From pattern to practice

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From pattern to practice: evaluation of a design pattern fostering trust in Virtual teams
Ellen Rusman, Jan van Bruggen, Ron Cörvers, Peter Sloep, Rob Koper
Open University of the Netherlands

Introduction

Recently, the field of computer science has acknowledged the idea that findings from the domains of psychology and sociology matter to the design of group systems. The design of group systems that support Computer Supported Collaborative Learning (CSCL) and Working (CSCW) integrates knowledge of how people work and learn in groups with knowledge of enabling technologies (Preece, 2000, Schümmer & Lukosch, 2007; Wilson, 1991). This had led to several requirements for task-related functionality, such as facilities for communication, file-sharing, calendaring and scheduling (Vick, 1998). However, there are other, often less-obvious requirements. These relate to the support of psychological and social processes, which impact group cohesion and team performance, such as group dynamics and people's perceptions of each other. These processes have traditionally been studied in social sciences. As they are essential corner stones for team performance and interaction, they are thus also relevant for team performance in mediated environments. Indeed, according to Ackerman (2000), the main problem in group systems nowadays is the discrepancy between the social needs and expectations of the user and the computer system functionality.

Although 'social informatics' (Grudin, 1994; Kling, 1999; Preece, 2000) acknowledge the relevance of findings from the social sciences for the design of group systems, this does not guarantee their systematical incorporation in the actual practice of systems design. Kling (1999) notices that such findings are '*scattered in the journals of several different fields*' (p.1), which makes it hard to locate important studies. Moreover, system designers usually don't have enough time to orient themselves in domains which *might* contain parts and ideas which are useful (Erickson, 1997).

To overcome knowledge transfer and time problems the notion of 'design patterns' was introduced into the field of computer science; it was meant to enhance interdisciplinary

communication and foster re-use of effective concepts (Borchers, 2003; Erickson, 2000). Design patterns provide a systematic, action-and design-oriented approach to incorporate findings from sociology and psychology in the design of computer systems. A pattern is a 'description of a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over' (Alexander, 1977). The strength of a design pattern is that it captures the essence of a "problem – solution"-dyad in a specific context, and presents it in such a way that it can be applied and adapted in different settings (Erickson, 2000; Dearden, Finlay, Allgar & McManus, 2002; E-LEN, 2004; Goodyear, 2005).

Design patterns for collaborative environments have been developed in several projects, such as E-LEN (2004), Patterns4Groupware (Schümmer, Fernandez, & Holmer, 2002; Schümmer & Lukosch, 2007) and the project that created the COLLAGE platform (Hernández-Leo et al., 2006). The development of a design pattern (language) is a cyclic and collaborative process, a design-cycle that comprises the identification of a 'core idea', the production of a draft version, the collection of evaluative information and the (multiple) refinement based on the evaluative findings. It also involves the identification of related patterns (E-LEN, 2004; Retalis. Georgiakakis, Dimitiradis, 2006). In previous projects the main focus was on the identification and development of design patterns which could be used as a means of communication during interdisciplinary and participative design of e-learning systems (Goodyear, Avgeriou, Baggetun, Bartoluzzi, Retalis, Ronteltap & Rusman, 2000). Several methods for the identification of patterns have been suggested, involving bottom-up and top down approaches (e.g. Baggetun, Rusman, Poggi, 2004) as well as a combination of these approaches (Retalis, Georgiakakis, & Dimitriadis, 2006).

In this article the focus is on the evaluation of an existing pattern. Various methods for the evaluation of patterns have been applied: review in the initial phase of pattern development by other experienced practitioners (designers/developers) taking the role of 'shephards' in so-called pattern writing workshops (Coplien, 1999; Harrison & Neil, 2000); implementation of the pattern in practise and measurements of user experiences and its success (or failure) in a case study (as was done in the

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TELL-project); usability (was it easy to understand and use it in the new context?) or by evaluation of its use by and usability for novice designers (Baggetun, Rusman & Poggi, 2004).

In this article we report on the implementation, evaluation and verification of the pattern 'Provide personal identity information' (Rusman, 2004) by means of a case study. This pattern is part of a group of patterns, which were developed around Computer Supported Collaborative Work (CSCL) within the E-LEN project. At the moment the pattern is linked only to the CSCL-pattern language developed in E-LEN, but it shares goald with the pattern group around "User Gallery" (Schümmer, Lukosch, & Slagter, 2005) developed in the CURE-project, in particular the patterns that were added to familiarize participants with each other (USER GALLERY) and (HELLO HELLO). Our pattern was developed to foster initial interpersonal trust and thus improve interaction among virtual team members in business as well as educational settings. However, presenting identity information as a means of improving interaction has also been suggested from the perspective of workspace awareness (Dourish & Belotti, 1992; Gutwin & Greenberg, 1998, 1999, 2002). Workspace awareness involves enabling users to build knowledge about their and other users' interactions with the workspace, by providing them with information about "who they are working with, what they are doing, where they are working, when various events happen and how those events occur". Providing information about the identity of fellow system users is helping users to answer questions like "who is participating?"and "who is that?" (p.420 & 421, Gutwin & Greenberg, 2002). Like a high positive interpersonal trust level among virtual team members (Corbitt, 2004; Kanawattanachai & Yoo, 2005; Raes, 2006; Walther, 2005), the sense of being aware of others is also known to be one of the mechanisms which helps to improve collaboration in a mediated setting (Gutwin & Greenberg, 1999; Gutwin & Greenberg, 2002). In this article, however, we will concentrate on the effects of a personal identity profile on fostering interpersonal trust among virtual team members and we will not discuss the effects on interaction separately. The case study described is a pilot with the aim to collect feedback on the effects of the implementation and specific instantiation of an identity profile in mediated contexts on interpersonal trust. We also aim to collect feedback on the information elements that users prefer in a personal identity profile. In a next phase a new version of the profile will be developed in a participatory design process involving a large number of students. This profile will

then be tested on its effects on interpersonal trust level, as well as on the interaction between project team members. This analysis is out of scope of the current article.

We will first describe the essence of the pattern 'Provide personal identity information'. Then we elaborate on the context of and the problem within the case of the European Virtual Seminar on Sustainable Development (EVS), that lead to the application of the pattern. Next we describe the implementation of the pattern within the EVS and the considerations leading to its implementation. Then we report on the means of acquiring user experiences with the implementation and the results of this evaluation. Finally, we draw some conclusions and reflect on the experiences with the implementation of the pattern.

Method

The pattern: 'Provide personal identity information"

The pattern: "Provide personal identity information" aims to foster trust in mediated collaborative settings by providing information about individual team members. It is expected to have a positive effect on interpersonal trust building and the development of first impressions irrespective of the context in which the collaboration is situated (business or educational setting). The 'virtual team' as a working method is gaining popularity in both contexts. For both settings we assume that an increased interpersonal trust level within a team improves interaction and collaboration which in turn will improve work and learning processes. This does not imply that the instantiation of the pattern will be the same in all settings. We expect that the information which should be provided within the personal profile is partially dependent on the context. The pattern was developed within the E-LEN project (2004). It was based on a literature review of collaboration and trust, and on known uses of profiles in other, non e-learning, trust-requiring contexts. So, to identify this pattern, an inductive as well as a deductive approach was combined (Baggetun, Rusman & Poggi, 2004). An abstract of the identified pattern is (Rusman, 2004):

Problem   People are not or infrequently collaborating due to a lack of trust and lack of a mental image of other people they ought to be collaborating with.

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Analysis	One of the conditions of successful collaboration is the feeling of trust, mutual accountability and common ground between the members of a group. Collaboration and cooperation is much less likely when dealing with an anonymous actor. To build this relationship of trust and understanding between people, they need to get a feeling and a mental image of the kind of person they are collaborating with. One way to get such an estimate of the person you are dealing with is to provide personal identity information in the collaborative environment. Other possibilities are to provide an 'ice-breaking' activity (Kear, 2004; Salmon, 2003) or to make people aware of the issue of trust in a mediated environment by means of a training at the start of a project (Beranek, 2000) Although these solutions also have a positive effect on trust building, they delay the start of a project and don't provide a means to easily review information on which a trust estimation is based during the rest of the project.
Solution	Provide static as well as dynamic information on personal identity (Danis, 2000).
Context	Applicable to synchronous and asynchronous distributed text-oriented interaction in a collaborative environment. Mainly aimed at designers and developers of electronic groupware environments. Especially necessary when people don't know each other in advance and there are no opportunities to organise one or more face-to-face meetings to get a mental image of people.

The original pattern contains additional information on the following elements: name, category, abstract, problem, analysis, known solutions, research questions, known uses, context, references, related patterns, author and date. This complete pattern can be retrieved from: http://www2.tisip.no/E-LEN/patterns_info.php (within SIG 3, collaborative learning) (E-LEN, 2004).

The context: European Virtual Seminar (EVS)

The European Virtual Seminar on Sustainable Development (EVS) is one of the modules within the curriculum of the School of Environmental Science at the Open University of the

Netherlands (OUNL). The OUNL is an open, distance-learning institute, offering flexible learning opportunities at university level, independent of time and place. It provides higher education opportunities for students without the usual entry qualifications or for those over the age of twenty-seven, for whom government grants for higher education are no longer available (National committee of Inquiry in Higher education, 1997). Its student population consists of adults, of which sixty-five percent fall within the age category of twenty-six to forty-five (OUNL, 2006). In EVS the OUNL collaborates with several partner universities across Europe, whose student populations consist of adolescents (EVS, 2007) falling within the more traditional student group aged about eighteen to twenty-five.

The "European Virtual Seminar on Sustainable Development (EVS)" is an international and multidisciplinary ICT-mediated dialogue on issues in sustainable development between students from different universities within Europe. Problems of sustainable development are typically complex, and perspectives on the nature and solution of these problems are likely to vary with national, cultural and disciplinary background. Transboundary competence, i.e. the ability to communicate and collaborate across the boundaries of nation, culture and discipline, is an essential competence for sustainable development. In the heterogeneous student groups in EVS, students directly experience different peer perspectives during their dialogue on sustainable development issues, while trying to reach a joint solution of the problem (Cörvers, Leinders & van Dam-Mieras, 2007). During a period of four and a half months they worked collaboratively on a case in groups of four to six students with different nationalities and from different disciplines. The group members communicated via text (chat or discussion forum) in English, which for none of the students was their mother tongue. Although chat was available, students mainly communicated asynchronously through the use of the discussion forum. The main group product is a report that presents an advice to solve the sustainable development issue they have researched. Each student group was coached by a tutor whose focus is on the group process; students can acquire additional advice on the content of the case study from an expert.

Although EVS has been running successfully since 2001 (Cörvers, Leinders & van Dam-Mieras, 2007), according to the coordinator, who has been involved with EVS from the start, some interaction problems remain. One problem is that students do not communicate directly from the beginning of the project. Another problem is that they do not know what expertise and input to expect from their group members. These type of interaction problems in virtual teams are not only common within EVS, but have been detected repeatedly in a variety of virtual team settings (Häkkinen, 2004; Jarvenpaa & Leidner, 1999).

Although group members are interacting during the project and in general deliver products of high quality, the coordinator wanted to accelerate interaction, in particular in the initial phase (the first two weeks) of the project. As the characteristics of EVS largely overlap with the 'context' description of the pattern - students have no opportunities for face to face interaction and no future collaborative activities are planned, we set out to investigate whether the provision of personal identity information would help students to form impressions and expectations of their group members, and improve communication within EVS.

What was implemented?

We implemented a simple solution for the provision of personal identity information as suggested in the pattern (Rusman, 2004) that was adapted from an earlier version referred to as a 'PEXPI': 'personal expertise inventory' or 'personal identity and expertise profile' (Brouns, Bitter-Rijpkema, Sloep, Kester, van Rosmalen, Berlanga, & Koper, 2007; Ogg, van Elk, Hondius, Stofberg, Bitter-Rijpkema, Emans, Schoonenboom, 2004; Rutjens, Bitter-Rijpkema & Crutzen, 2003). The PEXPI provides static information about each group member. We asked each participant of EVS to fill the PEXPI-template. The PEXPI subsequently became part of their collaborative environment. The categories of information within the PEXPI-template were:

INSERT TABLE 1 HERE

Target group and evaluation methods

We implemented the pattern in a group of 32 EVS students. The students were divided in two groups which had no mutual contacts: students who filled in a PEXPI right from the start and students who prepared a PEXPI only after two and a half weeks. It was expected that students who could use the PEXPI right from the start would have an advantage over the students who could access it only after two and a half weeks. Unfortunately, after three weeks, five students discovered that they could not combine this course with their work for other courses they participated in. These students left, leaving 27 active students in total. As a consequence, two study groups became too small. They were discontinued and students were distributed over the remaining five study groups. Two of the five remaining groups had a PEXPI from the beginning of the project and three groups after two and half weeks. Although the initial research objective was to compare these two groups quantitatively, we had to abandon it due to the small numbers of students in each experimental group. Instead, we focussed on the information collected through the questionnaires and telephone interviews (Appendix 1 and 2, respectively). With it we could answer the following questions:

- What information did students use to form an impression of others online rather than face to face? An impression is the perception of another person, concerning how behaviour, characteristics, dispositions and causes of events involving this person are perceived and interpreted (Arnold, 1998)

- Was the profile implemented useful for online impression formation among students?

- What information in the profile was especially useful for online impression formation of others?

- Did students miss relevant info in the profile which would allow them to form an online impression of others?

- Would students appreciate dynamic information in the profile of their team members?

To analyse the data, we followed the approach of Laat & Lally (2003) and Steinfield et.al. (2001). They consider triangulation of a limited set of quantitative and qualitative data an approach

which provides sufficient information for verification, falsification or refinement of cognitive processes and thus it is also applicable to impression formation.

Questionnaire

Two and a half weeks after the start of the project we presented an electronic questionnaire to the students. Questions were asked on the impression they had formed on their fellow students, and for those who had the PEXPI available, on the role that the PEXPI played in their project (see for the questions appendix 1). The questionnaire contained both closed and open questions but the closed questions were ignored in view of the small sample size. The answers on the open questions were coded (see first table of Appendix 4) so as to gain insight in the type of information the students used to acquire an impression of a virtual team member. The coding scheme was based on research on computer-mediated impression formation and trustworthiness estimation (Jacobson, 1999; Liu, 2001; Riegelsberger, Sasse, & McCarthy, 2004) and adapted, based on the acquired data. Information in the interview was coded with this scheme. Subsequently, coded information was reviewed on repeating constructs and repetition counts were kept. We asked students to explain how they formed an impression of the most and least trustworthy person in their team. All remarks on the information channel used to acquire this impression were counted. All information given in the answers of different students was combined and is represented in Table 2.

Interviews

In addition to the questionnaire, in-depth semi-structured telephone interviews were held with thirteen students at the end of the project (after four and a half months). Seven of these 13 students had the availability of the PEXPI from the start of the project and six students only after two and a half weeks. They were questioned on their impression of team members and about their experience with the PEXPI (see Appendix 2, for the core questions of a more elaborate scheme). Answers were coded according to the more elaborate version of the coding scheme (Appendix 4), using ATLAS. ATLAS is an environment for qualitative analysis of large bodies of textual data (and also audio, video). It offers a variety of tools to accomplish the tasks associated with any systematic approach to "soft" data – i.e., material which cannot be sufficiently analyzed using formal, statistical approaches

(ATLAS, 2002-2008). It supports the development of a coding scheme and the subsequent coding and analysis of qualitative data with the developed scheme.

Results

Questionnaire

16 students responded, corresponding to a 75% response rate (gender: 69% female, 31% male; age: 56% 19 - 25, 31% 26 – 35 and 13% 36 – 45 years). None of the respondents knew their team members before the collaboration in EVS. After two and a half weeks the respondents had mainly communicated through means of mail, with text chat mentioned by 38% as an additional means of communication.

Table 2 represents the information that individuals mentioned in the answers to the open questions in the questionnaire, as well as counts of information repetitively mentioned in answers (number of times mentioned in brackets). If no brackets appear, info was just mentioned once. We sorted and ordered students' answers in five categories of information, which emerged from the answers given in the questionnaire. Information categories which were used by students to form an impression within EVS are: (1) personal and private characteristics; (2) communication style and mode; (3) behaviour; (4) work and task-related and (5) other.

INSERT TABLE 2 HERE

Table 2 represents the open answers of all sixteen students who responded to the questionnaire, whether or not they had the PEXPI available. After two and a half weeks, students already formed an impression of each other. Students either used a PEXPI to derive personal or private characteristics from their team members when it was available to them. If not available, students still use all information available through the channels of mail, chat or discussion forum to construct an impression. In those cases, impression is derived from the communication style and mode, as well as general and task-related behavior of team members. This indicates that people have the need to form an impression of others when communicating online, independent of the fact whether they are supported by extra means, like a PEXPI.

Students also answered questions about the students that they trusted most and least in their team. They were asked whether this impression would be the same if they would have met this person face to face, rather than online. After two and a half weeks most students thought their impression would be different if they would have met the person whom they indicated as most or least trusted face to face. There was a difference between how reliable they thought their online formed impression was, dependent on their trust decision: 62% of the students thought that their impression of the student they trusted most would be different in a face-to-face setting and 75% of the students thought that their impression would be different for the student whom they trusted least. They gave several explanations for the general difference between face-to-face and online formed impressions, where one explanation summarizes the different responses neatly: "*a face to face situation is a much more complex encounter with a lot of factors external to the work that influence the contact. This can be positive or negative*". This indicates that, whatever source of information they used to construct their impression, students were overall more careful to depend on their impression formed of others in an online setting than they would have been in a face-to-face setting.

Differences mentioned between online and face-to-face encounters were indicated as both being positive and negative, with some people stating that they expected their impression to be more clear and unprejudiced when they only 'met' online, whereas others expressed doubt whether they could

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'completely get to know another person' through mail and chat, without meeting face to face. One student stated:

> "*I have the experience that people can seem very different in online communication and in real life. Not that the person is better or worse in real life, but just different*"

Other students thought that their impression would be the same, having either confidence in their judgment of human nature or basing it on the stability of response in the first phase.

Students were additionally asked whether, if there would be a personal identity profile available, they would appreciate dynamic information within this profile, i.e. would like it to be updated regularly, and what info they then would appreciate. Table 3 summarizes the response.

INSERT TABLE 3 HERE

The majority of the students had no problems with displaying dynamic information to their fellow students: 63% didn't mind, 6% was indifferent, 31% objected to it. The reasons for allowing this information to be displayed varied: it was considered fair towards team members, provided they would also be able to see theirs; it was not considered as secret or sensitive information and it allowed students to see the working schedule and activity of their team members. The reasons for not wanting this information displayed were related to information considered as private and/or sensitive.

Interviews

13 students were interviewed after four and a half months, seven students (from two different study groups) used the PEXPI from the start and six students (from two different study groups, see Appendix 3) after two and a half weeks.

In the interview students were questioned on impression formation within their team (Appendix 2). To structure the results all answers were coded with an elaborate version of the coding scheme used to analyse the open answers of the questionnaire (Appendix 4). Table 4 reports the frequencies of the codes and example citations.

It is remarkable that information coming from other persons in the same group was not used to form an impression (code 'OP'), only a remark of a tutor was mentioned. So, reputation information seemed not to be spread actively by communication of team members within the group during the four and a half months that the project was running.

Students were also asked which information was most important for impression formation. Table 5 represents the frequencies of information mentioned in their answers. Not all student could pinpoint the most important information for their impression formation process.

INSERT TABLE 5 HERE

Role of PEXPI

Seven out of the interviewed students, had the PEXPI available from the start. All seven filled in the PEXPI with personal data. Five of the six students who didn't have the PEXPI at the start didn't fill in the PEXPI when it became available after two-and half weeks. They did notice the template when it became available. One student filled in the template. His profile was read by his two team members who were interviewed and they both referred in the interview to information which they read in this template, especially related to work experience. All the students who had the PEXPI from the start did read the PEXPIs from their colleagues, and four of them read them more than once, during the project. With one exception, students who had the PEXPI available from the start found it useful for impression formation. The one who didn't find it useful, stated that it provided only basic information of others, and that more detailed information was needed to base an impression on. An example statement, reflecting the general tendency of usefulness within the student interviews: "*It [the PEXPI] is the only idea that you have of your team members….It is the only way that you can get a kind of personal bond with them and see what they look like and to form an impression of what kind of person they are*" (student 2, part 2, 19.37)

Half of the group of students who didn't have the PEXPI available from the start indicated that it would have been useful. Two other students of this group indicated that they would have used it if it would have been there in the beginning of the project, but that after two and a half weeks they already formed an impression based on the interaction with their group members. One of the student's who didn't have a PEXPI available to him from the start searched the web for personal data of the team to find "*more information about education and hobbies and some opinions of team members (student 10)*".

Info available in PEXPI

None of the information in the PEXPI was considered irrelevant. Students did not necessarily want extra information to be added to the PEXPI, although some suggestions for additional information categories were given. Table 6 represents the information categories that were considered as the most relevant and important information for impression formation (Table 6). The information which was available in the PEXPI is marked with an (*).

INSERT TABLE 6 HERE

The opinion on the addition of dynamic information differed among students. Five students did not want dynamic information to be added and three students favoured the idea. The other students were neutral. Arguments mentioned for the inclusion of dynamic information were expectancies of improvement of the working process and a sense of shared responsibility through the visibility of availability and log-in behaviour. Arguments mentioned against inclusion were expectancies of an increase in competitive behaviour and students acting like a 'police officer', while the purpose was to co-operate in a team instead of competing. Also a sense of 'big brother watching you' was mentioned against the display of dynamic information.

Some pre-planned chat sessions were mentioned several times in the tips to improve the course, mainly because it would allow talk on a more personal level, next to work-related communication. But, also the danger that important things would have been posted there and got lost, was mentioned here. This could be prevented by recording these chat logs, so that nothing gets lost.

Discussion and conclusions

Students will construct an image of each other, whether they initially have a profile available or not. If no profile is available in the initial phase, they will ground their impression in whatever information is available about their team members, e.g. their communication style and their on-and off task behaviour. But, a PEXPI can be a helpful tool to support this initial impression formation process. When available, all interviewed students used it in the beginning phase of the project: they filled it in as well read the descriptions of their team members. When the PEXPI wasn't available to students,

they indicate they would have liked to have it in the initial phase of the project. When if came available after two and a half weeks, it was not considered useful anymore and the majority of those students didn't fill in the PEXPI at that time. It seems that students have a need for personal information of each other to form an impression. This was also emphasized by the fact that some suggested an informal chat session at the beginning of the project, to exchange this kind of information. After the initial phase, personal characteristics are still important to form an impression of others, but the behaviour and communication style of people will become more important determining factors for the impression. So, presenting static personal information in a profile is especially useful in the beginning phase of a project.

Unfortunately, the case study encompassed relatively small numbers of students. Nevertheless, for an exploration of the usefulness and the effect of an implemented design pattern, the combination of an explorative questionnaire followed up by in-depth interviews, did provide insights. To enable the evaluation of a pattern, qualitative information methods seems to be more valuable in order to acquire useful information regarding the effects of a pattern. The pattern was easy applicable to the context of this case study, due to its description of contextual conditions and action oriented nature. The context description made it possible to judge if this pattern would be suitable for the problems within this specific case, the European Virtual Seminar on Sustainable Development (EVS). Remember that in it students don't know each other in advance, don't have the opportunity to meet and mainly communicate text-based. These characteristics of the context are important restricting elements of the pattern, as in face-to-face teams students will have different channels and more opportunities to acquire information to form an impression of their team members (e.g. at the coffee machine) and are therefore not so much in need of a profile.

Student responses indicate that the relatively simple and inexpensive implementation of a profile, such as PEXPI, did meet a need of students within EVS. It helped them to get to know more about their team members before and during collaboration. Results also indicate that the PEXPI was repeatedly read by some members and referred to by all who had it available to them. From these 16

results, it seems that a PEXPI is especially useful and relevant to form an image of the people in the beginning of a project. The majority of students who only had access to a PEXPI after two and a half weeks of collaboration didn't use it anymore, but indicated that they would have found it very useful had they had it from the start of the project. Although we don't have hard evidence that the implementation of this pattern increased interaction and participation within this exploratory case study of the EVS, it seemed to have helped students to form an initial image of their fellow team members. Admittedly, the questionnaire and the interviews also indicate that within two and a half weeks the students without a PEXPI also formed a basic impression of their team members, based on information exchanged in messages. This indicates that students will form an impression in any case from all available information. Nevertheless, also these students indicated that a PEXPI would have been useful in the first phase of the project. As time passes, irrespective of whether or not they initially had a PEXPI at their disposal, students seem to form their impression mainly on perceived behaviour, communication style, and mode and quality of work of their team members during the project. Based on the experience from this case study, an addition to the context factor of the original pattern 'Provide personal identity information' can be made: the usefulness and effectiveness of the solution offered in the pattern should be restricted especially to the initial phase of a computer-mediated collaborative project.

Students did not miss information in the current PEXPI, but small changes can be made to the template on the basis of their suggestions. The addition of two categories of information was recommended: 'opinions on task relevant topics' and 'future professional plans, activities, aspirations and inspirations'. All information categories in the PEXPI were considered relevant. The most important and relevant information was 'educational background', 'non-work/study related personal information' (e.g. spare time activities; what they like, e.g. music, hobbies), the photo and their professional background/working experience.

Student opinions were divided on the topic of the representation of dynamic information, both in the questionnaire and in the interviews. An addition to the 'solution' element of the original pattern description, can be recommended. Static information representation can be mentioned as a cheap, easy to implement and working solution, whereas some extra notes and discussion of the possible

advantages (e.g. see if and when a person is active to find overlapping working times, easier to manage task and collaborative process) and disadvantages (expectancies of an increase in competitive behaviour, students acting like a 'police officer', a sense of 'big brother watching you') of dynamic individual identity information display can be added. Also an additional argument for providing identity information, from the perspective of the awareness theory, can be made. It further seems that users don't necessarily need to have dynamic information of each individual explicitly displayed in order to form an impression, as they naturally derive this information automatically from the context and the communication behaviour of their team members. Also a reference to a possible new pattern, the dynamic information display on group level, instead on personal level, to make dynamic information display less threatening for individuals, can be made to the original pattern. This new pattern would have a different underlying objective: instead of supporting initial trust estimations and impression formation it would be aimed at the support of management and co-ordination of virtual team work by providing awareness support for group activities.

Although students indicate that they have formed an impression of fellow students in an online setting, the majority still expects that their impression will be different when they meet team members face to face. Further investigation on the effect of the PEXPI on perceived trustworthiness and participation in the initial phases of collaboration within virtual teams is needed. Additionally, it would be interesting to study the factors - within the categories of behaviour, communication, and work and task related information - that contribute most to the impression formed in a mediated collaborative setting.

Concluding, the design pattern allowed transfer of design knowledge from one context to another and supported online impression formation in the initial phases of a virtual project team. The pattern was evaluated by means of a case study in an 'educational setting'. This resulted in a personal identity profile that contained some information elements that are relevant to learning contexts in particular, e.g. 'field of interest' and 'suggestions'. But, the pattern of 'presenting personal identity information' as such, should also be applicable to business settings.

Knowledge which was gathered and integrated from different disciplines and case studies became practically available through the design pattern format and, through it's action-oriented nature, could

be easily used and transferred to another case study. The format of a design pattern and especially the 'context' element allowed the designers to judge if the pattern was applicable to this context. The implementation of the pattern didn't need to be complex to sort an effect. The implementation of only part of the solution provided in the pattern, a static profile description, already realized the objectives strived for. The PEXPI can be included as an example in the pattern description. Based on the experiences from this case study, some extra additions to the pattern, concerning dynamic information representation, can be recommended. We also learned that users especially value the implementation, in the form of a PEXPI, within two and a half weeks from the start of a collaborative project. These findings contribute to the refinement of the original pattern.

Thus the case study provided useful evaluative information regarding the pattern, and allowed the refinement of the existing pattern on several key aspects. It also provided a 'core idea' for a new pattern: the presentation of interactive information on group level instead on a personal level, in order to prevent objections regarding personal privacy. The case study proved itself as a useful method to identify and evaluate a new design pattern. Looking at scenarios as abstractions derived from experience in real case studies Retalis, Georgiakakis and Dimitriadis (2006) also pointed to the use of case studies not only for pattern evaluation but also for pattern identification purposes. However, the organization and run of a 'real' case study is a rather time-consuming enterprise that is best restricted to design patterns that have already been evaluated by means of the shepharding process.

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Appendix 1: Questions in questionnaire EVS

Personal details
- What is your gender?
- What age group are you in?

You and your team
- Did you know your team members before you collaborated with them?
- Did you use any of the following additional means of communication to collaborate with your team members during the project? If yes, mark the means you have used.

You and your team members

For the person you trusted most in your team:
- On which particular information available in your online team work environment do you base your impression of …? Try to be as specific as possible
- Which particular information available in your online team work environment was the most important while forming your impression of …?
- Would your current impression of …. be the same if you would have met him/her in a face to face setting? Please explain your answer
- Which information did you miss in order to build a reliable impression of …?

For the person you trusted least in your team:
- On which particular information available in your online team work environment do you base your impression of …? Try to be as specific as possible
- Which particular information available in your online team work environment was the most important while forming your impression of …?
- Would your current impression of …. be the same if you would have met him/her in a face to face setting? Please explain your answer
- Which information did you miss in order to build a reliable impression of …?

You and your team work environment
- Would you appreciate it when the online teamwork environment contained information on your team members which reflects their behaviour? (e.g. tasks assigned to team member and their current status, last login time of team member, number of total logins) If yes, please indicate which information you would like and why you would find it useful
- Would you allow information about your behaviour being displayed in the online collaborative teamwork environment (e.g. tasks assigned to you and their current status, last login time, number of total logins) and made available for you team members?
  If yes, please indicate why
- Do you have any other tips/suggestions related to information which could be helpful to you to form an impression of your team members?

Appendix 2: Interview schema EVS

Impression of EVS team members (through time)

Within EVS you have worked with people you have never met. It was a real 'virtual team' with only text based communication
- Did you find it difficult to form an impression of your team members in EVS? Please explain why.
- Did you miss any info in order to form an impression of your team members in EVS? If yes, please explain what info you missed.
- Did you change your impression of your EVS team members through time? If yes, on basis of what additional info and/or experiences did you change your impression?
- What info did you consider most important while forming a changed impression/to update your impression of your team member(s)?
- Would your current impression of your team members be the same if you would have met them in a face to face setting? Please explain why.

Role of PEXPI
- Did you have the availability of the PEXPI from the start of the project?
- Did you read the PEXPI's of your team members in EVS? If yes, when did you read the PEXPI's? (only in the beginning, throughout the project). How often did you look at the PEXPI's of your team members?
- Did you find the PEXPI useful? In what respect did you find it useful/in useful?
- What info in the PEXPI do you consider as relevant?
- What info in the PEXPI do you consider as irrelevant?
- What info in the PEXPI did you find the most relevant? Why?
- What info would you like to add to the PEXPI?
- Do you think a dynamic part of the PEXPI can help to form an image of your team members? A dynamic part of a PEXPI can be seen as an information display which changes based on the behaviour of your team members, e.g. number of logins on a certain time. Please explain why a dynamic part can help/can not help to form an image of your team members.

EVS environment in general
- Which info did you miss in the overall EVS environment to form an impression of your team members?
- Do you think an informal space (e.g. a virtual café, chitchat chatroom) could have helped your teamwork within EVS? Why?
- Do you have any other tips/suggestions related to information which could be helpful to form an impression of your team members in EVS?

Thank you very much for your collaboration !

Appendix 3: Overview interviewed students EVS

PEXPI initially	Code name	Participated in SG
	Student 1	2
	Student 2	2
	Student 3	2
	Student 4	2
	Student 5	2
	Student 8	4
	Student 9	4
No PEXPI initially	**Code name**	**Participated in SG**
	Student 6	3
	Student 7	3
	Student 10	5
	Student 11	5
	Student 12	5
	Student 13	5
Total:	**13 students**	

Appendix 4: coding schema

Used to codify open answers in the questionnaire and answers in the interview

Source of information used for impression formation (S-INF)	
Characteristics of person (direct experience during 1st encounter)	CHARPSN
Behaviour of person (direct experience during interaction)	BEHPSN
Info from other persons within group	OP
Info derived from context/setting (by reasoning)	CONTXTINF
Most important info for impression formation	MIMP

Used to codify answers in the interview

PEXPI (PEX)	
Role of PEXPI	ROL
- Notice availability of PEXPI	- AV
- Read PEXPI	- RE
- Usefulness of PEXPI	- USE
Design of PEXPI	DES
- Relevant info in PEXPI	- REL
- Irrelevant info in PEXPI	- IREL
- Most relevant info	- MREL
- Missing info	- MIS
- Dynamic info in PEXPI	- DYN

Tips (T)	
Impression formation	- IMP
EVS in general	- EVS

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TABLES

Table 1: the PEXPI template used in EVS

<div style="border:1px solid black;">

PEXPI

[a photo: please insert a picture of yourself]

Personal:

First name:	Insert your first name
Family name:	Insert your family name
Gender:	Insert your gender (male/female)
Birthday:	Insert date and year of birth
University:	Insert name of your university
City and country:	Insert name of city and country where you live
Contact information:	Insert your e-mail adress and other relevant contact information

About me
Tell what you want to tell about yourself

Interests and hobbies

Tell what you want to tell about your non-work related areas of interest and hobbies.

Expectations of EVS

Insert what you expect of EVS

EVS availability

Tell when you can be reached for EVS work (and when you have a holiday)

Expertise areas

Tell in what areas you have expertise and how your peer EVS members can contact you on these subjects

Fields of interest

EVS issues you are interested in. Fields where you have no or not so much expertise, but in which you are interested and want to learn more.

Learn and work experiences

Shortly describe your relevant prior learn and work experiences.

Suggestions

Present ideas and links to webpages that are of interest to group members.

</div>

Table 2: representation of open answers in questionnaire

	Info channel	Info used	Impression statements
Impression based on	- chat (8) - e-mail (5) - discussion forum(4) - PEXPI (3)	**personal and private characteristics:** field of study; correct English language use; expectations; interests; photo (2), **communication style and mode:** written opinions; writing style (4) (e.g. coherence/word use/style, e.g. nice/polite/friendly); **behaviour:** availability; motivates other group members; no communication; absence of input (2); takes initiative (2); cooperation/participation/behaviour (5); **work and task-related:** quality of input/ideas/thoughts (8); personal report (2) **other:** everything available (2);	Nice; polite; competent; friendly; kind; open; fair; not self-oriented; sociable; anxious

Most important info for forming an impression	First chat session (3), discussion forum (2)	**personal and private characteristics:** field of study; personal interests; personal hobbies; PEXPI; **communication style and mode:** responding on suggestions/opinions of others; written opinions (2); communication strategy (3); participation/communication in discussions (4); frequency of communication (5); **behaviour:** answering on posted questions; initiative; friendliness; problem solving capability; information sharing behaviour; defensive behaviour; **work and task-related:** personal report; quality of input (4); dedication to the work (4)

Missing info for forming an impression	<u>**Personal and private characteristics:**</u> why he/she chose the subject that he/she studies; PEXPI; thoughts on other themes; what exactly he/she does as a job (2); social life (4); <u>**communication style and mode:**</u> body language; non-verbal communication; communication; informal talk (2); face to face contact (2) <u>**work and task-related:**</u> agenda; information if he/she is still participating in the course; information on the way of working; <u>**other:**</u> info on cultural background to make intercultural communication optimal; slide shows

Table 3: display of dynamic information in profile

Appreciate dynamic info ?	What info?	Why?	
Yes (63%)	Login statistics (6)	-	see if person is (still) active (3)
I don't care (6%)	Tasks assigned (3)	-	overview of cooperation status in
No (31%)	Status of tasks assigned (3)		group (2)
	Deadlines for tasks	-	gives more structure
	Appointments made and kept	-	can serve as an incentive
	Cooperation status of the other groups	-	to determine working times of others
		-	easier to manage tasks

Table 4: Source of information used for impression formation in general

Code	Count of fragments	Example citation
Characteristics of person (direct experience during 1st encounter) (CHARPSN)	54	Student 6: "*... wrote in the beginning that she wants to make better and more clear her English. So, I'm not sure if this is the right motivation for joining EVS*" Student 1: "*first of all you only have a photo of the project members. And you have a brief description of what they are doing, what are their hobbies and what they are doing normally*"

Behaviour of person (direct experience during interaction) (BEHPSN), comprising communication as well as work-and task related communication	Student 7: "*one person, he could almost never meet us in a chat session. So, (s)he didn't participate too much. And the other person, we collaborated and participated a lot. We had a lot of fun chat sessions together, two or three times a week available, at least*"
	Student 10: "*From the beginning all members of our team were working very well. And then some problems appeared and a solution of the problems, was better with some members than the other. And so, I had to change some opinions I had from the beginning*"

Info derived from context/setting (by reasoning) (CONTXTINF)	6	Student 1: "*what we all had in common is that we are interested in the subject of sustainable development*" Student 5: "*I think we were all interested in the subject of sustainable development… we had that in common. You mean on a more personal level? Well, I think most of us were about the same age, except for one team member who is a bit older. But the rest were like in the mid to late twenties.*"

Table 5: Most important info for impression formation (MIMP)

First introduction	1
Behaviour and communication while working	8
Quality of work	3

Table 6: most relevant information for impression formation

educational background (*)	8
non-work/study related personal information (*) (e.g. spare time activities; what they like, e.g. music, hobbies)	6
photo (*)	5
professional background/working experience (*)	3
age (*)	2
gender (*)	2
affiliation (university, organisation) (*)	2
expectation of course (*)	2
country, living place (*)	2
future plans, activities/professional aspirations & inspirations	2
opinions on, for task relevant, topics	1
motivation for course (*)	1
Name (*)	1