



Unlimited participation: Social software and knowledge building

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Participation in social-software projects

- In many social-software projects people's willingness to participate seems to be exceptionally high
- Of course, there are some people who perceive a social dilemma here and who try not to participate actively, but the number of users is that large that this carries no weight:
- Wikipedia (English version): more than 7 million registered users
- Wikipedia (German version): more than 500 thousand registered users
- Recent development: from purely collecting information to the advancement of knowledge



Initial considerations

- New tools and technologies that support CACL and knowledge building
- These technologies facilitate the interplay between individual and social processes
- An individual's and a community's knowledge can cross-fertilize each other and mutually support the development of each other
- This technological development requires a new theoretical framework for focusing on the tight conjunction between individual learning and collective knowledge building
- This framework is based on 3 theoretical approaches



Structure

- Scardamalia's and Bereiter's theory of knowledge building
- Luhmann's systems theory
- Piaget's model of equilibration

- Co-evolution model of cognitive and social systems

- Experimental study



Knowledge building

- Knowledge building is a socio-cultural process in a community
- KB is discourse oriented in the sense of common problem solving
- The community produces new, innovative knowledge and improves ideas
- KB as a self-organizational process in which ideas arise, are discussed, revised, or rejected
- Educational software such as CSILE or Knowledge Forum supports knowledge building



Systems-theoretical point of view

- People's cognitive systems are different from a social system
- Every system is defined by its differentiation to its environment
- A system's way of operating determines what belongs to the system
- A system is less complex than its environment and can be irritated from its environment
- The system reacts to irritations and, in this way, reduces the complexity of its environment → the system develops



Systems-theoretical point of view

- Cognitive systems and social systems have different kinds of operations
- Cognitive systems operate through cognitive processes whereas social systems operate through communication
- Each system is part of the environment of the other system → cognitive and social systems can irritate each other → each system can provide its complexity for the development of the other (“structural coupling”)
- → Learning and KB as reactions of systems to irritations



Processes of equilibration

- Irritation in the sense of cognitive conflicts
- Cognitive systems develop when people solve cognitive conflicts
- Cognitive conflict: when people's prior knowledge and information incorporated from their environment are somewhat incongruent
- Cognitive conflicts can be solved by processes of equilibration
- Two types of equilibration: assimilation and accommodation



Processes of equilibration

- Assimilation: people simply add new information to their prior knowledge
- Accommodation: people accommodate their prior knowledge to novel information
- In either case people have to somehow internalize information from their environment
- In this way, the cognitive system becomes more complex
- → Learning (through assimilation or accommodation)



Co-evolution model of cognitive and social systems

- Assumption: processes which take place in a cognitive system by means of internalization take place analogously in a social system (which we regard as being represented by an artifact) by means of externalization
- Through externalization a cognitive system can bring the own individual knowledge into the artifact
- Just as individuals can learn by internalizing new information, social systems can learn by incorporating information as well
- Equivalent to cognitive systems, social systems can develop new knowledge by assimilation or accommodation respectively
- They can develop by just adding new content (assimilation) or by changing their own structure (accommodation)



Co-evolution model of cognitive and social systems

- Emergent effects usually occur through such accommodations of artifacts
- → Higher complexity of the artifact → new equilibration processes in other people's cognitive systems
- Learning and KB are not independent from each other
- It is always a matter of internalization *and* externalization, i.e. of continuous exchange processes
- Mutual development of cognitive and social systems which is referred to as co-evolution
- KB as an interplay between cognitive systems and a social system
- Artifacts are not only considered as a means to an end but also as an end in itself



Four processes of learning and knowledge building

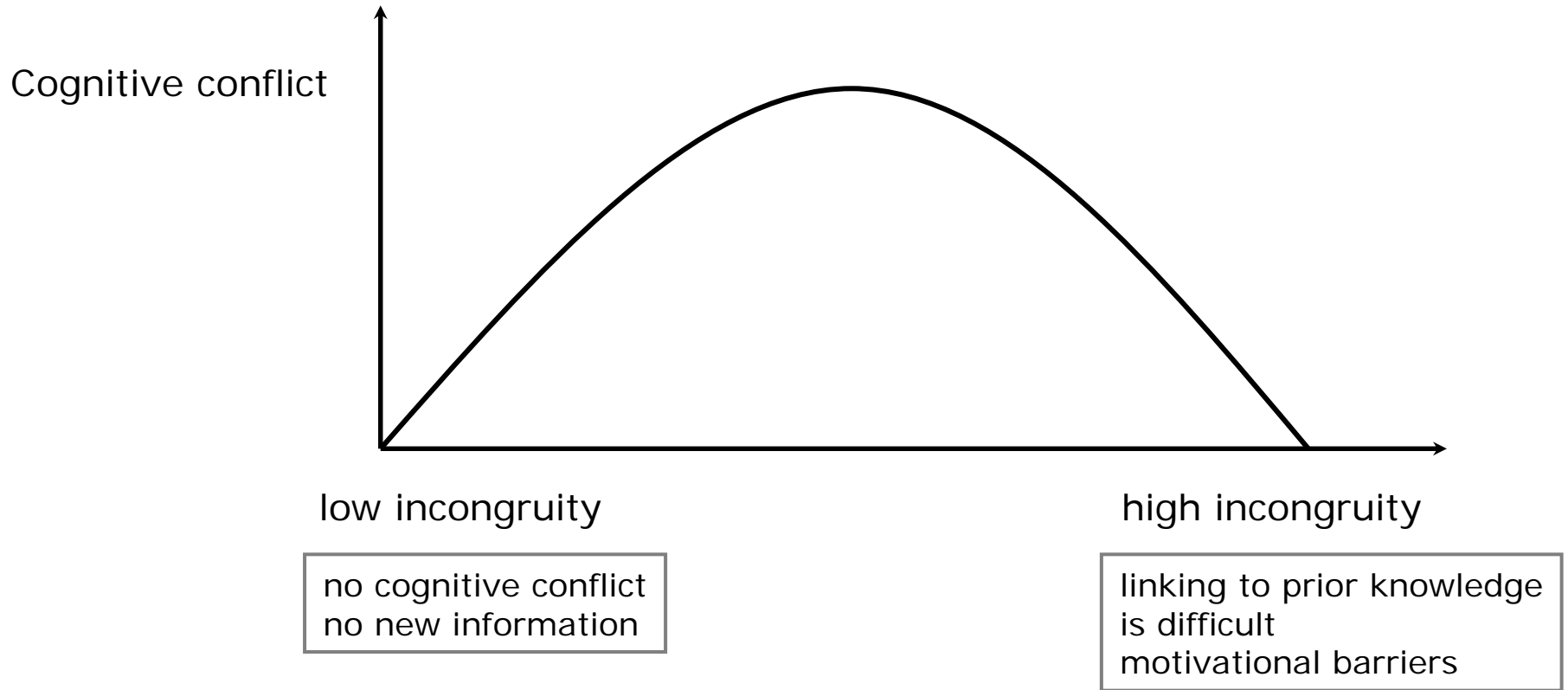
	externalization	internalization
assimilation	<i>quantitative knowledge building</i>	<i>quantitative individual learning (acquisition of factual knowledge)</i>
accommodation	<i>qualitative knowledge building</i>	<i>qualitative individual learning (acquisition of conceptual knowledge)</i>



Incongruity

- People's motivation to participate in processes of knowledge building is determined by the degree of the cognitive conflict
- The cognitive conflict depends on the (in)congruities between their individual knowledge and the information in the artifact
- With a very low degree of incongruity, there will be little need for equilibration
- In a situation with a very high degree of incongruity, people have few points of contact for equilibration
- In both cases, people will assimilate or accommodate very sparsely

Motivation to participate is determined by incongruity





Hypotheses

- H1 Incongruities on a medium level lead to higher quantitative increases of information in the wiki (external assimilation) compared to low and high incongruities.
- H2 Incongruities on a medium level lead to higher qualitative increases of information in the wiki (external accommodation) compared to low and high incongruities.
- H3 Incongruities on a medium level lead to a higher increase of factual knowledge (internal assimilation) compared to low and high incongruities.
- H4 Incongruities on a medium level lead to a higher increase of conceptual knowledge (internal accommodation) compared to low and high incongruities.

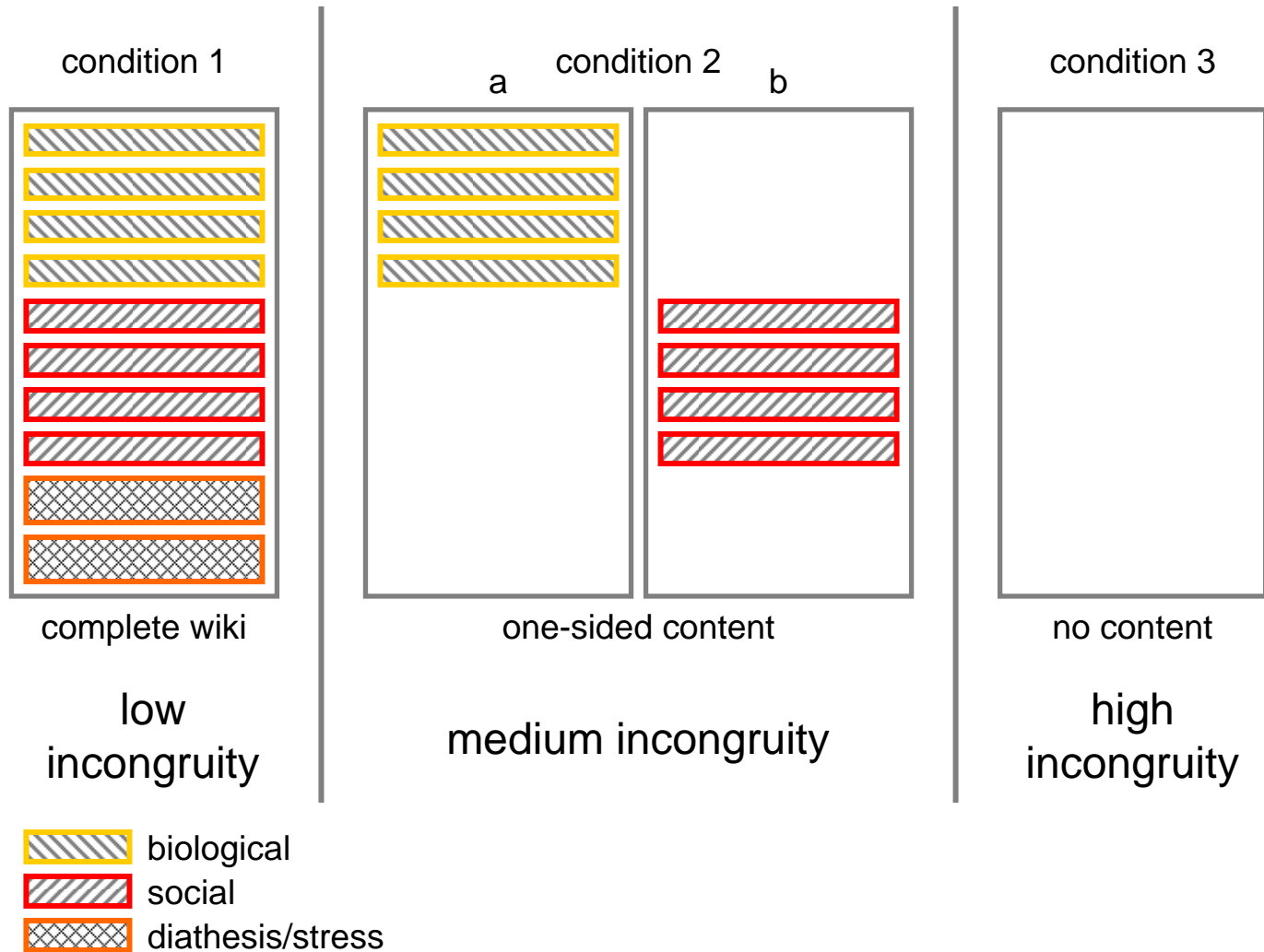


Experiment

- Laboratory setting
- Duration: 2 hours
- Cover story: Wiki on clinical psychology, topic: „causes of schizophrenia“
- All participants possessed high prior knowledge on the causes of schizophrenia (4 social, 4 biological, 2 integrative arguments)
- Participants:
 - 61 university students
 - 43 female, 17 male (1 missing value)
 - mean age 24.6 years ($SD=10.6$)



Three conditions with different levels of incongruity





Dependent variables

	Wiki's information	People's knowledge
Assimilation	<i>Sum of added words</i>	<i>Factual knowledge</i>
Accommodation	<i>Accommodation index</i>	<i>Conceptual knowledge</i>



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accommodation index

Allusion to the
diathesis-stress model

structure of
the arguments

<p>Je näher die Verwandtschaft mit einem Schizophrenen, desto wahrscheinlicher wird auch eine eigene Erkrankung.</p> <p>Das haben Familien- und Zwillingsstudien ergeben.</p> <p>Bei einem schizophrenen Elternteil beträgt sie 5-10%, bei einseitigen Zwillingen 45 % und etwa 14 % bei zweieiigen Zwillingen.</p> <p>Damit legt es nahe eine genetische Ursache der Schizophrenie anzunehmen.</p> <p>Es gibt es einige Befunde, die vermuten lassen, dass frühkindliche Infektionen eine Rolle spielen.</p>	<p>Je näher die Verwandtschaft mit einem Schizophrenen, desto wahrscheinlicher wird auch eine eigene Erkrankung.</p> <p>Das haben Familien- und Zwillingsstudien ergeben.</p> <p>Bei einem schizophrenen Elternteil beträgt die Wahrscheinlichkeit 5-10%, bei kranken Geschwistern 10%, bei einseitigen Zwillingen 45 % und etwa 14 % bei zweieiigen Zwillingen.</p> <p>Damit legt es nahe, eine genetische Ursache der Schizophrenie anzunehmen.</p> <p>Für die Hypothese der Vererbung der Schizophrenie spricht, dass sich bei den Kindern eines gesunden Elternteils, dessen einseitiger Zwilling an Schizophrenie erkrankt ist, höhere Erkrankungsraten finden.</p> <p>Auch wenn das Elternteil selbst nicht erkrankt ist, scheint sich trotzdem eine Disposition, an Schizophrenie zu erkranken, zu vererben.</p> <p>Obwohl phänotypisch keine Schizophrenie vorliegt, ist genotypisch eine Prädisposition vorhanden (einseitige Zwillinge sind genetisch identisch). Bei den Symptomen der Schizophrenie können positive Symptome (z.B. Halluzinationen) und negative Symptome (z.B. sozialer Rückzug) unterschieden werden.</p> <p>In einer Zwillingsstudie, die dieser Unterscheidung Rechnung trug, konnte festgestellt werden, dass bei den konkordanten Paaren der Anteil an negativen Symptomen größer war als bei den diskordanten Paaren.</p> <p>Zeigt ein Zwilling also eher die positiven Symptome einer Schizophrenie, so erhöht sich die Wahrscheinlichkeit, dass der andere Zwilling auch an Schizophrenie erkrankt.</p> <p>Ein Hinweis darauf, dass negative Symptome eine stärkere genetische Komponente haben.</p> <p>Hirnorganische Ursachen</p> <p>Es gibt es einige Befunde, die vermuten lassen, dass frühkindliche Infektionen eine Rolle spielen.</p>
<p>Die Häufigung schizophrener Erkrankungen bei Menschen, welche in Großstädten sowie in den ersten drei Monaten des Jahres geboren wurden, stützt diese Hypothese.</p> <p>In Frage kommen bestimmte Viren (Influenza- und Borna-Viren), oder Protozoen wie Toxoplasma gondii und bestimmte Bakterien.</p> <p>Eine himnorganische, neurologische Ursache für die Schizophrenie ist also sehr wahrscheinlich.</p>	<p>Die Häufigung schizophrener Erkrankungen bei Menschen, welche in Großstädten sowie in den ersten drei Monaten des Jahres geboren wurden, stützt diese Hypothese.</p> <p>In Frage kommen bestimmte Viren (Herpes simplex Typ II, Influenza- und Borna-Viren), oder Protozoen wie Toxoplasma gondii und bestimmte Bakterien.</p> <p>Eine himnorganische, neurologische Ursache für die Schizophrenie ist also sehr wahrscheinlich.</p>

on the one hand... on the other hand...
in contrast...
nevertheless...
however...



Dependent variables

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Accommodation	<i>Accommodation index</i>	<i>Conceptual knowledge</i>

21 statements about the causes of schizophrenia

The double bind hypothesis is an empirically sound theory about the causes of schizophrenia



correct



not correct



I don't know



Dependent variables

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open question

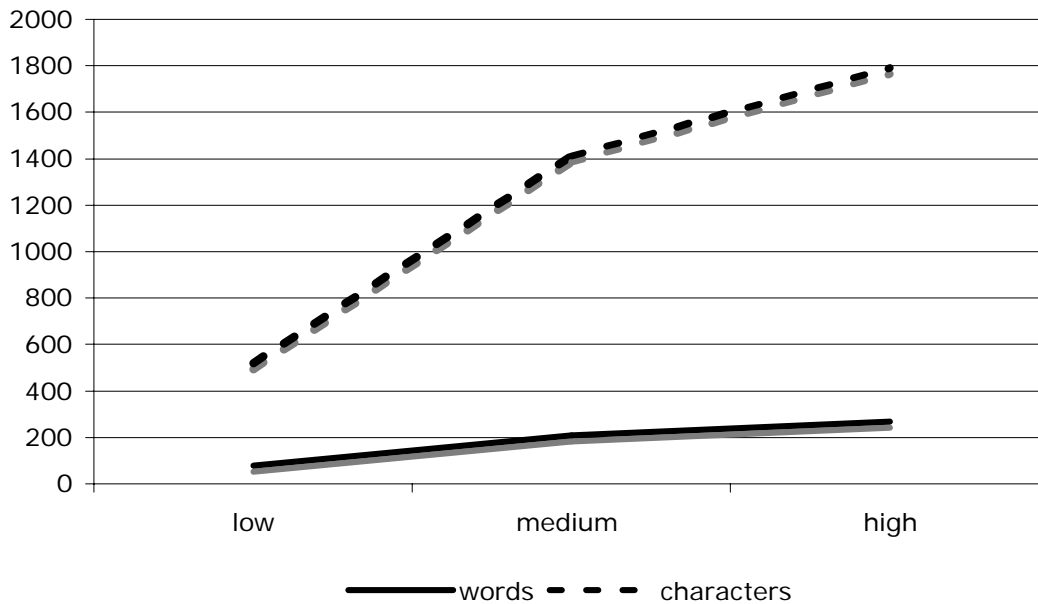
Participants were asked to provide „the best argument on the causes of schizophrenia.“

expert rating

simple answers

complex answers

	Wiki's information	People's knowledge
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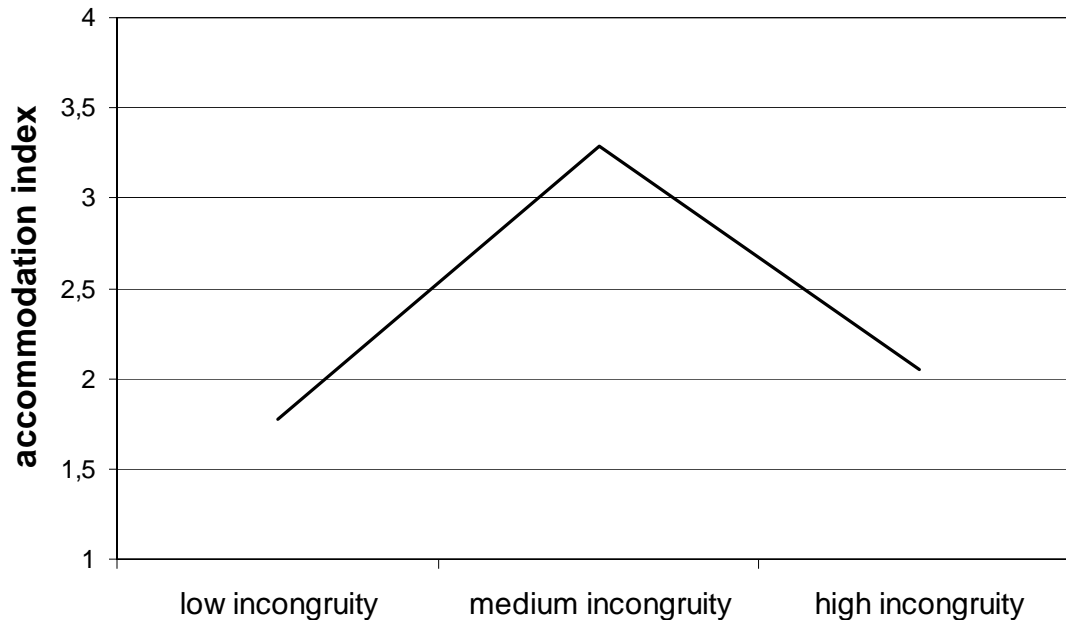


low	medium	high
78,78	210,00	268,70
519,22	1413,32	1790,45



Dependent variables

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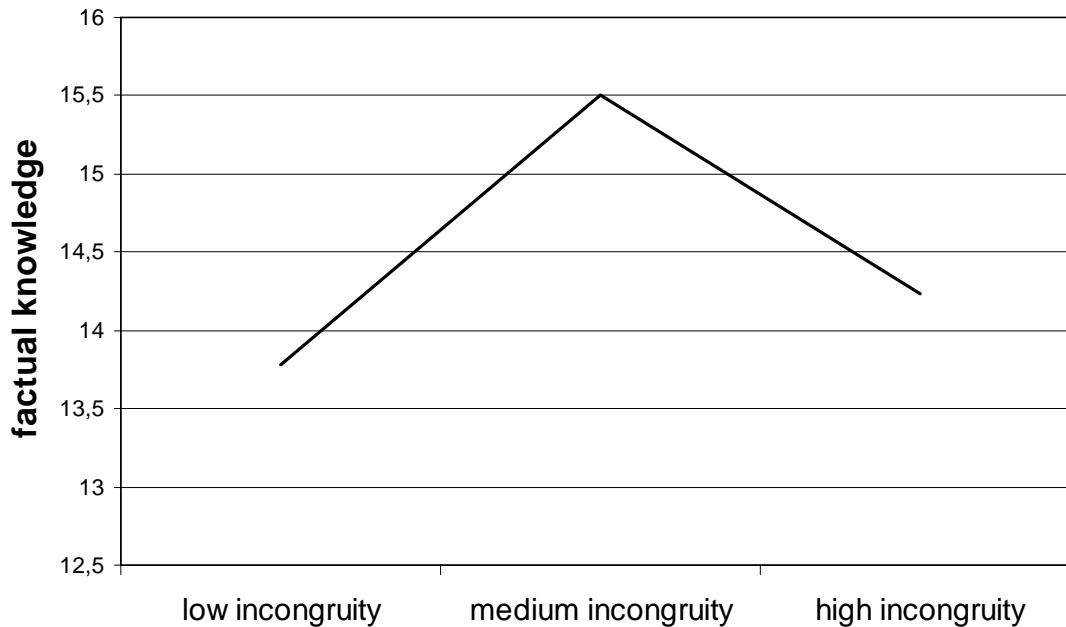
$M_{med}=3.29$ ($SD_{med}=2.70$) vs.
 $M_{low}=1.78$ ($SD_{low}=1.78$),
 $t(37)=2.04$, $p=.02$.

$M_{med}=3.29$ ($SD_{med}=2.70$) vs.
 $M_{high}=2.05$ ($SD_{high}=0.94$),
 $t(37)=1.93$, $p=.03$.



Dependent variables

	Wiki's information	People's knowledge
Assimilation	<i>Sum of added words</i>	<i>Factual knowledge</i>
Accommodation	<i>Accommodation index</i>	<i>Conceptual knowledge</i>



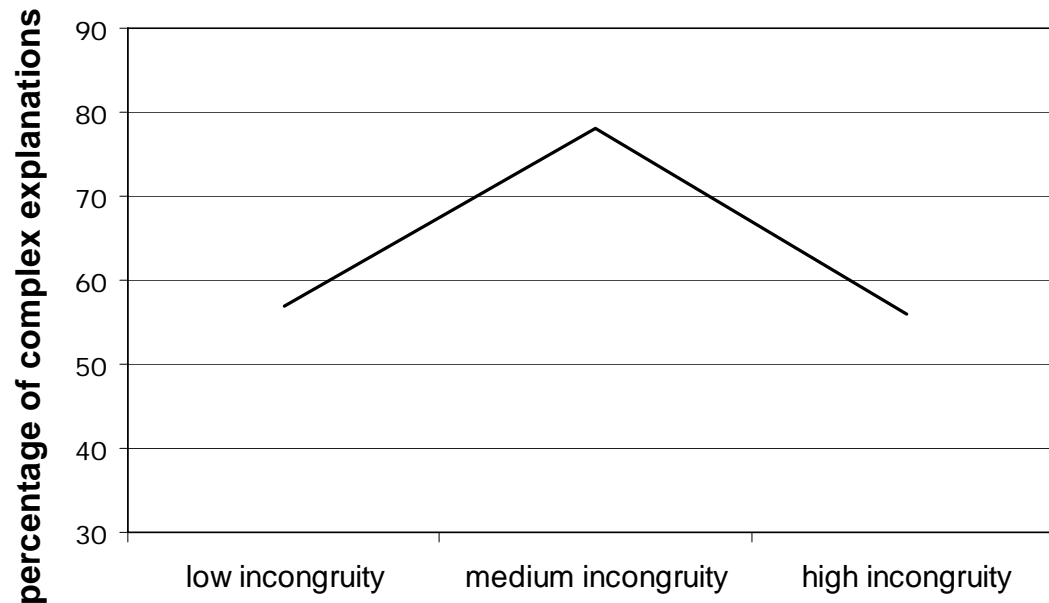
$M_{med}=15.50$ ($SD_{med}=2.30$) vs.
 $M_{low}=13.70$ ($SD_{low}=2.98$),
 $t(37)=2.16$, $p=.02$.

$M_{med}=15.50$ ($SD_{med}=2.30$) vs.
 $M_{high}=14.20$ ($SD_{high}=1.96$),
 $t(37)=1.96$, $p=.03$.



Dependent variables

	Wiki's information	People's knowledge
Assimilation	<i>Sum of added words</i>	<i>Factual knowledge</i>
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low vs. medium

$\chi^2(1, N=43)=4.23, p=.02.$

high vs. medium

$\chi^2(1, N=43)=5.23, p=.03.$



Conclusion

The processes of internal and external accommodation and assimilation can be observed in an experimental setting.

H1 external assimilation / sum of added words

H2 external accommodation / accommodation index ✓

H3 internal assimilation / factual knowledge ✓

H4 internal accommodation / conceptual knowledge ✓

A medium level of incongruity between people's knowledge and a wiki's information supports individual learning and leads to more qualitative knowledge building.



Thank you very much for your attention