Knowledge Exchange as a Motivational Problem – Results of an Empirical Research Program

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Abstract: In many situations of computer-supported collaborative learning, it is a challenge to increase the willingness of those involved to share their knowledge with other group members. To study a prototype of such a situation of computer-supported information exchange, we arranged a shared database setting as a basis of an empirical research program. This knowledge-exchange situation represented a social dilemma: while contributing information to a shared database led to costs and provided no immediate benefit to the individual, the entire group suffered when all members decided to withhold information. A series of experiments identified a multitude of influencing factors in this situation: group size, awareness of the importance of information, costs of entering information, use-related bonus systems, feedback and recommendations, and group awareness. This paper describes the impact of these factors on people's willingness to share their knowledge with their cooperators, and concludes with a discussion of some practical consequences.

Introduction

The emergence of the "Web 2.0" and "Social Software" brought a great vision: that people will now have the opportunity to collect and combine their knowledge throughout the world, regardless of location, time, status or education. They can exchange opinions and experiences; they can discuss and start conversations with each other. Through Social Software, the knowledge of individuals will contribute to a comprehensive pool of knowledge, which is kept up-to-date by continuous participation of many users. Forces of "autopurification" will ensure continuing high quality. *Wikipedia – the Online Encyclopedia* made this vision real. Millions of users have contributed information to that encyclopedia. In a process of self-regulation, criteria of quality have been established: that information should be objective, complete and supported by references. And it is a fact that Wikipedia is now an established source of surprisingly valid information. What appears to be emerging here corresponds to the vision of "world knowledge". In terms of quantity, quality and up-to-dateness, Wikipedia sometimes even seems to be better than some traditional encyclopedias compiled by editorial boards (Giles, 2005).

But the Wikipedia project demonstrates, at the same time, the limitations of this vision of a general exchange of knowledge. Of all the hundreds of millions of users, only a very small proportion participate actively in the production of these encyclopedia texts. So Wikipedia also demonstrates a phenomenon that has been known for a long time from other contexts: people will gladly use information from a pool that was compiled jointly, but will not automatically and unconditionally make the pool greater by adding contributions of their own.

Those who have reported experiences from virtual seminars (Hesse & Giovis, 1997), news groups (Sproull & Faray, 1997) and information pools of organizational knowledge-management systems (Ardichvili, Page, & Wentling, 2003; Riss, Cress, Kimmerle, & Martin, 2007) came to similar conclusions. The majority of the users of these systems will just "lurk", i.e. read and use the content of whatever is available, but only contribute little or nothing of their own. The number of active participants and contributors is extremely small compared to passive users and recipients.

This paper describes this phenomenon from a psychological perspective. It explains the motivational situation of a user, shows how this leads to lurking, and it explains the consequences for the group. Based on such a theoretical view, the paper describes an experimental setting that allows investigating people's motivation to contribute to a shared knowledge pool. It describes a series of experiments which studied the effect of various influencing factors, both situational ones and tool-specific ones.

Knowledge Exchange as a Social Dilemma

News groups, wikis and information pools have many common characteristics, despite all their differences. As contributions from single users are made available to all users, information in such settings is a *"public good"*. The value of a piece of information is not diminished by the fact that it is being used by other users. This means that the public good will not be used up or consumed in the course of time (*"non-rivalry"*; Barry & Hardin, 1982). Its content is available to all users, regardless of whether or not they have provided any of their own information (*non-excludability*; Head, 1972). In this context, the decision to enter or not to enter information into a shared pool is a situation that has been referred to as a *social dilemma* (Dawes, 1980; also: Cabrera & Cabrera, 2002; Jian & Jeffres, 2006; Kalman, Monge, Fulk, & Heino, 2002; Kimmerle & Cress, 2007, 2008;

Markus & Connolly, 1990; Rafaeli & LaRose, 1993; Thorn & Connolly, 1987). A social dilemma is a conflict between interests of a group and those of individual group members. It describes a situation where a decision which is the best choice for each individual is no longer the best of all options if all members of the group take the same decision. Social dilemmas may be described in terms of a payoff structure, reflecting the cost and benefit of a decision which each group member and the group as a whole have to bear. So what is the cost and benefit if people are supposed to enter information into a shared pool of information?

First of all, potential providers of knowledge will have no immediate benefit from providing their own information, as they continue to have access to the pool of information regardless of whether or not they contribute any information themselves. Supplying information even leads to costs in terms of time that is needed for writing things down or losing an advantage that resulted from not having disclosed that information before. So balancing cost and benefit will lead a potential information supplier to the conclusion that it may be more efficient not to supply any information and only benefit from the contributions of others; or in other words: regardless of what the others do, not supplying any information leads to a higher reward than supplying information. The dilemma lies in the fact that this cost-benefit ratio will not work if we are looking at the group as a whole.

If no one in the group has supplied any information, the pool will remain empty and no one will benefit from the others' knowledge. So the payoff of the whole group is the lowest if all members completely withhold their own information. Such a social dilemma cannot be solved by an individual. On the one hand, withholding information is the most favorable choice from an individual's point of view (as long as providing information is linked with cost). But, on the other hand, withholding information, if this is the line followed by all, makes the situation worse for all than if they had provided information. In this sense, we describe a situation in which people can supply information to a knowledge pool as an "information exchange dilemma" (Cress & Kimmerle, 2008). In the terminology of social dilemma research, supplying or entering information may be described as "cooperation" and withholding information as "defection".

In a social dilemma, individuals receive the highest payoff if they "defect" while all other group members "cooperate". But this maximum reward cannot be paid out to everyone. If each individual follows the egoistic line, the information pool will be empty, and no one will be able to benefit from the information supplied by others.

Social psychology has introduced the terms *social loafing* (Karau & Williams, 1993; Shepperd, 1993) or *free riding* (Kerr, 1983; Marwell & Ames, 1979) for reaping benefits from contributions of others without contributing oneself. Research on cooperation in groups has identified some factors that might reduce such uncooperative behavior. A meta-analysis by Karau and Williams (1993) on loss of motivation in groups pointed out that individuals will tend to pursue *social loafing*,

- if their own individual performance cannot be assessed by others;
- if the assignment or task that has to be achieved by the group is perceived as irrelevant;
- if there is no standard for comparing group performance;
- if the group consists of unknown strangers;
- if individuals have the impression that their performance is redundant, compared to the achievement and contribution of other group members.

All this applies to characteristics features of knowledge communication through information pools, databases, wikis, discussion forums etc. Non-synchronous computer-mediated written communication is characterized by a great amount of time needed for writing down information, by high transaction costs, a high degree of anonymity, and – because social stimuli are reduced – by little normative influence on participants of that communication (Clark & Brennan, 1991; Reid, Malinek, Stott, & Evans, 1996). To make it worse, users of a database will normally not know each other and will only to some small extent be able to anticipate which specific information is required by other people for their tasks and ends.

So the question remains how a real exchange of information can be stimulated under such unfavorable conditions. In our laboratory we conducted various studies involving systematic variation of several features of the situation and its payoff structure and of the communication tools used. These studies were conducted in an experimental environment that represented the social dilemma character of knowledge exchange. The following paragraphs will first describe this environment and then the results of these studies.

Experimental Examination of the Knowledge-Exchange Dilemma

The Assignment

In order to create a situation in which knowledge exchange represents a social dilemma with a clearly defined payoff, the following scenario was devised and implemented. Participants in the experiments acted as staff of the salary accounting department of some fictitious company. They worked synchronously, but locally distributed in groups of six individuals. Payment was supposed to be on the basis of a piece rate, i.e. each person was paid for individual performance. The group received data on the sales performance of a large group of

(fictitious) salespersons, in order to calculate the salaries that had to be paid to these people. The assignment was that each participant of the experiment had to calculate salaries for as many salespersons as possible, and the payment for participation in the experiment was based exclusively on the number of those calculated salaries.

A salesperson's salary in this experimental setting consisted of two components: a *basic salary* and a *premium* based on sales performance. During *Stage One* of the experiment, only basic salaries were calculated. This was a relatively simple calculation at the computer and took about 50 seconds to do. Each participant received 30 cent for each basic salary calculated. Each calculated basic salary could then be entered into a shared database, where it was available to other participants ("accounting staff") for the second stage of the experiment. Entering these data did, however, take some time during which no other basic salaries could be calculated. In other words, the more basic salaries a person entered into the database during the twelve minutes that Stage 1 lasted, the smaller was the time that was available for calculating more basic salaries, and the less this person could earn during Stage 1.

In *Stage Two* of the experiment, which lasted for nine minutes, the total salaries were calculated. Each participant received 25 cent for each total salary calculated. In order to calculate the total salary of a (fictitious) salesperson, this person's basic salary was needed. There were three ways of obtaining this information:

- The basic salary was available as the result of a previous calculation, if this particular participant had carried out that calculation during Stage 1.
- The basic salary could be retrieved from the database immediately (with no loss of time) if it had been calculated during Stage 1 by at least one other person and then entered into the database.
- If both was not true, the basic salary was not available in the system. In this case, the participant first had to calculate the basic salary (for no extra payment) in order to be able to calculate the total salary. This additional calculation required about 50 seconds each time.

The more basic salaries participants had to calculate during Stage 2, the more time they had to use up, which was then missing from their time for calculating total salaries. So in Stage 2, a participant earned the more money, the more other people had entered their calculations of basic salaries into the database during Stage 1.

The parameters for these experiments – i.e. the time that was available during Stage 1 and 2, the payment for calculating basic and total salaries – were calculated in such a way that a social dilemma was created that fulfilled the criteria as described above. Participants were (theoretically) able to earn (approximately) 23 Euros if they entered no information at all, but all other group members did. If this strategy had been pursued by all group members (by entering no information), each group member could have earned 18 Euros, which is less than if each group member had been cooperative and entered all calculated basic salaries. In this case each group member could have earned 20 Euros.

The Perceived Payoff Structure

In the experimental situation, participants were not explicitly informed of the payoff, but this was inherent in the assignment. After each successful salary calculation, an acoustic signal told them that they had just earned some more cents extra. During the entire experiment, the logo of a clock was on the screen, which was running backward and told participants how much time they still had. The awareness of a performance-related payment structure encouraged them to use their available time as effectively as possible, in order to calculate as many salaries as they could. The time that they had to wait for entering information into the database was perceived by them as time in which they effectively lost money.

In order to check if participants perceived this assignment as a social dilemma in the sense of the characteristics described above, they were asked – after having done the assignment – to estimate the following payoffs:

- Amount earned by a person who enters no information into the database, but whose five team mates enter each basic salary which they have calculated;
- Amount earned by a person if all group members (including that person) enter each basic salary which they have calculated;
- Amount earned by a person if all group members (including that person) enter no basic salary at all.

It became clear that participants were indeed aware of the social dilemma. Their estimates were that in the first case (social loafing in a group of cooperative people) someone might earn 26 Euros, in the second case (complete cooperation of all group members) 24 Euros and in the third case (complete defection of all group members) 16 Euros. These estimates show that the participants had realized that the situation contained a social dilemma. They had, however, over-estimated the extent to which they depended on other group members. They believed that they would benefit more from cooperation of the group members than was actually the case (cf. Cress, Kimmerle, & Hesse, 2006). Inter-dependence of the group members was perceived to be stronger than it

really was. This will even intensify the social dilemma, because people believe that their cooperation or defection has a stronger influence on others than was really the case in this experimental assignment.

Results of a Series of Experiments

In a series of experiments, various factors were examined which might influence the readiness of people to supply information to a pool of data – even if the consequence is that they receive less than the highest possible payoff. We will first present those studies thast varied the characteristics of the situation, and then those studies that modified the communication tool.

Cooperation Behavior in the Course of Time

Various empirical studies on social dilemmas have shown that the extent of cooperation will decrease in the course of time. One factor which will increase people's motivation to cooperate is the expectation that their own behavior encourages other players to cooperate as well. This *reciprocity expectancy* (Komorita, Chan, & Parks, 1993) makes people more cooperative, especially in those cases in which the group is aware of some common future during which group members can reciprocate the cooperative behavior of their team mates. In situations in which people will no longer be able to interact with each other, this reciprocity expectancy is correspondingly low. Accordingly, the cooperation rate tends to drop at the end of a cooperation phase (Rapoport & Suleiman, 1993).

Our own studies have shown that this effect also occurs in the information-exchange dilemma situation. Figure 1 shows that at the beginning of the experiment, 60 per cent of all basic salaries that had been calculated were entered into the database, and at the end, this rate dropped to 40-50 per cent. This significant decline occurred regardless of the duration of the experiment. Regardless of whether Stage 1 lasted 12 or 36 minutes, the decline of cooperation rates did not differ.

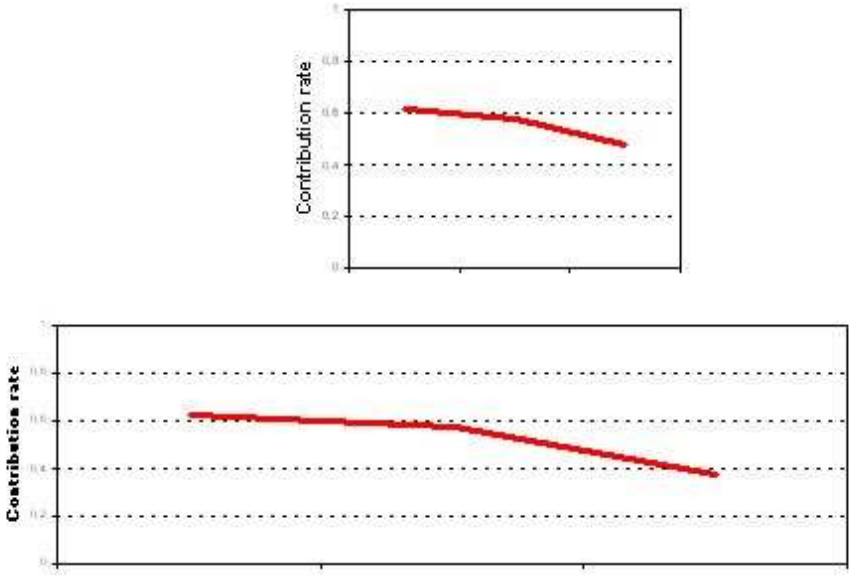

Figure 1. Contribution rate in the course of time. The upper diagram shows the rate of entering information in the condition where Stage 1 lasted for 12 minutes, the lower diagram in the condition that it lasted for 36 minutes.

Group Size

In many social dilemma situations, the size of the group influences the payoff an individual receives. This is the case if the public good produced by cooperation can only be consumed by a limited number of group members. Then the chance that an individual member of the group will benefit from the public good becomes the smaller the larger the group is. But this is not the case in the knowledge-exchange situation. The public good here (i.e. information available in the common pool) can be accessed by all group members, and its value is not diminished by the fact that it also used by others. This, so to speak, non-exhaustibility of the public good makes people's payoff independent of group size (Isaak, Walker & Thomas, 1984).

This independence of people's cooperation rate from group size in a knowledge-exchange dilemma was confirmed by an experiment. It made no difference if a participant was a member of a group of six people (working non-synchronously), or of a group of 50 people (working non-synchronously).

Awareness of the Importance of Information

Knowledge exchange through a shared database will in most cases imply an extremely anonymous type of communication. While speakers in face-to-face conversation receive verbal and non-verbal feedback if a message is understood, if it is relevant or not, these essentials are missing in a situation of knowledge exchange through a database (Kiesler, Siegel, & McGuire, 1984). Here, meta-knowledge, i.e. awareness of one's own expertise (Flavell & Wellman, 1977) and of the needs and expertise of others (Stasser, Steward, & Wittenbaum, 1995), plays a decisive role. Interacting groups will, in the course of time, build a "transactive memory", i.e. meta-knowledge about which specific information is available from which person or at which place. This transactive memory is an important factor of group performance (Littlepage & Silbiger, 1992). In the knowledge-exchange dilemma, the group's transactive memory is particularly important because a person may be more prepared to supply information to a database (which others can use) if that person is aware of possessing information which is so important that it will really help others to tackle their tasks. So we can assume that the more people expect that their knowledge is relevant to others, the more information will they enter into a database and make it available to others.

This assumption was confirmed in various experimental studies in which the experimental scenario was extended. In these experiments, Stage 1 distinguished between "important" and "less important" basic salaries. In the cover story, the "important" basic salaries were those of (fictitious) salespersons which had to be calculated urgently, i.e. those cases in which the corresponding total salaries were more likely to be calculated during Stage 2 than in the less urgent cases. In line with theory, our studies have confirmed a very stable effect in that people will enter much more important information than unimportant information. About 61 per cent of the important information was entered, but only 24 per cent of the unimportant information (Cress et al., 2006, Study 1).

Cost of Entering Information

Considering the payoff structure of the dilemma, it is not surprising that people tend to provide more important than unimportant information. If a person accepts bearing the cost of entering information into the database at all, it is a logical decision to do so in such a way that the group has the greatest benefit.

The situation is different, however, if entering important information leads to higher cost for the person who possesses that information (the "information carrier"). This might occur, for example, if preparing this information requires more time and effort. Then the information carrier has to decide either to accept these extra costs in order to give others greater advantage by supplying that important information, or to spare those extra expenses at the price of not giving the other group members maximum benefit.

This type of situation was reflected in the experiments by a condition in which entering "important" information into the database cost twice as much as entering "less important" information. In the former case, the participants had to wait for 20 seconds, in the latter only 10 seconds. A significant interaction occurred here. While in the equal cost condition, it was mainly important information that was entered, no such preference was observed in the condition with higher cost for entering important information (Cress et al., 2006, Study 2). Figure 2 shows this interaction.

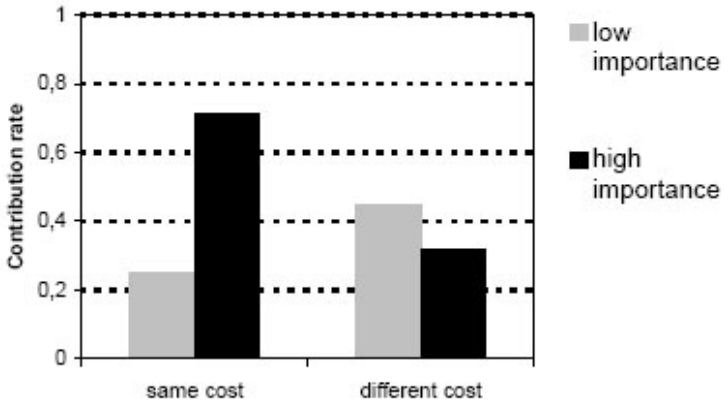

Figure 2. Significant interaction between cost of entering information and importance of information. When cost is the same, the rate of entering important information is significantly higher. This preference disappears in a situation in which entering important information leads to higher cost.

These findings show that in situations in which people have to accept extra cost for entering information that is relevant to others, they tend to be more egoistic: they will contribute less relevant information than in situations in which entering relevant information leads to no additional disadvantage.

Use-Related Bonus System

Not only a reduction of contribution costs may optimize the payoff structure, but also the implementation of some reward system. Some business companies have introduced bonus systems to reward their staff for sharing information. If such rewards are merely based on quantity, they may encourage people to enter mainly information which is of little relevance to other people, or in other words, to fill the database with "trash". It will in many cases make more sense to base such a reward system on quality or usefulness of the entries. One possibility to do this is a "use-related reward system". Here a person receives a bonus every time when another group member retrieves information that was provided by that person. When such a reward system is in existence, it will be in the interest of an information carrier to enter primarily those items which are relevant to others and, therefore, more likely to be retrieved.

One of our experiments tested the efficiency of such a use-related bonus system. Three conditions were compared: An environment with no bonus system, one with a bonus system that compensates precisely for the cost of entering information ("compensation bonus") and one which provides a bonus that exceeds the cost of entering information ("more-than-compensation bonus").

In terms of an objective payoff function (mathematically calculated), a social dilemma would no longer exist with this type of bonus system in both conditions. If the compensation bonus covers the cost of entering information into the database, cooperation is no longer a disadvantage from the user's point of view. With a more-than-compensation bonus, a user would even gain profit from database entries, as the bonus here is higher than the cost of providing these entries.

Interviews with users showed, however, that both types of bonuses were perceived as low. Neither the compensation nor the more-than-compensation bonus were perceived (subjectively) as really covering the cost. So – subjectively – both situations represented a social dilemma, even though – objectively – the payoff structure no longer reflected such a dilemma. Participants appear to be influenced by a misguided perception that even in this situation cooperation is an unfavorable strategy. Referring to people's behavior, the experiment revealed that the higher the bonus was, the more did users select "relevant" items of information for entering into the database (cf. Figure 3).

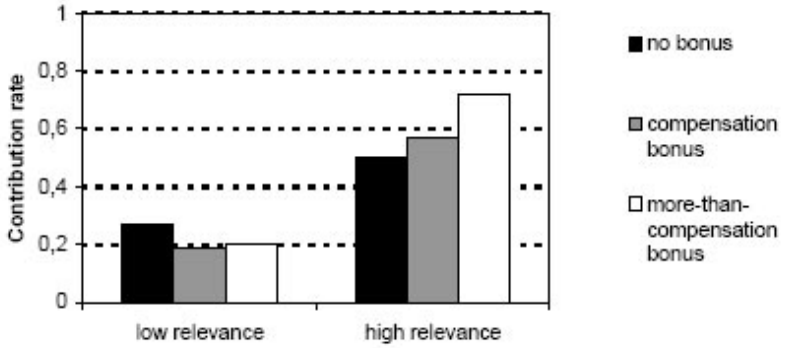

Figure 3. Significant interaction between amount awarded as use-related bonus, and relevance of information. The higher the bonus, the more relevant information will participants enter into the database.

Reducing Uncertainty through Feedback and Recommendations

If we compare the information-exchange dilemma to other social dilemmas, people not only have the choice between cooperation and defection. Any new information which they have at their disposal will allow them to take a new decision. People can select any proportion of their available knowledge to supply (or not supply) it to others. When they have taken such decision, they will not receive any immediate feedback on decisions taken by other people. Only after a certain period of time of having used the database, a user will get a – mainly vague – impression of the other users' behavior. The total number of all database entries will only permit a rough assessment of the extent to which the other people have been cooperative or defective. The larger the group is, the more difficult is a correct assessment of the other group members' readiness to cooperate. But a valid assessment of other people's behavior would be extremely important from the individual user's point of view, because in a situation of uncertainty people often model the behavior of others. If they feel that others are cooperative, they will also behave in a cooperative manner. If they feel that others defect, they will also show a more egoistic behavior.

To check this expected effect of feedback information about other people's behavior, a further experiment included a feedback tool, which provided each participant with information about the number of entries that other group members had supplied to the database. With the presentation of a diagram with two

bars, one showing the number of that user's own entries, the other one the average number of entries provided by other group members, the users could compare their own behavior with that of other members. The following conditions were compared: in one condition, participants were told that the other group members had entered an average of three values. In the other condition, the information was that others had entered an average of eight values. As expected, both groups behaved differently: people who believed that the average of the others was eight, provided significantly more entries than those who assumed that the average of the other group members was three (Cress & Kimmerle, 2007).

Apart from providing feedback about the behavior of others, there is another possible way of reducing uncertainty. A recommendation might be given that proposes how many pieces of information a person should contribute. In a situation of uncertainty in which people do not know how to behave adequately, such recommendations act as anchors (Tversky & Kahneman, 1974). Accordingly, we can expect people in a social dilemma situation to stick to such recommendations even if it is evident that there are no sanctions for not obeying them. Further experiments confirmed the influence of a recommendation in the information-exchange situation. A recommendation that proposes entering many pieces of information – eight in this case – leads to significantly more entries than a recommendation that proposes only entering three pieces of information (Cress & Kimmerle, 2007).

What happens if both factors, recommendation and feedback about the cooperation rate of others, are provided simultaneously? Will their effects be additive or will they interact? An experiment in which both factors were manipulated in a 2x2 factorial design (with "high recommendation" / "low recommendation" and "high feedback" / "low feedback" levels) showed that the provision of recommendations does not interact with social feedback. Both forms of reducing uncertainty work independently. Both factors lead to significant main effects, but there is no interaction. But it was also found that neither a recommendation nor feedback will motivate participants to achieve such high cooperation rates as the recommendation and the feedback had proposed. In the high recommendation and high feedback conditions, eight entries were the recommendation or supposed average. Compared to the low recommendation and no feedback condition, this led to a significant increase of cooperation, but in all four groups the participants supplied far less than an absolute number of eight database entries.

Group Awareness

Computer-mediated communication is characterized by a high degree of anonymity of communication. If group members are located in different places and work on different assignments, they possess hardly any social cues about the existence of the others. "Group awareness tools" are frequently used in computer-mediated communication to make individual users aware of the existence and needs of other users (Carroll, Neale, Isenhour, Rossen, & McCrickard, 2003, Kimmerle, Cress, & Hesse, 2007). Such tools may provide pictorial representations of group members or information about these people and their activities. It is a wide-spread assumption that such tools will make the group more salient to individual users and increase their readiness to cooperate with the rest of the group.

But this is doubtful according to findings from social psychology. Group awareness tools will not in all cases improve cooperation, in some cases they may even induce the opposite effect. A social-psychological theory, the so-called SIDE model (Social Identity model of Deindividuation Effects, Lea, Spears, & de Groot, 2001), states that visual anonymity will not always be an obstacle to norm-conforming behavior. It may reinforce or diminish the influence of norms, depending on the predominant social or personal identity of the individual (Tajfel & Turner, 1979).

In the anonymous situation, people who regard themselves as group members will perceive the group as a very homogenous entity. This is due to the fact that they have no other information about the other people, apart from the fact of their membership of the group. Once anonymity is lifted and group members appear as distinct individuals, the group appears as much more heterogeneous. This makes the group norm less binding. So if cooperation is the group norm, reducing anonymity may lead to more egoistic behavior. With people who perceive themselves primarily as individuals, the reduction of anonymity leads to the opposite effect. In the anonymous situation, these people are hardly aware of the existence of other people. If anonymity is lifted and other group members become visible (say, through pictures), the existence of these other people is perceived more strongly. Such individuals will now tend to behave as group members who are more inclined to assist others.

This assumption was tested in an experimental study (Cress, 2005). "Social value orientation" (McClintock, 1978) was measured to distinguish between two categories of people, those who perceive themselves as group members (pro-socially oriented people) and those who perceive themselves as individuals (individually oriented people). This social value orientation is a personality trait, describing if persons tend to act according to their own interests or to those of others in social situations. In the experiment, one environment was used which displayed pictures of the other group members on the screen. The other environment did not provide any pictures. Figure 4 shows that the assumptions made by the SIDE model were confirmed. Apart from

the general main effect of social orientation (pro-socially oriented people are more cooperative than individually-oriented people), the experiment also demonstrated a significant interaction effect: pictures of the others increased cooperation from individually-oriented people, but led to a decline of cooperation from pro-socially oriented people.

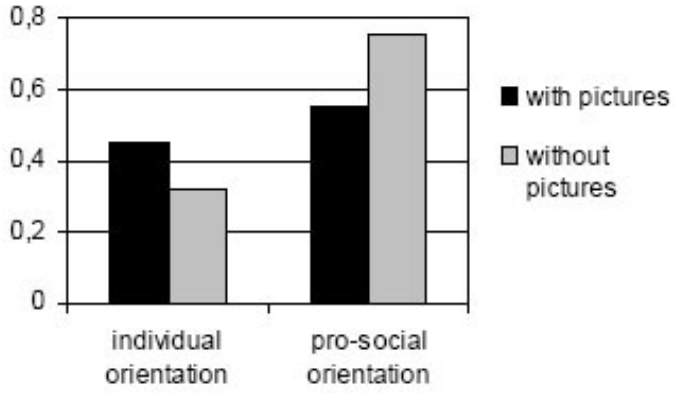

Figure 4. How pictures of group members influence people with individual and pro-social orientation. Significant main effect and significant interaction effect.

The results show that the provision of group-member pictures has two different effects. The database users get aware of the existence of other group members (leading to higher cooperation from individualists) and they get aware of their heterogeneity (reducing cooperation from pro-socials). One possible conclusion is that visualizations of group members will promote cooperation from all types of users if they portray the group members, to the greatest possible extent, as a homogenous group. In virtual worlds people may not only be represented by real pictures (say, photographs) but also by avatars, i.e. graphical representations or figures, so this idea may be implemented by using identical avatars for all group members.

Some Practical Consequences

Which conclusions may be drawn from these results for forums, wikis, databases and other communication tools?

First of all: we have to be aware that through such channels a lively exchange of knowledge will not occur automatically, even if technical systems make it easy to establish a shared knowledge pool and if people have easy access to that pool – say, by using Web 2.0 tools – and can enter information easily. For a group of users – a workgroup, business company, online community etc – the existence and availability of such a pool is extremely efficient, but participation may be unattractive from the individual user's point of view. As soon as an individual has to spend time and effort for giving away information and may lose power by doing so, a social dilemma will occur, which will prevent active participation in knowledge exchange by contributing one's own information. In such a situation, people who possess knowledge will give it away primarily under conditions which imply positive consequences for themselves. So what opportunities exist to demonstrate to such users the benefit of their own active participation?

An attempt may be made to change the structure of the dilemma situation. One way is to reduce the cost of passing on one's knowledge. It is also possible to provide some additional benefit. Knowledge carriers may, for example, regard the passing on of knowledge as an opportunity to establish a positive reputation within their community. Being regarded by others as an expert and competent colleague, is very attractive in the eyes of most people.

But such structural modifications will not completely remove the dilemma, because as soon as people are confronted with any costs of their contributions, they will have the impression of being in a social dilemma. Social-psychological approaches may be relevant here: people will be more cooperative if they take into account not only their own interests, but also the benefit of other participants. In knowledge transfer situations, the group and other group members and their needs should be as salient as possible. This will work best if the group works for a common goal and there is a high degree of group identity and reciprocity. A norm or recommendation to propose high cooperation should also exist at the same time.

The questions which were dealt with in this article will continue to play an important role in the future, both in simple forms of knowledge transfer and in computer-mediated collaborative construction of new knowledge. Motivation of the participants, their readiness to cooperate actively, will always be a fundamental requirement of successful knowledge processes.

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