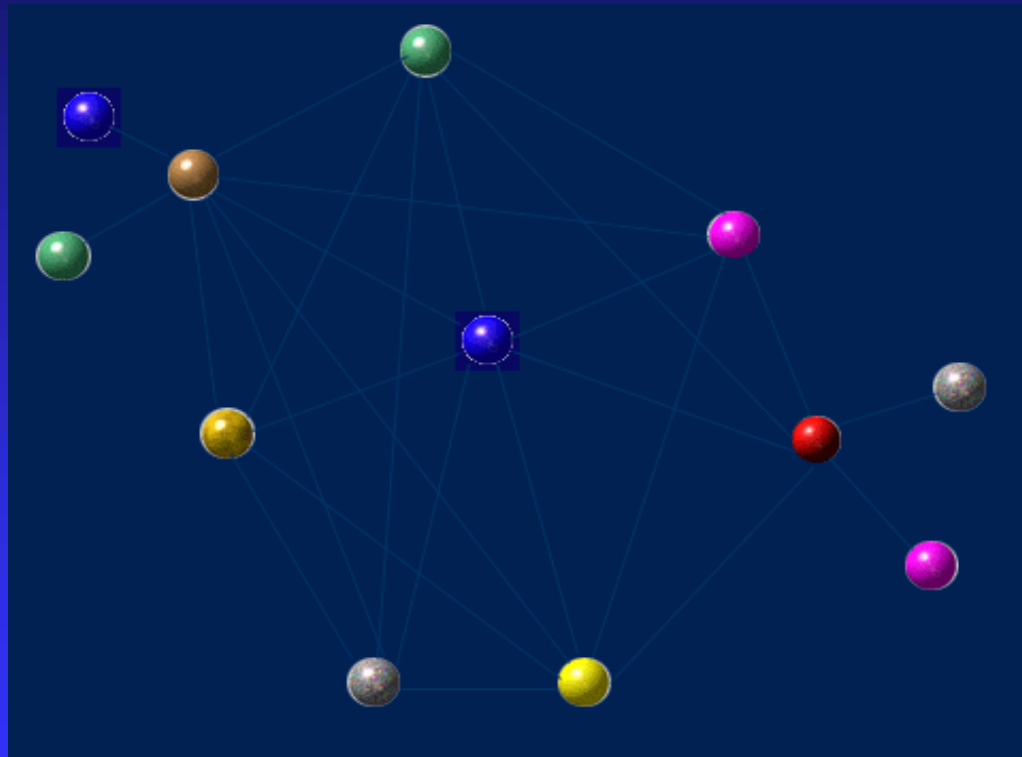


Co-evolution of knowledge networks and 21st century organizational forms



November 4, 2002

Noshir Contractor

University of Illinois at Urbana-Champaign

Lovegety



- 1. Turn on the power and set the MODE button you want with MODE button. You can confirm the MODE you chose as the red indicator blinks.
- 2. Lamp blinks when (someone with) a Lovegety for the opposite sex to yours set under the same MODE as yours comes near.
- 3. FIND lamp blinks when (someone with) a Lovegety for the opposite sex to yours set under some different mode from yours come near. In that case, you may try the other MODES to “GET” tuned with (him/her) if you like.



Wish List: 9 Innovations in Search of Inventors

David Pogue, New York Times, March 28, 2002

OUTLINE

- Multi-theoretical multi-level network perspective
- Communication and knowledge networks
- Theories on the emergence of knowledge networks
- Empirical research on the emergence of knowledge networks

Aphorisms about Networks

■ Social Networks:

◆ Its not what you know, its **who** you know

■ Cognitive Social Networks:

◆ Its not who you know, its **who they think** you know.

■ Knowledge Networks:

◆ Its not who you know, its **what they think** you know.

Cognitive Knowledge Networks

**It's not
who you know.**

**It's what
who you know
knows.**

There's research. And then there's research written by the world's top analysts and strategists. The leading industry authorities on everything from E2B and healthcare to investing in the Pacific Rim. Bottom line? The only people who should be guiding your investment decisions are the people who are truly "in the know." Who measure success one investor at a time. Move your money. Get well connected.

Well Connected

**MORGAN STANLEY
DEAN WITTER**

msdw.com

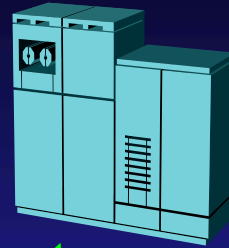
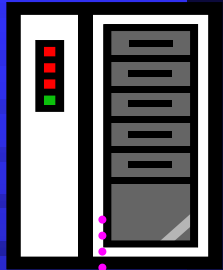
*Source: msdw.com/news, December 1999

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Source: Newsweek,
December 2000

INTERACTION NETWORKS

Non Human Agent to
Non Human Agent
Communication



Non Human Agent
(webbots, avatars, databases,
“push” technologies)
To Human Agent



Publishing to
knowledge repository



Retrieving from
knowledge repository

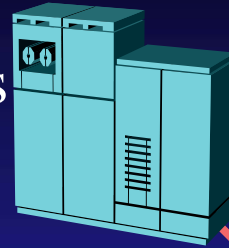


Human Agent to Human Agent
Communication



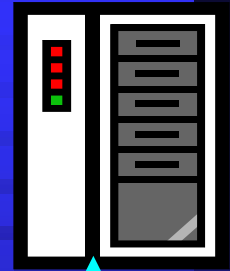
COGNITIVE KNOWLEDGE NETWORKS

Non Human Agent's
Perception of Resources
in a Non Human Agent



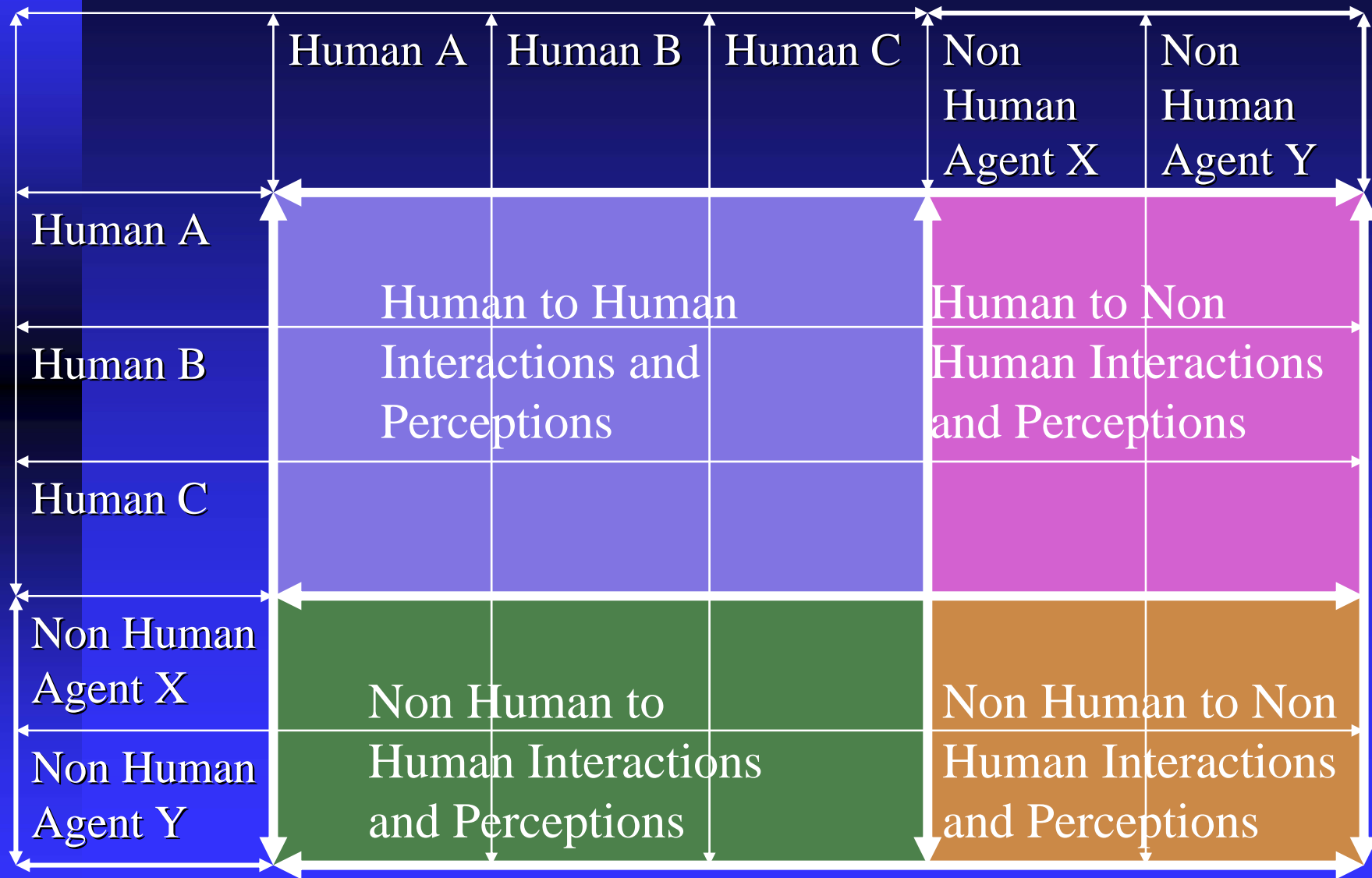
Human Agent's Perception of
Provision of Resources in a
Non Human Agent

Non Human Agent's
Perception of what a Human
Agent knows



Human Agent's Perception of
What Another Human Agent
Knows





Source: Carley, 2001

WHY DO WE
CREATE,
MAINTAIN,
DISSOLVE, AND
RECONSTITUTE OUR
COMMUNICATION AND
KNOWLEDGE NETWORKS?



Why do actors create, maintain, dissolve, and reconstitute network links?

- Theories of self-interest
- Theories of mutual interest and collective action
- Theories of social and resource exchange
- Theories of contagion
- Theories of balance
- Theories of homophily
- Theories of proximity
- Theories of co-evolution

Source: Monge, P. R. & Contractor, N. S. (2003). Theories of Communication Networks. New York: Oxford University Press.

What Have We Learned About These Network Mechanisms?

- Research typically looks at only one of these mechanisms
- The outcomes of these mechanisms often contradict one another
- Some mechanisms are studied more often than others
- These mechanisms operate at multiple levels: Actor, Dyad, Triad, ... Global

Co-evolution of knowledge networks and 21st century organizational forms

- NSF KDI Initiative, \$1.5 million, 1999-03.
- Co-P.I.s: Monge, Fulk (USC), Levitt, Bar, Kunz (Stanford), Carley (CMU), Wasserman, Hollingshead (Illinois).
- Dozen industry partners (global, profit, non-profit):
 - ◆ Boeing, 3M, NASA, Fiat, U.S. Army, American Bar Association, European Union Project Team, Pew Internet Project, etc.

MTML analysis of information retrieval and allocation

- Why do we create information retrieval and allocation links with other human or non-human agents (e.g., Intranets, knowledge repositories)?
- Multiple theories: Transactive Memory, Public Goods, Social Exchange, Proximity, Contagion, Inertial Social Factors
- Multiple levels: Actor, Dyad, Global

UIUC Team Engineering Collaboratory: David Brandon, Roberto Dandi, Meikuan Huang, Ed Palazzolo, Cataldo “Dino” Ruta, Vandana Singh, and Chunke Su)

Theory of Transactive Memory:

Good things are more likely to happen in work teams when ...

- Members know “who knows what” and “who knows who knows what”
 - ◆ Reduces workload for each member
 - ◆ Lessens redundancy of information
- Teams are more effective if they have high knowledge differentiation: different members have expertise in different areas.



Task

Expertise Recognition,
Retrieval Coordination,
Directory Updating

Personal
Expertise



Directory
of others'
expertise

Personal
Expertise



Directory
of others'
expertise

Communication

Personal
Expertise



Directory
of others'
expertise

Personal
Expertise



Directory
of others'
expertise

Information

Information Allocation

Personal Expertise



Directory of others' expertise

Personal Expertise



Directory of others' expertise

Communication

Personal Expertise



Directory of others' expertise

Personal Expertise



Directory of others' expertise

Public Goods Theory:

Good things are more likely to happen in work teams when ...

- Members are motivated to collectively contribute to, and benefit from, a public good
 - Reduces the need for members to find out who knows what
 - Reduces the need for members to individually seek or provide information to other members.
- Teams are more effective if they have high communality:
 - members independently access (publish and retrieve) knowledge from a public good.



Retrieval

Individual knowledge

Perceived provision of resources

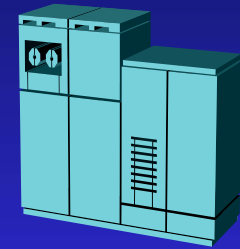


Publishing

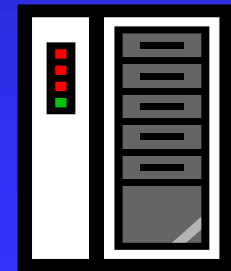
Gain = the perceived value for accessing the database - total cost.

Individual knowledge

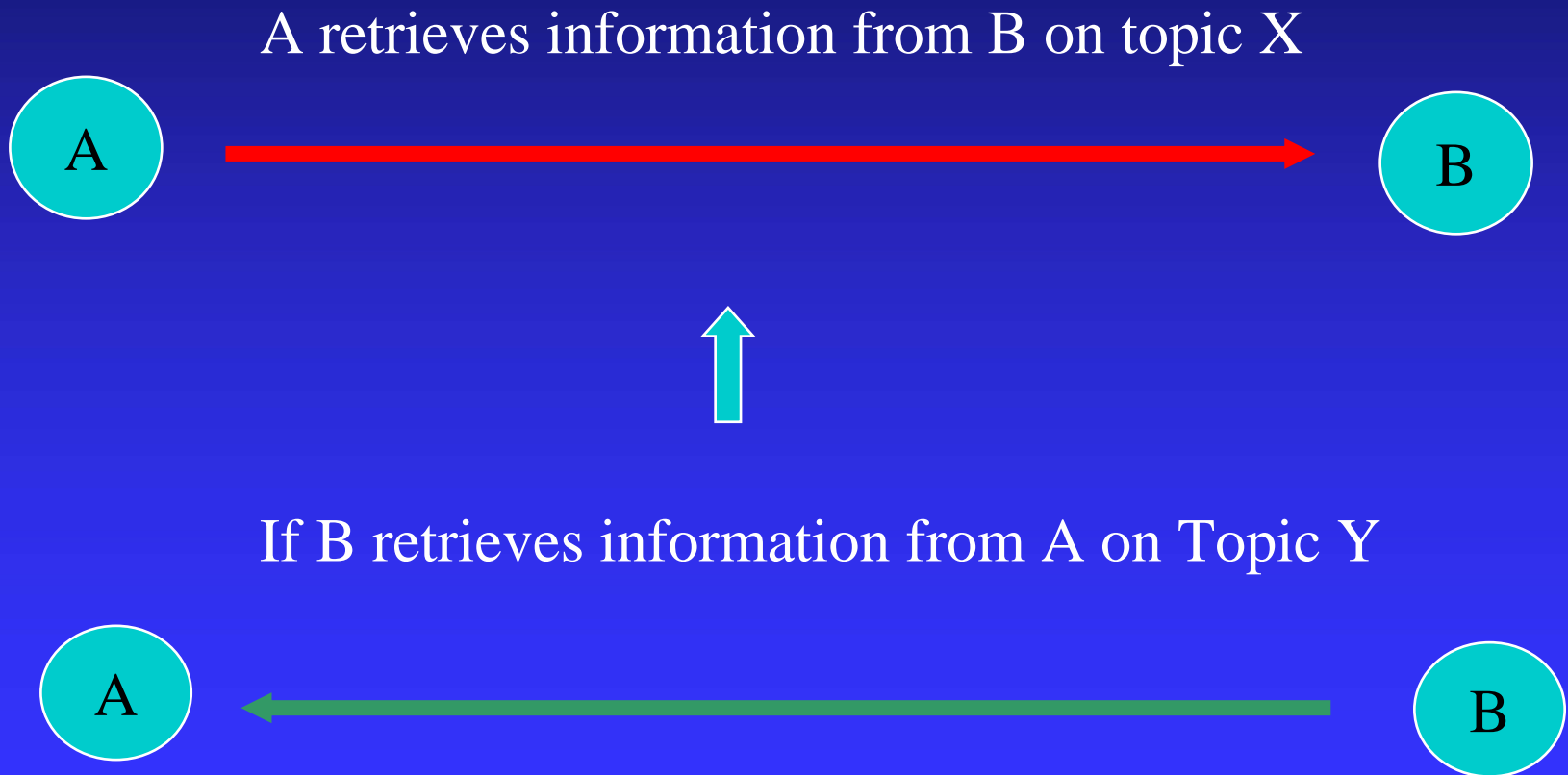
Perceived gain from database



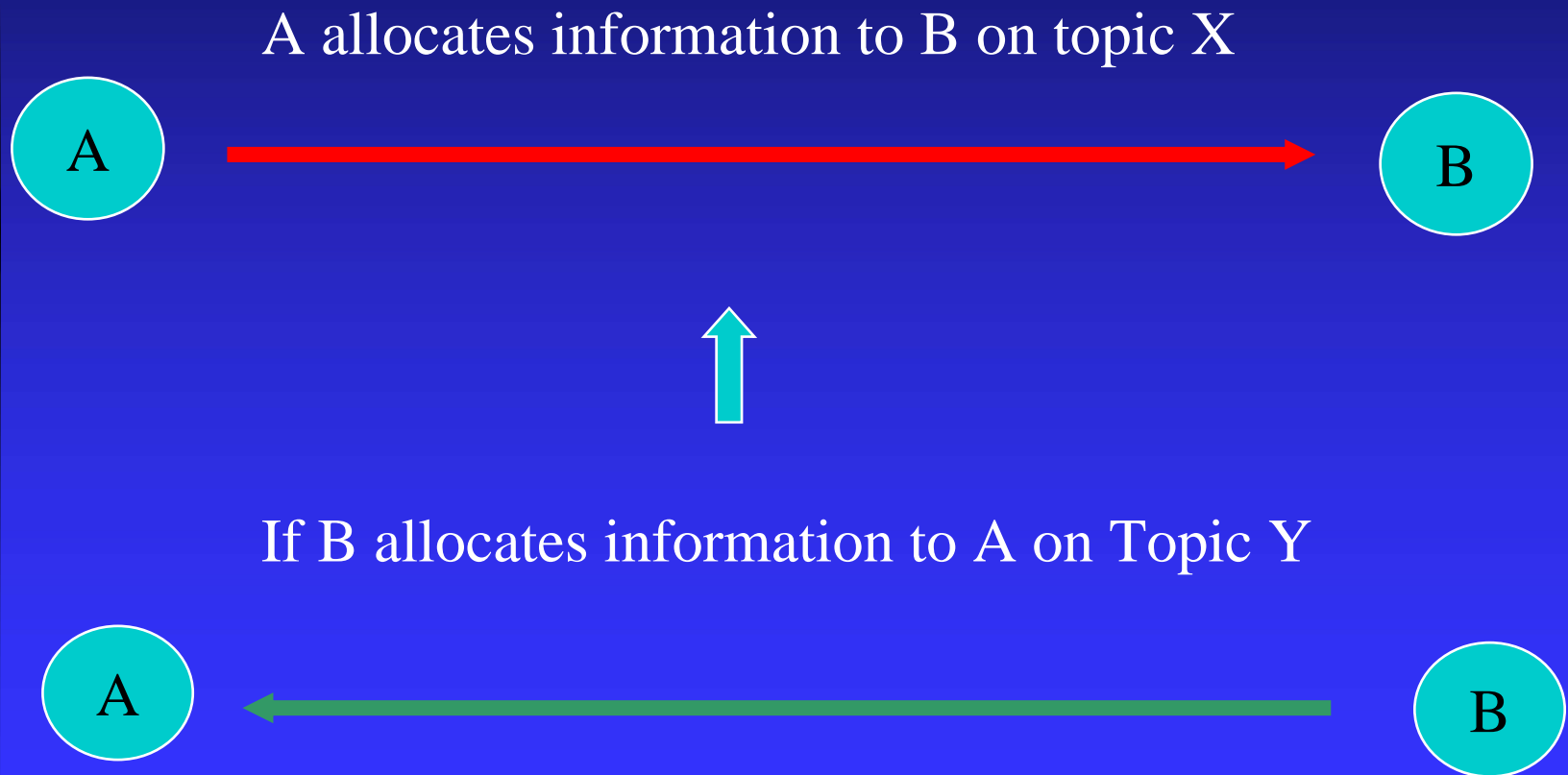
Publishing



Theories of social exchange



Theories of social exchange



Theories of proximity

- A retrieves information on topic X from B if A is proximate to B
- A allocates information on topic X to B if A is proximate to B

Theories of contagion

- A retrieves information on topic X from B if others in A's communication network also retrieve information about topic X from B
- A allocates information on topic X to B if others in A's communication network also allocate information about topic X to B

Theories of social inertial factors

- A retrieves information on topic X from B if A is currently/previously collaborating or communicating with B
- A allocates information on topic X to B if A is currently or previously collaborating or communicating with B

Public Goods / Transactive Memory

- Allocation to the Intranet
- Retrieval from the Intranet
- Perceived Quality and Quantity of Contribution to the Intranet

Transactive Memory

- ◆ Perception of Other's Knowledge
- ◆ Communication to Allocate Information

Communication to Retrieve Information

Inertia Components

- Collaboration
- Co-authorship
- Communication

Social Exchange

- Retrieval by coworkers on other topics

Proximity

- Work in the same location

The Dataset: EU Research Team

- ◆ 17 Participants
 - ☞ 8 Principal Researchers, 9 Junior Researchers
- ◆ Across 7 locations
 - ☞ Rome, Patras, Milan, Manchester, Amsterdam, Nijmegen, Surrey
- ◆ Intranet: Blackboard
- ◆ Duration / History: 1 Year

Knowledge Areas and Tasks

■ Knowledge Areas:

- ◆ Social Psychology (sp)
- ◆ CMC Technologies (cmc)
- ◆ Organizational Theory (ot)
- ◆ Qualitative Methods (ql)
- ◆ Quantitative Methods (qt)
- ◆ Semiotics (s)

■ Activities:

- ◆ Theoretical Research (tr)
- ◆ Empirical Research (er)
- ◆ Project Administration and Management (pam)
- ◆ Communication and Coordination (cc)

Instrumentation I

- Self-report on individual knowledge expertise and task responsibilities
- Perceptions of others' knowledge expertise and task responsibilities
- Retrieval and allocation of information about specific knowledge areas from specific other human and non-human agents

Data Collection: Perceptions of Expertise

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What level of knowledge do you believe 2 has in the area of **Kndg Area 1**?

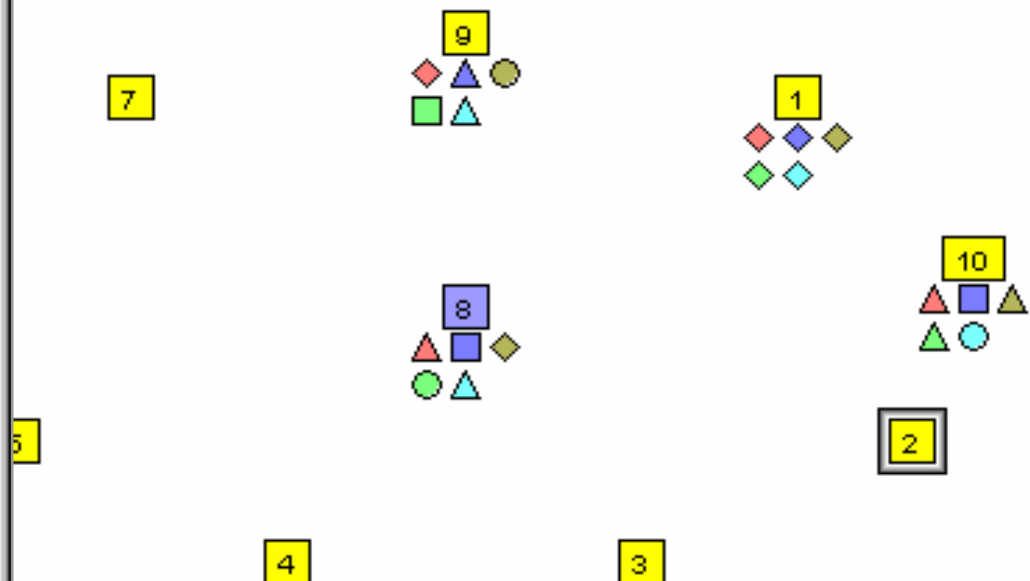
? I don't know

○ None

□ Beginner

△ Intermediate

◇ Expert



Kndg Area 1

◇ Expert

△ Intermediate

□ Beginner

○ None

? I don't know

Kndg Area 2

◇ Expert

△ Intermediate

□ Beginner

○ None

? I don't know

Kndg Area 3

◇ Expert

△ Intermediate

□ Beginner

○ None

? I don't know

Kndg Area 4

◇ Expert

△ Intermediate

□ Beginner

○ None

? I don't know

Kndg Area 5

◇ Expert

△ Intermediate

□ Beginner

○ None

? I don't know

Instrumentation II

- Self-report on publishing and retrieval from non-human agents
- Perceptions of others' publishing and retrieval from non-human agents
- Self-report of overall communication with others
- Perceptions of overall communication between others (Cognitive Social Structures)
- Social inertia factors: previous and current co-authorship and collaboration
- Location

Data Collection: Communication to Retrieve Information

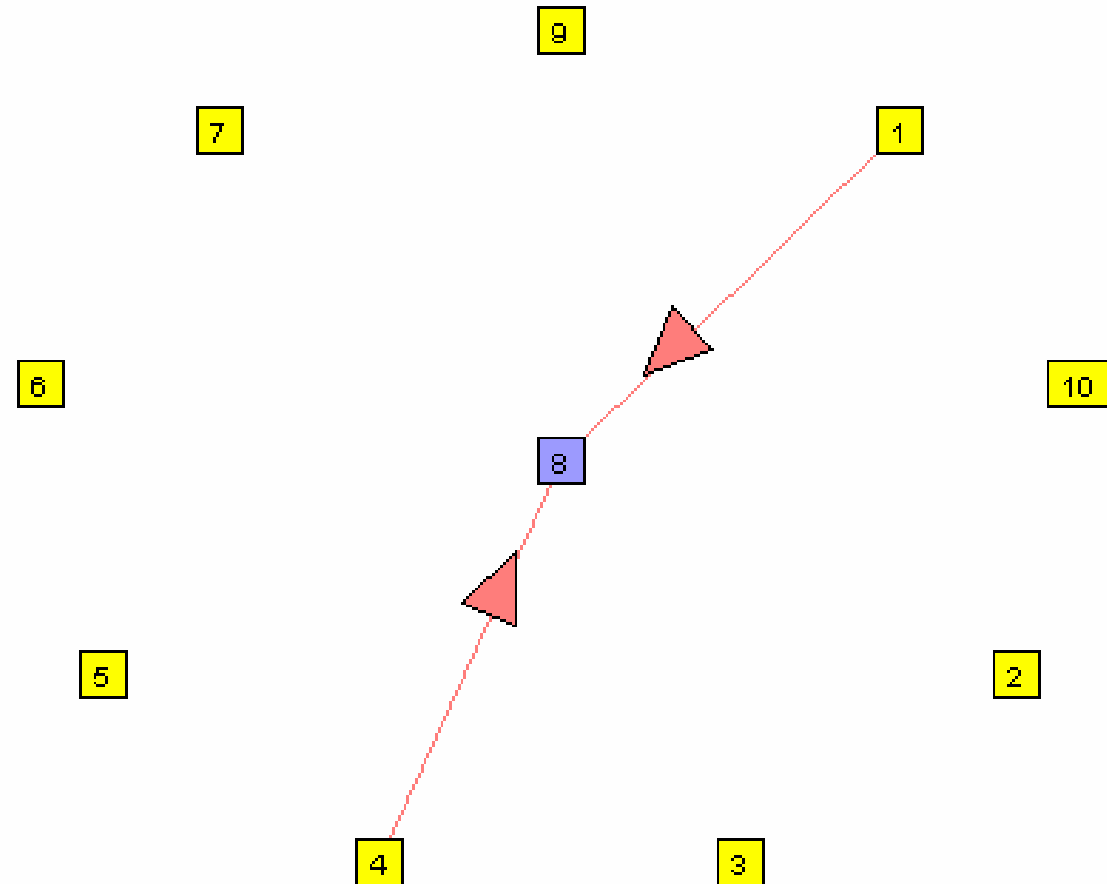
Question 11a (of 48)

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Getting Information About Kndg Area 1

In your work, you may need information about **Kndg Area 1** that you do not possess. Using the adjacent screen, please indicate one or more person(s) from whom you are likely to **retrieve information** by clicking on their names.

Start with the name at the top and move clockwise around the circle so that you do not miss anyone.



TM: CRI and Perceived Knowledge (KO)

H: People will tend to retrieve information from those whom they perceive as knowledgeable for specific knowledge areas.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	KO	0.710***
cmc	CRI	KO	0.479***
ot	CRI	KO	0.564***
ql	CRI	KO	0.521***
qt	CRI	KO	0.526***
s	CRI	KO	0.427***

Whether person A retrieves information from person B is positively correlated with how knowledgeable A perceives B is in that knowledge area.

TM: CRI and Communication to Allocate Information (CAI)

H: People tend to retrieve information from those whom they allocate information to in a certain knowledge area.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	CAI	0.292***
cmc	CRI	CAI	0.343***
ot	CRI	CAI	0.179*
ql	CRI	CAI	0.209**
qt	CRI	CAI	0.113
s	CRI	CAI	0.375***

Whether person A retrieves information from person B is positively correlated with whether A allocates information to B in that knowledge area except in Quantitative Methods.

TM: CAI and Perceived Knowledge

H: People tend to allocate information to those whom they perceive knowledgeable in a certain knowledge area.

	Var1	Var2	Corr
sp	CAI	KO	0.234***
cmc	CAI	KO	0.178*
ot	CAI	KO	0.209**
ql	CAI	KO	0.187
qt	CAI	KO	0.165
s	CAI	KO	0.361***

Whether person A allocates information to person B is positively correlated with how knowledgeable A perceives B is in that knowledge area except in Quantitative and Qualitative Methods.

TM: Organizational Required Knowledge and Perceived Knowledge

H: People will retrieve information from those whom they perceive as being responsible for tasks that require specific knowledge areas for completion.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>		<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	ORK	0.210**	sp	CRI	KO	0.710***
cmc	CRI	ORK	0.136	cmc	CRI	KO	0.479***
ot	CRI	ORK	0.159	ot	CRI	KO	0.567***
ql	CRI	ORK	0.227**	ql	CRI	KO	0.521***
qt	CRI	ORK	0.109	qt	CRI	KO	0.526***
s	CRI	ORK	0.126*	s	CRI	KO	0.427***

Perception of others' knowledge is a better indicator of who people would go to to retrieve information than who they perceive as responsible for tasks that require such knowledge areas.

TM: Organizational Required Knowledge and Perceived Knowledge

H: People will allocate information to those whom they perceive as being responsible for tasks that require information in that knowledge area for completion.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>		<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	ORK	0.056	sp	CAI	KO	0.234***
cmc	CAI	ORK	0.292**	cmc	CAI	KO	0.178*
ot	CAI	ORK	0.131	ot	CAI	KO	0.209**
ql	CAI	ORK	0.227	ql	CAI	KO	0.187
qt	CAI	ORK	0.339**	qt	CAI	KO	0.165
s	CAI	ORK	0.189**	s	CAI	KO	0.361***

Perception of others' knowledge is a better indicator of who people would go to to retrieve information than who they perceive as responsible for tasks that require such knowledge areas.

TM/PGT: Allocation of Information to the Intranet

H: People are more likely to retrieve information from those who are perceived as publishing more to the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	AI	0.388***
cmc	CRI	AI	0.339***
ot	CRI	AI	0.289**
ql	CRI	AI	0.158*
qt	CRI	AI	0.090
s	CRI	AI	0.266***

People's perceptions of who is publishing to the intranet is a good indicator of who they will go to to retrieve information. They may assume that whoever is publishing information must also be knowledgeable.

TM/PGT: Retrieval of Information from the Intranet

H: People are more likely to retrieve information from those who are perceived as retrieving more often from the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	RI	0.213**
cmc	CRI	RI	0.213**
ot	CRI	RI	0.195*
ql	CRI	RI	0.069
qt	CRI	RI	0.128
s	CRI	RI	0.213**

There is a tendency for people to retrieve information from the same people who they think are using the Intranet to retrieve information.

TM/PGT: Allocation of Information to the Intranet

H: People are more likely to allocate information to those whom they perceive as publishing to the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>QAP Corr</u>
sp	CAI	AI	0.189**
cmc	CAI	AI	0.267**
ot	CAI	AI	0.193*
ql	CAI	AI	0.093
qt	CAI	AI	0.329**
s	CAI	AI	0.184*

People are likely to allocate information to the people who they think publish to the Intranet on the specific knowledge areas.

TM/PGT: Retrieval of Information from the Intranet

H: People are more likely to allocate information to those whom they perceive as retrieving from the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	RI	0.145
cmc	CAI	RI	0.333*
ot	CAI	RI	0.183*
ql	CAI	RI	0.346*
qt	CAI	RI	0.393**
s	CAI	RI	0.181*

People are likely to allocate information to the people whom they think are using the Intranet to retrieve information.

TM/PGT: Perceived Provision

H: People are more likely to retrieve information from those who are perceived as contributing to the provision of the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>QAP Corr</u>
sp	CRI	Prov	0.667***
cmc	CRI	Prov	0.448***
ot	CRI	Prov	0.442***
ql	CRI	Prov	0.346***
qt	CRI	Prov	0.310**
s	CRI	Prov	0.453***

There is a strong relation between who one retrieves information from, based on the combined perceptions of level of knowledge and allocation to the Intranet.

Publishing by knowledgeable people does not reduce their likely request load.

TM/PGT: Perceived Provision

H: People are more likely to allocate information to those who are perceived as contributing to the provision of the Intranet.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	Prov	0.252**
cmc	CAI	Prov	0.192*
ot	CAI	Prov	0.285**
ql	CAI	Prov	0.132
qt	CAI	Prov	0.339**
s	CAI	Prov	0.279**

People are more likely to allocate information to those who they perceive as being knowledgeable and allocating to the intranet.

This may be a way for them to identify who is currently or actively using the knowledge area.

Social Exchange: CRI

H: People retrieve knowledge from others because others retrieve knowledge from them on other topics.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	(All CRI - sp)	0.05
cmc	CRI	(All CRI -cmc)	0.18**
ot	CRI	(All CRI - ot)	0.11
ql	CRI	(All CRI - ql)	0.07
qt	CRI	(All CRI - qt)	0.05
s	CRI	(All CRI - s)	-0.08

So, people retrieve knowledge from others about CMC because others retrieve knowledge from them on other topics but this is not the case for the other knowledge areas.

No apparent social exchange mechanism for retrieval.

Social Exchange: CAI

H: People allocate knowledge to others because others allocate knowledge to them on other topics.

	Var1	Var2	Corr
sp	CAI	(All CAI - sp)	0.20**
cmc	CAI	(All CAI -cmc)	0.20***
ot	CAI	(All CAI - ot)	0.14*
ql	CAI	(All CAI - ql)	0.05
qt	CAI	(All CAI - qt)	0.07
s	CAI	(All CAI - s)	0.11

So, people tend to allocate information to each other on a given topic because others allocate to them on the five different topics.

There is more evidence of social exchange for the allocation of information than the retrieval of information.

Proximity

H: People are more likely to retrieve information from (allocate to) those who are in the same location.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>		<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	Loc	0.084	sp	CAI	Loc	0.268***
cmc	CRI	Loc	0.251***	cmc	CAI	Loc	0.379***
ot	CRI	Loc	0.258***	ot	CAI	Loc	0.386***
ql	CRI	Loc	0.248***	ql	CAI	Loc	0.144*
qt	CRI	Loc	0.170**	qt	CAI	Loc	0.096
s	CRI	Loc	0.128*	s	CAI	Loc	0.199*

Proximity is a good predictor for both communication to retrieve and allocation information.

Contagion I

H: People are more likely to retrieve information from an individual when the people they communicate with retrieve from that individual.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	[COM][CRI]	0.620***
cmc	CRI	[COM][CRI]	0.348**
ot	CRI	[COM][CRI]	0.457***
ql	CRI	[COM][CRI]	0.388***
qt	CRI	[COM][CRI]	0.382***
s	CRI	[COM][CRI]	0.387***

There is a consistent tendency for people to retrieve information from an individual when the people they talk to retrieve from that individual. That is, there is a strong contagion effect for the retrieval of information.

Contagion II

H: People are more likely to allocate information to an individual when the people they communicate with allocate to that individual.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	[COM][CAI]	0.085
cmc	CAI	[COM][CAI]	0.034
ot	CAI	[COM][CAI]	0.174*
ql	CAI	[COM][CAI]	0.035
qt	CAI	[COM][CAI]	-0.071
s	CAI	[COM][CAI]	0.060

There is a no real tendency toward a contagion effect for the allocation of information.

People on this team seem to be more influence by their communication partners for the retrieval of information than they are for the allocation of information.

Impacts of Inertial Social Factors on Information Retrieval

H: People tend to retrieve information from those who they collaborate or co-author with previously.

	Var1	Var2	Corr		Var1	Var2	Corr
sp	CRI	PCOL	0.13*	sp	CRI	PCOA	0.15*
cmc	CRI	PCOL	0.27***	cmc	CRI	PCOA	0.17**
ot	CRI	PCOL	0.36***	ot	CRI	PCOA	0.22***
ql	CRI	PCOL	0.16*	ql	CRI	PCOA	0.11
qt	CRI	PCOL	0.30***	qt	CRI	PCOA	0.20***
s	CRI	PCOL	0.21***	s	CRI	PCOA	0.03

Generally speaking, whether person A retrieves information from person B is positively correlated with whether A collaborates or co-author with B previously.

Impacts of Inertial Social Factors on Information Retrieval

H: People tend to retrieve information from those who they collaborate or co-author with currently.

	Var1	Var2	Corr		Var1	Var2	Corr
sp	CRI	CCOL	0.12*	sp	CRI	CCOA	0.07
cmc	CRI	CCOL	0.15*	cmc	CRI	CCOA	0.17*
ot	CRI	CCOL	0.25***	ot	CRI	CCOA	0.09
ql	CRI	CCOL	0.24***	ql	CRI	CCOA	0.11
qt	CRI	CCOL	0.17*	qt	CRI	CCOA	0.15*
s	CRI	CCOL	0.06	s	CRI	CCOA	0.13

Generally speaking, whether person A retrieves information from person B is positively correlated with whether A collaborates with B currently. However, the correlation between CRI and current co-authorship is only significant in knowledge areas CMC and QT.

Impacts of Inertial Social Factors on Information Retrieval

H: People tend to retrieve information from those who they report they frequently communicate with.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CRI	FCself	0.19***
cmc	CRI	FCself	0.00
ot	CRI	FCself	0.26***
ql	CRI	FCself	0.28***
qt	CRI	FCself	0.10*
s	CRI	FCself	0.19***

Generally speaking, whether person A retrieves information from person B is positively correlated with the frequency of communication A reports with B.

Impacts of Inertial Social Factors on Information Allocation

H: People tend to allocate information to those who they collaborate or co-author with previously.

	Var1	Var2	Corr		Var1	Var2	Corr
sp	CAI	PCOL	0.185*	sp	CAI	PCOA	0.270**
cmc	CAI	PCOL	0.248*	cmc	CAI	PCOA	0.260**
ot	CAI	PCOL	0.347***	ot	CAI	PCOA	0.344***
ql	CAI	PCOL	0.144	ql	CAI	PCOA	0.146*
qt	CAI	PCOL	0.096	qt	CAI	PCOA	0.217**
s	CAI	PCOL	0.311**	s	CAI	PCOA	0.175*

Generally speaking, whether person A allocates information to person B is positively correlated with whether A collaborates or co-author with B previously.

Impacts of Inertial Social Factors on Information Allocation

H: People tend to allocate information to those who they collaborate or co-author with currently.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>		<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	CCOL	0.274***	sp	CAI	CCOA	0.276**
cmc	CAI	CCOL	0.179*	cmc	CAI	CCOA	0.373***
ot	CAI	CCOL	0.319***	ot	CAI	CCOA	0.272***
ql	CAI	CCOL	0.136	ql	CAI	CCOA	0.137
qt	CAI	CCOL	0.111	qt	CAI	CCOA	0.303**
s	CAI	CCOL	0.150*	s	CAI	CCOA	0.232**

Generally speaking, whether person A allocates information to person B is positively correlated with whether A collaborates or co-author with B currently.

Impacts of Inertial Social Factors on Information Allocation

H: People tend to allocate information to those who they report they frequently communicate with.

	<u>Var1</u>	<u>Var2</u>	<u>Corr</u>
sp	CAI	FCself	0.194**
cmc	CAI	FCself	0.337***
ot	CAI	FCself	0.303***
ql	CAI	FCself	0.231***
qt	CAI	FCself	0.126
s	CAI	FCself	0.133*

Generally speaking, whether person A allocates information to person B is positively correlated with the frequency of communication A reports with B.

Theoretical Summary Table

CRI

CAI

Variable	Corr Range	Kndg Areas	Corr Range	Kndg Areas
TM				
- KO	0.4 – 0.7	6/6	0.2 – 0.4	4/6
- CRI			0.2 – 0.4	5/6
- CAI	0.2 – 0.4	5/6		
- ORK	0.1 – 0.2	3/6	0.2 – 0.3	3/6
PGT				
- AI	0.2 – 0.4	5/6	0.2 – 0.3	5/6
- RI	0.2	4/6	0.2 – 0.4	5/6
- Prov	0.3 – 0.7	6/6	0.2 – 0.3	5/6
Social Exchnng	0.2	1/6	0.1 – 0.2	3/6
Proximity	0.1 – 0.3	5/6	0.1 – 0.4	3/6
Contagion	0.3 – 0.6	6/6	0.2	1/6
Comm	0.1 – 0.3	5/6	0.1 – 0.3	5/6

Pulling Theories Together: Regression

- A series of regression analyses for each knowledge area that include components from each theory as the independent variables and CRI (and CAI) as the dependent variable

Multi-Theoretical Analysis: Retrieval

TM - PGT - Social Exchange - Proximity –
Contagion (MRQAP)

	R-square	Sig	Contributors
sp	0.57	p < 0.001	CAI, Prov, Contagion
cmc	0.32	p < 0.001	CAI, Prov, Contagion
ot	0.30	p < 0.001	Prov, Proximity, Contagion
ql	0.26	p < 0.001	CAI, Prov, Proximity, Contagion
qt	0.20	p < 0.001	Prov, Proximity, Contagion
s	0.32	p < 0.001	CAI, Prov, Proximity, Contagion

Pulling Theories Together: p^*

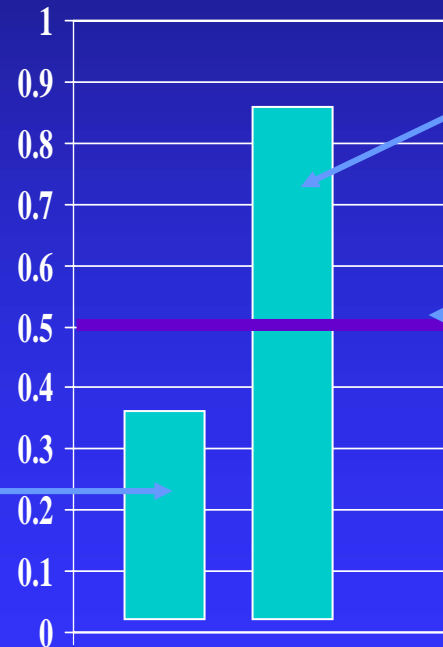
- Using a multivariate p^* procedure, we combined the primary relations from each of the theories into a single analysis
- This framework allows us to test for the additive predictability of each theory as well as interaction effects between the theories
- Focus for analysis:
Predicting a tie between two actors for CRI
based on multiple theories

Interpreting Results

Multivariate p^* analyses:

- ◆ Probabilities
- ◆ Range: 0 to +1
- ◆ Baseline = 0.5 = 50%

Less
than
chance



Greater
than
chance

Chance

Multi-theoretical p*

Theoretical Predictors of CRI

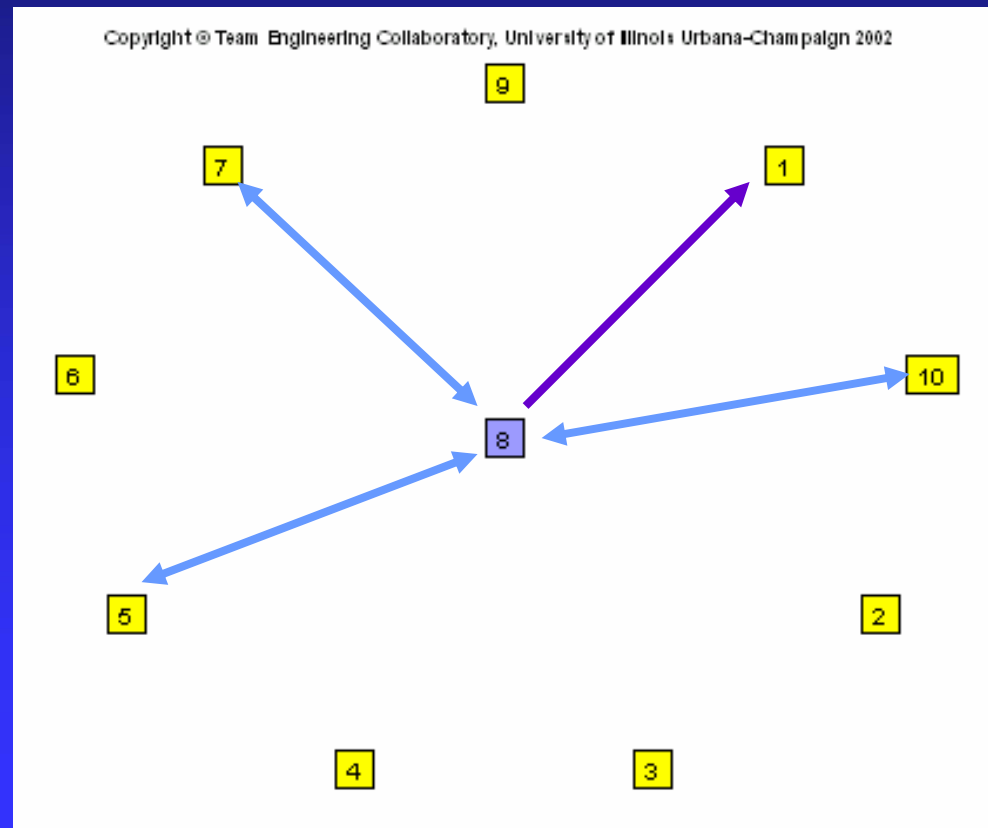
1. Social Communication

0.144***

Communication to
Retrieve Information



Social Communication



Multi-theoretical p*

Theoretical Predictors of CRI

2. Perception of Knowledge
& Communication to Allocate

0.995***

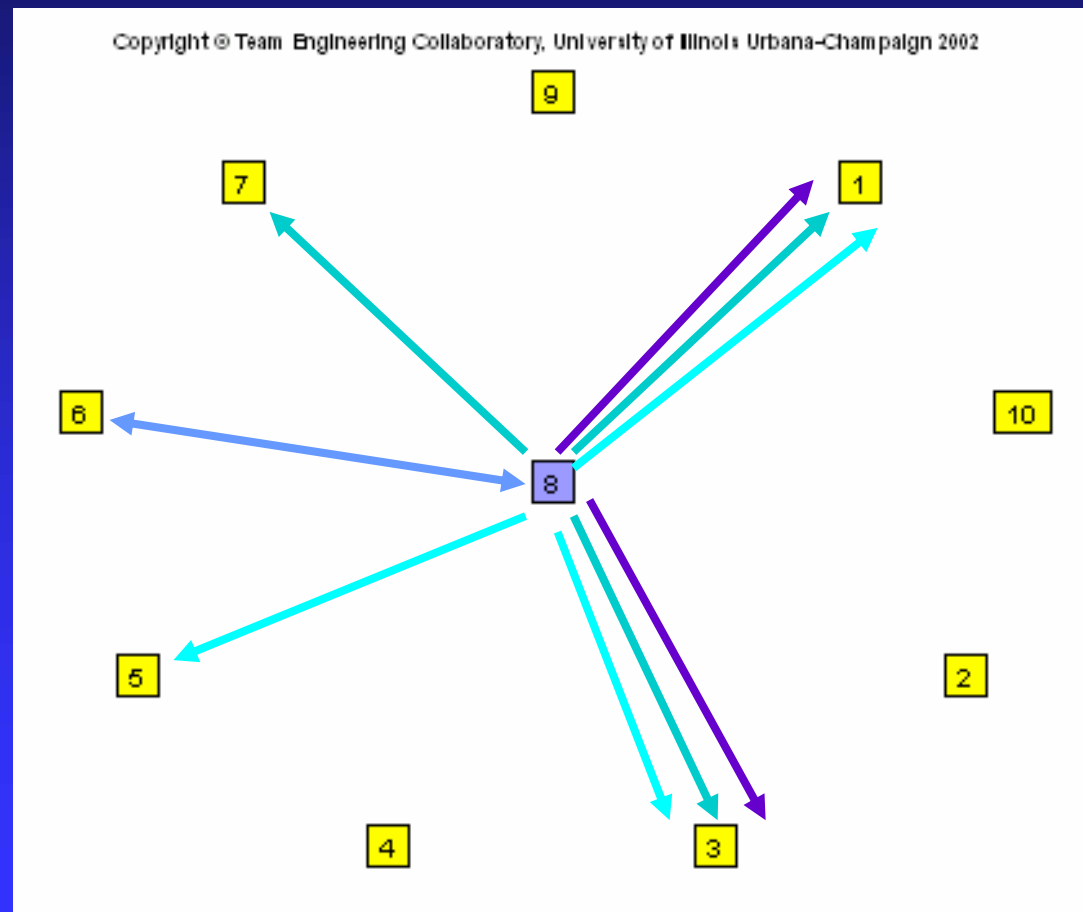
Communication to
Retrieve Information



Perceived as
Knowledgeable



Communication for
Allocation



Multi-theoretical p*

Theoretical Predictors of CRI

3. Perception of Knowledge & Provision 0.972***

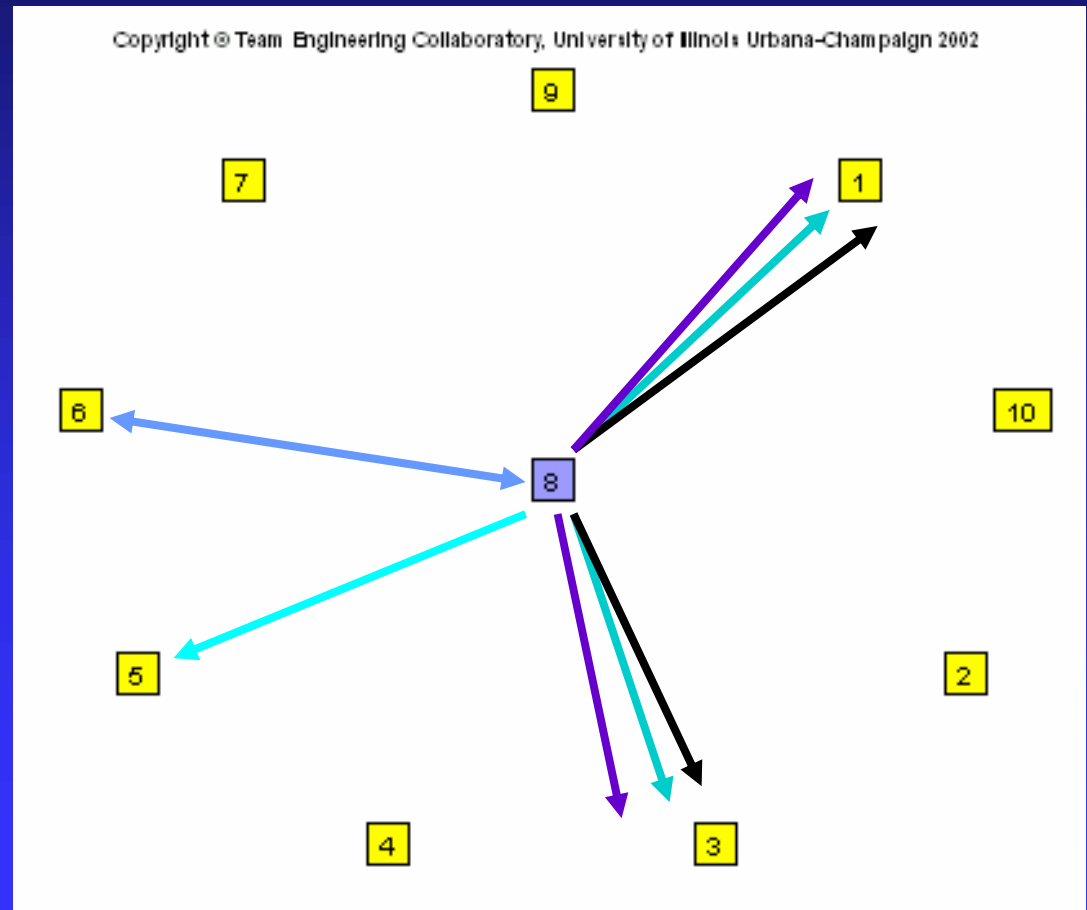
Communication to
Retrieve Information



Perceived as
Knowledgeable



Provision to Intranet



Multi-theoretical p*

Theoretical Predictors of CRI

4. Perception of Knowledge, Social Exchange,
& Social Communication 0.851***

Communication to
Retrieve Information



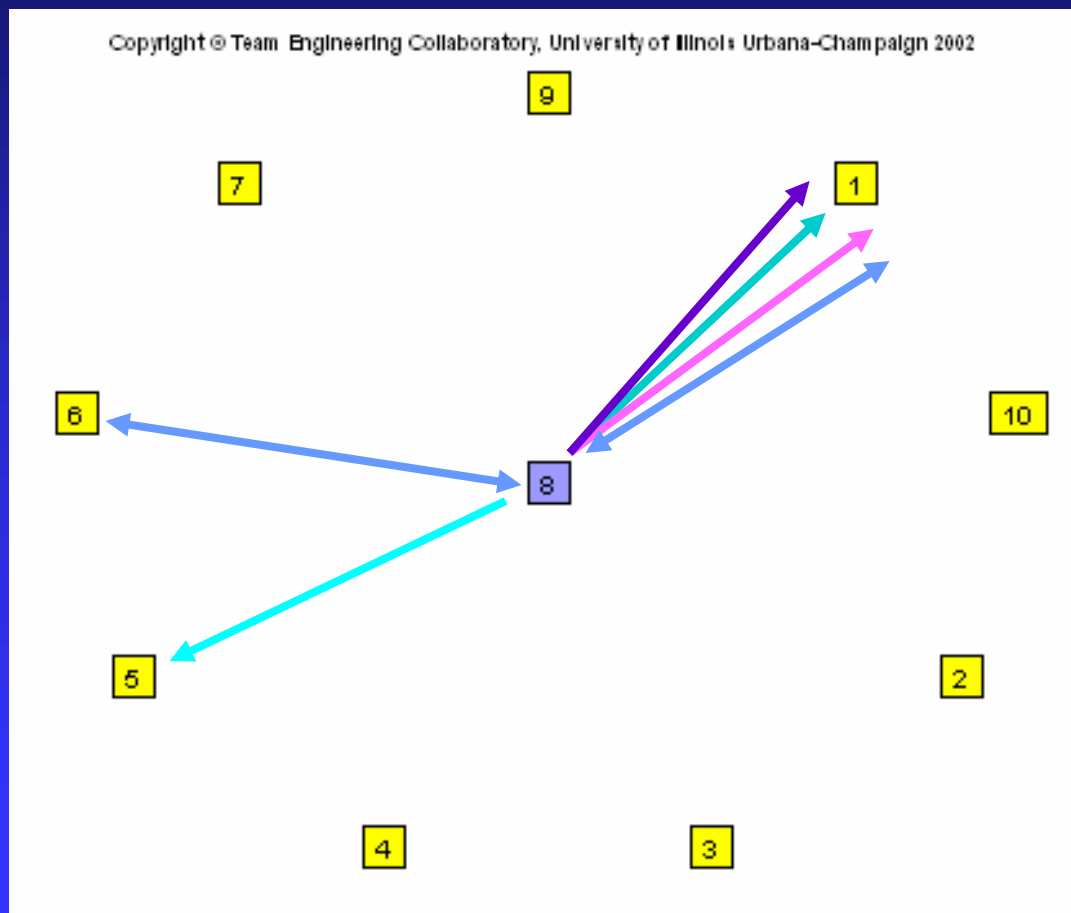
Perceived as
Knowledgeable



Social Exchange



Social Communication



Multi-theoretical p*

Theoretical Predictors of CRI

5. Perception of Knowledge, Proximity,
& Social Communication

0.882***

Communication to
Retrieve Information



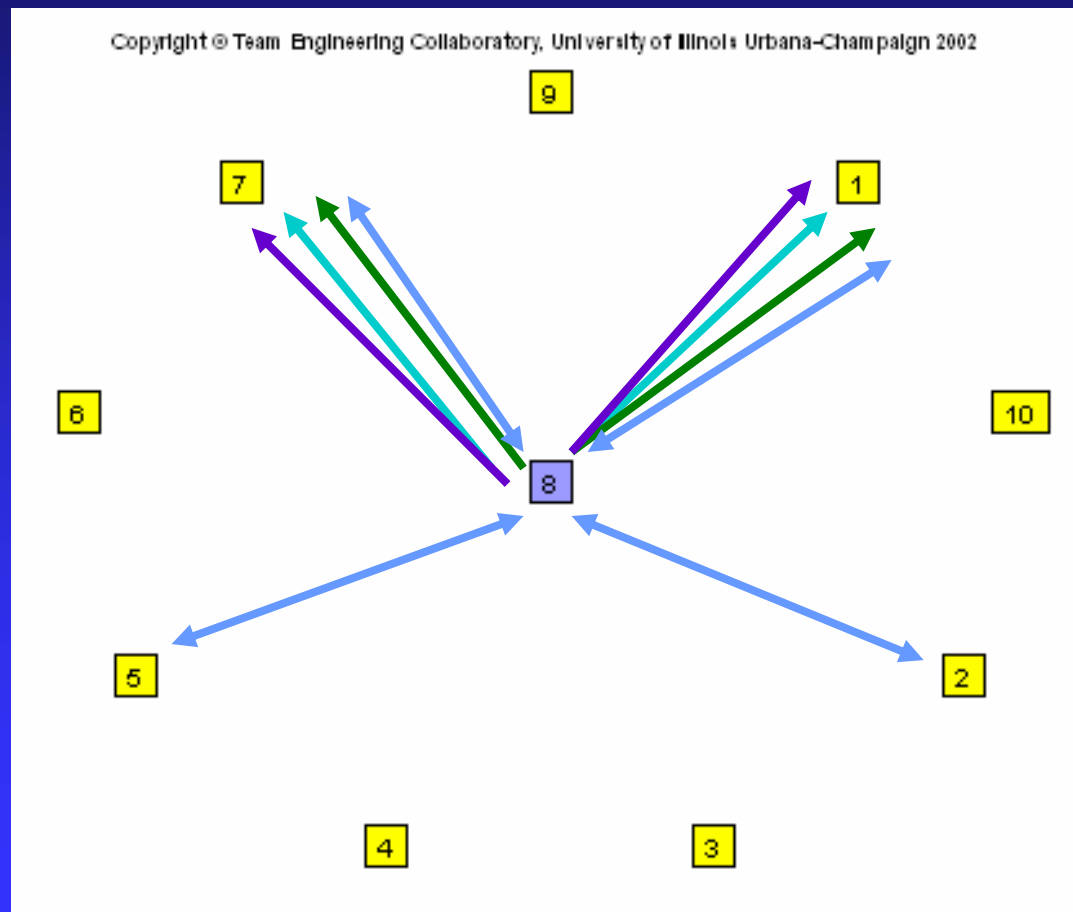
Perceived as
Knowledgeable



Proximity



Social Communication



Multi-theoretical p*

Theoretical Predictors of CRI

1. Social Communication	0.144
2. Perception of Knowledge & Communication to Allocate	0.995
3. Perception of Knowledge & Provision	0.972
4. Perception of Knowledge, Social Exchange, & Social Communication	0.851
5. Perception of Knowledge, Proximity, & Social Communication	0.882

Summary

- Communication to Retrieve Information can be explained by multiple theories
- Combining multiple theories shows that there are interactions between the theoretical mechanisms that help predict retrieval
- Strongest theoretical predictors based on p^* analyses are:
 - ◆ Transactive Memory
 - ◆ Public Goods Theory / Transactive Memory

Multi-Theoretical Analysis: Allocation

TM - PGT - Social Exchange - Proximity –
Contagion (MRQAP)

	R-square	Sig	Contributors
sp	0.16	p < 0.001	CRI, Proximity
cmc	0.23	p < 0.001	CRI, Proximity
ot	0.20	p < 0.001	Prov, Proximity
ql	0.06	ns	
qt	0.12	p < 0.01	Prov
s	0.22	p < 0.001	CRI, Proximity, Contagion

Summary

- Communication to retrieve information can be explained from various theoretical mechanisms
- Strongest predictors are
 - ◆ Perception of other's knowledge
 - ◆ Provision of intranet
 - ◆ Contagion

Summary

- Communication to allocate information can be explained by various theoretical mechanisms
- Strongest predictors are
 - ◆ Communication to Retrieve Information
 - ◆ Perception of who Allocates to Intranet
 - ◆ Perception of who Retrieves from Intranet
 - ◆ Communication Between Team Members

The role of TM/PGT in explaining retrieval and allocation on the Intranet

- **SUBSTITUTION** of human-to-human communication for information allocation or retrieval with the use of the intranet
- **AUGMENTATION**: increasing expertise reachability

PGT: Production Function - IRI

H: The higher the value of production function the more a person will retrieve from the Intranet

$$\text{PdF Retrieval} = [\text{IInt} \times (\text{KO} \times \text{AI})] \times (\text{GINT} - \text{DRI})$$

↑
↑
↑
↑

Individual Interest

Provision

Gain

Costs

	Var1	Var2	SPSSCorr
cmc	PdF Retrieval	Ind Retrieval	0.600(*)
ot	PdF Retrieval	Ind Retrieval	0.771(**)
qt	PdF Retrieval	Ind Retrieval	0.506(*)
ql	PdF Retrieval	Ind Retrieval	0.432
sp	PdF Retrieval	Ind Retrieval	0.389
s	PdF Retrieval	Ind Retrieval	0.947(**)

PGT: Production Function - IAI

- H: The higher the value of production function the more a person will allocate to the Intranet

$$\text{PdF Allocation} = [\text{PCI} \times (\text{KO} \times \text{AI})] \times (\text{GINT} - \text{DINT})$$

Collective Interest

Provision

Gain

Costs

	Var1	Var2	SPSSCorr
cmc	PdF Allocation	Ind Allocation	-0.155
ot	PdF Allocation	Ind Allocation	-0.167
qt	PdF Allocation	Ind Allocation	-0.118
ql	PdF Allocation	Ind Allocation	0.599(**)
sp	PdF Allocation	Ind Allocation	-0.065
s	PdF Allocation	Ind Allocation	1.000(**)

TM/PGT: CRI-RI

H: The more a person perceives certain people are retrieving from the Intranet the more that person retrieves from those people

	<u>Var1</u>	<u>Var2</u>	<u>QAPcorr</u>
cmc	CRI	RI	0.213**
ot	CRI	RI	0.213**
qt	CRI	RI	0.195*
ql	CRI	RI	0.069
sp	CRI	RI	0.128
s	CRI	RI	0.213**

People think that those who they retrieve from are also those who retrieve from the Intranet.

TM/PGT: CAI-AI

H: The more a person perceives people allocating to the intranet the more that person allocates to those people

	<u>Var1</u>	<u>Var2</u>	<u>QAP Corr</u>
sp	CAI	AI	0.189**
cmc	CAI	AI	0.267**
ot	CAI	AI	0.193*
ql	CAI	AI	0.093
qt	CAI	AI	0.329**
s	CAI	AI	0.184*

People think that those who they allocate to are also those who publish on the Intranet.

TM: AI and RI

- H: The more a person perceives people allocating on the Intranet, the more that person perceives they are retrieving from it

	<u>Var1</u>	<u>Var2</u>	<u>QAPcorr</u>
cmc	AI	RI	0.279*
ot	AI	RI	0.530***
qt	AI	RI	0.610***
ql	AI	RI	0.390**
sp	AI	RI	0.398***
s	AI	RI	0.627***

People think that people that retrieve from the Intranet also allocate to the Intranet

TM/PGT: Ignorance & Information Retrieval

- H: The more a person is ignorant of others' expertise, the more that person retrieves from the Intranet

Legend:

From KO:

"I don't know"=1

Otherwise=0

	<u>Var1</u>	<u>Var2</u>	<u>SPSScorr</u>
cmc	Ignorance	Ind Retrieval	0.046
Ot	Ignorance	Ind Retrieval	-0.207
qt	Ignorance	Ind Retrieval	-0.083
ql	Ignorance	Ind Retrieval	-0.508(*)
sp	Ignorance	Ind Retrieval	-0.277
S	Ignorance	Ind Retrieval	-0.455

People who don't know the expertise of other group members don't use the Intranet to retrieve knowledge

TM/GPT: Ignorance of KO & Ind Allocation

H: The more a person is ignorant of others' expertise, the more that person allocates to the Intranet

Legend:
From KO:
"I don't know"=1
Otherwise=0

	<u>Var1</u>	<u>Var2</u>	<u>SPSScorr</u>
cmc	Ignorance	Ind Allocation	-0.021
ot	Ignorance	Ind Allocation	-0.273
qt	Ignorance	Ind Allocation	0.093
ql	Ignorance	Ind Allocation	-0.676(**)
sp	Ignorance	Ind Allocation	-0.217
s	Ignorance	Ind Allocation	-0.405

People who don't know the expertise of other group members don't use the Intranet to allocate information

TM/PGT: Use of the Intranet (RI)

H: The more a person perceives that knowledgeable people retrieve from the Intranet the more that person will retrieve from the intranet

	<u>Var1</u>	<u>Var2</u>	<u>SPSSCorr</u>
cmc	Use by Knowledgeable People	Ind Retrieval	0.564(*)
ot	Use by Knowledgeable People	Ind Retrieval	0.765(**)
qt	Use by Knowledgeable People	Ind Retrieval	0.485(*)
ql	Use by Knowledgeable People	Ind Retrieval	0.841(**)
sp	Use by Knowledgeable People	Ind Retrieval	0.593(*)
s	Use by Knowledgeable People	Ind Retrieval	0.804(**)

How much a person thinks knowledgeable people retrieve from the Intranet influences how much that person retrieves from the Intranet

TM/PGT: Use of the Intranet (RI)

- H: The more a person perceives that knowledgeable people retrieve from the intranet the more that person will publish on the intranet

	<u>Var1</u>	<u>Var2</u>	<u>SPSSCorr</u>
cmc	Use by Knowledgeable People	Ind Allocation	0.489(*)
ot	Use by Knowledgeable People	Ind Allocation	0.384
qt	Use by Knowledgeable People	Ind Allocation	0.386
ql	Use by Knowledgeable People	Ind Allocation	0.559(*)
sp	Use by Knowledgeable People	Ind Allocation	-0.095
s	Use by Knowledgeable People	Ind Allocation	0.851(**)

How much a person thinks knowledgeable people retrieve from the Intranet influences how much that person allocates to the Intranet

TM & PGT

- H: The more people retrieve from a person on a knowledge area, the more that person allocates to the Intranet on that knowledge area

	<u>Var1</u>	<u>Var2</u>	<u>SPSSCorr</u>
cmc	CRI	Ind Allocation	0.284
ot	CRI	Ind Allocation	0.370
qt	CRI	Ind Allocation	0.716(**)
ql	CRI	Ind Allocation	0.279
sp	CRI	Ind Allocation	0.584(*)
s	CRI	Ind Allocation	0.448

People who are in high demand for information retrieval are likely to allocate to the Intranet

TM & PGT

H: The more others allocate to a person on a knowledge area, the more that person allocates to the Intranet on that knowledge area

	<u>Var1</u>	<u>Var2</u>	<u>SPSSCorr</u>
cmc	CAI	Ind Allocation	0.019
ot	CAI	Ind Allocation	0.147
qt	CAI	Ind Allocation	0.550(*)
ql	CAI	Ind Allocation	0.519(*)
sp	CAI	Ind Allocation	0.545(*)
s	CAI	Ind Allocation	0.363

People who have been allocated a lot of information are likely to allocate to the Intranet

Other Theories explaining retrieving and allocation of information on the Intranet

- We tested hypotheses from these theoretical mechanisms:
 - - **Social Contagion**
 - - **Social Exchange**
 - - **Inertial of Social Factors**
 - - **Proximity**

but we found only few significant results, possibly because of lack of statistical power.

Summary

- The perceived use of the Intranet by the knowledgeable people is the strongest predictor for both people's information allocation and retrieval on the Intranet.
- The Intranet didn't substitute for human-to-human communication to allocate or retrieve information.
- Instead the Intranet was used as a further channel to reach expertise.