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ABSTRACT (REQUIRED)

Microblogging is the new Web 2.0 hype in the media. Techies, politicians, family members and many more use Twitter to keep in touch with their interest groups, their voters or their friends and relatives. We wanted to know whether Twitter can also keep us aware about our team colleagues, how this improves teamwork and finally why Twitter is accepted and used in teams. Based on an action research study about Twitter usage in a team of seven researchers and the findings of prior literature, we attempt to extend the unified theory of technology acceptance (Venkatesh 2003) and adapt it to the specific context of microblogging in teams. Extending the performance expectancy construct, we propose two groups of factors inherent to social software that should be integrated into the UTAUT: the task characteristics of other users and the individual motivations for using social software.

Keywords (Required)

Twitter, technology acceptance and use, awareness, microblogging, teamwork

INTRODUCTION

To date, we experience a proliferation of new Web 2.0 tools with a great deal of them offering now functions for updating the user`s status. One of the best-known and most successful tools for this phenomenon called microblogging is Twitter. Typically, a Twitter message answers the question "What are you doing?"; but any possible textual content can be sent unless it does not exceed 140 characters. The messages are received by any user that subscribes to the senders messages and can be viewed via a website, instant messenger-like clients, cell phone or email. Hence, users are free to decide which messages they want to receive and can organize themselves in self-changing networks. In such networks, each user has a personal webpage displaying a history of his last updates and information about the users interests.

Generally, Twitter provides the users with small messages that support awareness. Awareness is the *"understanding of the activities of others, which provides a context for your own activity"* (Dourish and Bellotti 1992). Awareness about who knows what and who does what is crucial for coordinating actions with colleagues (Brandon and Hollingshead 2004). Moreover, awareness about team members helps to create a shared work context and enhance shared understanding among team members (Liang et al. 1995). The knowledge about the colleagues' expertise as well as a shared understanding are the prerequisites for knowledge sharing in teams (Ko et al. 2005).

The majority of empirical studies about microblogging have focused on the leisure time use of Twitter (e.g. (Java et al. 2007; Krishnamurthy et al. 2008). Only Zhao and Rosson (2009) and Günther et al. (2009) have analyzed Twitter with respect to its use at the work place. However, in both studies, the participants mainly used Twitter in their leisure time and could only state assumptions about the effects that microblogging might have on collaborative work in teams. Thus, most of their findings are hypotheses about what would happen if participants would use Twitter at work. Little is actually known about the 'real' motivations to use Twitter and the tool's 'real' impact on teamwork.

To address this research gap, we probed Twitter in a real-life team of seven researchers. Our situated empirical study gives an in-depth exploration of Twitter usage at work and in particular attempts to answers the following questions:

1. How can Microblogs be used at work?

2. Why is Microblogging accepted and used at work and in particular what affects a user's belief that using tools like Twitter will help him or her to attain gains in job performance?

3. How does Microblogging usage impact on team performance?

Our analysis of the results contributes to answer these questions by constructing a model for Twitter acceptance on the basis of the unified theory of technology acceptance and use (UTAUT) by Venkatesh (2003). In particular, our study focuses on an extension of the performance expectancy construct.

In what follows, we briefly illustrate the research method and elaborate on our research findings. Then, integrating our findings with prior research evidence, we propose a refined model of acceptance and use of microblogging in work contexts. In a conclusion, we briefly summarize the contribution to research, state the limitations and outline a future research agenda.

RESEARCH METHOD

The study was conducted using the participatory action research method (Greenwood et al. 1993). The idea of action research is to yield an in-depth analysis of a specific real world context by allowing the researcher to be part of the subject under observation. The strength of action research therefore lies in its capacity to gain deep insight from the researcher's involvement and provide a rich picture of a phenomenon (Wood-Harper 1992).

Moreover, Participatory action research involves continuous cycles of evolutionary learning in which the researchers together with the studied subjects identify major issues, concerns and problems, plan actions, implement actions, evaluate the effects and formulate the learning (Greenwood et al. 1993). For reasons of simplicity and better readability of the study, the results of this action research project will be synthesized and presented in one "block". Yet, we note that data was gathered in a series of iterative cycles.

In the setting of the study, a team of seven researchers –among them one of the authors– agreed to adopt Twitter, as one of their communication channels over a period of three weeks. The team consisted of a Professor, three PhD students (two of them lecturers) and three master students (one of them the first author). The core of the team had been working together on different research projects for more than three years; all test participants had worked for at least four months in the team. The team was therefore fully established – team members were professionally experienced, both individually and as a group; and the team was socially well integrated. Like most research groups, in addition to undertaking research, they also needed to attend to the ongoing task of finding research sponsors and of building the research team itself. Free of any constraints the team members were able to use Twitter to support any of their tasks.

We gathered data in three different ways. First, we wrote down our own observations and the actions planed and carried out to facilitate Twitter usage. This allowed us to assess participants' communications with others, and what was actually done – not what is said to be done. Second, evidence about the communication between participants was gathered by conducting a content analysis of the messages sent via Twitter. Third, the participants were asked to fill out a short semi-structured online questionnaire. Since the questionnaires were filled out anonymously data was less likely to be biased by the researcher. Based on the questionnaire data, we conducted follow-up interviews to explore the perceptions of Twitter usage in a team by each individual participant.

RESEARCH FINDINGS

Observations and Actions

Usage

In the first few days not many tweets were posted, and the information content of the messages was relatively low. Typically the messages were about a person's whereabouts and which document he/she was working on:

> *Participant E: I am working on my thesis again tonight.*

> *Participant K: Is working on the paper.*

> *Participant A: out for coffee.*

It was noted that, generally, users began to provide more in-depth information of status. Rather than stating merely that they were doing 'something' on their research projects, they began to describe which particular research field they were studying or which problems they were recently experiencing in their work:

> *Participant G: Writing something on Knowledge-Sharing Projects in FPOs and NPOs*

> *Participant E: I have been working on my thesis - I am worried about the testing components - but will get advice tomorrow.*

Increasingly, people began adding a personal touch to their messages, by commenting on other participants' tweets or uttering their personal feelings about issues they encountered during their work day.

> *Participant D: I'm still waiting for Second Life. The IT helpless people still need to push another button and can't do it till later this afternoon. So tricky...* (One researcher was conducting a project about Second Life.)

> *Participant G: is still working hard on the Knowledge Sharing paper. It's fun to do this on a Friday evening :)*

The latter message in particular indicates that Twitter was also used by the participants to signalise to the Professor that effort was being made to get tasks done. Members also took advantage of the fact that all tweets come with a timestamp: for example, some team members would send a "leaving the office" when going home late at night, to demonstrate their after-hours work effort.

Several actions were taken to increase the usage of Twitter in the group. In the first week the auto nudging function was activated. This function sends an automatic reminder message, if a person has not posted a status update for 24 hours. In the second week, participants had not been required to have the automatic nudging function activated and were free to twitter when and what they wanted; but some participants preferred to have the nudging function sending them an automatic reminder message.

Moreover, frequent use of the Twitter site for writing and reading tweets was found to be very cumbersome. Therefore the team members had a client called Twhirl (Seesmic 2008) configured to launch on PC start-up running in the background. Instead of loading up the Twitter site and logging in, once the user's credentials have been presented, the Twhirl client remains always logged in; it can be activated simply by clicking on its taskbar icon.

In the last week, a service that sends Twitter messages to cell phones was put in place. All members of the team, however, agreed to have only direct messages and status updates of the professor sent to their phones. All team members appreciated the cell phone messages and it turned out that they wanted to receive these messages in particular for knowing when the professor was available for meetings.

Impacts on Teamwork

We observed various situations were Twitter proved to be of benefit for teamwork. We can classify these situations in four distinct categories:

- **Facilitation and coordination of transitions between individual and shared work.** Participants occasionally used Twitter to organize ad-hoc team meetings. These meetings mostly had an informal and voluntary character, like having a time-off for a coffee or meeting one-on-one for discussing an urgent issue.

- **Enhancement of coordination of actions.** It is suited to micro-coordination, such as the delegation of tasks. For macro-coordination activities like goal-setting, Twitter was not used, but status updates gave insight into current tasks, intentions and work rhythms of colleagues. The team was always informed what the Professor was working on, which also gave a good insight on whether one should disturb him and ask a question or rather not. Also for example a team member would post that he was far from finishing a part of a paper in order to inform his team mates that it would not make sense to meet the same day.

- **Promotion of social interaction.** Like instant messaging, Twitter was extensively used for informal communication, either as group messages to the whole team or direct messages to one single person. Equally important was the fact that status updates provide a context for making contact with others. Twitter provided group members with information about the others' backgrounds, current information about their work and a variety topics that can serve as starting points for a conversation.

- **Promotion of sharing of tacit and explicit knowledge.** Status updates kept participants aware of opportunities to assist each other or share information. In addition, spontaneous sharing of information in the form of short headlines about task-related news or URLs to other documents have potential.

Content Analysis

Our coding scheme is derived from the four awareness categories identified by Weisband (2002): availability awareness, activity awareness, process awareness, social awareness and the category sharing information/URLs, which was added as an important content category identified in the context of Twitter by Java et al. (2007). How the coding scheme was applied to sample Twitter posts is illustrated in Table 1:

Content Category	Example Twitter Message
Activity awareness. All information about activities directly associated with the group's task – namely, to carry out research.	*Participant G: is doing his literature review of the importance of Creativity in the HCI community.*
Availability awareness. All insights that aid other users to see whether the person is available for a meeting. In contrast with activity awareness, this kind of information is not directly related to the team's task.	*Participant A: is off for a coffee - back in 20 mins*
Process awareness. All information about what has to be done, who has to do it and when it has to be done. In particular, information about where, when and with whom to have a meeting.	*Participant B: hi everybody, the Second Life meeting will take place in about 10 min.* *Participant E: I haven't forgotten about the PP slides and will send them hopefully tomorrow*
Social awareness. All information that is not related to the task itself, but serves to socialize with team members.	*Participant A: Whoever laughs, has free resources.* *Participant C: Met a big grey kangaroo on the driveway this morning as I walked back home with the newspaper.*
Sharing information/URLs. All knowledge shared in form of URLs, ideas or news about recent events.	*Participant A: endnote is extremely slow with word 2007 - does anyone know a solution for this?* *Participant B: have a look at why second life makes or does not make sense in companies: http://is.gd/2wco*

Table 1: Coding Scheme

For reasons of simplicity and, more importantly, to guarantee an unequivocal assignment of coding blocks to the distinct categories, sentences were defined as the basic units of analysis.
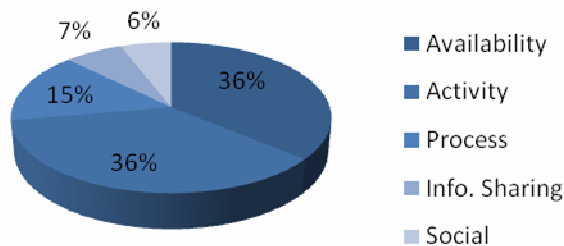

Figure 1: Information Content

In total, 222 tweets or 260 sentences were posted by the users; Figure 1 above illustrates the share of every content category in the total number of sentences posted and can be regarded as the typical "Twitter pattern". It becomes evident that information about availability and activity was the most sent content; most users combined the two categories in one tweet (cf Table 1). The third-most important category was process awareness; while sharing information and social awareness played a minor role.

A closer look at the messages in each content category reveals: To provide awareness of their activities, the participants mainly gave updates about their thesis documents, presentations, scientific papers or the development status of prototype software. Availability awareness mostly included whether or not a team member was in the office, at a client's or at home, and through which channels (e.g., email, cell phone, Twitter) the person was reachable. The third-most important category, process awareness, mainly embraced the questions what had to be done and when for projects of the chair, or which paper or thesis draft had to be handed in to the Professor, and when. Information was shared mostly by sending links to papers or newspaper articles and commenting on these. Social awareness included all kinds of topics related to the team members' personal backgrounds, but also compliments on others' work.

Interviews and Semi-Structured Questionnaire

Performance Expectancy

The results of the interviews with respect to the participants belief to increase their performance expectancy through Twitter can be categorized in performance expectancy through acquiring and proving awareness. The performance expectancies from acquiring awareness, i.e. from reading others' Twitter messages were:

- the need to know about team member activities and availability, particularly when a person was dependent on another team member's work, and
- to be up-to-date about recent news and developments related to the team task.

The performance expectancies from providing awareness, i.e. from posting Twitter messages were:

- to show that effort was made,
- to get feedback from team members when a task was successfully accomplished, or
- for assistance on a specific task from another team member.

Moreover, two factors that affect performance expectancy and Twitter use emerged in the interviews. In the first place, participants that were working closely together such that the completion of their tasks was directly dependent on others were more likely to read Twitter messages of the persons s/he was relying on. Thus, task interdependency is one factor that positively influences the relevance of messages and thus increases the probability that they are read.

In addition, participants who were working on similar tasks were reading each other's Twitter messages more regularly. Twitter was used to find out whether another person is working on the same topic and, if so, to track how the person is progressing. We thus identified task similarity as a second factor that influences the relevance of information sent via Twitter. The right part of Table 2 visualizes for each team member with which other person s/he was in a relationship characterized by high task interdependence or high task similarity. The table shows, for instance, for participant A, that high task interdependency with C and G as well as high task similarity with B and G is associated with increased intention of participant A to read Twitter messages as well as to send Twitter messages.

Generally, all participants were dependent in their tasks on the advices and directions of the Professor, which is why his messages had the highest relevance. Participant A and B (the master students) encountered very similar problems when beginning to writing down research (high task similarity), wherefore they stated in the interviews that they were reading each other's Twitter messages. Trying to learn from the more experienced members of the team, both of them were paying attention to the posts of the PhD student (participant G). One of them (participant A) even found out via Twitter, that the PhD student (participant G) was currently writing a paper about his topic and thus began working more closely with him. Hence, it can happen that participants that discover that they are working on the same task begin to divide work among each other such that their tasks also become interdependent. The Professor, on the other hand, was mainly occupied with leading the team as a whole. To him all participants were equally important. Nonetheless, he had quite similar tasks with the other lecturers. In contrast to this, participant E was not working on a very similar task or dependent on the others with the exception of being dependent on the Professor. Therefore, he was mainly interested in the availability and activity of the Professor and therefore considered the messages of the others as unnecessary.

Participant	High task interdependency with	High task similarity with	Intention to read other messages (Behavioral Intention)	Messages sent (Use Behavior)
A (Master)	C, G	B, G	High	82
B (Master)	C	A, G	High	66
C (Prof)	-	D, F	High	18
G (PhD)	C, A	A	High	11
D (Lecturer)	C	C	Low	18
E (Master)	C	-	Low	16
F (Lecturer)	C	C	Low	11

Table 2: Behavioral intention and use behavior with regard to task interdependency and task similarity

IMPLICATIONS OF FINDINGS AND MODEL FORMULATION

In the beginning, the problem with Twitter was not to understand how to Twitter, but rather what to Twitter. Within the relatively short time of three weeks we observed a fast evolution of Twitter messages suggesting that users learned to better use Twitter in order to maximize its utility. We cannot track the impact of this evolution on overall group performance, but we experienced various situations in which Twitter positively influenced collaboration in the team.

In the following, the implications of the findings will be integrated with prior research. A sound basis for this is the UTAUT developed by Venkatesh et al.(2003), which comprehensively summarizes past research about technology acceptance and use. As stated in the beginning the analysis will not cover all constructs and moderators in the UTAUT. Instead we attempt to provide an in-depth analysis and extension of the performance expectancy construct (cf. Figure 2).

Performance expectancy (from enhanced awareness)

Performance expectancy is defined as *"the degree to which an individual believes that using the system will help him or her to attain gains in job performance"*. The content analysis showed that Twitter was exclusively used for conveying availability, activity, process and social awareness and sharing information. In line with Zhao and Rosson (2009) we therefore believe, that Twitter users mainly capitalize on the benefits of awareness such as improved coordination and enhanced knowledge sharing as well as sharing small pieces of knowledge in the form of links. Consequently, we adapted this construct to the construct *performance expectancy from enhanced awareness*, which we define as the degree to which an individual believes that microblogging-mediated awareness will help him or her to attain gains in job performance. We propose that performance expectancy from enhanced awareness is determined by attributes related to the Twitter friends of a user (task interdependency and task similarity) and attributes related to the individual motivation of the user him/herself (reputation and expected relationships).

Task interdependence

Thompson (1967) defines three different forms of task interdependence: pooled, sequential, and reciprocal, whereas pooled is the lowest and reciprocal the highest value of task interdependence. In this article, task interdependence is defined as the degree to which a user of a microblog is dependent in his or her tasks on other users. Our results suggest that participants want to be connected with task interdependent colleagues because it increases their performance expectancy. The reason for this may be that task interdependency is a precondition for coordination (Malone and Crowston 1994; Thompson 1967). Microblogs support coordination by providing awareness of knowing who knows what and who does what. We thus hypothesize:

> *H1: The higher the task interdependence between a users and his/her Twitter friends, the greater the performance expectancy.*
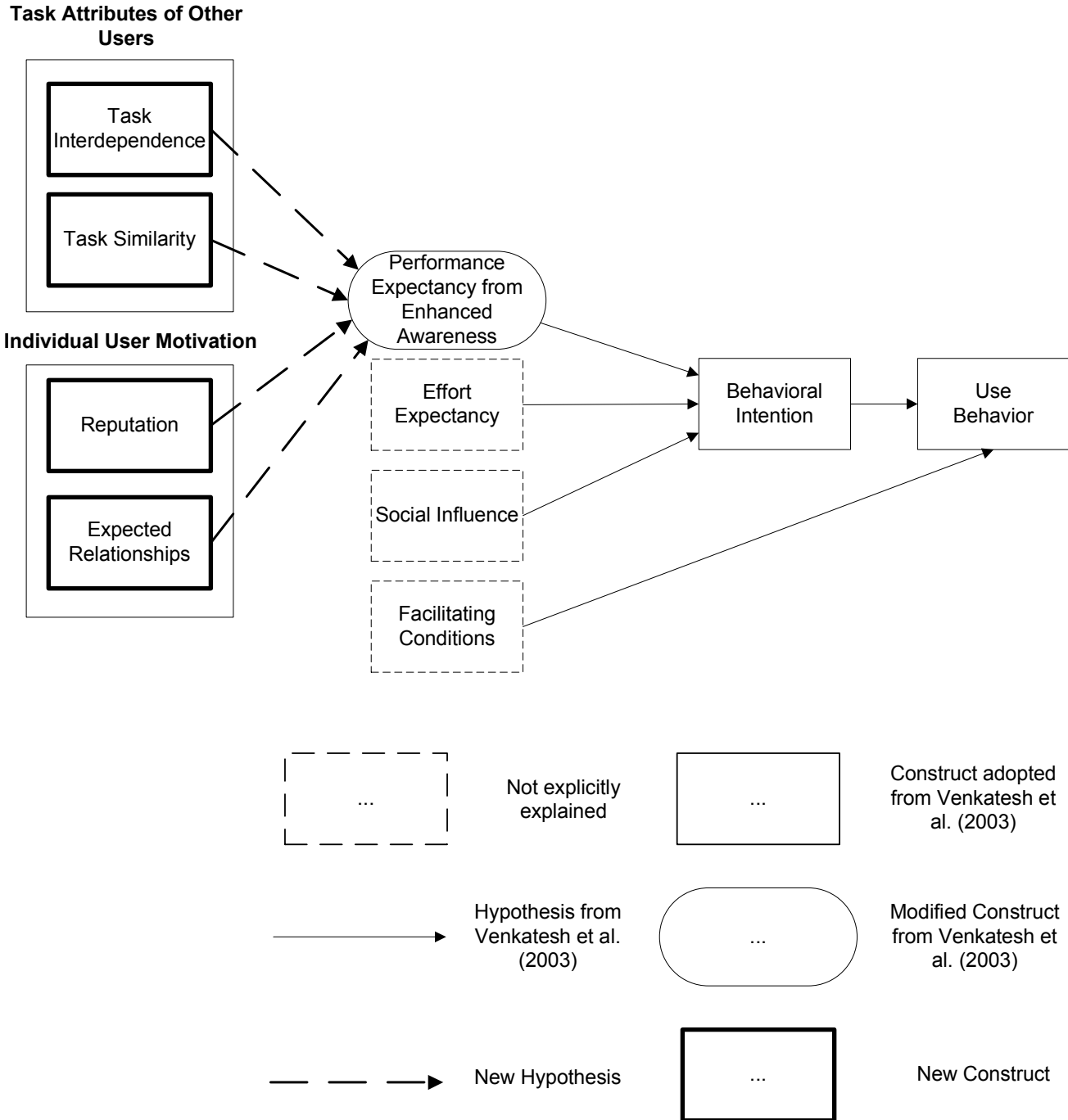
**Task Attributes of Other
Users**

Individual User Motivation

Figure 2: Modified UTAUT Model

Task similarity

Task similarity is the degree to which tasks of users are similar. People that work on similar task often have similar perceptions of issues and problems at work which results in an increased mutual understanding. Mutual understanding is a premise for easily coming into contact and sharing knowledge (Ko et al. 2005). The interviews and the content coding showed that people that use Twitter with the aim to share knowledge or enhance knowledge sharing via increasing awareness about their work want to be connected with individuals that work on similar tasks. Indeed Twitter communities mainly

consist of people with the same interest, working on similar tasks, share opinions, experiences and work material like links to articles and websites (e.g. Krishnamurthy et al. 2008). We thus hypothesize:

> *H2: The higher the task similarity between a user and his/her Twitter friends, the greater the performance expectancy of a user.*

Reputation

Reputation can be defined as *"the degree to which the use of an innovation is perceived to enhance one's image or status in one's social system"* (Moore and Benbasat 1991). McLure-Wasko and Faraj (2005) state that reputation is positively related to knowledge contribution. Consistently with Günther et al.'s (2009) model, we find evidence that reputation positively impacts on performance expectancy. In the setting of the study participants repeatedly used Twitter for documenting their work status with the aim to show the other team members that effort is made, i.e. they tried to build up a reputation as reliable and competent workers. In addition, team members may use Twitter for signaling expertise in a certain knowledge domain.

> *H3: The higher the motivation of a user to build up a reputation, the greater the performance expectancy of the individual microblog user.*

Expected Relationships

Based on Bock et al.'s (2006) definition of anticipated reciprocal relationships which *"capture the employees' desires to maintain ongoing relationships with others, specifically with regard to knowledge provision and reception",* expected relationship can be defined as the expectation of a user that he or she could obtain an improved mutual relationship through using the social network. Participants built and maintained relationships in the team using Twitter and helped each other by providing feedback when a task was successfully accomplished or assistance when a person needed help to complete a task. This is consistent with Günther et al. (2009) who suspect a positive relationship between expected relationships and performance expectancy. Thus, we propose that:

> *H4: The higher the expected relationships with other Twitter users, the greater the performance expectancy.*

CONCLUSION AND FUTURE WORK

In contrast to traditional software systems such as e.g. office software or workflow systems, microblogs much stronger incorporate the social aspects of collaborative work. The presented model adapts the UTAUT to these idiosyncrasies of microblogging by adding constructs related to work teams such as the characteristics of other users (task interdependency and task similarity) as well as constructs that reflect the motivation of an individual to aspire for social status (expected relationships and reputation).

The added constructs emerged from a profound knowledge base which integrates our action research in a real work context with the findings of prior studies. In contrast to these prior studies our study shows Twitter 'in action' and complements other studies with an in-depth exploration of the performance expectancy construct.

Finally, we have to remark that our extended UTAUT model remains incomplete as it only focuses on factors impacting on performance expectancy. Hence, more exploratory research is needed to study the effects on social influence and facilitating conditions. Moreover, an extended model would have to be tested either by a series of case studies in different contexts (participants of different age, gender, experience and voluntary/ mandatory contexts) or using a survey with a sufficient sample size.

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