



Augmented Knowledge Communication Spaces

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Pour your opinion to make it grow (*text on the watering can*)

©Kaiser Matthies, Berlin, for Deutsches Museum, Munich



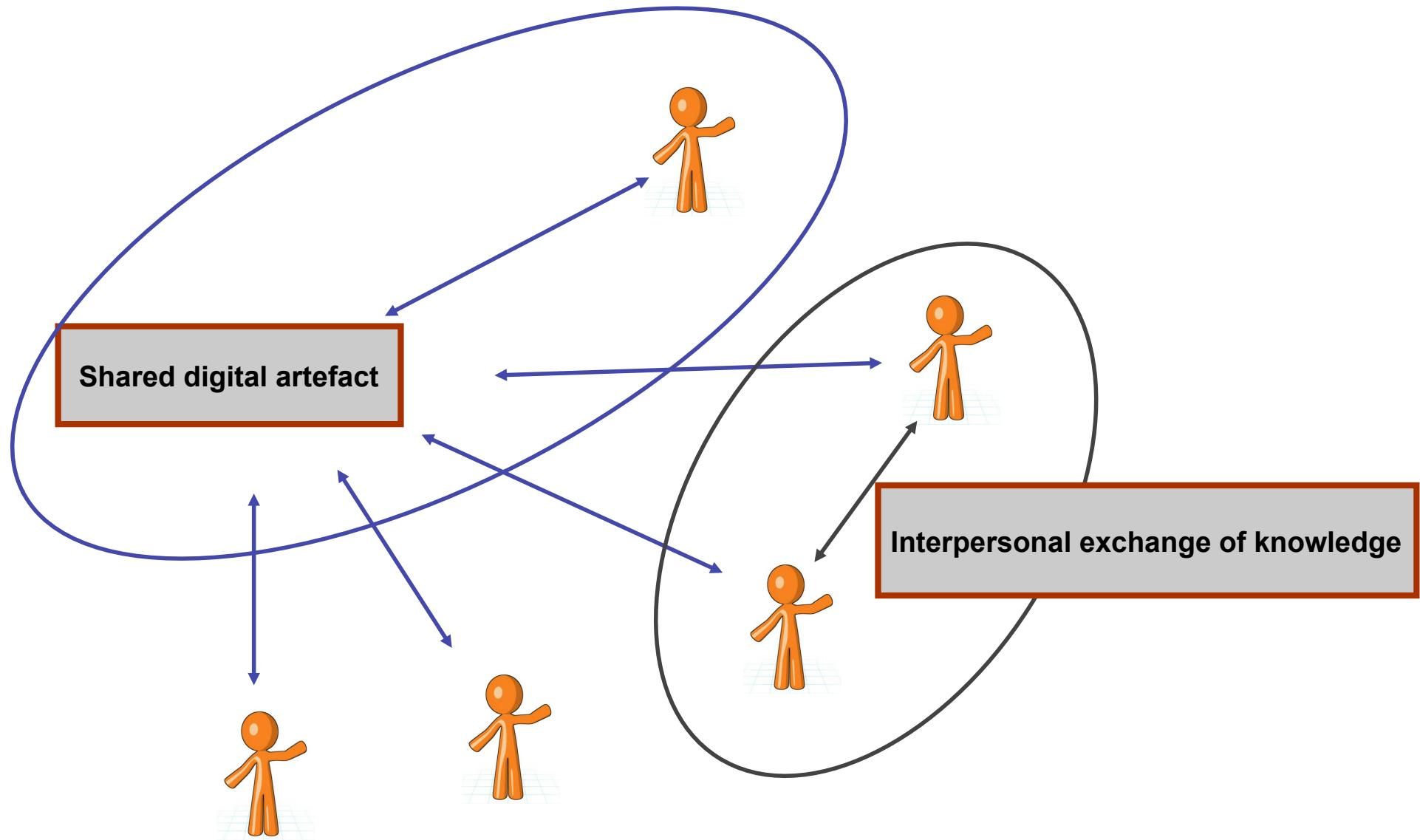
Pour your opinion
to make it grow !

or

„how to overcome
your *myside bias*“

starting from the problem that individual argumentation is biased with regard to preference-consistent information (*myside bias*)

Tools in augmented knowledge communication spaces can support people to overcome a myside bias (and much more!)





Web 2.0 | Tools und Services

Wikis

03/1995



01/2001



06/2003



02/2004



02/2005



Blogs

08/1999



01/2004



Networks

02/2004

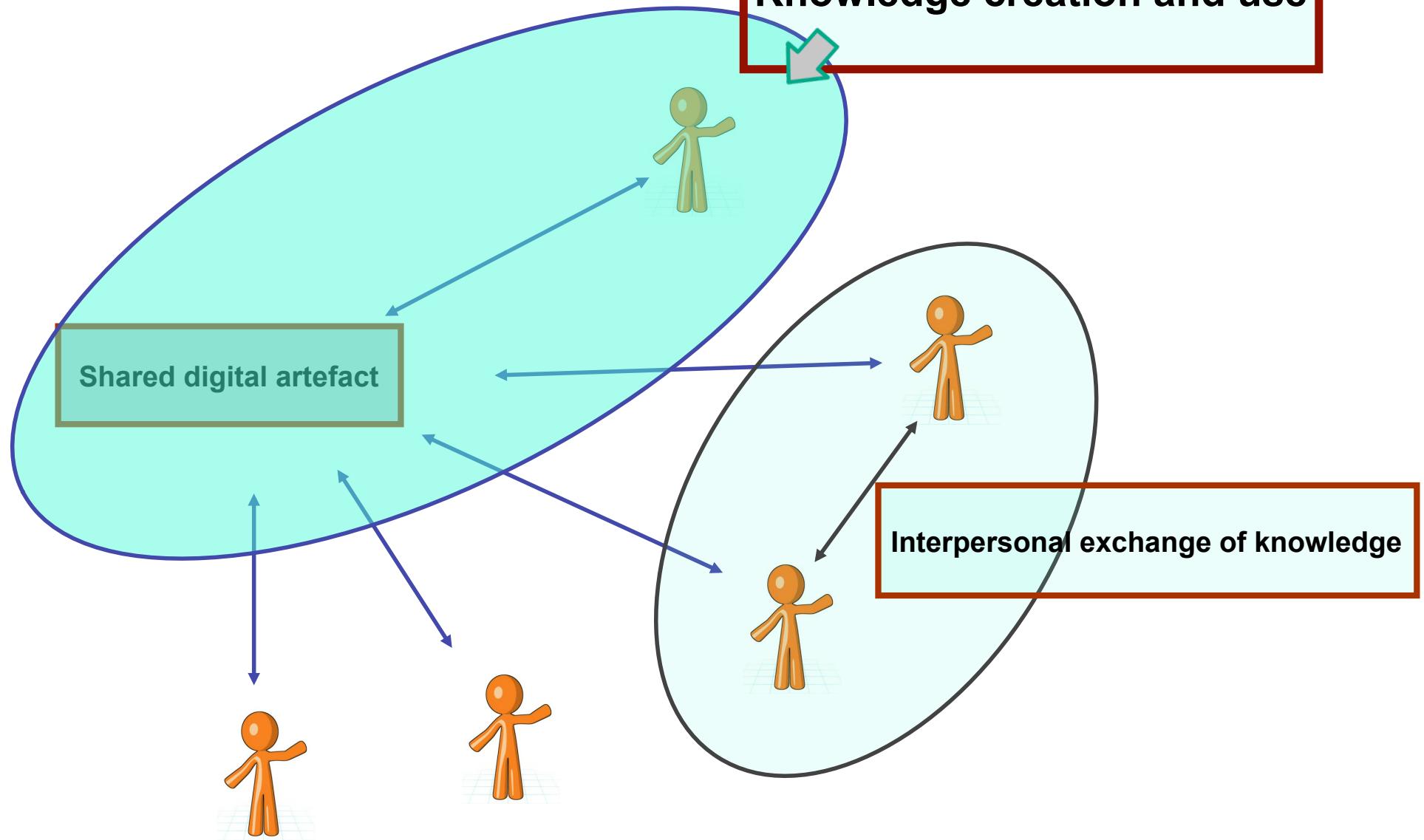


03/2006



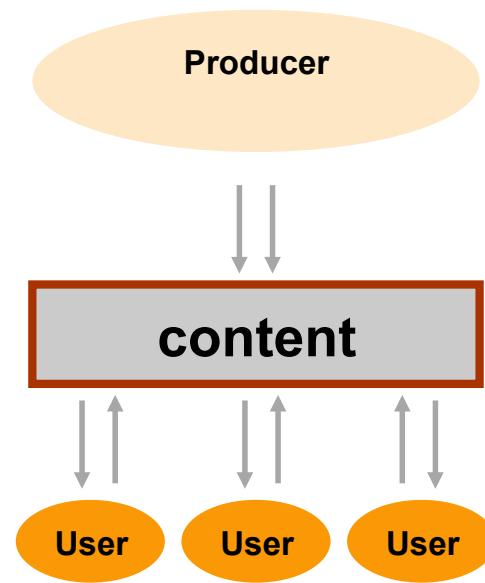
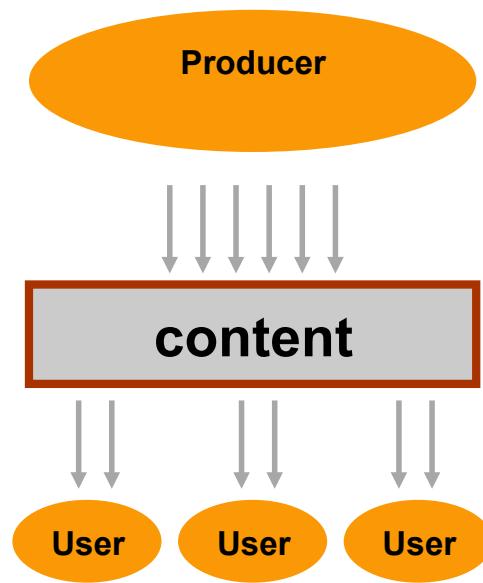
11/2005







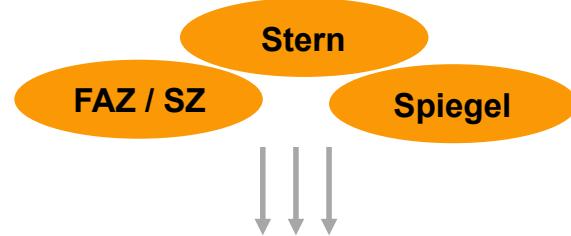
Knowledge 2.0 | user generated



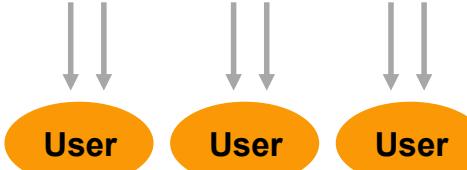


Knowledge 2.0 | aggregated

newspapers



Content|Agenda



watchblogs

bildblog

S. Niggemeier

Bild

netzpolitik

basicthinking

FAZ / SZ

blogs

spon.de

heise.de

twitter

youtube

facebook

virtual networks

newspapers

FAZ / SZ

Content|Agenda

Content|Agenda

FAZ / SZ

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

Content|Agenda

online

spon.de

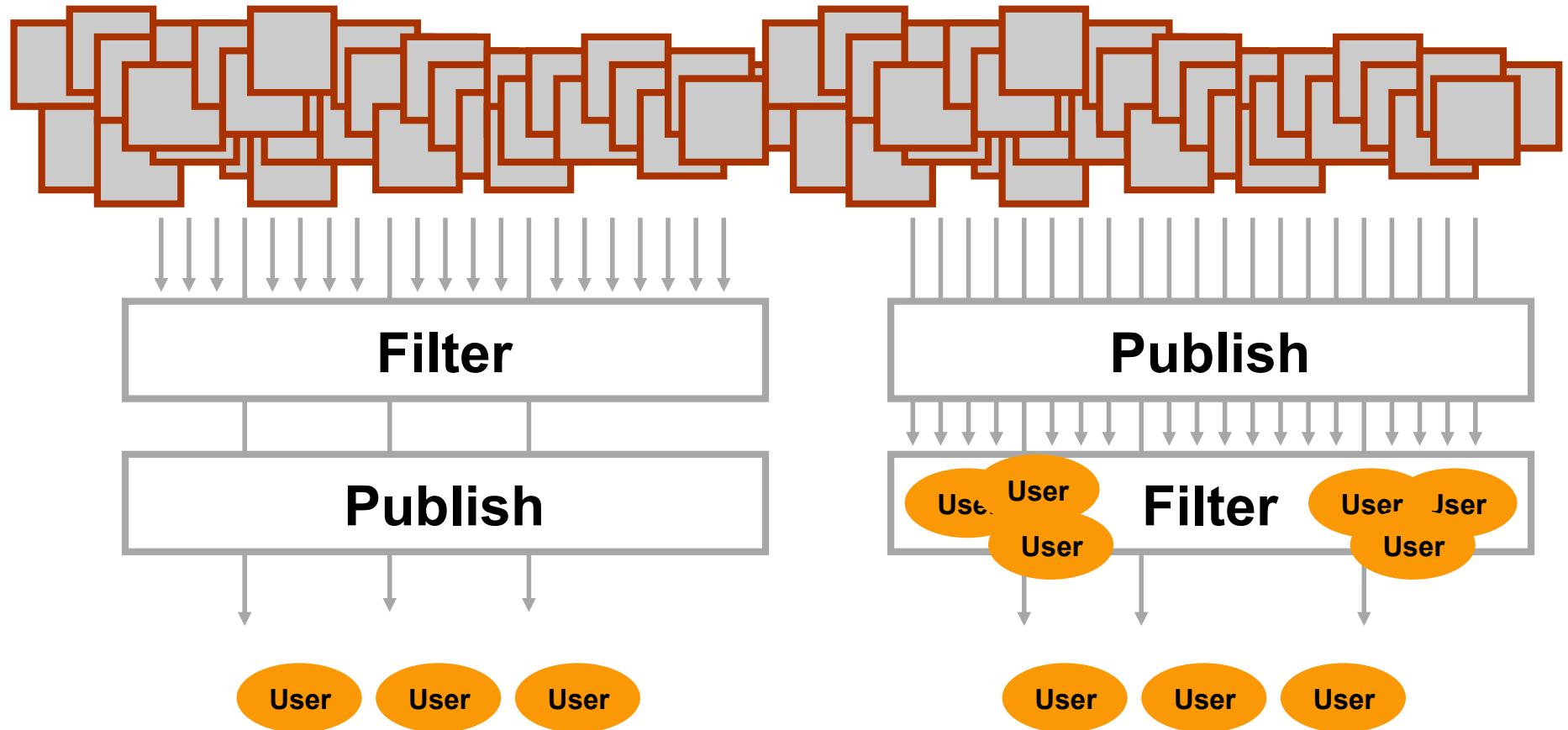
heise.de

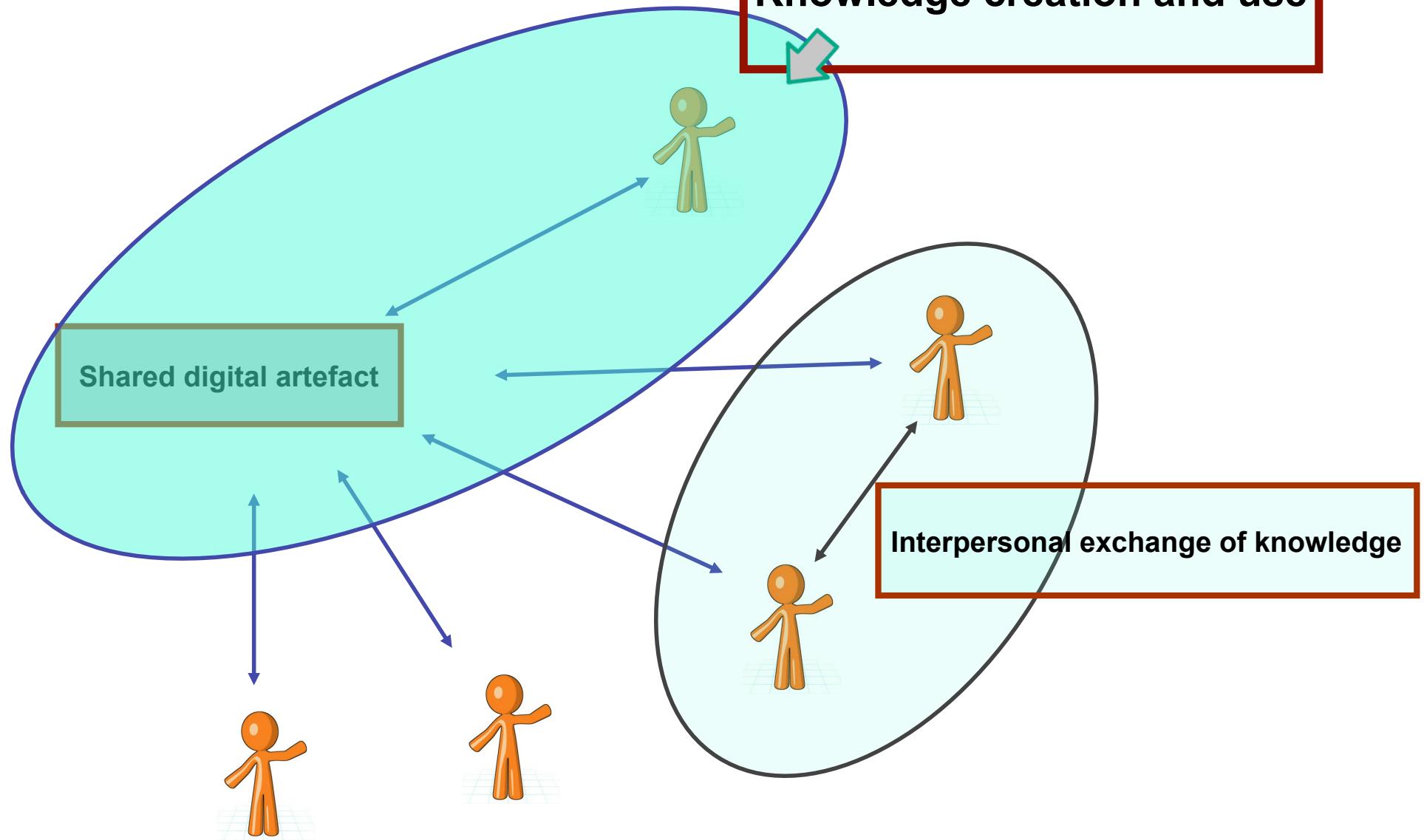
youtube

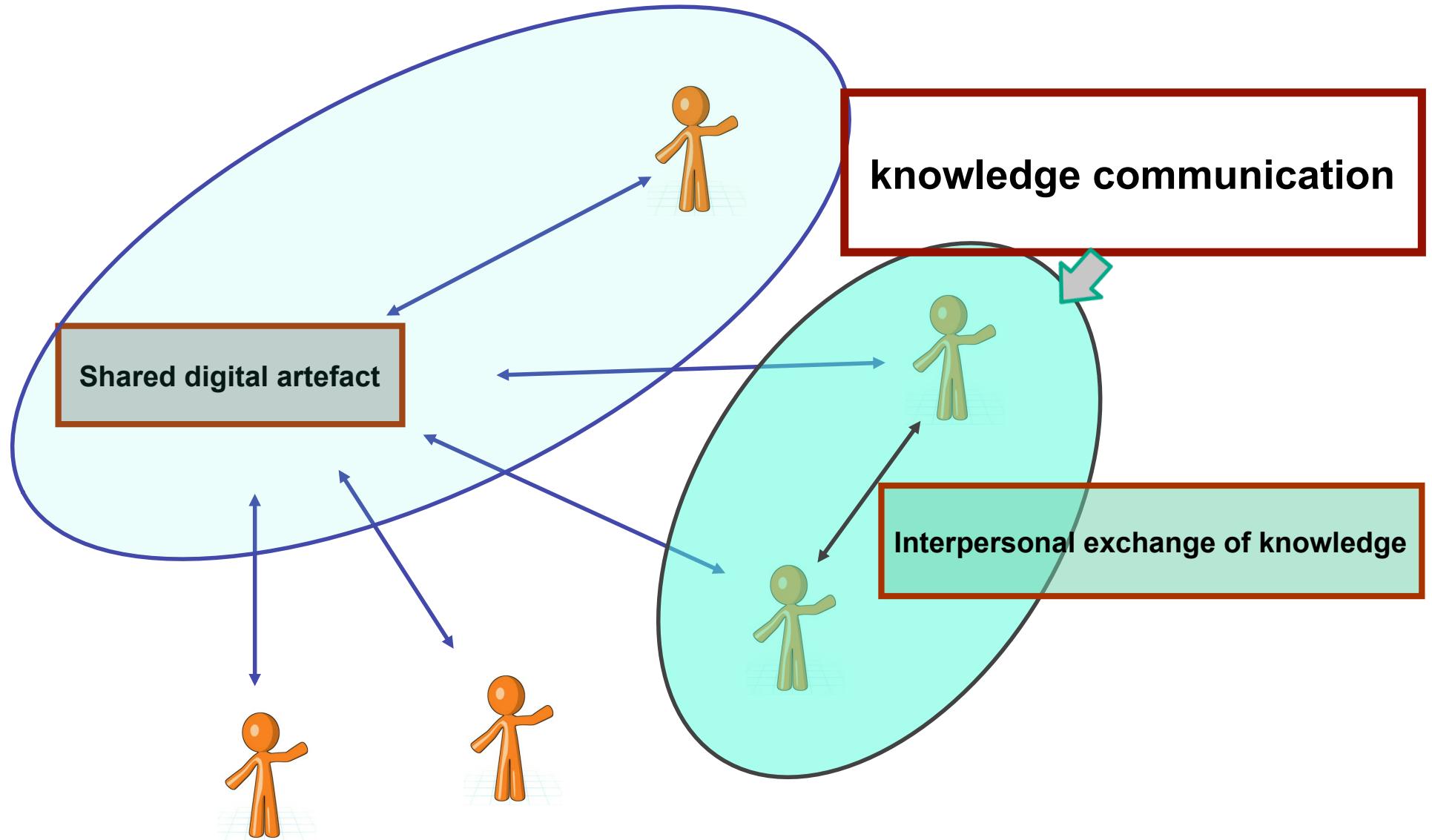
facebook



Knowledge 2.0 | aggregated but with new filtering demands









My Profil

- Who I am
- Who are my friends

My Groups

- Joint interests
- Coordination
- Showing ones colors
- Group profil

Status update to Friends

- What I am doing
- What I am interested in
- Pictures, Videos, Links
-

General Functions

- *Information management*
- *Social relation management*
- *Identity management*



- **One of the 21st Century Challenges:**

exchange of relevant information to solve problems, to take decisions and to be well informed to judge about something by means of the 21st century



Demands coming from problems of knowledge communication with intransparency

- Which knowledge, attitudes or opinions do other have
- How are these e.g. opinions distributed?
- My opinion compared to others?
- What do people think about a certain argument or subject?

⇒ *achieve transparency*



Demands coming from problems of knowledge communication with biased information processing

- Preference of consistent information (confirmation bias)
- Low tendency to integrate inconsistent information (myside bias)
- Preference of shared over unshared information (hidden profile bias)
- Strong influence of majorities (majority bias)

=> *Support evaluation and integration of controversial information*



- Besides identity management and the management of social relations, facebook could be used for information management
- *But:* Facebook is not primarily designed to support information management
- *But:* Facebook cannot easily be used for controlled and systematic empirical research



- *However: Facebook is in an evolutionary process of development and can also be mashed up a lot*
- *Nevertheless our Conclusion is: For the sake of controlled experimentation we are mainly using dedicated software tools to investigate and support knowledge communication*





- **Assumption:** Knowledge Communication Spaces (Wikipedia, Facebook, Forums) can benefit from additional support mechanisms, which would lead to

Augmented Knowledge Communication Spaces



Augmented Knowledge Communication Spaces

- **The Scenario**
- Communication partners are often not aware of the concrete expertise and dispositions of the partners and sometimes enter a scenario not knowing the history of it
- To be successful one has to overcome these deficits and can probably expect even more



Augmented Knowledge Communication Spaces

- Two **Principles of Support**
 - Mirroring: providing information about the concrete expertise and dispositions of the partners (→ group awareness)
 - Guiding: directing knowledge communication activities through transformation and salience (→ social navigation)



Augmented Knowledge Communication Spaces

- Dedicated **arrangements and tools** have been tried out in our research along two principal lines:
- *Line A*: to deliver direct information to establish a common ground between the participating members (disclosure function)
- *Line B*: to mine, aggregate, and transform information in order to facilitate reflection and change courses of action (intervention function)



Augmented Knowledge Communication Spaces

Tools and Studies



Lines and Tools (Studies)

Line A = disclosure function: overcoming intransparency

- 1 making self rated knowledge assessment visible
- 2 making in concept maps externalized knowledge visible
- 3 making knowledge differences and conflicts visible

Line B = intervention function: overcoming limitations

- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias



Tools and Studies of Line A

disclosure function: overcoming intransparency

- 1 making self rated knowledge assessment visible
- 2 making in concept maps externalized knowledge visible
- 3 making knowledge differences and conflicts visible



Tools and Studies of Line A

disclosure function: overcoming intransparency

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Line A Tools 1

iwm Institut für Wissensmedien
Knowledge Media Research Center
kmrc

Studie - Virtuelle Lerngruppe
Lernpartner C

Immunsystem	C B
Aufgabe	<input checked="" type="checkbox"/>
unspezifisch	<input type="checkbox"/>
spezifisch	<input type="checkbox"/>
zellulär-humoral	<input type="checkbox"/>
Komplementsystem	C B
Rezeptorkennung	<input type="checkbox"/>
Zytolyse	<input type="checkbox"/>
Markierung	<input type="checkbox"/>
Antikörperergänzung	<input type="checkbox"/>
T-Lymphozyten	C B
Reifung	<input type="checkbox"/>
Peptiderkennung	<input checked="" type="checkbox"/>
Reaktion	<input type="checkbox"/>
Notwendigkeit	<input type="checkbox"/>
T-Killer und T-Helferzellen	C B
Differenzierung	<input type="checkbox"/>
T-Killerzellen	<input type="checkbox"/>
T-Helferzellen	<input type="checkbox"/>
HIV	<input type="checkbox"/>
Antikörper	C B
B-Lymphozyten-Aktivierung	<input type="checkbox"/>
Antikörper-Produktion	<input type="checkbox"/>
B-Gedächtniszellen	<input type="checkbox"/>
Antikörper-Wirkung	<input type="checkbox"/>
Phagozytose	C B
Phagozyten	<input type="checkbox"/>
Erkennung	<input type="checkbox"/>
Prozess	<input type="checkbox"/>
Antigenpräsentation	<input type="checkbox"/>

Antikörper

B-Lymphozyten-Aktivierung

Zur Produktion von Antikörpern werden B-Lymphozyten benötigt, die wie Phagozyten antigen-präsentierende Funktion haben. B-Lymphozyten sind Träger der spezifischen humoralen Immunantwort. B-Lymphozyten detektieren Antigene mit ihren Rezeptoren. Wenn neben der Detektion von Antigenen noch T-Lymphozyten Zytokine ausschütten, werden B-Lymphozyten aktiviert.

Antikörper-Produktion

Aktivierte B-Lymphozyten teilen sich mehrfach. Die Mehrzahl der entstehenden Zellen sind Plasmazellen (ca. 500 je B-Lymphozyt), die Antikörper produzieren (je Plasmazelle ca. 2000 Antikörper pro Sekunde). Antikörper sind frei abgegebene lösliche Formen der B-Zell-Rezeptoren.

B-Gedächtniszellen

Die Reakt. der Zellen geht in einen Ruhezustand über, speichert Informationen und stellt einen Teil des immunologischen Gedächtnisses (B-Gedächtniszellen) dar. Bei späteren Kontakten mit diesen Pathogenen erfolgt die Produktion von Antikörpern schneller und stärker, da Antigene sofort erkannt werden.

Antikörper-Wirkung

Die produzierten Antikörper (im Bild blau) besetzen das Antigene (im Bild rot) am Erreger, wobei Antikörper auf spezifische Antigene ausgerichtet sind. Dadurch wird der Abbau des Antigens durch Komplement beziehungsweise durch Phagozytose beschleunigt.



Schreibe bitte Deine Erklärung zum angegebenen Thema für Lernpartner B in das Textfeld!

1. Bitte erkläre das Thema T-Lymphozyten

*Erklärung

abschicken

- Problem: Communicators do not know how much their interaction partners know
- Solution: Partner Knowledge Awareness Tool provides self-rated degrees of understanding about content elements (Dehler Zufferey, Bodemer, Buder, & Hesse, 2011)



Line A Tools 1

- Learners read hypertext and rated their degree of understanding with regard to text nodes
- Tool provided knowledge awareness either about oneself or about oneself and partner

Immunsystem	C B	
Aufgabe	<input checked="" type="checkbox"/>	
unspezifisch	<input checked="" type="checkbox"/>	
spezifisch	<input checked="" type="checkbox"/>	
zellulär-humoral	<input checked="" type="checkbox"/>	
Komplementsystem	C B	
Fremderkennung	<input checked="" type="checkbox"/>	
Zytolyse	<input checked="" type="checkbox"/>	
Markierung	<input checked="" type="checkbox"/>	
Antikörperergänzung	<input checked="" type="checkbox"/>	
T-Lymphozyten	C B	
Reifung	<input checked="" type="checkbox"/>	
Peptiderkennung	<input checked="" type="checkbox"/>	
Reaktion	<input checked="" type="checkbox"/>	
Notwendigkeit	<input checked="" type="checkbox"/>	
T-Killer und T-Helferzellen	C B	
Differenzierung	<input checked="" type="checkbox"/>	
T-Killerzellen	<input checked="" type="checkbox"/>	
T-Helferzellen	<input checked="" type="checkbox"/>	
HIV	<input checked="" type="checkbox"/>	
Antikörper	C B	
B-Lymphozyten-Aktivierung	<input checked="" type="checkbox"/>	
Antikörper-Produktion	<input checked="" type="checkbox"/>	
B-Gedächtniszellen	<input checked="" type="checkbox"/>	
Antikörper-Wirkung	<input checked="" type="checkbox"/>	
Phagozytose	C B	
Phagozyten	<input checked="" type="checkbox"/>	
Erkennung	<input checked="" type="checkbox"/>	
Prozess	<input checked="" type="checkbox"/>	
Antigenpräsentation	<input checked="" type="checkbox"/>	

Antikörper

B-Lymphozyten-Aktivierung

Zur Produktion von Antikörpern werden B-Lymphozyten benötigt, die wie Phagozyten antigen detektieren. B-Lymphozyten sind Träger der spezifischen humoralen Immunantwort. B-Lymphozyten detektieren Antigene und aktivieren sich. Wenn neben der Detektion von Antigenen noch T-Lymphozyten Zytokine ausschütten, werden B-Lymphozyten verstärkt aktiviert.



Antikörper-Produktion

Aktivierte B-Lymphozyten teilen sich mehrfach. Die Mehrzahl der entstehenden Zellen sind Plasmazellen. Diese produzieren (je Plasmazelle ca. 2000 Antikörper pro Sekunde). Antikörper sind frei im Blut und binden an B-Zell-Rezeptoren.



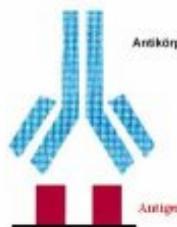
B-Gedächtniszellen

Der Rest der Zellen geht in einen Ruhezustand über, speichert Informationen und stellt einen Teil der Zellen (B-Gedächtniszellen) dar. Bei späteren Kontakten mit diesem Pathogen erfolgt die Produktion von Antikörpern sofort erkannt werden.



Antikörper-Wirkung

Die produzierten Antikörper (im Bild blau) besetzen das Antigene (im Bild rot) am Erreger, wobei Antikörper unterschiedlich ausgerichtet sind. Dadurch wird der Abbau des Antigens durch Komplement beziehungsweise durch Phagozytose ermöglicht.



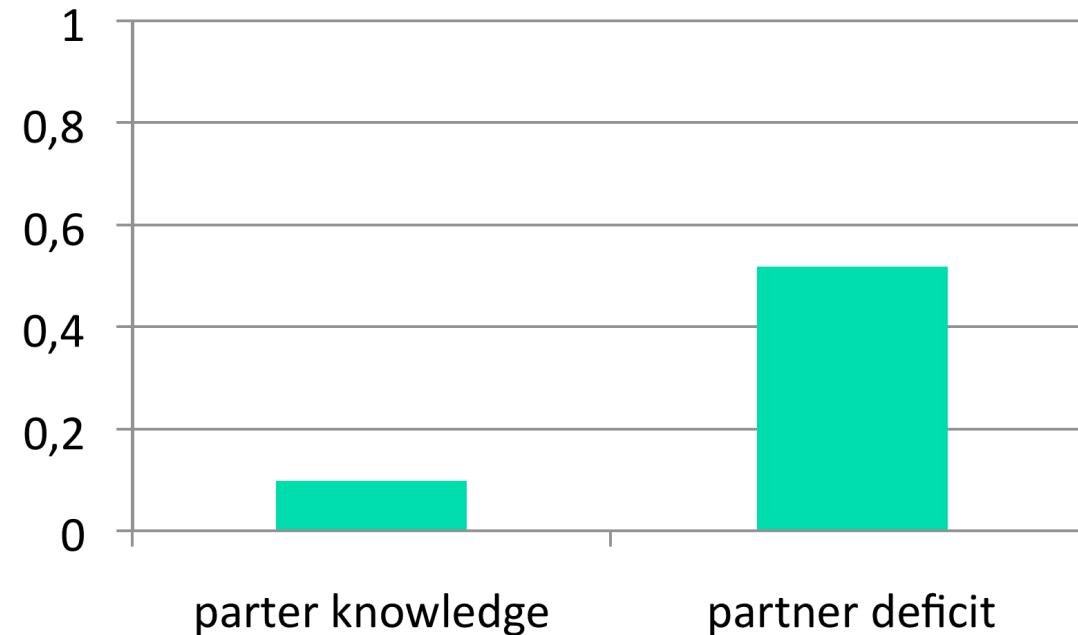
Schreibe bitte Deine Erklärung zum angegebenen Thema für Lernpartner B in das Textfeld!

1. Bitte erkläre das Thema T-Lymphozyten

* Erklärung

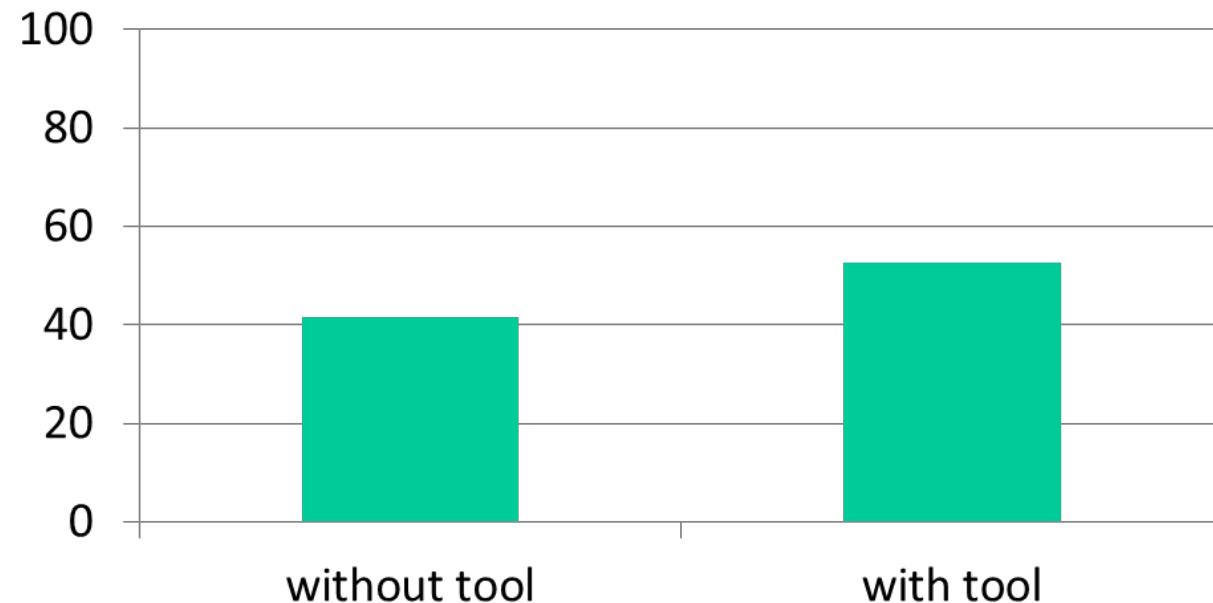
abschicken

Adaptation towards...



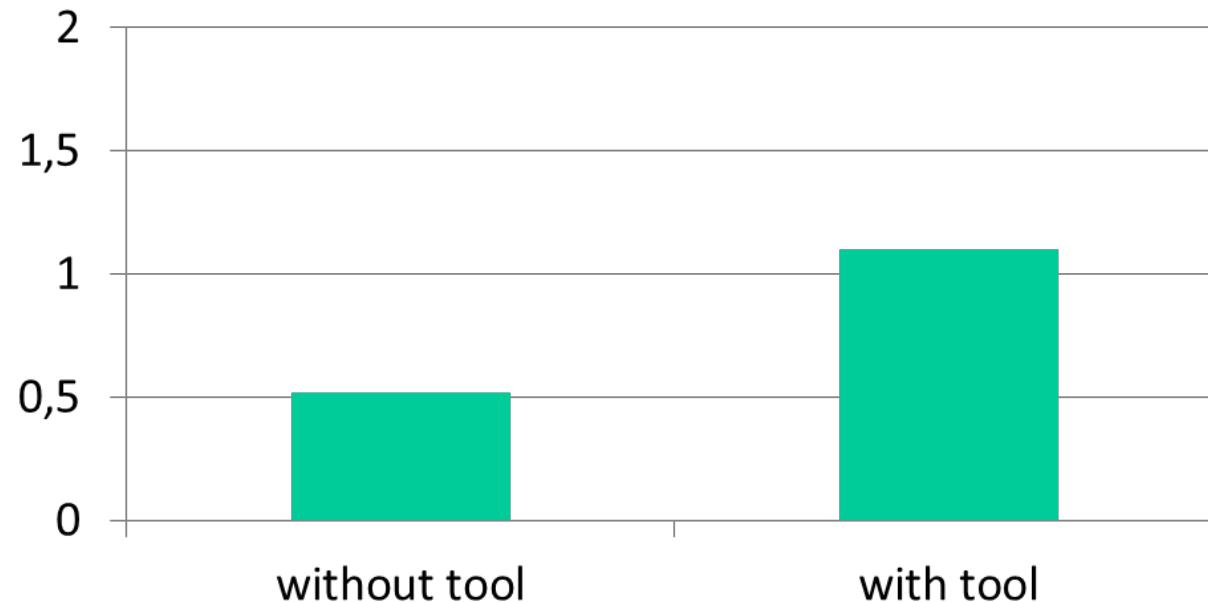
- Knowing about partner knowledge leads to adaptation towards partner deficits; $t(20) = 2.62$, $p < .05$
- (average number of elaborations per explainer)

Inferential knowledge



- Knowing about partner knowledge increases knowledge of the explainer; $F(2,40) = 4.92, p < .05$
- (average percentage of correct answers in individual inferential knowledge test)

Knowledge transformation



- Knowing about partner knowledge increases knowledge transformation of the explainer (more deviations of explanations from original order); $F(1,40) = 4.72, p < .05$
- (average number of deviations from original presentation order)



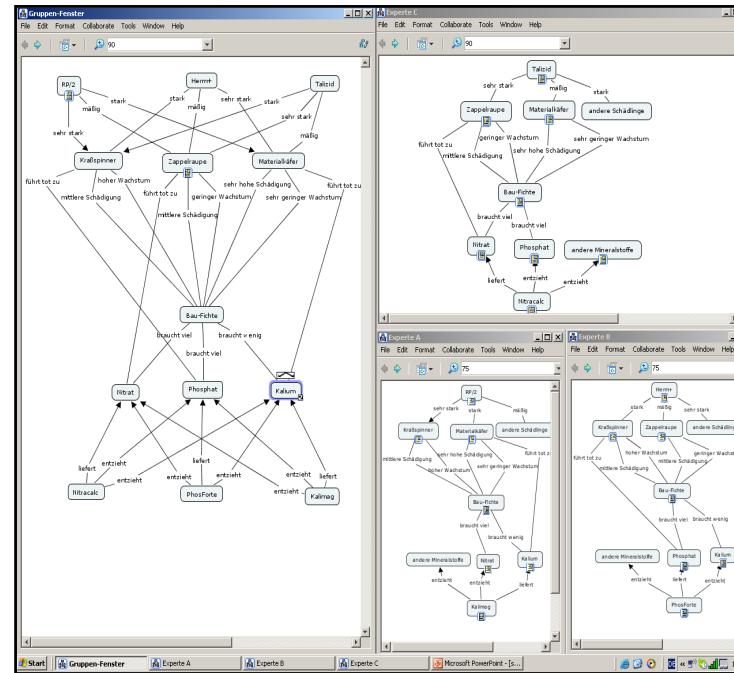
Tools and Studies of Line A

disclosure function: overcoming intransparency

- 1 making self rated knowledge assessment visible
- 2 making in concept maps externalized knowledge visible
- 3 making knowledge differences and conflicts visible



Line A Tools 2



- Problem: Communicators conceptualize their knowledge differently
- Solution: Knowledge and Information Awareness Tools display different conceptualizations (Engelmann & Hesse, 2010)



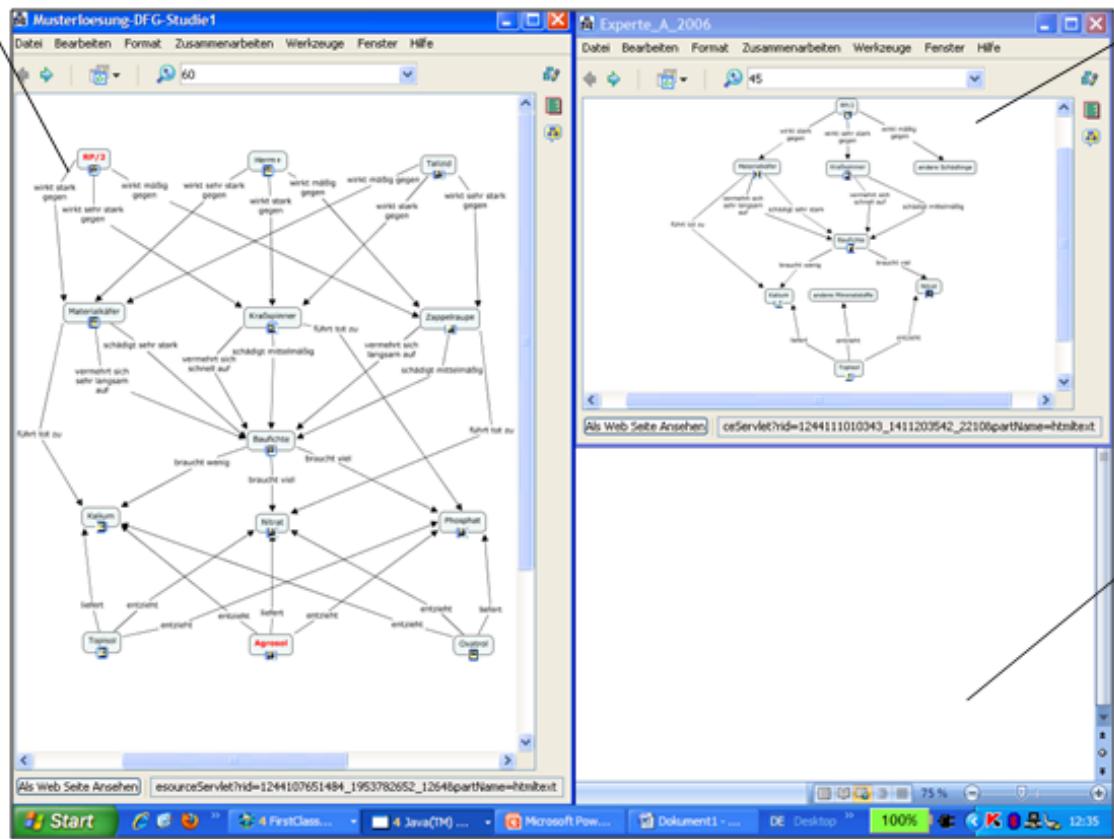
Line A Tools 2

- Learners externalized their knowledge as individual concept maps
- Tool displayed individual concept maps and prompted learners to construct a joint concept map



Line A Tools 2

Shared Working Window



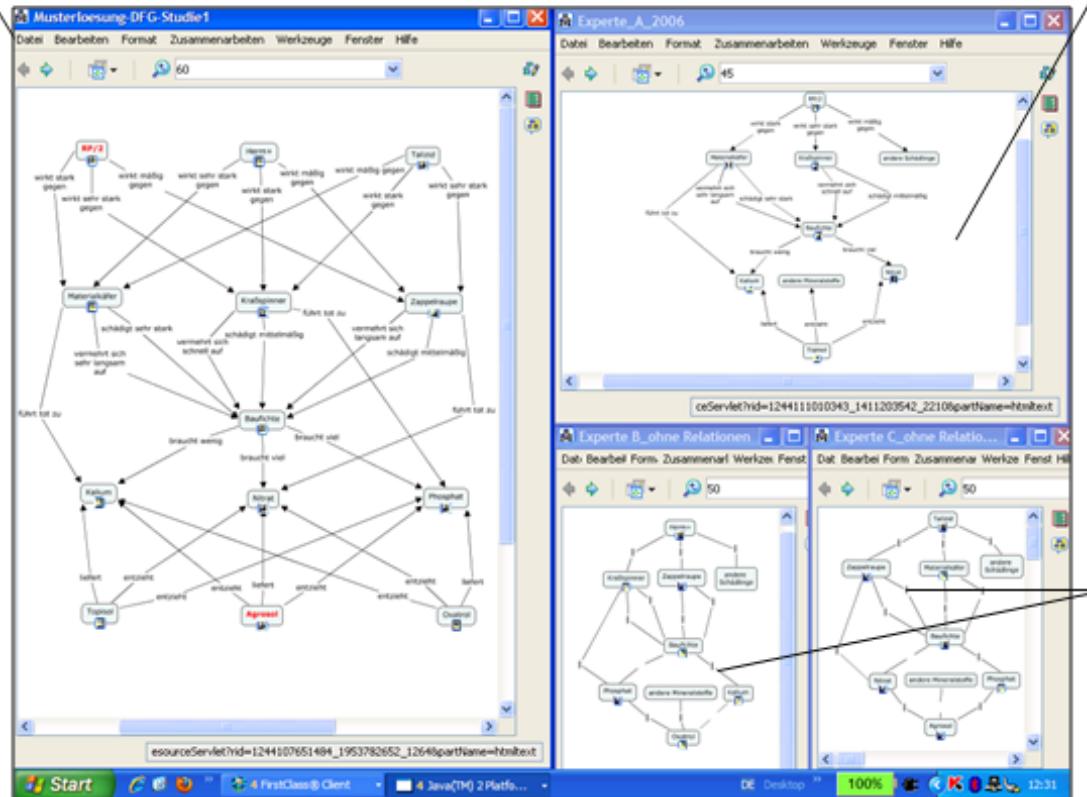
Own Working Window

Without Working Windows of the Collaborators



Line A Tools 2

Shared Working Window



Own Working Window

With Working Windows of the Collaborators



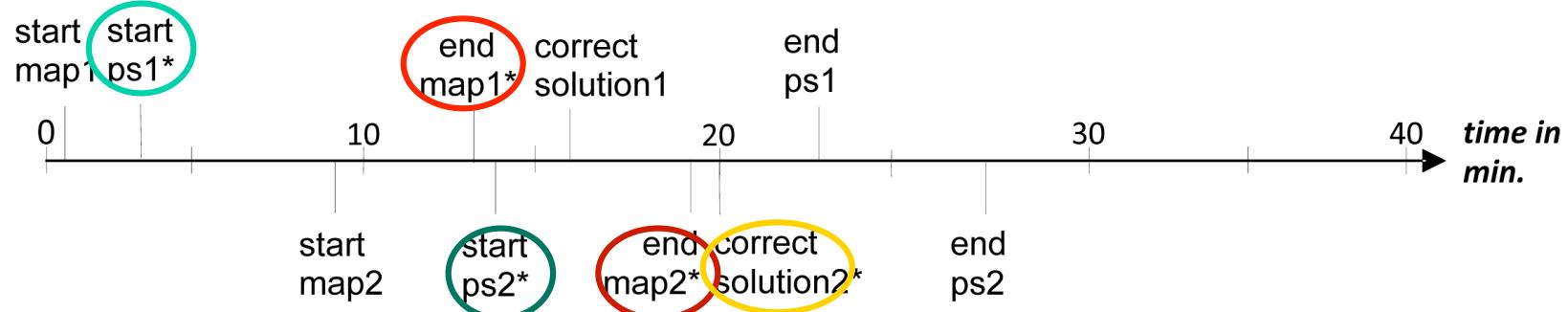
Quality of problemsolving:

Variable	Result	Mean	p	η_p^2
Correct solution (1)	EG = CG		n.s.	
Correct arguments for solution (1)	(EG > CG)	$M_C = 1.4$ $M_E = 2.1$	<.10	.08
Correct solution (2)	EG > CG	$M_C = 0.55$ $M_E = 0.95$	<.01	.21
Correct arguments for solution (2)	EG > CG	$M_C = 0.85$ $M_E = 2.1$	<.01	.37

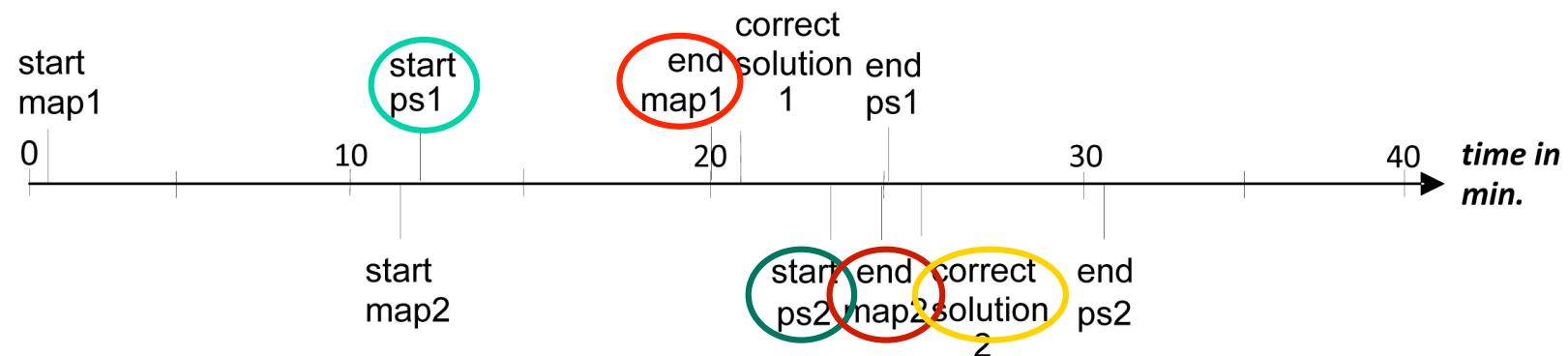
- **EG with better solution, especially with complex problem**



Experimental group



Control group



* significant differences between the two conditions



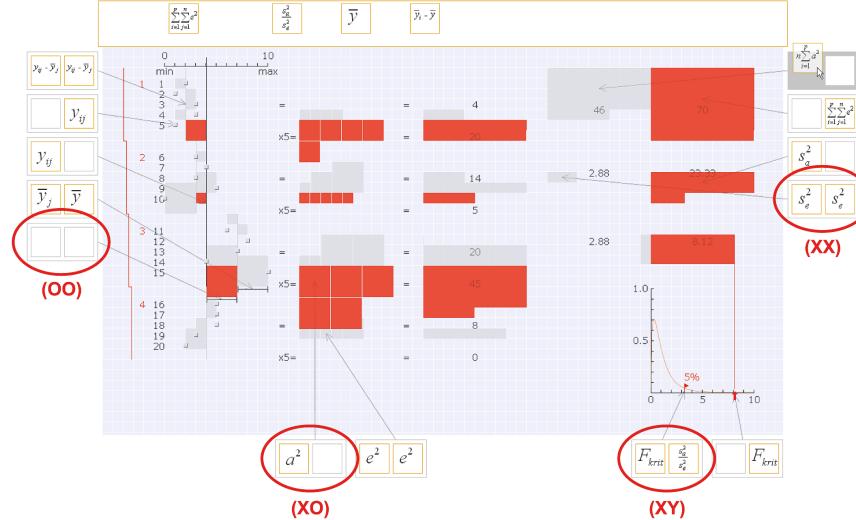
Tools and Studies of Line A

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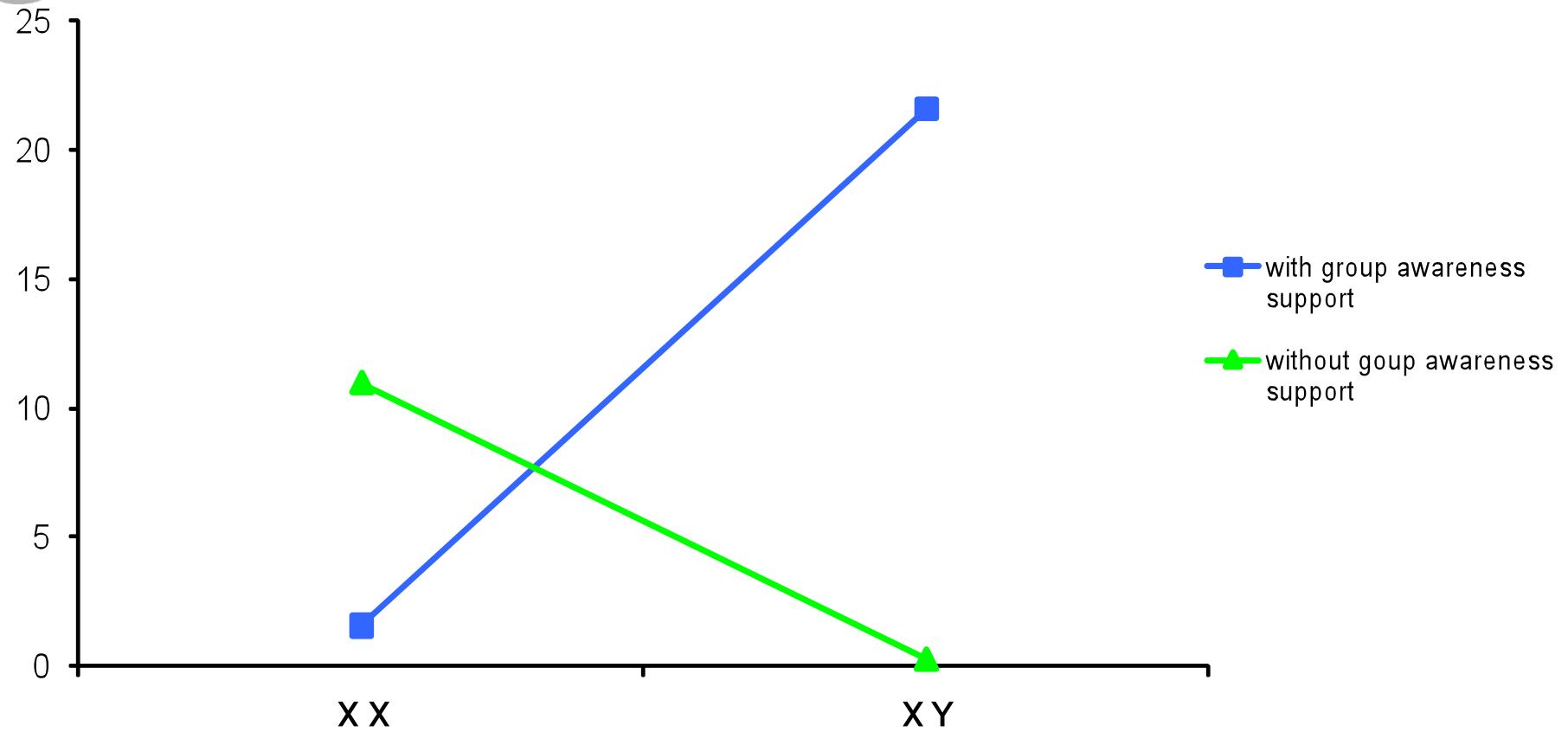
Line A Tools 3



- Problem: Communicators do not see possible differences and conflicts easily
- Solution: Awareness Tools display critical values (Bodemer, 2011)

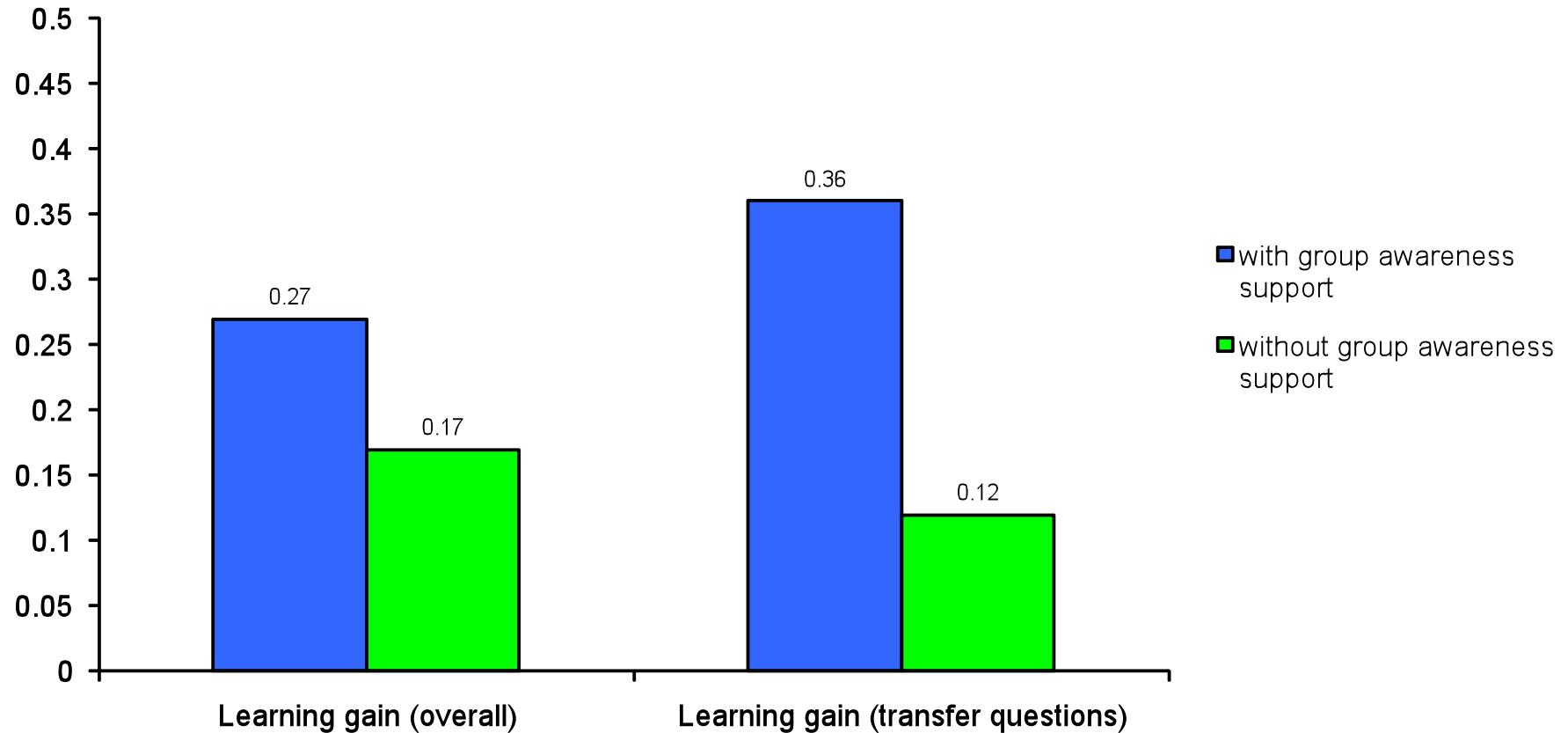


Collaborative Integration:
guiding by presenting knowledge constellations



Constellations affect collaborative elaboration:
results for contribution type „broaden & deepen“

(relative number of contributions)



Group awareness and discussing controversies lead to better learning
(relative frequencies of knowledge test score differences)



Tools and Studies of Line B

intervention function: overcoming limitations

- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias



Tools and Studies of Line B

intervention function: overcoming limitations

- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias



Line B Tools 1

Bitte markieren Sie diejenige Quelle, die Ihnen besonders interessant erscheint, um sich weiter über das Problemfeld zu informieren.

Keine Fairness: Doping im Sport wird nur deshalb stärker als Problem wahrgenommen, weil die Funktionen der Muskeln leichter zu verstehen sind. Hirndoping ist jedoch genauso unfair.
-> mehr

Kreatives Enhancement akzeptiert: Hätten bekannte Künstler keine Drogen wie Alkohol, Absinth und Marihuana konsumiert, würde eine große Anzahl von klassischen Werken in der Musik- und Kunstwelt fehlen.
-> mehr

Leistungserwartungen nivellieren sich: Neuro-Enhancement nutzt seinen Anwendern nur, so lange die Substanzen nicht allen zugänglich sind. Ansonsten gleicht sich der gewonnene Nutzen wieder aus.
-> mehr

Enhancement als Erziehung: Auch die Veränderungen, welche durch Lernen zweifelsfrei im Gehirn hervorgerufen werden, stellen einen Eingriff in die neuronalen Funktionswege dar.
-> mehr

Übermäßige Perfektionierung angestrebt: Die Ära der liebenswerten kleinen Macken könnte bald vorbei sein. Die Forschung ist auf der Suche nach Methoden, uns perfekt zu machen. Das brauchen wir nicht.
-> mehr

Natürliche Stimulanzen verbreitet: Auch Koffein, Alkohol und Schokolade beeinflussen den zerebralen Zustand, tragen zur Selbstoptimierung bei und sind in der modernen Gesellschaft akzeptiert.
-> mehr

Folgende Informationsquelle wird Ihnen empfohlen:

Berufsrisiken verringern: Besonders bei Berufen, in denen Fehler beträchtliche Auswirkungen nach sich ziehen (wie bei Fluglotsen, Chirurgen oder Berufssoldaten), sollte die Leistungssteigerung toleriert werden.
-> mehr

Soziale Lösungen geeigneter: Die Leistungsanforderungen in der Gesellschaft nehmen permanent zu. Diese Anforderungen sollten eigentlich den Fähigkeiten der Menschen angepasst werden – nicht umgekehrt.
-> mehr

Weiter

- Problem: **Information search** is biased with regard to preference-consistent information (confirmation bias)
- Solution: Preference-inconsistent recommender system (Schwind, Buder, & Hesse, 2011)



Line B Tools 1

- Users were confronted with arguments on a controversial issue, and were requested to select one argument for further inspection
- Tool provided no recommendation vs. preference-consistent recommendation vs. preference-inconsistent recommendation
- Results: reduced confirmation bias and better elaboration through preference-inconsistent recommendations

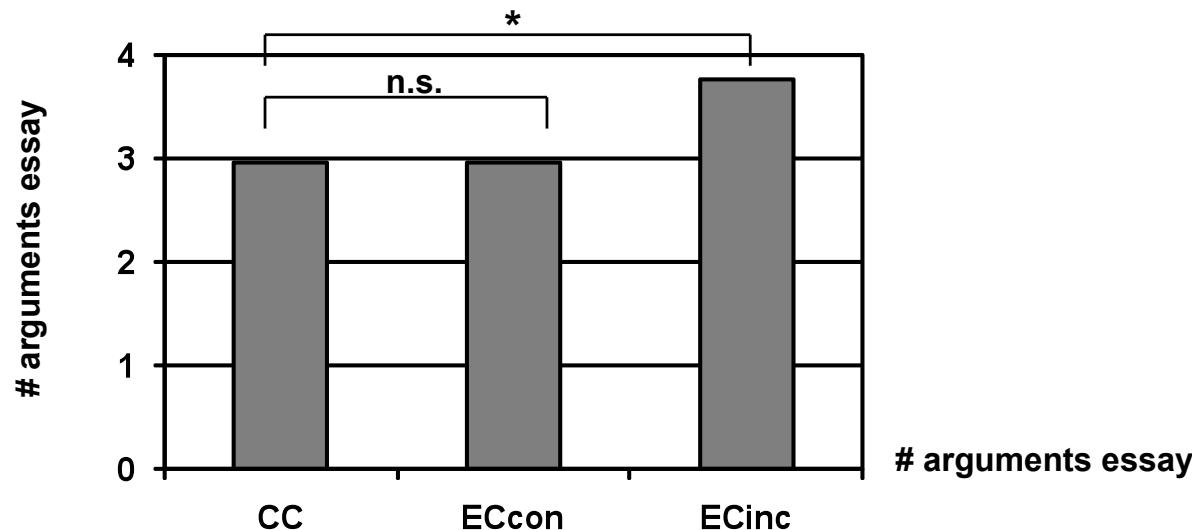
The following information resource is recommended to you:

- Maximizing existing potentials:** Neuro-enhancers improve our ability to concentrate by stimulating neurotransmitters in the brain. They do not improve intelligence; they only make perfect use of existing powers.
[>> more](#)
- Pervasiveness of natural stimulants:** Caffeine, alcohol, and chocolate also affect the mind, and contribute to self-improvement. These stimulants are accepted in modern society.
[>> more](#)
- No fairness:** Performance enhancement in sports is generally regarded as unfair. Neuro-enhancers introduce the same inequalities for cognitive capacities.
[>> more](#)
- Enhancement of creative powers:** If well-known artists had not taken neuro-stimulating drugs like alcohol, absinth or marijuana, many great works of art and music would have been missing.
[>> more](#)
- Minimizing risks at the workplace:** Neuro-enhancement should be embraced particularly for professional fields where human failure is likely to lead to detrimental outcomes (e.g. air traffic controllers, surgeons, or military personnel).
[>> more](#)
- Leveling out of advantages:** Neuro-enhancement only gives a competitive edge as long as the substances aren't available to everybody. With easy access for everybody, the benefits will level out.
[>> more](#)
- Persistence of effects:** The experiences that people make under the influence of neuro-enhancers can forever change their personality, even if the enhancers themselves have no immediate side effects.
[>> more](#)
- Striving for undesirable perfectionism:** The era of lovable little quirks might be over quite soon. Research is looking for ways to make us perfect. We don't need that.
[>> more](#)



Results Essay | How many arguments were generated?

- IV Condition (CC vs. EC_{con} vs. EC_{inc})
- DV # arguments essay



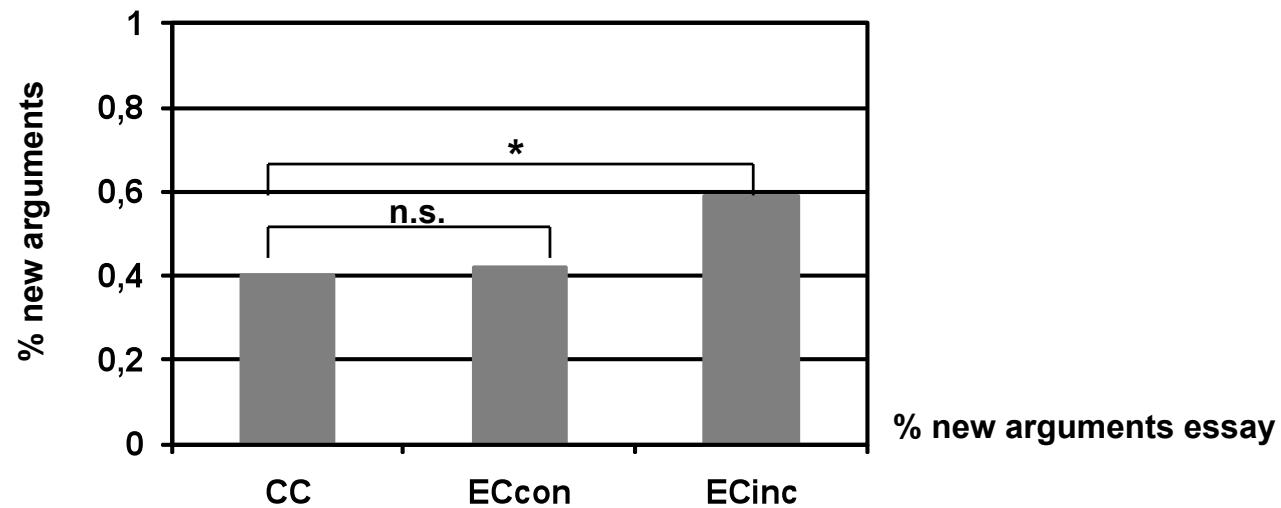
ME Condition: $F(2,86) = 2.98; p = .056$

(Generation of novel arguments: percentage of novel arguments mentioned in essays)



Results Essay | How many arguments were *new*?

- IV Condition (CC vs. EC_{con} vs. EC_{inc})
- DV % new arguments essay



ME Condition: $F(2,86) = 3.37; p < .05$



Tools and Studies of Line B

intervention function: overcoming limitations

- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias



Line B Tools 2

Der blaue Punkt markiert Ihre eingegebene Meinung zum Thema Nanotechnologie
- der rote Balken die durchschnittliche Meinung der anderen Besucher, die vor Ihnen ihre Meinung eingegeben haben.

Unten werden die eingegebenen Statements der drei letzten Besucher der Ausstellung angezeigt.

Ich bin absolut gegen Nanotechnologie  Ich bin absolut für Nanotechnologie

Dies hier sind die drei zuletzt eingegebenen Statements anderer Besucher der Ausstellung Nanodialog:

"Ich bin erschrocken, dass so viele Möglichkeiten des Missbrauchs bestehen. Der Einsatz zu militärischen Zwecken macht mir Angst, es erscheint mir wahnsinnig, mit Nanotechnologie „bessere“ Tötungsmittel herzustellen. Und auch unter Gesichtspunkten des Datenschutzes ist Nanotechnologie in den falschen Händen ein großes Risiko."

"Nanotechnologie - nein danke...Für besonders problematisch halte ich Klonen, "Roboter", sogenannte Monster, da sie den Menschen entmenschlichen und entwürdigen d.h. der Mensch ist nicht mehr das höchste Wesen, sondern eine lächerliche Gestalt, die nach Belieben veränderbar ist. Die Natur wird außer Kraft gesetzt und mittels molekularer Veränderung kann z.B. die DNA von Embryonen verändert werden, werden Behinderungen im Voraus festgestellt, kann man abtreiben, man kann also über das Leben von anderen entscheiden über natürliche Voraussetzungen hinweg."

"Ich bin absolut gegen Nanotechnologie. Bedenklich finde ich vor allem den Einsatz in der Medizin. Da dies noch nicht ausreichend erfasst wurde mit all seinen Risiken. Was, wenn es zu unerwarteten Mutationen oder unerwarteten Reaktionen des menschlichen Körpers kommt, wenn Nanopartikel leichtsinnig eingesetzt werden, z.B. als „Operationsroboter“? Eingriffe durch "Nanochirurgen" in den menschlichen Körper finde ich gruselig..."

- Problem: **Individual argumentation** is biased with regard to preference-consistent information (myside bias)
- Solution: support reflective judgement



Reflective Judgment

Informal Reasoning

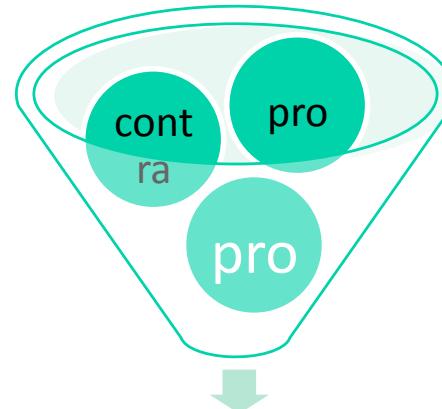
“Reasoning about causes and consequences and about advantages and disadvantages, or pros and cons, of particular propositions or decision alternatives” (*Zohar & Nemet, 2002*)

Critical Thinking

“Ability to properly construct and evaluate arguments” (*Facione, 1986*)

Reflective Thinking

“Ability to evaluate knowledge claims and to explain and defend their points of view on controversial issues” (*King & Kitchener, 1994*)



reflected
judgement

Critical thinking and well informed decision making

- to question assumptions
- to evaluate arguments
- to integrate controversial information
- to take alternative interpretations into consideration
- to draw founded conclusions
- to evaluate again after getting new information

**Der blaue Punkt markiert Ihre eingegebene Meinung zum Thema Nanotechnologie
- der rote Balken die durchschnittliche Meinung der anderen Besucher, die vor Ihnen ihre Meinung eingegeben haben.**

Unten werden die eingegebenen Statements der drei letzten Besucher der Ausstellung angezeigt.

Ich bin absolut gegen Nanotechnologie Ich bin absolut für Nanotechnologie

Dies hier sind die drei zuletzt eingegebenen Statements anderer Besucher der Ausstellung Nanodialog:

"Ich bin erschrocken, dass so viele Möglichkeiten des Missbrauchs bestehen. Der Einsatz zu militärischen Zwecken macht mir Angst, es erscheint mir wahnsinnig, mit Nanotechnologie „bessere“ Tötungsmittel herzustellen. Und auch unter Gesichtspunkten des Datenschutzes ist Nanotechnologie in den falschen Händen ein großes Risiko."

"Nanotechnologie - nein danke...Für besonders problematisch halte ich Klonen, "Roboter", sogenannte Monster, da sie den Menschen entmenschlichen und entwürdigen d.h. der Mensch ist nicht mehr das höchste Wesen, sondern eine lächerliche Gestalt, die nach Belieben veränderbar ist. Die Natur wird außer Kraft gesetzt und mittels molekularer Veränderung kann z.B. die DNA von Embryonen verändert werden, werden Behinderungen im Voraus festgestellt, kann man abtreiben, man kann also über das Leben von anderen entscheiden über natürliche Voraussetzungen hinweg."

"Ich bin absolut gegen Nanotechnologie. Bedenklich finde ich vor allem den Einsatz in der Medizin. Da dies noch nicht ausreichend erfasst wurde mit all seinen Risiken. Was, wenn es zu unerwarteten Mutationen oder unerwarteten Reaktionen des menschlichen Körpers kommt, wenn Nanopartikel leichtsinnig eingesetzt werden, z.B. als „Operationsroboter“? Eingriffe durch "Nanochirurgen" in den menschlichen Körper finde ich gruselig..."



Adjustment after feedback

after congruent feedback:

$$t(19) = -5.32, p < .001$$



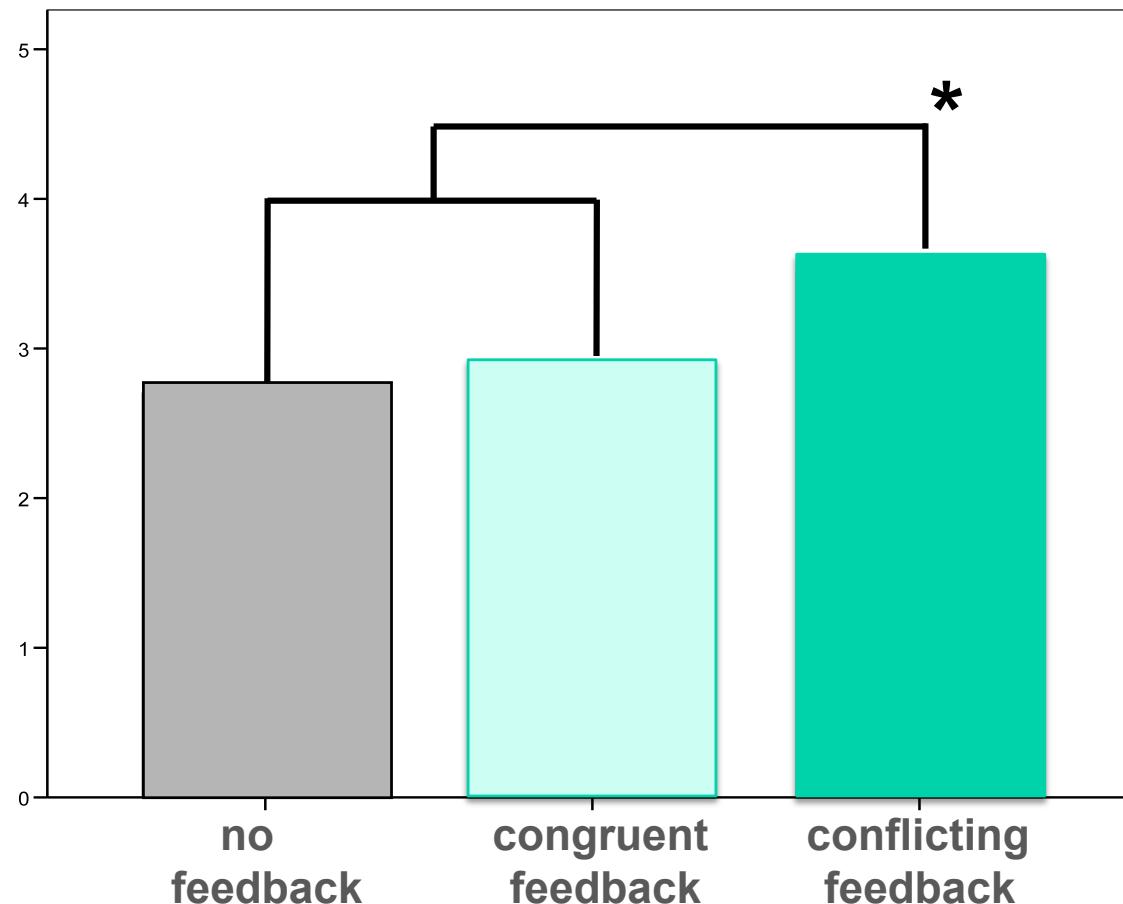
after conflicting feedback:

$$t(17) = -2.15, p < .05$$





Reflective Judgement Score



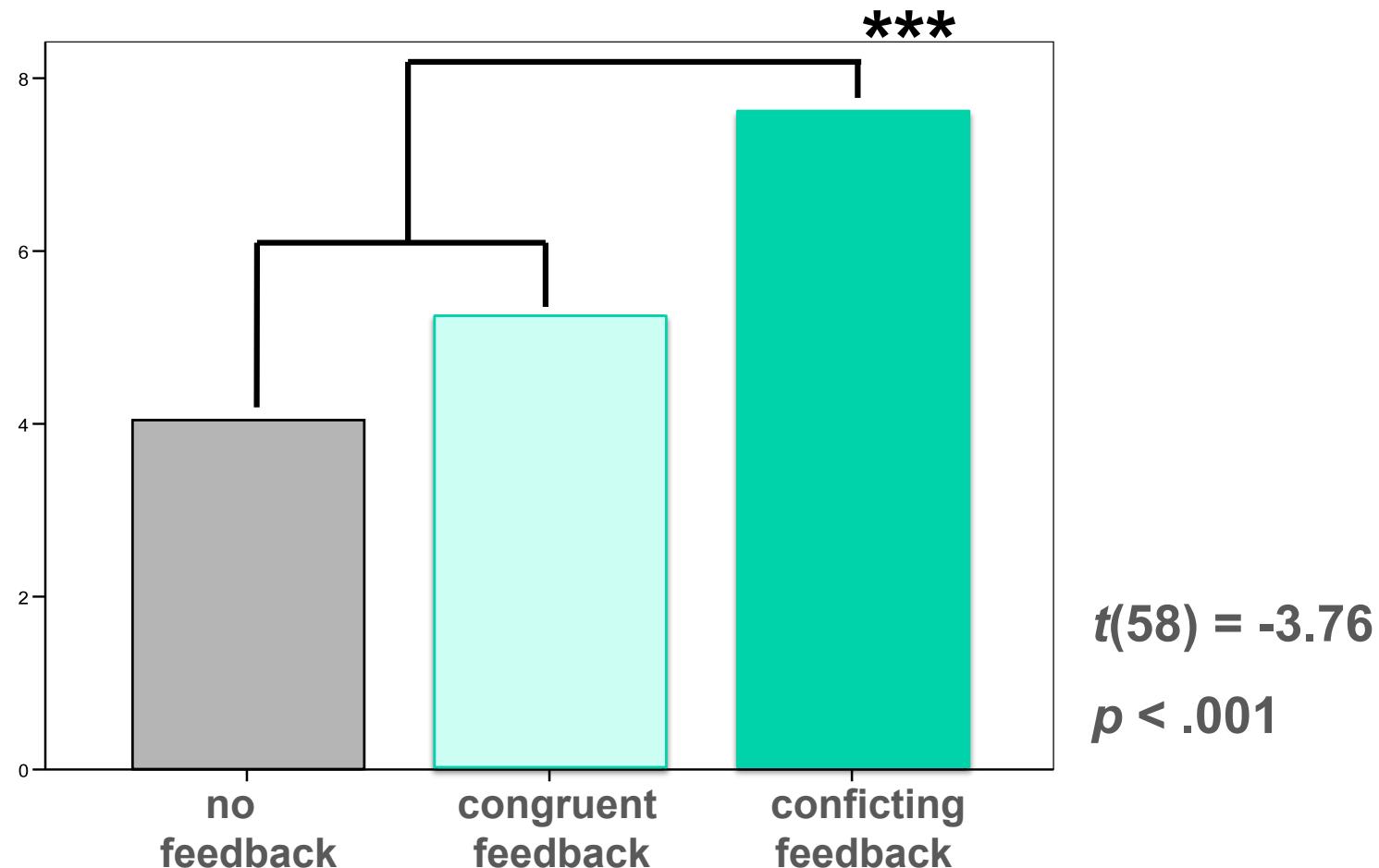
$$t(53) = -2.33$$

$$p < .05$$

(arguments/rationale: 1 no, 2 weak, 3 good, 4 integrated counterposition, 5 full pro/con integration)



Counterargument / Rebuttal Construction Score



(Counterarguments over 3 tasks (max. 3x5=15))



Tool 2: Summary

Disagreement ...

- ... reduced the myside bias in argumentation,
- ... fostered formation of opinions that take counterpositions into account,
- ... enhanced the ability to construct counterarguments and successful rebuttals of the personal opinion.



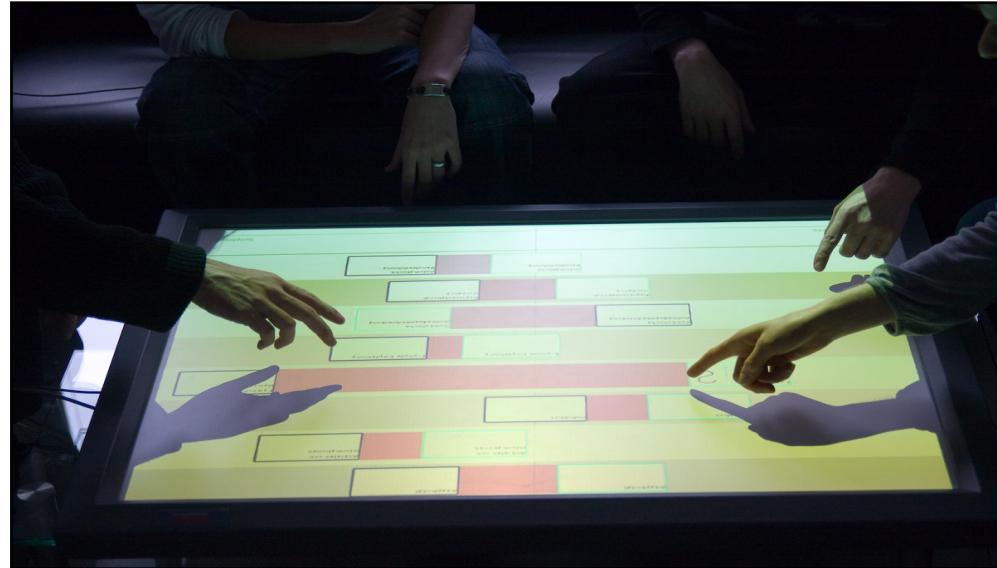
Tools and Studies of Line B

intervention function: overcoming limitations

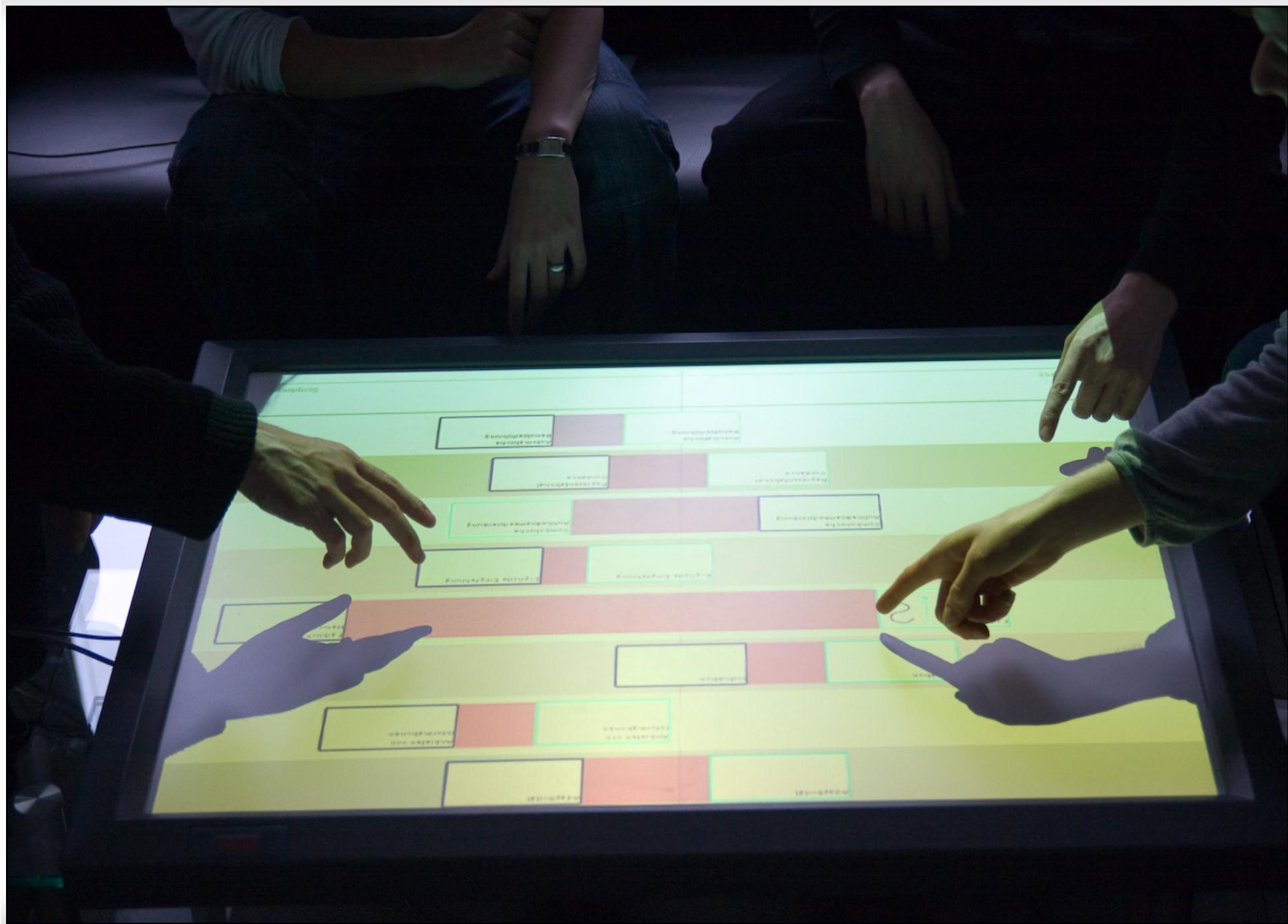
- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias

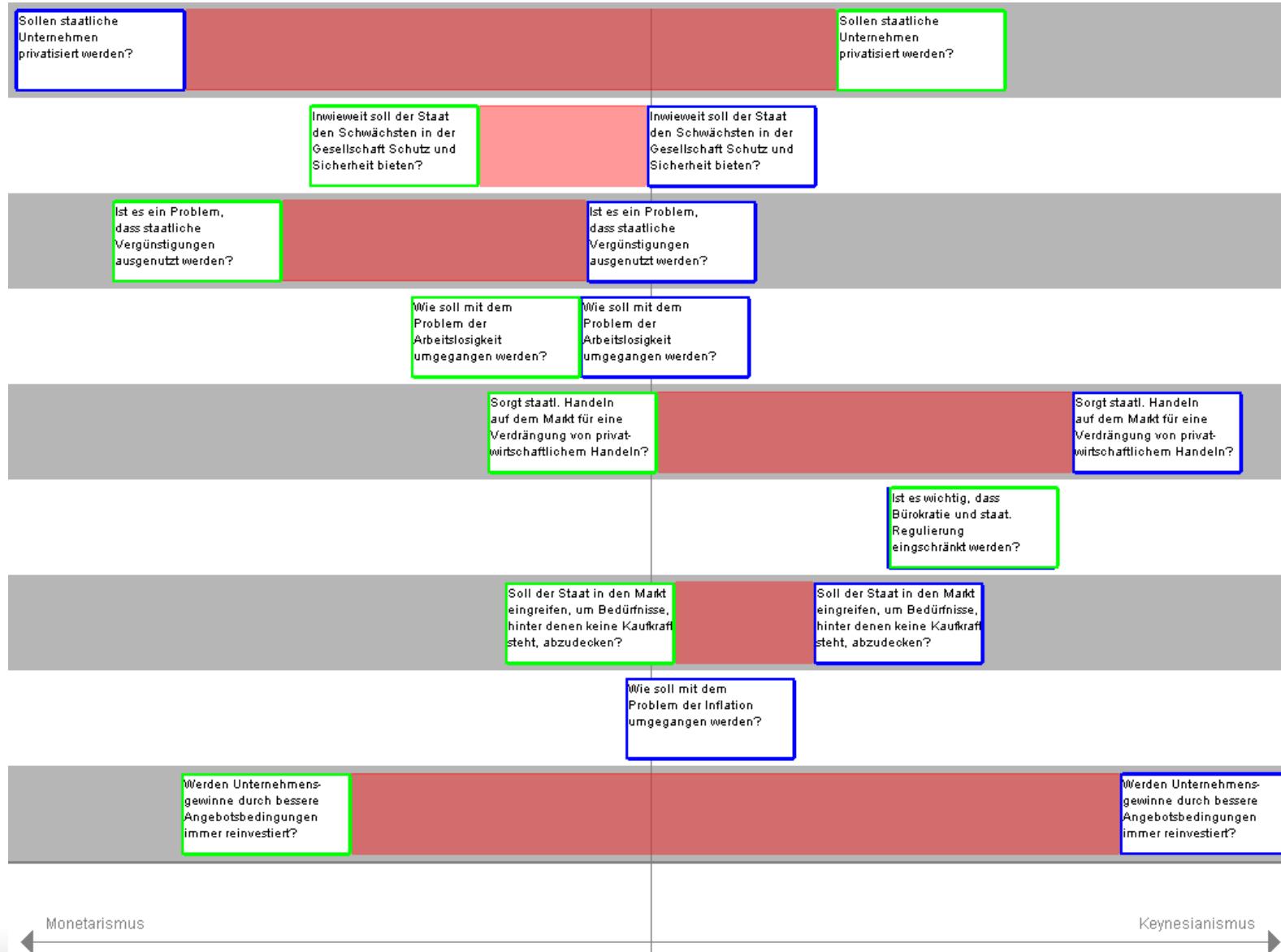


Line B Tools 3



- Problem: **Communicators prefer consensual information**, but conflicts foster learning
- Solution: Making controversy visible – leading to more discussion about controversial content - Study: Multi-touch table tool makes conflicting issues salient (Bodemer, in preparation)



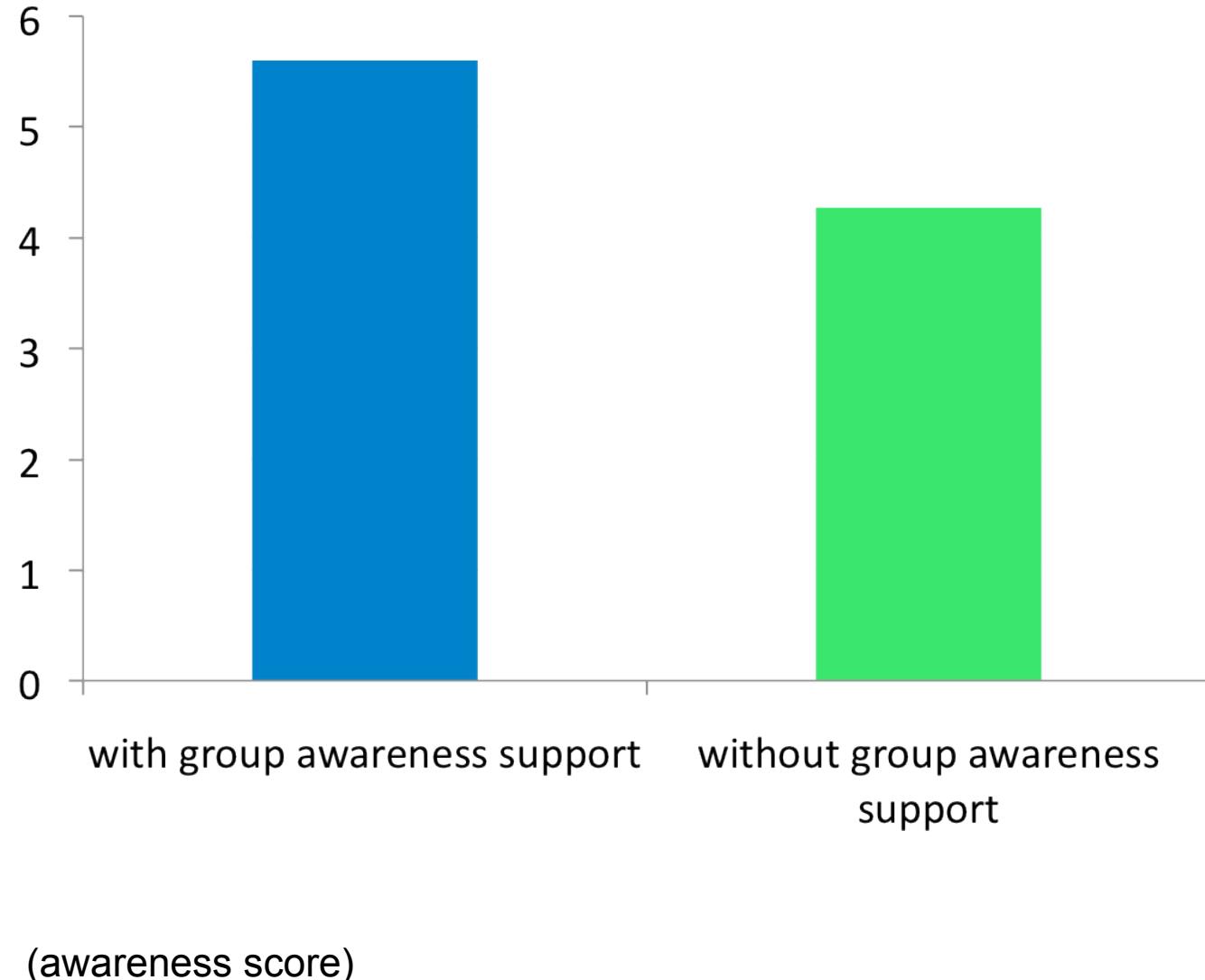


Monetarismus

Keynesianismus



Conflict Cards support perceived salience of controversial opinions





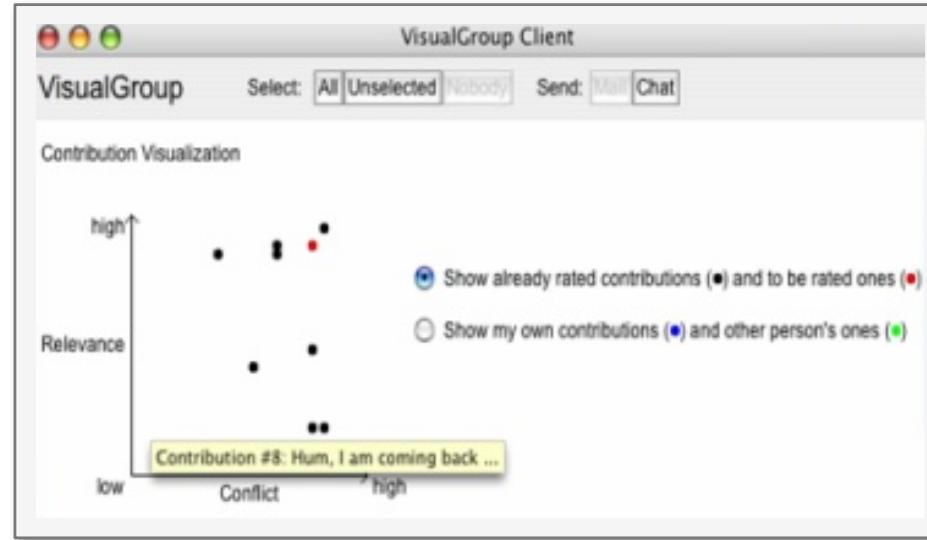
Tools and Studies of Line B

intervention function: overcoming limitations

- 1 overcoming confirmation bias
- 2 overcoming myside bias
- 3 overcoming consensual information bias
- 4 overcoming majority bias



Line B Tools 4



- Problem: **Majority factions dominate minority factions even when majorities are incorrect**
- Solution: Augmented Group Awareness Tools make minority contributions salient (Buder & Bodemer, 2008)



Line B Tools 4

- Small groups discussed a controversial issue in an online forum
- Groups consisted of a majority that advocated an incorrect viewpoint vs. a minority advocating a correct viewpoint
- Learners rated discussion contributions on agreement and novelty (→ salience of minority)
- Results: better post-discussion decision quality of groups

Topic: Computer with AI (Artificial Intelligence) as a replacement of humans someday??

intelligence. One solution would be to have the PCs networked, where each pc act as a neuron and each network connection a pathway.

Your ratings ... Relevance: 1 2 3 4 5 Agreement: 1 2 3 4 5

Contribution # 6

I agree that human intelligence is even more ingenious than what we usually think - you can try to start and think about it if you imagine what it takes just to - for example - make a cup of coffee. All the eye-hand coordination, knowing where the sugar is, knowing that the boiling water shouldn't go on your hands etc. However, I don't see how networking all the computers achieve a breakthrough in machine intelligence. It would bring together great computational power and resources, but can that be equated with intelligence?

Your ratings ... Relevance: 1 2 3 4 5 Agreement: 1 2 3 4 5

Contribution # 7

We should distinguish here between two separate questions, which tend to get mixed up. The first question is: When will we succeed in creating a computer program that will be able to fool people into believing they



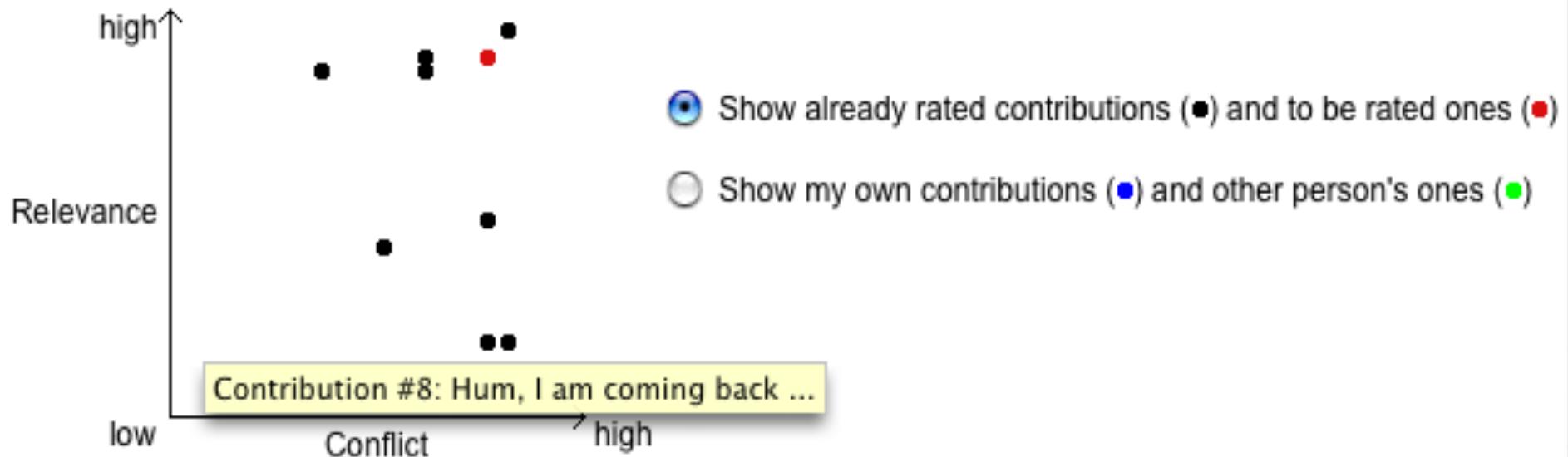
VisualGroup Client

VisualGroup

Select:

Send:

Contribution Visualization



Go: vg Humans_and_Computers ai

View:

Topic: Computer with AI (Artificial Intelligence) as a replacement of humans someday??

intelligence. One solution would be to have the PCs networked, where each pc act as a neuron and each network connection a pathway.

Your ratings ...

Relevance:

1	2	3	4	5
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Agreement:

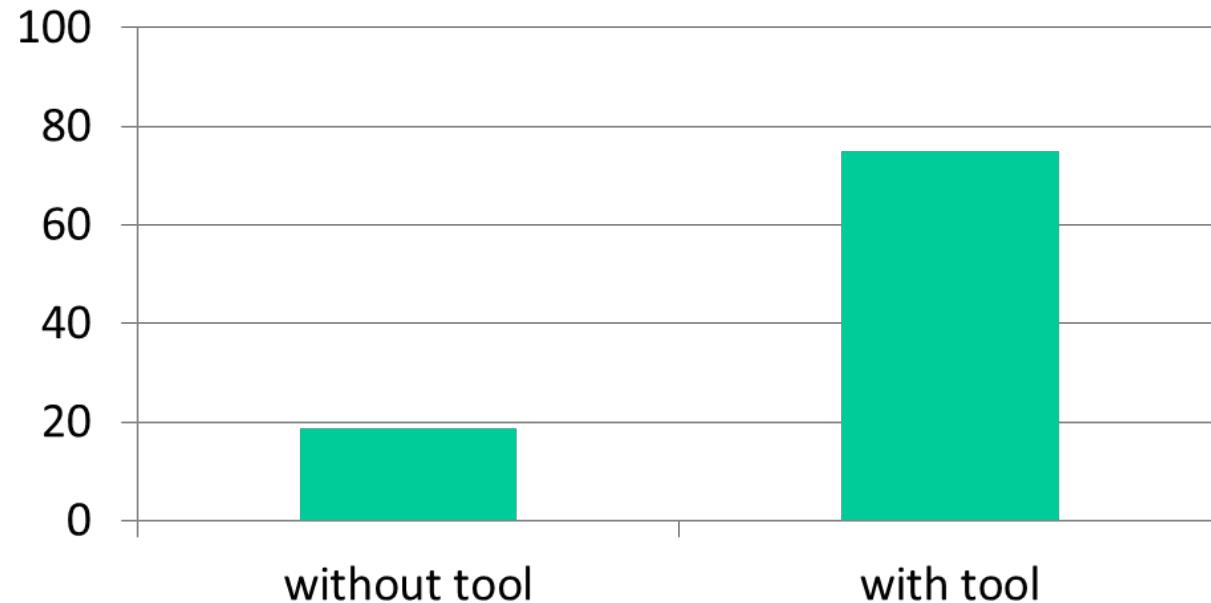
1	2	3	4	5
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Contribution # 6



Results

Group Decision



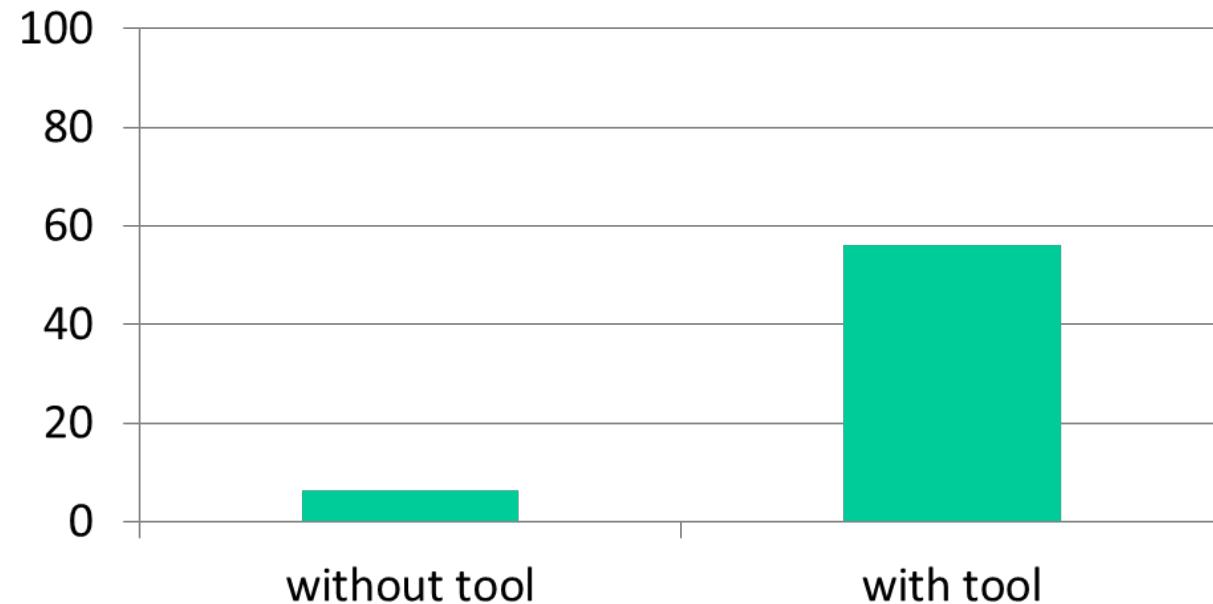
With augmented group awareness tool, a larger number of groups arrived at the correct (minority) decision; $\chi^2_{0,95(2)} = 6.57$ $p < .05$

(percentage of groups per condition that arrived at the correct minority viewpoint)



Results

Deliberation Style



With augmented group awareness tool, a larger number of groups exhibited an evidence-driven deliberation style (opposed to a verdict-driven style);

$$\chi^2_{0,95\,(2)} = 8.22 \quad p < .05$$

(percentage of groups per condition that exhibited an evidence-driven deliberation style opposed to a verdict-driven style)



Anders als andere Industrien, die Investitionsniveaus mit sich bringen, die für Entwicklungsländer unerreichbar sind, kann man mit Nanotechnologie neue Materialien und Geräte preiswert herstellen. Dies könnte zu einer Verringerung der Kluft zwischen den reichen und den armen Ländern führen.

stimme ich nicht zu



stimme ich sehr zu

ist für mich nicht relevant



ist für mich sehr relevant

Wenn das bestehende Modell der Nanotechnologie-Entwicklung weiterverfolgt wird, wird sich die Kluft zwischen den Armen und Reichen der Welt vergrößern, da die Investitionen in die Nanotechnologie vornehmlich von und zum Wohle der reicherer Länder durchgeführt werden.

stimme ich nicht zu



stimme ich sehr zu

ist für mich nicht relevant



ist für mich sehr relevant

Not everything that is observable might be interesting; and not everything that is interesting might be observable

Focusing on observable interaction is desirable, however, it can never explain the whole story. Just as individual thought is an inextricable context for individual thought, individual thought is an inextricable context of collective action.



Transferable learning

Individuals are parts of numerous small groups, and it would not be helpful to think that learning gained in one group does not transfer to interaction with group B. To bridge this gap, we need to understand the social context of learning.



“Naïve” assumptions about mental representations

The observation that individuals do not know for certain about internal mental states of others does not mean that they do not make assumptions about such states. For this reason an hermeneutic approach focusing on the social context of mental representations is needed.



Tools for group cognition

Support for group cognition requires more than just media for exchange of messages. That might suffice for individual cognition. However, support for group cognition requires support for group interaction phenomena like referencing, sequentiality, indexicality, and so on.





**Conclusions from seven (shown)
and more (done) studies**



Augmented Knowledge Communication Spaces

- **Conclusion 1/4 (*disclosure function – group awareness*)**
- Compared to f-t-f scenarios internet based communication is missing some information, e.g. some contextual information and certain direct feedback components
- However: **Tools with a disclosure function** allow to achieve an awareness to **compensate** for it or even to be **superior** as relevant critical features are selected and thus become more salient than in f-t-f situations and get so higher attention



Augmented Knowledge Communication Spaces

- **Conclusion 2/4 (*intervention function – social navigation*)**
- Internet based communication compared to f-t-f communication can take advantage from computational power und means of making relevant feature graphically visible and partly easy to manipulate
- **Tools with an intervention function** allow to achieve an augmented knowledge communication space and thus can become **superior** in comparison with f-t-f situations



Augmented Knowledge Communication Spaces

- Conclusion 3/4
- *What mechanism make the “knowledge communication space” “augmented”?*
- The disclosure function takes advantage from the fact, that our capacity limited cognitive system will pay attention to salient information
- The intervention function even delivers information which cannot easily be derived without the computational power of a computer



Augmented Knowledge Communication Spaces

- Conclusion 4/4
- *Why are these mechanism so helpful”?*
- The disclosure function concentrates on crucial features of knowledge exchange
- The intervention function tries to overcome critical deficits in knowledge exchange



Augmented Knowledge Communication Spaces

- **Application to a wide range of scenarios:**
 - e.g. to seminar and small group interactions
 - e.g. to collaborative interactions in work live beyond study time
 - *(also to OECD call for measuring collaborative problem solving in PISA 2015 – making this a highly valued skill)*



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Thank you for your attention