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- A psychological view on pattern-based task management -

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Abstract. *Collective knowledge construction is often inhibited by motivational barriers. In this paper we present pattern-based task management (PBTM) as a system to construct collective knowledge and show ways how to foster motivation. We present the motivational structure of the knowledge sharing situation as a social dilemma which feeds free-riding. To avoid this, we concentrate on ways to overcome the dilemma from a psychological perspective by presenting concrete suggestions on increasing users' motivation to actively participate in PBTM. The goal is to foster collective knowledge construction as a social process.*

1. Introduction

The performance of an organization strongly depends on the utilization of its potentials which mainly consists of its employees' work experience. If an employee lacks some, she may ask a colleague. This works quite well with small groups, but cannot be simply transferred to large and global organizations. For example, if an employee in Germany has to work on a task, which an employee in India has already dealt with, then she will not even notice this. Generally such situations cause a waste of organizational resources.

Such problems can be avoided by leveraging transactive memory (TM) [Weg87], i.e. the sum of the individuals' memories plus communication between them. By establishing TM, up-to-date and action-related individual knowledge is mobilised to construct collaborative knowledge, e.g., by introducing an experience transferring task management system. Recently, pattern-based task management (PBTM) [Ris05] has been introduced as such a system. It allows individuals to publish abstract work patterns derived from their task execution. The central challenge for the realization of

such a system consists in motivating individuals to provide the required work patterns. This paper describes the challenges with respect to motivation on the way towards the implementation of a TM system.

This paper is structured as follows. Section 2 presents the PBTM approach as a system that realizes collective knowledge construction for the TM. In Section 3 we will demonstrate how to motivate users' participation from a psychological perspective. To this end, barriers for knowledge sharing will be presented. Then the concrete payoff structure for individual users is explained, describing a social dilemma. In the last part possible ways to motivate user participation in a psychological manner are presented. Here we show social aspects that are essential for voluntary cooperation in the environment of the PBTM. Finally, Section 4 describes areas of possible future research.

2. Pattern-Based Task Management Approach

The pattern-based task management [Ris05] is an approach that addresses the problem of how to turn personal knowledge into collective, i.e. organizational, knowledge. The PBTM offers support for individual task execution and simultaneously realizes reuse of process expertise in the organization. The central means of knowledge transfer are task patterns that incorporate abstracted and collected knowledge based on the experience of several task executions. The generation of task patterns is realized by a pattern lifecycle. This lifecycle starts with the creation of an initial task pattern from an individual task by abstracting from user-specific information. Thus it is ensured that the task pattern only contains knowledge that is relevant for the organization. By using a task pattern, individuals access the organizational knowledge, receiving guidance for the execution of their tasks. The pattern lifecycle is concluded by an adaptation step where the task pattern is enriched and improved by the task executor with the knowledge gained through the task execution. In this way the task pattern lifecycle represents a means for transferring personal knowledge into a TM.

3. User Motivation from a Psychological Perspective

An essential precondition for the success of the collective learning process is knowledge sharing [Pes06]. Therefore, users of PBTM need to be motivated to share their knowledge on work experiences with others. Working with PBTM requires users to invest time and effort in order to share their knowledge. To motivate users to render this effort, several motivational

barriers have to be overcome, which describe why people under different circumstances are not willing to share their knowledge [Cre06]. First, externalising knowledge is very time-consuming, e.g., it must be written down and well elaborated, to enable others to understand it. Second, knowledge exchange via computer systems is an impersonal communication situation. Users do not know for whom they invest time and effort.

These motivational barriers can be overcome in two ways [MB83] by appropriately designing the PBTM system. One way is to change structural conditions in order to lower the costs of knowledge contribution and to increase the benefits of knowledge consumption, as seen from the user's perspective. However, these changes can only partially solve the problem. Enhancing the user motivation to participate in a psychological way appears more promising to us. The prerequisite for this is an analysis of the payoff structure of the individual user in this situation. This is done in the next section. Based on this payoff structure, we discuss the psychological factors to motivate PBTM users.

3.1. Individual Cost-Benefit Analysis

Providing task patterns for other users is very costly, e.g., by efforts related to the abstraction of task knowledge to patterns. The pattern provider has no direct benefits from her contribution, since she has already gained the experience regarding the respective task. Only other users may benefit from it. From a game theoretical point of view [NM44], providing own task patterns to a central storage, is *cooperation*. Withholding this information is *defection*. Considering the user's behaviour from a cost-benefit analysis perspective, she should use the PBTM system just to access information without sharing her own. Hence, from a rational point of view the *dominant strategy*, i.e. the strategy which leads to the highest individual outcome, for each user is to defect. The fact that users can benefit from the PBTM system without contributing to it, enforces the dominance of defection. Following this strategy leads to behaviour called *free-riding* [Ols65]. It describes persons, who do not contribute to achieve the common goal (here: to have an updated and rich information PBTM system) but even though benefit from it. Free-riding involves a motivation loss in group work. However, if everyone follows the individual dominant strategy, the group as a whole will suffer because of the deficient knowledge exchange. Therefore, this situation fulfils the characteristics of a *social dilemma* [Daw80]. This describes paradoxical situations, where the individually most rational choice is the least rational choice for the group as a whole. The social dilemma itself has no solution, but its negative consequences may be reduced.

There are hints that free-riding is indeed a key issue in knowledge sharing. Studies about knowledge exchange via shared databases (DB) [Cre06] have identified three types of users. About 20% of the participants are fully co-operative, i.e. they share their knowledge with others. About 30% are fully defective, i.e. they do not give away any of their knowledge. The left-over 50% pursue a mixed strategy. These are the persons, whose motivation can be influenced. The analogy of the situation to the PBTM case as well as modification suggestions will be presented in the next section.

3.2. Social Aspects in Voluntarily Knowledge Sharing

We have seen that motivational barriers for knowledge exchange and users' behaviour arise from the fundamental structure. In the following we will suggest ways to resolve the dilemma on the basis of the individual payoff structure. Thereby we refer to shared DB research[1]. Although PBTM is not identical to a shared DB case, there are central common features. In this paper we use the term shared DB referring to a central, permanent storage of a data pool, which is maintained of a certain group and where each group member may supply data to or recall data from [CTH92]. Thus, the shared DB resembles the PBTM regarding task patterns as the respective data. By applying these patterns to their tasks, users improve their work and ideally update task patterns in the PBTM. Therefore, PBTM can be considered as a kind of shared DB. As in the DB case, there is no clear benefit for providers in case of contribution. Yet, there are also differences. In the PBTM scenario patterns are a more complex kind of data from a user's point of view than in the shared DB experiments [Cre06]. They rely on human interpretation and therefore PBTM also causes costs for the recipients. Furthermore, also the costs for task pattern updates by the contributors are higher since task pattern handling is more complicated than dealing with numbers in the shared DB. These facts even increase the dilemma.

Beside individual factors the mentioned research describes two main ways for enhancing cooperation by using social strategies: reducing anonymity and reducing insecurity. Here we see a major field for improving PBTM.

Reducing Anonymity

As mentioned above, PBTM uses an anonymous communication form where users do not know for whom they invest time and effort. To reduce anonymity the following factors established significant influence.

1Our findings are basically taken from the DFG-research project "knowledge exchange via shared databases", e.g. [Cre06].

- *Providing information about other users* like names, affiliation to a department, function within the company, and pictures of them to increase the awareness of the group. For example, within the PBTM application task patterns can indicate users who have used this task pattern. This increases the awareness of being a group member compared to being an individual and may increase the willingness to cooperate. However, the effect of this information does not necessarily lead to higher cooperation rates [Cre06]. This effect depends on intensifying the salience of the group as a homogenous mass instead of showing lots of different individuals with different needs. Therefore, social awareness information should emphasise the similarities of the group members and not their differences.
- *Displaying contribution behaviour (from an anonymity perspective)* leads to higher cooperation rates, but also increases the pressure on the individual resulting in negative attitudes towards the tool [Cre06]. Certainly, in the case of PBTM, identifiability may have additionally negative consequences for the contribution since it affects privacy issues. Hence, it is better to slightly motivate knowledge exchange instead of forcing it. This is possible through giving feedback about the contribution behaviour of the whole group. For the PBTM example, each time a user starts the system, a feedback graphic is presented displaying the changes in task patterns as a frequency distribution. The effects of providing feedback will be elaborated more precisely below.

Reducing Insecurity

The other crucial issue of knowledge exchange is that users are insecure whether to share information and in case of sharing, how much information to share [CTH92]. They do not have any hints on what to do. For reducing this insecurity, the following factors are important.

- *Displaying contribution behaviour (from an insecurity perspective)* gives users an orientation on how active they shall be. Research has shown that users orient on this kind of feedback and adapt their behaviour to it [Cre06]. But, the problem is that if others are uncooperative, a single user will adapt to that. Thus, for feedback design, guidelines need to be considered [Cre06]: Mirror the behaviour of the whole group, not of each single participant, so that nobody feels forced to contribute; If the contribution rates decline in time, choose a cumulative format for showing them, so a positive development is conveyed; Instead of displaying the average contribution per person (e.g. “0.3

contributions"), prefer a positive format that motivates to cooperate (e.g. "Over 50% of the users already have contributed.").

- *Establishing behaviour recommendations.* Research [Cre06] has shown that recommending how much to contribute from a top-down perspective makes users adopt their behaviour to it, even though it cannot be controlled or penalised. For example, after finishing the execution of a task in the PBTM system, the user gets a recommendation to update the used pattern or to create a new pattern. When implementing this into the PBTM system, optically salience is important, e.g. as a pop-up window, because only a mentally present recommendation can influence the behaviour.
- *Clarifying the relevance of ones own information for others.* Information labelled as important for other members is far more often contributed to a shared DB compared to less important information [Cre06]. The PBTM system maintains statistical data on the usage of each pattern. For example, the frequency of usage serves as an indicator for the importance of pattern. In this case the user receives the information that a specific task pattern has been significantly more often used than a possible alternative. In a similar way it is also possible to use the available information to classify experts for specific topics.
- *Enabling relevant communication among the group*, i.e. negotiating on their own how much to contribute, will lead to higher cooperation rates [Led95]. For example, for the PBTM system, several users having executed the same task pattern should update it in order to ensure relevance and improvements. After execution, they receive a recommendation to update the pattern. They then can join a discussion forum thread or a wiki page assigned the specific task pattern. This enables relevant communication for the PBTM users leading to discussions on the improvement of the task pattern and fosters the improvement and update of task patterns. In contrast, enabling free communication with larger groups might cause confusion instead helping to coordinate the contributions. However, discussing specific task patterns limits the group size to the respective users which in turn makes discussion feasible.

Additional Hints from Wikipedia Research

Further indications about user motivation to voluntarily share knowledge in similar situation come from research findings about Wikipedia, e.g. [Jae05], a new research area with yet little results available.

The analogy between wikipedia and PBTM consists in the fact that in both cases users jointly work on the improvement of shared information and that

the recipients of this information are unknown, i.e., no direct reciprocity can be expected. Also here contributions cause considerable costs. However, there are also differences. In Wikipedia we find a broader audience, which strengthens the anonymity of the situation and the probability of contribution. Moreover, the shared information is less abstract. Hence, it is easier to prepare than task patterns. Keeping these limitations in mind, we take a look at the available findings.

The major cause of voluntarily contribution behaviour appears to be intrinsic motivation [Jae05], e.g. joy in writing, interest in jointly improving quality of content; conviction, that information should be available for free; upgrade of own articles; personal learning through writing. This confirms our focus on motivational factors. However, a case study [Gra06] has shown that some users do not like their contributions to be worked over, because it did not correspond to their social norms. This case indicates the importance of establishing proper social norms, e.g. netiquette. Similar norms should also be established for PBTM.

4. Conclusions

We have seen that social aspects play a crucial role for users' willingness to share their knowledge in shared DB. A promising way to enhance this willingness is increasing social awareness. We have pointed out five factors which improve users' motivation in this respect: (1) Simply providing information about other users; (2) Statistics about other user's contributions; (3) General behaviour recommendations; (4) Emphasising the importance of a potential contributions to other users; (5) Enabling relevant communication among the users. We have applied these findings to the PBTM case.

Our major goal is to foster collective knowledge construction as a social process based on PBTM. Here we want to establish a social learning process that takes place in a collaborative framework with the goal to achieve a more efficient learning effect for the individual and the group [Pes06].

However, further aspects should be considered. As mentioned in the introduction, one precondition for a smooth organizational performance is to establish a transactive memory. Hereby, communication between individuals is necessary. So far, we have concentrated only on one communication party: the knowledge provider. On the other hand the knowledge recipient appears to be likewise or even more important [Dav06]. Actually both sides mutually influence each other. Generally, advantages on the provider side are related to efforts on the receiver side and vice versa. Collective knowledge can not be established until both sides are in a certain equilibrium. For this, further research on these aspects is needed.

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