities
  - Different degrees of connectivity and information exchange

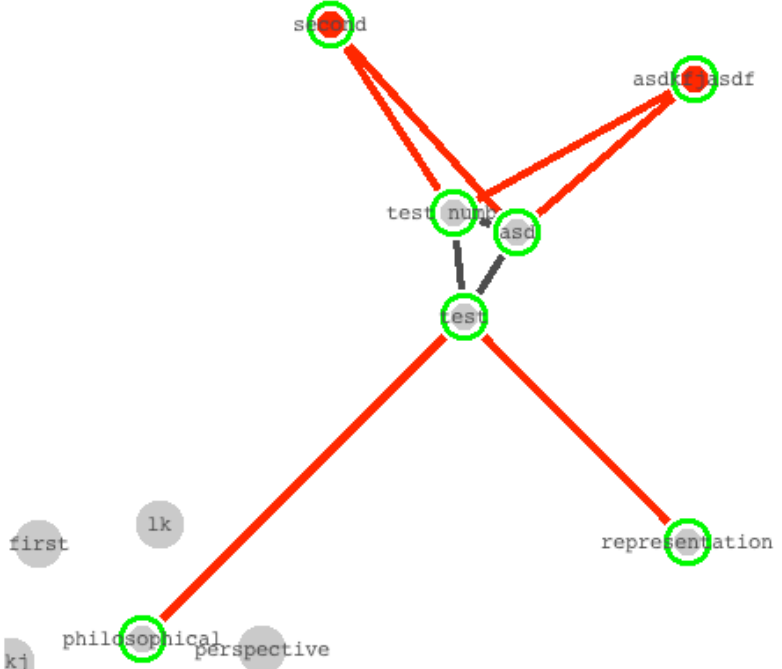




# How Chance Discovery Can Support Creativity?



Solution Center - Innovation Guided Solution Input Form



Type a new innovation guided solution

**List of Keywords:**

- [peirce](#)
- [test number](#)
- [american](#)
- [asd](#)
- [test](#)
- [aristotle](#)
- [asdkfjasdf](#)
- [philosophical](#)
- [referred](#)
- [representation](#)
- [second](#)
- [sometimes](#)

Discussion Subject

- XMB-Test

User Information

Xavier Llorà (xllora)  
DISCUS administrator

[Close window]

Logged Users

Online Buddies

My DISCUSsions

- XMB-Test
- Analysis of Female D
- Single Females Mob
- Mobile Phone for Sir
- Mobile phone
- DISCUS

[\[Close window\]](#)

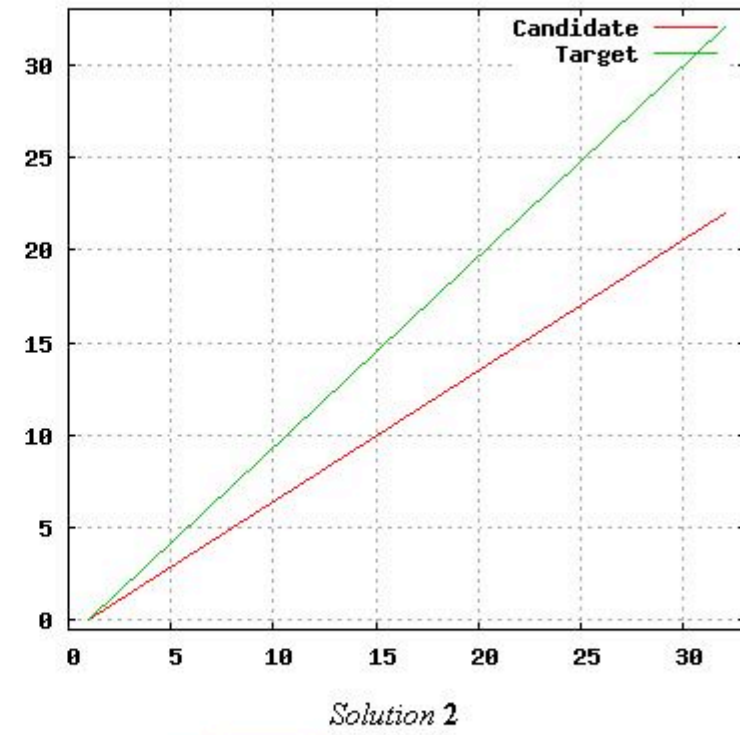
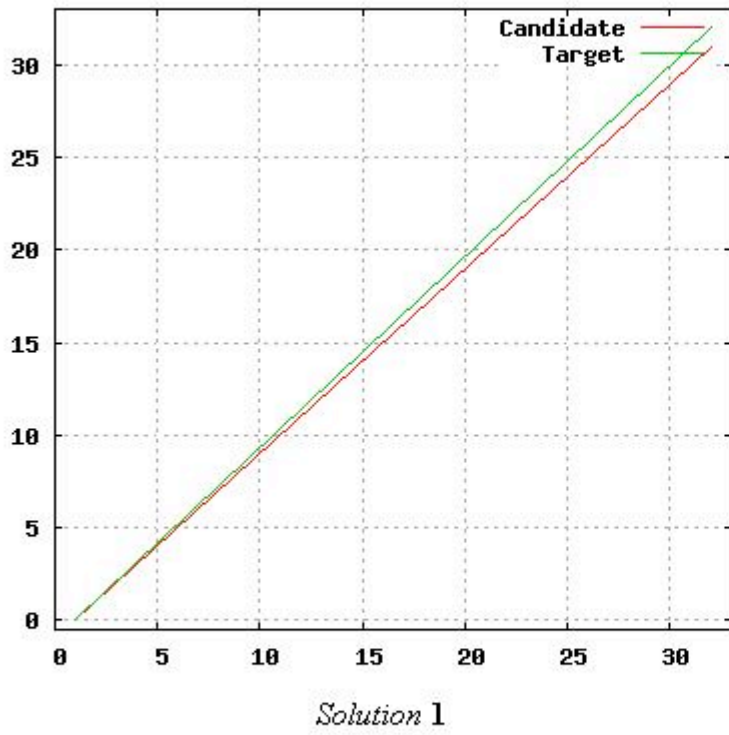
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# DISCUS, IGA, & Research

Current session status: *Iteration 1. Comparison 16.*

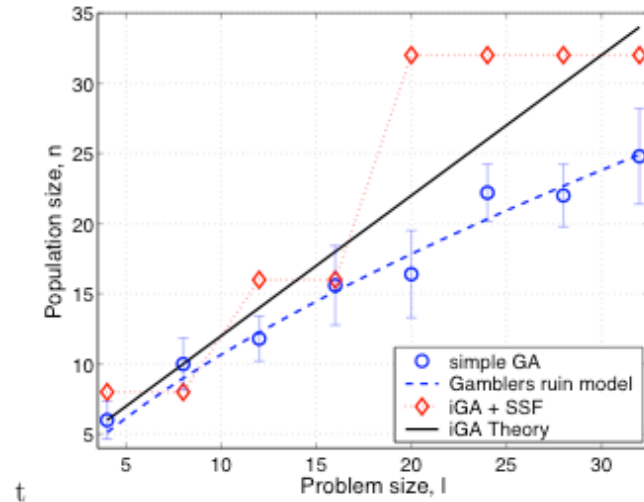


Please, select the best solution:

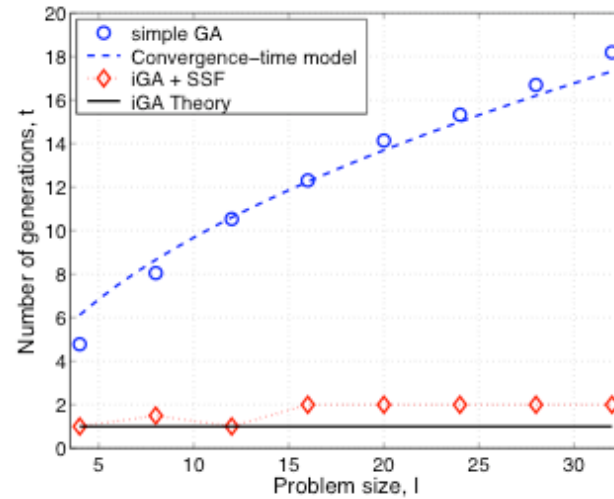
- None
- Solution 1
- Solution 2
- None

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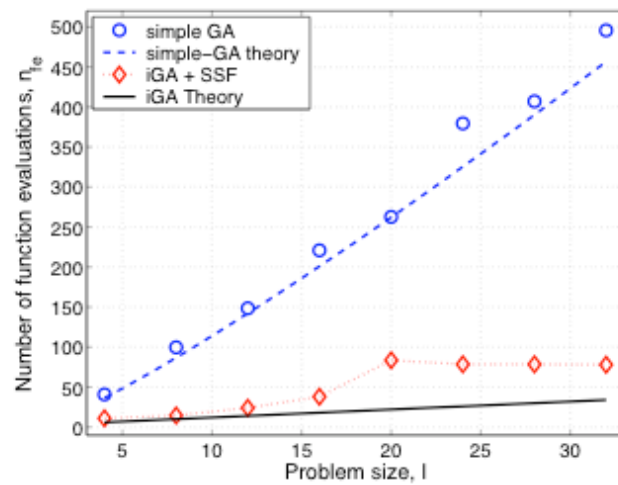
# DISCUS, IGA, & Research



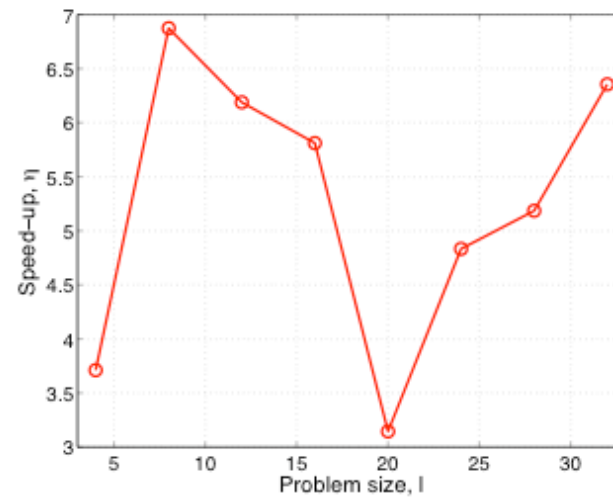
(a) Population Size



(b) Convergence Time



(c) Function Evaluations



(d) Speed up



Let's D.I.S.C.U.S. it!  
These are not Castles in the Air



# DISCUS 2.2 Functionalities

## Group management

- User information and profiling
- Dynamic group formation and management
- Leader identification (owner)

## Discussions, models, and data sources

- Flexible discussion definition
- Grant/revoke access to models and data sources
- Dynamic management by the discussion owner

## Analysis tools

- Automatic web crawlers
- Document analysis



# DISCUS 2.2 Functionalities

## Collaborative support

- Asynchronous collaboration (bulletin boards)
- Documents and results sharing (via attachments)
- Synchronous collaboration (instant messaging & chat rooms)
- On-line analysis of the discussions using KG & IDM
- Collaborative solution creation using HBGA
- Automated topic guided search
  - Connection to outside search engines
  - Connection to DISCUS archives
- Multilanguage support for western languages
- Questions and answers + bug tracker



# Let's use it

🔷 The big test: *March 2005*

🔷 The players:

- IlliGAL DISCUS members
- Hakuodo Inc. researchers (second largest advertisement company in Japan)

🔷 The goal:

- Future trends in the cell phone market

🔷 The participants:

- Members of the University of Illinois campus (mostly students)



# The Process and DISCUS

- ▶
▶
▶
 (1) Global Habit data base analysis
- ▶
▶
▶
 (2) Profile identification for potential participants
- ▶
▶
▶
 (3) Questionnaire collection (100 participants)
- ▶
▶
▶
 (4) Participant clustering and selection
  - 50 participants split on 10 focus groups
- ▶
▶
▶
 (5) Online focus groups analysis
  - KeyGraphs
  - Influence Diffusion Models
- ▶
▶
▶
 (6) Scenario creation
- ▶
▶
▶
 (7) Scenario evaluation

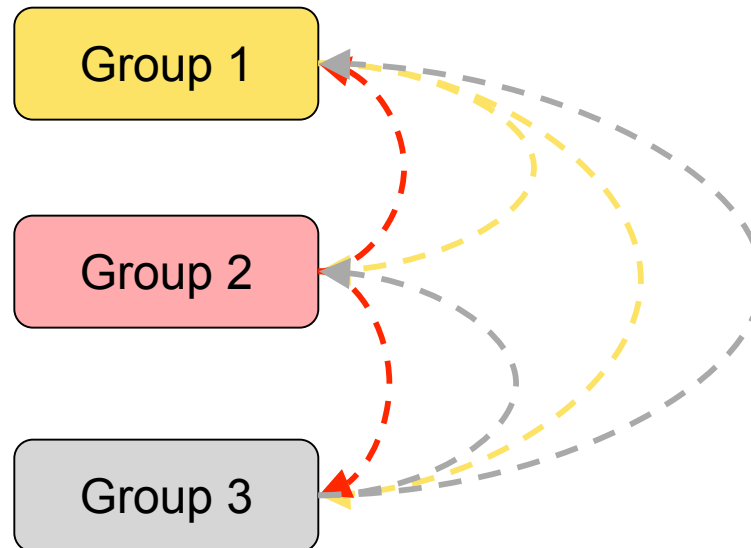


# DISCUS and Focus Groups

## Sequential information sharing



## Parallel information sharing



## Mixed configurations





# Getting The Focus Group Ready





# Through a DISCUS Glass

- An initial question was posted
- Participants were only allowed to communicate using DISCUS
- The conversation was examined by researchers using the DISCUS tools
- A second question was posted after the initial discussion
- The new conversation was also analyzed
- New scenarios were created
- Participants evaluate each of the scenarios proposed



# Focus Groups



 DISCUS



 DISCUS



# Researchers

 DISCUS ←



→  DISCUS





# What Did the Participants See?





# A Real Prototype

Resources

[- Knowledge Center Mining](#) - [- Google Search](#) - [- Solution center](#) - [- KeyGraph Analysis](#)

Discussion Board

## Houses

| [Start new thread](#) | [Show all bodies](#) | [Hide all bodies](#) |

Pages: « 1 2

**Air conditioner** · Portercircle · replies: 11
May 26, 2004 - 7:21 PM

**Transcontinental influence** · xllora · replies: 8
May 26, 2004 - 7:43 PM

| | | [Post Reply](#)

In late 18XX and early 19XX there was a strong japanese influence in western culture. For instance, impresionist were fascinated with japanese prints. They even reproduce some of the prints in their pictures. The samme think can be seen in some architects, such as Frank Lloyd Wrigh. He was greatly influenced by japanes house, and that was clearly reflected in some of his houses (I've attached some pictures) Some of this influences still remain in US architecture. Do you think that the lack of space in Japan the main reason for not having a kind of urbanism closer to the US one?

*Keywords:*  
house influence clearly greatly pictures reflected

Attachment(s):

frank-lloyd-wright-home-studio.jpg	29733 bytes
frank-lloyd-wright-robie-exterior.jpg	33530 bytes
frank-lloyd-wright-robie-livingroom.jpg	25080 bytes

**Transcontinental influence** · Portercircle · replies: 5
May 26, 2004

**Transcontinental influence** · tarndai · replies: 0
May 26, 2004

**Transcontinental influence** · fli · replies: 0 · *unread*
May 26, 2004

**The global KeyGraph?** · Yukio · replies: 2
May 26, 2004 - 7:33

Pages: « 1 2

Discussion

- Houses
- Resources

User Information

Xavier Llorà (xllora)  
DISCUS administrator

[Close window]

Logged Users

- Online Members (1)  
Yukio
- My DISCUSsions (11)  
Cleaner Demo  
Demo for Cleaner

frank-lloyd-wright-robie-living...

DISCUS © 2003 IBM/ALU/SA/UTUC



# A Real Prototype

The screenshot displays a web browser window titled "DISCUS: Distributed Innovation and Scalable Collaboration in Uncertain Settings - Microsoft Internet Explorer". The browser shows a "Resources" page with a "Discussion Board" section. The "Houses" topic is expanded, showing a discussion about "Air conditioner" and "Transcontinental influence". A chat window titled "Room: xlloraYukio - User: xllora" is open, showing a conversation about Japanese influence on houses. A graph visualization is displayed in the center, showing nodes for "japanese", "influence", "culture", "house", "prints", and "western". The graph shows connections between "japanese", "influence", "culture", and "house".

**Resources**

DISCUS

[- Knowledge Center Mining - Google Search - Solution center - KeyGraph Analysis]

**Discussion Board**

**Houses**

Air conditioner · Port

Transcontinental influence

In late 18XX and early 19XX, for instance, impressionism and some of the prints in the style, such as Frank Lloyd Wright's, were clearly reflected in some of the influences still remain in the main reason for not having a kind of urbanism closer to the US one?

*Keywords:*  
house influence

Attachment(s):

**Room: xlloraYukio - User: xllora**

Chat

think that the lack of space in Japan is the main reason for not having a kind of urbanism closer to the US one?

Yukio: Yes, that kind of house display a clear Japanese influence

xllora: However, I have the feeling that they only share the look, being later westernized

Yukio: Culture and tradition have a great influence on what people want from a house.

Yukio:

Actions

Message:  Send

Java Applet Window

graph.graphlayout.GraphLayoutApplet started

Messages: U · unread

May 26, 2004 - 7:50 PM

2


May 26, 2004 - 7:33 PM

« 1 2



# A Real Prototype

Resources



[- Knowledge Center Mining](#) - [- Google Search](#) - [- Solution center](#) - [- KeyGraph Analysis](#)

**Discussion Board**


Houses

[| Start new thread](#) | [| Show all bodies](#) | [| Hide all bodies](#) |


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DISCUS

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**Discussion**

- ◆ Houses
- ◆ Resources

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Online Members  
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**Solution Center**

+ Housing

Air conditioning is a must.

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CONCEV 2005

52





# The Take Away Message

## 🔷 The question:

*“Could it be possible to take advantage of computer-mediated communication nature to support human innovation and creativity processes?”*

## 🔷 The Answer:

*Yes*

## 🔷 The key elements to successfully support innovation and creativity

- Genetic algorithms
- Chance discovery
- Collaboration tools over the net
- Data and text analysis tools



# More Information

## 🔗 Contact us

- Xavier Llorà ([xllora@illigal.ge.uiuc.edu](mailto:xllora@illigal.ge.uiuc.edu))
- David E. Goldberg ([deg@illigal.ge.uiuc.edu](mailto:deg@illigal.ge.uiuc.edu))

## 🔗 Visit


- DISCUS site (<http://www-discus.ge.uiuc.edu/>)
- IlliGAL blog (<http://illigal.blogspot.com/>)
- IlliGAL web site (<http://www-illigal.ge.uiuc.edu/>)

## 🔗 Book:

- Goldberg, D. E. (2002). *The Design of Innovation*. Boston, MA: Kluwer Academic, (<http://www-doi.ge.uiuc.edu/>)



# A Real Prototype



## Login

User:

Password:

[\[New User\]](#)

**Login Tips**  
Username and password are case sensitive. Please, check your keyword configuration.

**Available languages**

- Catalan
- English


**Problems?**  
Do you have a question? Do you want to report a bug?

[Brief us!](#)

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# A Real Prototype



Ongoing discussions

Discussion	Description			
<a href="#">Houses</a>	What is the most important feature of a house, if you think of buying one?			
Owner	Discussion type	Discussing group	Current state	Starting date
<a href="#">Matsumura, Naohiro (nao)</a>	<a href="#">Resource</a>	<a href="#">Houses</a>	Running	2004-05-25

Discussion	Description			
<a href="#">Car</a>	What is the most important feature of a car, if you think of buying one?			
Owner	Discussion type	Discussing group	Current state	Starting date
<a href="#">Administrator, DISCUS (admin)</a>	<a href="#">Resource</a>	<a href="#">DISCUS team</a>	Running	2004-05-26

Discussion	Description			
<a href="#">Scenarios</a>	Let's purify our scenarios about "Houses" or "Life style with a car".			
Owner	Discussion type	Discussing group	Current state	Starting date
<a href="#">Administrator, DISCUS (admin)</a>	<a href="#">Resource</a>	<a href="#">DISCUS team</a>	Running	2004-05-27











Owned discussions

User Information

Yukio Ohsawa (*Yukio*)  
*Guest on-line user*

[Logout]

Logged Users

-  Feipeng Li (*fi*)
-  Yong Liu (*ylu88*)
-  Naohiro Matsumura (*nao*)
-  Yukio Ohsawa (*Yukio*)
-  Rob Schultz (*rschultz*)
-  Hiroshi Tamura (*tamda*)
-  Dave Washburn (*dave\_washburn*)
-  Hua Xie (*huaxie*)
-  Masataka Yoshikawa (*yoshikawa3*)
-  Daniel Zhang (*dczhang*)

Available languages

- Catalan
- English

Problems?

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Discussion Board

**Houses**

[| Start new thread](#) | [Show all bodies](#) | [Hide all bodies](#) |

Pages: « 1 2

**Air conditioner** · Portercircle · replies: 11 ☑ May 26, 2004 - 7:21 PM

**Air conditioner** · nao · replies: 1 ☑ May 26, 2004 - 6:37 PM

**Air conditioner** · xllora · replies: 8 ☑ May 26, 2004 - 7:21 PM

**Air conditioner** · Portercircle · replies: 1 ☑ May 26, 2004 - 6:54 PM

**Air conditioner** · xllora · replies: 0 ☑ May 26, 2004 - 6:54 PM

**Air conditioner** · tamdai · replies: 0 ☑ May 26, 2004 - 6:35 PM

**Air conditioner** · chenju · replies: 4 ☑ May 26, 2004 - 7:21 PM

**Transcontinental influence** · xllora · replies: 8 ☑ May 26, 2004 - 7:43 PM

**Transcontinental influence** · Portercircle · replies: 5 ☑ May 26, 2004 - 7:43 PM

**Transcontinental influence** · tamdai · replies: 0 ☑ May 26, 2004 - 7:07 PM

**Transcontinental influence** · fli · replies: 0 · *unread* ☑ May 26, 2004 - 7:30 PM

**The global KeyGraph?** · Yukio · replies: 2 ☑ May 26, 2004 - 7:33 PM

**The global KeyGraph?** · xllora · replies: 1 ☑ May 26, 2004 - 7:33 PM

Pages: « 1 2

Discussion

- Houses
- Resources

User Information

Xavier Llorà (*xllora*)  
DISCUS administrator

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  - Yukio
- My DISCUSsions (11)
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  - Demo for Cleaner
  - LLGA
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  - Scenarios
  - Car
  - Houses
  - Demo for supermanq
  - A discussion to show

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Discussion Board
Discussion

## Houses

| [Start new thread](#) | [Show all bodies](#) | [Hide all bodies](#) |

Pages: « 1 2 »

**Air conditioner** · Portercircle · replies: 11
May 26, 2004 - 7:21 PM

**Transcontinental influence** · xlora · replies: 8
May 26, 2004 - 7:43 PM

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In late 18XX and early 19XX there was a strong japanese influence in western culture. For instance, impresionist were fascinated with japanese prints. They even reproduce some of the prints in their pictures. The samne think can be seen in some architectes, such as Frank Lloyd Wrighth. He was greatly influenced by japanes house, and that was clearly reflected in some of his houses (I've attached some pictures) Some of this influences still remain in US architecture. Do you think that the lack of space in Japan is the main reason for not having a kind of urbanism closer to the US one?

*Keywords:*  
house influence clearly greatly pictures reflected

Attachment(s):

frank-lloyd-wright-home-studio.jpg	29733 bytes
frank-lloyd-wright-robie-exterior.jpg	33530 bytes
frank-lloyd-wright-robie-livingroom.jpg	25080 bytes

**Transcontinental influence** · Portercircle · replies: 5
May 26, 2004 - 7:43 PM

**Transcontinental influence** · tamdai · replies: 0
May 26, 2004 - 7:07 PM

**Transcontinental influence** · fli · replies: 0 · *unread*
May 26, 2004 - 7:30 PM

**The global KeyGraph?** · Yukio · replies: 2
May 26, 2004 - 7:33 PM

Pages: « 1 2 »

- Houses
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User Information

Xavier Llorà (*xlora*)  
DISCUS administrator

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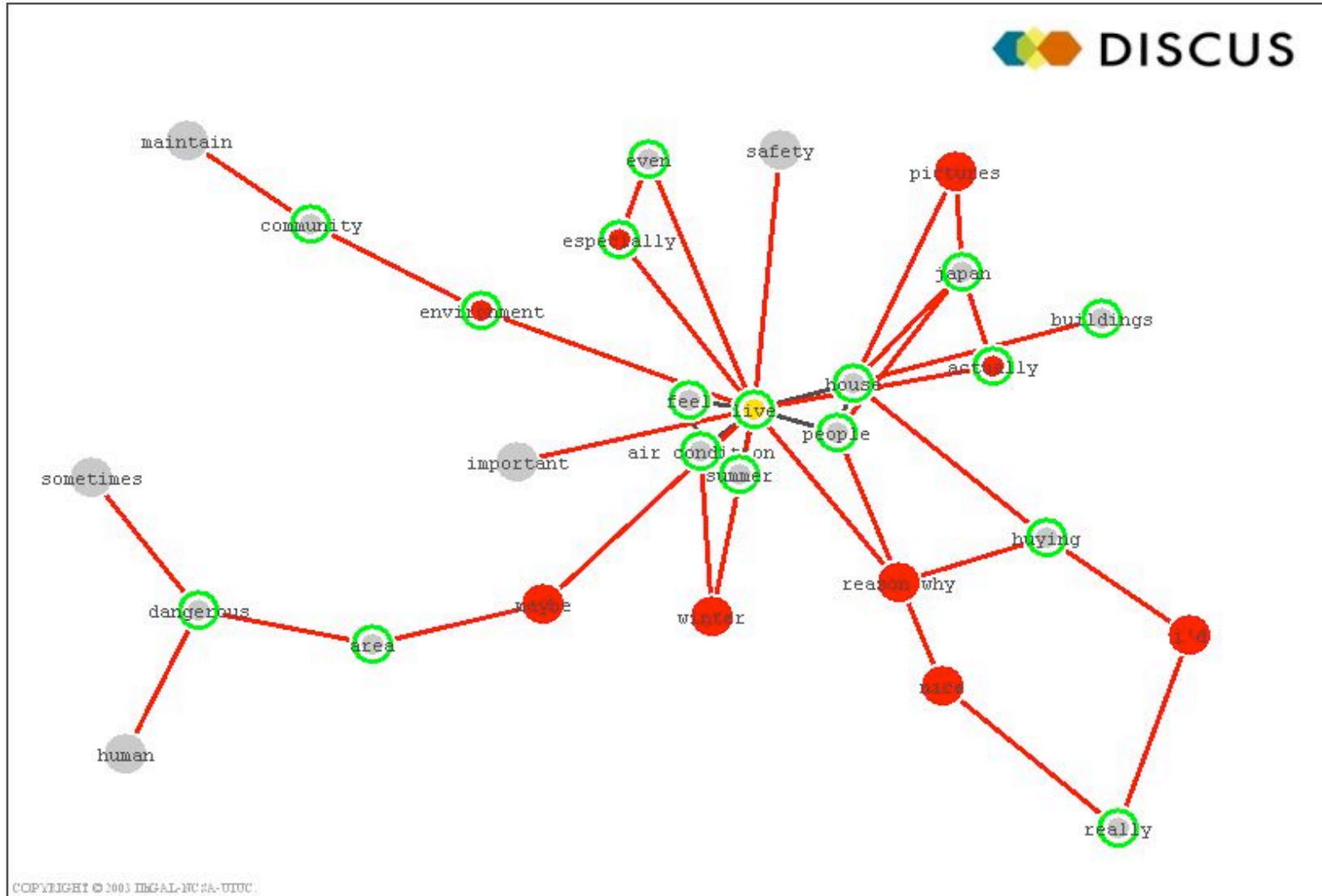
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Xavier Llorà

58



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Resources DISCUS

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Discussion Board Discussion

Houses

- [-] Air conditioner · Portercircled
- [-] Air conditioner · nao ·
- [-] Air conditioner · xllora
- [-] Transcontinental influence
- [-] The global KeyGraph? · Y

First I came to the States, I fo regarding the usage of air con conditioners are indispensable States, especial, in the northe conditioners in the room all the conditioners at windows, and interesting.

Keywords: feel air conditioners

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Google Search: air conditioners - Microsoft Internet Explorer

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**Houses** | Start new thread | Show all bodies | Hide all bodies

Discussion

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DISCUS

**2 Groups**  
**3 Clusters**  
**12 Documents**

**Theme: xavier web urbana tqe time**  
[engineering education department illinois urbana](#)

**reform EDUCATION Engineering** 8  
Document ID: 2488 Last modified: Tue, 11 Aug 1998, 13:10:10 CDT Language: en  
 Charset: iso-8859-1 Size: 84485 Session 2525 Teamwork for a Quality  
 Education: 1Low-Cost, Effective Edu ...  
<http://gal11.ge.uiuc.edu/cgi-bin/search.cgi?cc=1&URL=ftp:%2F%2Fgal4.ge.uiuc...>

**llor xavier catalunya el agencies** 1  
Xavier Llor - The Net  
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**9 documents in 2 clusters**

**Theme: visa pictures application delhi house**  
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**Requirements** 3  
Next: Procedure Up: Visa Previous: Visa Requirements Take the following documents  
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**3 documents in 1 clusters**

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Category	Count
MGA chr stack	1
mnoGoSearch software web	2
GALE GE classes	3
IlliGAL Links Genetic	4
algorithms problem GAS	5

**Theme: gale ge classes uiuc illigal (11)**

11 documents sorted by: Weight

- 823.0 [IBAgent \(GALE reference manual\)](#)  
function asd(){parent.document.title= IBAgent (GALE reference manual) ; Overview □ Package □ Class □ Use □ Tree □ D ...  
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- 815.0 [CLAgent \(GALE reference manual\)](#)  
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Overview (GALE reference manual) - Microsoft Internet Explorer

Overview Package Class Use **Tree** Deprecated Index Help

PREV NEXT FRAMES NO FRAMES All Classes

GALE (**Genetic** and Artificial Life Environment) is fine-grained parallel data mining.

See: [Description](#)

Packages	
<a href="#">edu.uiuc.ge.illigal.gale</a>	Base package for GALE software.
<a href="#">edu.uiuc.ge.illigal.gale.agents</a>	Knowledge representations evolvable
<a href="#">edu.uiuc.ge.illigal.gale.board</a>	Tools for board-based evolution imple
<a href="#">edu.uiuc.ge.illigal.gale.config</a>	Configuration of GALE.
<a href="#">edu.uiuc.ge.illigal.gale.data</a>	Data storage and manipulation tools u
<a href="#">edu.uiuc.ge.illigal.gale.distance</a>	Groups some distance metrics used by
<a href="#">edu.uiuc.ge.illigal.gale.io</a>	Input/Output interface used by GALE

GALE (**Genetic** and Artificial Life Environment) is fine-grained parallel data mining. Its main contributions are simplicity and its knowledge-indepe

Knowledge Miner - Microsoft Internet Explorer

4 Groups  
5 Clusters  
460 Documents

**Theme: algorithms problem gas genetic illinois**

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**BBS GAS Goldberg**  
Document ID: 666 Last modified: Wed, 21 Apr 2004, 13:12:29 CDT Language: en Charset: iso-8859-1 Size: 125930 Analysis of Mixing in Genetic Algorithms: A Survey Kumara Sastri Davi ...  
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