A closer look on social presence as a causing factor in computer-mediated collaboration

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1. Introduction

Previous studies identified several factors to influence successful online collaboration (Fussell et al., 1998; Lou, Abrami, & D’Apollonia, 2001). Among these factors are group cohesion and optimised coordination in groups. Gradually, social aspects, such as perception of belonging to a group or trusting group members, move into the centre of attention because they are essential for effective learning (Kreijns, Kirschner, & Jochems, 2003). Several pitfalls and obstacles have been identified (Kreijns et al., 2003) to influence groups’ performance. Examples of such obstacles are social loafing in virtual groups, coordination complications, establishing and maintaining cognitive as well as social mechanisms like social interaction that is based on a sense of trust or being part of a team (Kreijns et al., 2003), which in turn will lead to more meaningful cognitive processes such as not interpreting critique as a personal attack.

Detailed insight into social presence provides understanding of how online collaboration can be supported better. Existing research often investigates factors that influence social presence. However, research findings are not always straightforward. Therefore, the below presented study examines the concept of social presence and takes it one step further by investigating its potential as a causing factor.

2. Theoretical background

While there are many elements within the social dimension, this work emphasizes social presence. Among researchers, presence is considered a crucial part of online environments (Whitelock, Romano, Jelfs, & Brna, 2000). Social presence is defined as the degree to which a person is aware of another person in a technology-mediated communication setting (Short, Williams, & Christie, 1976). Even though many more definitions have emerged since the work done by Short et al. (1976), they put a strong emphasis on the role technology plays for the concept. The current study emphasizes this importance as well and therefore takes up the definition by Short et al. (1976). Researchers have pointed to the importance of understanding individuals’ perceptions in order to understand social presence (Hwang & Park, 2007). For example, the presence of a message sender influences the recipient’s understanding and in turn influences intersubjective interpretation. Rourke, Anderson, Garrison, and Archer (1999) stress this by viewing social presence as the ability of participants to project themselves socially and emotionally in a community of inquiry. This study aims at the lack of research concerning the relationship of participants’ individual differences in social presence perception and their experience within the field of computer-mediated collaboration. In order to shed further light onto the reasons why individuals experience social presence differently, three factors will be illuminated (Arrow, McGrath, & Berdahl, 2000): The task, the handling of the task and the medium, but also measures of the
individual such as motivation and attitude will be investigated in more detail. In general, a larger body of research suggests that social presence is related to increased satisfaction (Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003). However, evidence can be found that a misfit between the medium and a task’s social need can negatively influence the experience of social presence (Chou & Min, 2009) as well as communication performance (Mennecke, Valacich, & Wheeler, 2000). For example, simple tasks with unambiguous answers benefit from media which offer only low social presence, while judgement tasks require media which allow high social presence (Chou & Min, 2009). In addition, a larger body of research suggests that social presence is related to increased satisfaction (Gunawardena & Zittle, 1997; Hostetter & Busch, 2006; Richardson & Swan, 2003). This stresses the point that social presence influences the individuals’ perception of online settings.

Lately, researchers have claimed that the direction of the relationship between social presence and related variables is not clear. In current research, social presence is often seen as either a cause or an influenced factor (Gunawardena, 1995; Wise, Chang, Duffy, & del Valle, 2004). Due to research diversity and to different operationalisations of measuring social presence in online collaboration, it is not clear whether the degree of social presence is to a greater extent influenced by participant variables or affects participant variables. For example, a participant’s higher motivation could be on the one hand the result of more involvement which in turn leads to the experience of increased social presence. On the other hand a participant could be more motivated and involved because of a high amount of social presence experienced. This uncertainty of direction can also be found in research. For example, Short et al. look at social presence as the ability of a medium, whereas Rourke et al. view it as an ability of a learner. These are two very different perspectives that result in different operationalisations: The first looks at variations in different media settings whereas the latter looks at the individuals taking part in such a setting.

This experimental study pursues a detailed investigation of this relationship of dependence. It expands the concept of social presence by illuminating the potential of social presence as a causing factor. Indeed, former research in computer-supported collaboration shows that effects are not straightforward (Cress, 2005) and reciprocal effects might be at work.

So far, no research study has investigated the causal direction between social presence and related variables, such as media, tasks and members. The combination of both views on social presence will provide further guidance on the interpretation of today’s research diversity concerning the concept of social presence.

The aim of this experimental study is to investigate both aspects further: The relation of social presence and the perception of task and medium, as well as the role of prior ICT and online media experience in online communication/collaboration.

3. Research questions and hypotheses

The research questions addressed by the study are derived from current research on social presence in the field of computer-mediated collaboration. As sketched above there is still a lack of research investigating participants’ perceptions in order to understand the concept of social presence further. Moreover, there are unclear research findings into the causal relationship of social presence and related concepts.

3.1. Influence of social presence on the perception of the task

Even though the task itself does not directly influence the level of social presence experienced, this level might influence participants’ perception of the task. This assumption acts under the presumption of an optimal task–medium fit, based on research findings, e.g. by Chou and Min (2009). An optimal task–medium fit is accomplished when a task’s social need is met by the medium’s potential to convey social presence: Simple tasks require media with low social presence conveyance and complex tasks require media with high social presence potential.

**Hypothesis 1.** The more sociable an environment, the less strenuous and threatening will a task be perceived. A high degree of social presence leads to a positive attitude towards the task.

3.2. Influence of social presence on the perception of the medium

Previous research found that the level of immediacy, i.e. how quickly a response is given to an action, leads to increased social presence levels (Weinel & Hu, 2007). Different media allow for different reaction times to a response and consequently, different levels of social presence are experienced according to the level of immediacy.

High levels of social presence have been found to result in high levels of perceived learning satisfaction and perceived satisfaction with the instructor (Richardson & Swan, 2003). Assuming that higher social presence levels lead to a less strenuous perception of the task, it will also lead to increased satisfaction with the medium.

**Hypothesis 2.** The higher the amount of perceived social presence, the higher the level of satisfaction with the online environment.

3.3. Influence of social presence on the perception of the collaboration

The level of social presence influences the perception of collaboration within the team. Lower levels of social presence can diminish communication quality (Roberts, Lowry, & Sweeney, 2006) and as a result influence the perception of the collaboration.

**Hypothesis 3.** The higher the amount of perceived social presence, the more favourable the collaboration is experienced.

3.4. Prior ICT and online media experience

The effects of social presence on the judgement of the task and the medium vary with the level of participants’ prior ICT and online media experience. For example, a higher level of preexisting computer-expertise is related to a higher level of social presence experienced (Hostetter & Busch, 2006; Mykota & Duncan, 2007).

**Hypothesis 4.** The more participants are experienced with ICT and online media, the more easily will they experience social presence and therefore perceive the online environment, i.e. the medium, more favourable.

4. Method

4.1. Experimental Design

As shown by Yang, Chung, and Chien (2008) for asynchronous computer-mediated collaboration, providing an open communication environment can promote social presence. This concept was transferred to a synchronous communication environment and used to vary the amount of social presence experience within an online condition. Research argues that cues, such as sharing personal information, within computer-mediated collaboration,
manipulate the level of presence felt (Wise et al., 2004). Thus, the experimental design considers one independent variable: The sociability of the online environment is manipulated by three conditions (sociability in increasing order): 1. task-oriented online puzzling, 2. Social Presence Online puzzling, 3. face-to-face (f2f) puzzling. i.e. social presence f2f control group. Social presence is defined as the degree to which a person is aware of another person in a technology-mediated communication setting, therefore the face-to-face setting serves as a control condition, as this provides the most possible amount of cues.

Research described above suggests that the perceptions of the task as well as the medium are influenced by the amount of social presence experienced in online environments. As dependent variables the perception of task, task handling and task environment are measured by questionnaires. Items concerning the task aim at the estimation of the amount of cognitive strain the task poses on participants. Items concerning the task handling, target the collaborative aspect in the team work. Items concerning the task environment capture the perception of the medium. While task and task environment judgements aim more at a participants’ perception of their individual experience, the variable task handling aims at the perception of the collaboration.

Participant’s ICT experience and online media experience are also measured with questionnaires referring, by two aspects of pre-existing experience: 1. The ICT experience scale focuses on the general ability to handle computers and 2. The online media experience scale aims at the experience with online communication.

4.2. Participants

The study was conducted at the Technical University of Darmstadt, Germany and the University of Salzburg, Austria with 60 participants who were students at one of the two universities. The participants’ age ranged between 20 and 43 years, with a mean of $M = 25.27$ (SD = 5.68). Out of the 60 participants, 49 were female (81.7%) and 11 were male (18.3%). We recruited each member of a team from different semesters to ensure that the members of a dyad did not know each other. This allowed for consistent comparison across dyads as we assumed that naturally participants with a higher level of intimacy would also create initial higher levels of social presence.

4.3. Procedure and task

As described above three conditions were examined in this study. Two conditions were conducted online and the third condition, the control group, was conducted in a face-to-face mode. The two online conditions differed in the amount of sociability: one condition was strictly task-oriented and the other had an additional social focus. The differing sociability was ensured through the instruction given at the beginning of the experiment. All conditions were initially the same, they varied only according to the given instruction.

To each of the three conditions 20 participants were randomly assigned. All were instructed and given a questionnaire. The instructor also talked them through the functionality of the online environment. The task took 30 min. Participants were informed that the task was too complex to be solved within 30 min and their goal was to achieve a solution as best as possible. Afterwards, all participants answered the second half of the questionnaire.

The task was to solve an online mouse puzzle in a dyad (see Fig. 1). Each of the team members had 8 cards with mouse heads and tails. Team members had to align matching colored heads and tails of a mouse. The puzzle could only be solved by using all 16 cards at once.

4.4. Instruments

A number of different instruments were used to gather data in the experiment. The questionnaire was split in two: one part was administered before and one after the experiment. The questionnaire in the beginning was composed of two scales: General Task Attitude and Specific Task Attitude (see Table 1).

Both scales of the first questionnaire were derived, in a slightly changed format, from the instrument FAM [Fragebogen zur Erfassung aktueller Motivation in Lern- und Leistungssituationen (‘‘Instrument to determine motivation during learning and performance tasks’’) (Rheinberg, Vollmeyer, & Burns, 2001)]. The original instrument by Rheinberg et al. (2001) was composed of 18 items, measuring four different aspects of motivation during learning and motivation tasks. The four aspects are: failure orientation, success probability, engagement/interest and challenge. The scale General Task Attitude was composed of most of the FAM’s items from the engagement and failure orientation scales. The Specific Task Attitude scale was composed of most items out of the success probability and challenge scales from the FAM.

The participants’ judgement of the task, the task handling as well as the puzzle environment were assessed after the experi-
Furthermore, their experience with ICT and online media were also asked at this point. The latter two served as covariates. Experience with ICT was composed of items from the ICT literacy instrument by Markauskaite (2005). One variable, Judgement of Online Environment, was calculated in two versions as only one version allowed for a proper comparison with the control group. This variable was composed of many questions concerning the communication in the online environment. Since the control group communicated face-to-face, the items in question were deleted for comparability reasons. The slimmed-down comparable version is called Judgement of Collaboration. For a detailed overview, see Table 2.

The operationalisation of all three variables to determine either the task, the medium or the interactive collaborative aspect was accomplished by drawing on research from earlier phases of our research. Items were derived from the pool of questions administered during an earlier study by Weinel and Hu (2007). The questions were slimmed down, since the original set of questions was developed for a long term course. The experimental study considered only relevant questions for the actual experimental setting.

### 5. Results

At first, the quality of instruments and implications for the variables are presented. Secondly, findings concerning social presence and its potential as a causing factor are presented. Finally, further light is shed onto the influence of experience with ICT and online media. Results for this study were calculated with SPSS 17.0 for Windows.

Due to technical problems the textbased chat data could not be restored and was lost in large parts to scientific investigation. Consequently, the possibility of triangulation was lost and a check if the instruction was induced as intended was lost as well. However, there is no indication that the chat data would have changed the results in any way. Furthermore, observations by the investigator during the experiment as well as informal discussions between participants and the investigator after the experiment indicated

### Table 1

<table>
<thead>
<tr>
<th>Scale</th>
<th>Items</th>
<th>Value range</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Task Attitude (Final version: 9 items)</td>
<td>- “I like such tasks.”</td>
<td>1 (not true at all) to 7 (entirely true)</td>
</tr>
<tr>
<td></td>
<td>- “I like the role as a scientist.”</td>
<td></td>
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<tr>
<td></td>
<td>- “I feel under pressure.”</td>
<td></td>
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<tr>
<td></td>
<td>- “The task seems interesting.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Afraid to embarrass me.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “The task is fun.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Embarrassed to fail.”</td>
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</tr>
<tr>
<td></td>
<td>- “Uneasy when thinking of the task.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “The requirements paralyze me.”</td>
<td></td>
</tr>
<tr>
<td>Specific Task Attitude (Final version: 7 items)</td>
<td>- “Can handle the difficulty of the task.”</td>
<td>1 (not true at all) to 7 (entirely true)</td>
</tr>
<tr>
<td></td>
<td>- “Will not master the task.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Excited to see how well I will do.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Will make an effort.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Anyone can solve a task like this.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “I cannot do this.”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- “Will be proud to solve the task.”</td>
<td></td>
</tr>
</tbody>
</table>

* Paraphrased only.
Cronbach’s Alpha of 5.1. Instrument reliability significantly regarding their previous online media or ICT experience. We also checked afterwards that groups did not differ significantly before the start of the experiment, through randomisation. Nevertheless, missing data triangulation surely improved the validity of the results. We ensured that the groups did not differ significantly and holds no claim to be objective and theory-driven. The authors recommend to include that type of data in a theory-driven way in future experimental settings to allow for triangulation. Nevertheless, missing data triangulation surely imposes a limit on the current study and data can only be interpreted within this limitation. We ensured that the groups did not differ significantly before the start of the experiment, through randomisation. We also checked afterwards that groups did not differ significantly regarding their previous online media or ICT experience.

5.1. Instrument reliability

Most variables achieved a satisfactory reliability measure with a Cronbach’s Alpha of $\alpha \geq 0.7$ (see Table 3). Three variables included items that needed to be deleted to achieve a more reliable scale: Specific Task Attitude, Task Judgment and Experience with online media. That participants followed instructions. Such data was only gathered informally and holds no claim to be objective and theory-driven. The authors recommend to include that type of data in a theory-driven way in future experimental settings to allow for triangulation. Nevertheless, missing data triangulation surely imposes a limit on the current study and data can only be interpreted within this limitation. We ensured that the groups did not differ significantly before the start of the experiment, through randomisation. We also checked afterwards that groups did not differ significantly regarding their previous online media or ICT experience.

5.2. Effects of social presence on perceptions of task, medium and collaboration

Descriptives for dependent variables with respect to experimental condition are presented in Table 4. The attitude towards tasks in online environments (General Task Attitude) was most positive during the Social Presence F2F treatment ($M = 4.97, SD = 1.00$), followed by Social Presence Online ($M = 4.95, SD = 0.91$) and finally the Task Oriented Online treatment ($M = 4.36, SD = 0.98$). The attitude towards the specific puzzle task (Specific Task Attitude) was most positive during the Social Presence Online treatment ($M = 4.95, SD = 0.92$) and finally the least positive during the Task Oriented Online treatment ($M = 4.82, SD = 0.78$).

With only slight differences, participants judged the task more strenuous during the Task Oriented Online treatment ($M = 2.80, SD = 0.54$), followed by Social Presence F2F ($M = 2.78, SD = 0.59$). The task was judged least strenuous during the Social Presence On-

<table>
<thead>
<tr>
<th>Scale</th>
<th>Items</th>
<th>Value range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Judgement of Task (3 items)</td>
<td>&quot;I felt under stress during task.&quot;</td>
<td>1 (none) to 5 (a lot)</td>
</tr>
<tr>
<td>Task Handling Judgement (4 items)</td>
<td>&quot;Level of mental activity driven by the task.&quot;</td>
<td>1 (do not agree at all) to 5 (agree entirely)</td>
</tr>
<tr>
<td>Judgement of Online Environment (10 items)</td>
<td>&quot;Our collaboration was successful.&quot;</td>
<td>1 (do not agree at all) to 5 (agree entirely)</td>
</tr>
<tr>
<td>Judgement of Collaboration (5 items)</td>
<td>&quot;We found an efficient way to work on the task.&quot;</td>
<td>1 (do not agree at all) to 5 (agree entirely)</td>
</tr>
<tr>
<td>Experience with Online Media (2 items)</td>
<td>&quot;We established a common ground.&quot;</td>
<td>1 (none) to 5 (a lot)</td>
</tr>
<tr>
<td>Experience with ICT (6 items)</td>
<td>&quot;I have experience with chat.&quot;</td>
<td>1 (do not have this ability) to 6 (I am completely confident)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scale</th>
<th>N of items</th>
<th>M of scale</th>
<th>SD of scale</th>
<th>Cronbach’s $\alpha$</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Task Attitude</td>
<td>9 items</td>
<td>32.43</td>
<td>7.55</td>
<td>.78</td>
</tr>
<tr>
<td>Specific Task Attitude</td>
<td>7 items</td>
<td>34.30</td>
<td>5.41</td>
<td>.62</td>
</tr>
<tr>
<td>Judgement of Task</td>
<td>3 items</td>
<td>7.35</td>
<td>2.34</td>
<td>.70</td>
</tr>
<tr>
<td>Judgement of Online Environment</td>
<td>10 items</td>
<td>15.50</td>
<td>3.41</td>
<td>.83</td>
</tr>
<tr>
<td>Judgement of Collaboration</td>
<td>5 items</td>
<td>18.68</td>
<td>3.92</td>
<td>.79</td>
</tr>
<tr>
<td>Experience with Online Media</td>
<td>2 items</td>
<td>8.28</td>
<td>1.62</td>
<td>.66</td>
</tr>
<tr>
<td>Experience with ICT</td>
<td>6 items</td>
<td>23.58</td>
<td>4.86</td>
<td>.87</td>
</tr>
</tbody>
</table>

Comparable version of Judgement of Online Environment: items aiming at online communication were deleted.

Served as covariates.
line treatment (M = 2.76, SD = 0.77). Among the two online conditions, participants judged the online environment (Judgement of Online Environment) more positive during Task Oriented Online treatment (M = 3.46, SD = 0.68) compared to Social Presence Online (M = 3.40, SD = 0.69). The task handling (Task Handling Judgement) was judged most positively during the Social Presence F2F treatment (M = 4.43, SD = 0.41), followed by the Task Oriented Online treatment (M = 3.85, SD = 0.92) and the Social Presence Online treatment (M = 3.76, SD = 0.86).

Similarly, the collaboration (Judgement of Collaboration) was judged most positively during the Social Presence F2F treatment (M = 4.25, SD = 0.49), followed by the Task Oriented Online treatment (M = 3.72, SD = 0.75). The least positive did participants judge their collaboration during the Social Presence Online treatment (M = 3.39, SD = 0.87). Furthermore, Table 4 presents descriptives for two single items that are carried over for relevance reasons. Participants judged their task solution as more successful during the Social Presence F2F (M = 3.00, SD = 0.80), followed by the Task Oriented Online treatment (M = 2.65, SD = 0.93). The least successful was the task solution judged during the Social Presence Online treatment (M = 2.25, SD = 0.80). Furthermore, participants felt they could express their feelings best during the Social Presence F2F treatment (M = 4.35, SD = 0.81); both online conditions did not differ, participants perceived them as being less able to express their feelings Social Presence Online (M = 3.45, SD = 1.15) and Task Oriented Online (M = 3.45, SD = 1.05).

In order to test for significant differences between treatment groups, inferential statistics were applied. In a first step, all dependent variables were tested for normal distribution of values. Results of the “One-Sample Kolmogorov–Smirnov Test” showed that all but one variable did not differ statistically significant from a normal distribution. For these variables, the prerequisite for the application of parametrical test procedures was given. Only one variable, Judgement of Task Handling, was not distributed normally and non-parametrical test procedures were applied here. Another prerequisite for the application of parametrical tests is the homogeneity of variances. Only one variable revealed significantly different variances: Judgement of Collaboration (the shorter, comparable version of the participants’ Judgement of Online Environment). To Judgement of Collaboration, non-parametrical tests were applied as well. The complete version of the scale Judgement of Online Environment was considered separately, since it was only answered by the two online groups.

The ANOVA for the three qualifying variables revealed only a significant influence for the General Task Attitude (F(2, 57) = 2.50, p (one-tailed) = .05, \( \eta^2 = .08 \)). The other two variables showed no significant influence of the online environment’s sociability on the attitude towards this specific puzzle task (Specific Task Attitude) (F(2, 57) = .17, p (one-tailed) = .42, \( \eta^2 = .01 \)) or the Judgement of the Task (F(2, 57) = .02, p (one-tailed) = .49, \( \eta^2 = .00 \)).

General Task Attitude is only significant at the one-tailed level (p = .046). Means for General Task Attitude in each of the conditions hint to the fact that both groups with the possibility for social exchange, online and face-to-face, differ from the task-oriented group. This again provides only partial support for Hypothesis 1.

The ANOVA for Judgement of Online Environment revealed no statistically significant differences between groups (F(1, 38) = 0.09, p (one-tailed) = .40, \( \eta^2 = .00 \)). This does not support Hypothesis 2.

Non-parametric tests for both qualifying variables, Task Handling Judgement (\( \chi^2(2) = 8.51, p = .01 \)) and Judgement of Collaboration (\( \chi^2(2) = 11.48, p = .00 \)), indicated a statistically highly significant difference among the three levels of social presence. The Kruskal–Wallis test indicated for both variables the lowest mean rank during the social presence online condition (Task Handling Judgement: M = 24.70; Judgement of Collaboration: M = 22.70). The social presence face-to-face condition (control group) received the highest rank (Task Handling Judgement: M = 39.60; Judgement of Collaboration: M = 40.83), see also Table 5.

Post hoc tests for both variables confirmed Hypotheses 3 only partially. Based on the Mann–Whitney U measure, both variables revealed significant differences between online conditions and the face-to-face condition. The social presence online condition and the social presence face-to-face condition differed significantly (Task Handling Judgement: U = 100.50, p = .01; Judgement of Online Collaboration: U = 83.00, p = .00). Furthermore, both variables revealed a difference between the task oriented and the social presence face-to-face condition (Task Handling Judgement: U = 117.50, p = .02; Judgement of Online Collaboration: U = 110.50, p = .01). This confirms hypothesis 3 only partially.

5.3. Covariates: ICT and online media experience

The correlational analysis for ICT and online media experience and the dependent variables revealed a relationship between them (see Table 6). Experience with ICT correlated positively with the perception of task aspects. The more experienced someone was with ICT, the less they felt under pressure to perform well (General Task Attitude) (r = .33, p = .01). After task completion, they were also the ones to judge the task as less strenuous (Task Judgement) (r = -.24, p = .03).
The experience with online media revealed a slightly different connection to the dependent variables (see Table 6). It was connected to all three types of dependent variables: task, media, and collaboration. More participants were experienced with online media, the less they felt under pressure to perform well [General Task Attitude] \((r = .32, p = .01)\), the more favourable they judged the online environment [Judgement of Online Environment] \((r = .25, p = .03)\) and the more positively they perceived their collaboration [Task Handling Judgement] \((r = .28, p = .02)\). The prior experience with ICT or online media was not connected at all to the specific task judgement, which captured the attitude towards the puzzle task.

A subsequent covariance analysis with prior ICT experience or online media experience in dependence with varying social presence revealed no significant influence on any of the four dependent variables. This does not support Hypotheses 4.

### 6. Discussion

#### 6.1. Social presence as a causal factor

The task at hand proved to be complex enough to require collaboration but not too complex for participants to undergo a lengthy training process. The results are limited to that type of task and should be interpreted with that limitation in mind.

Results provide insights into the relationship between task and social presence. Findings revealed that social presence influences the participants’ attitude towards the task. Interestingly, when asked directly after the instruction about their general task attitude, participants in the two social conditions expressed less pressure and less unease than participants in the task-oriented condition. The initial lower levels of stress for social conditions were affected most distinctly by the amount of social presence experienced. Participants favoured communication in a face-to-face setting over the communication in the online environment. They judged the communication as more successful, enjoyed the collaboration more and were of the opinion that they found an efficient way to solve the task. Even though there was a trend within the two online conditions for the task-oriented condition to have a more positive effect on the judgement of the medium, this trend was not statistically significant. Again, this supports threshold considerations by Wise et al. (2004). They reported that even though both groups experienced different levels of social presence, they still perceived the messages as friendly and positive.

The above stated arguments receive further support through the finding that participants in both online conditions felt they could express their feelings equally well. The study showed no difference between the online conditions, while revealing differences between the online conditions and the face-to-face condition. Participants in the control group felt they could express their ideas more clearly.

The above stated arguments continue findings from earlier studies by Weinel and Hu (2007). These findings showed that the level of social presence experienced within a medium in the experimental study did not lead to differences in the perception of the medium itself. While the difference in social presence (face-to-face

<table>
<thead>
<tr>
<th>Condition</th>
<th>Task Oriented Online</th>
<th>Social Presence Online</th>
<th>Social Presence (F2F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Task Handling Judgement</td>
<td>20</td>
<td>27.20</td>
<td>24.70</td>
</tr>
<tr>
<td>Judgement of Collaboration</td>
<td>20</td>
<td>27.98</td>
<td>22.70</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20.83</td>
</tr>
<tr>
<td>Test statistics(^b)^</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi-Square</td>
<td></td>
<td>8.51</td>
<td>.01</td>
</tr>
<tr>
<td>df</td>
<td>2</td>
<td>11.48</td>
<td>.00</td>
</tr>
</tbody>
</table>

\(^a\) Kruskal–Wallis Test.

\(^b\) Grouping variable: Condition.

The role of social exchange in communication: Expectations towards social exchange are mostly based on the experience with face-to-face communication. However, online communication differs from this form of communication in various ways. The study pointed to this gap between expectations and online experience. This confirms conclusions from an earlier study (Weinel and Hu, 2007), ambiguity and uncertainty in online communication can be minimised through the use of chat protocols and norms. More research is needed to determine how such rules can influence the perceived quality of the communication.

These findings could also be explained by considerations from Wise et al. (2004): Social presence is a variable with some kind of threshold and it is important to exceed a critical level. In order for it to alter participants’ perceptions or interactions, participants need to feel a certain level of someone else’s involvement. Participants of both online conditions experienced a form of involvement in different ways: (1) through communication in the chat and (2) by watching the movement of puzzle pieces done by their teammate.

Such findings support and extend research (e.g. Rourke et al., 1999; Swan, 2003) contradicting the notion of social presence as a capability of the medium itself, as introduced initially by Short et al. (1976). Participants found other ways to convey social presence than the medium’s abilities and judged the involvement of their team member, e.g. by movement of puzzle pieces. Interactive responses are one way to convey social presence (Rourke et al., 1999). The greater the immediacy, the greater the social presence felt. Another way is the use of emoticons or verbal expressions to introduce intimacy into text-based communication.

Furthermore, the medium as well as the collaborative aspect were affected most distinctly by the amount of social presence experienced. Participants favoured communication in a face-to-face setting over the communication in the online environment. They judged the communication as more successful, enjoyed the collaboration more and were of the opinion that they found an efficient way to solve the task. Even though there was a trend within the two online conditions for the task-oriented condition to have a more positive effect on the judgement of the medium, this trend was not statistically significant. Again, this supports threshold considerations by Wise et al. (2004). They reported that even though both groups experienced different levels of social presence, they still perceived the messages as friendly and positive.

The above stated arguments continue findings from earlier studies by Weinel and Hu (2007). These findings showed that the level of social presence experienced within a medium in the experimental study did not lead to differences in the perception of the medium itself. While the difference in social presence (face-to-face

<table>
<thead>
<tr>
<th>Experience with Online Media</th>
<th>Pearson Correlation</th>
<th>Specific Task Attitude</th>
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<th>Task Handling Judgement</th>
<th>Judgement of Collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sig. (1-tailed)</td>
<td>.32</td>
<td>.08</td>
<td>-.16</td>
<td>.28</td>
<td>.25</td>
</tr>
<tr>
<td>Experience with ICT</td>
<td>Pearson Correlation</td>
<td>Sig. (1-tailed)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>.33</td>
<td>.07</td>
<td>-.24</td>
<td>.11</td>
<td>.11</td>
</tr>
</tbody>
</table>

Table 5

Overview of non-parametric test results (Kruskal–Wallis test) for both not normally distributed variables: Judgement of Collaboration and Task Handling Judgement.

Table 6

Correlations between ICT and online media experience with dependent variables \((N = 60)\).
vs. online) across media led to different perceptions of a medium, the variations within one particular medium were not strong enough to alter the perception. This leads to the assumption that the concept of social presence is a stronger predictor of behavior when looking at differences across media, as opposed to variations within one medium. It supports the idea of a threshold that has to be overcome in order to have any effect (Wise et al., 2004). Apparently, the variation of social presence within one medium is not strong enough to overcome this threshold. This is different across media, and the effect of social presence can be measured. Again, these findings support Hypothesis 2 only partially.

Furthermore, the interaction was also perceived differently among the groups. Participants judged the handling of the task more favourable during the face-to-face condition, compared to the online conditions. A trend among the online conditions crystallized, pointing to the lesser of the two social presence conditions being favoured. While this trend did not show to be statistically significant, it could possibly be explained by findings concerning the proper task-media fit (Chou & Min, 2009; Mennecke et al., 2000). Possibly, the task did not inherit the amount of social interaction that was intended by the author. As already stated above, it might have been sufficient for participants to follow the movements of the puzzle pieces to gain a feeling of social presence through this measure of involvement. This would lead to the conclusion that the optimal task–medium fit in this case would be found when only discussing the task and not considering personal information.

Finally, while earlier research found that different media convey different levels of social presence (e.g. Weinel and Hu, 2007), the current study revealed that increased levels of social presence also influence the perception of the medium. Furthermore, earlier research did not reveal an influence of the task on social presence. However, as shown in the experimental study, different levels of social presence alter the perception of the task. Furthermore, social presence influences the perception of group interactions, which in turn have been found to influence the social presence experienced (e.g. Wise et al., 2004). Such findings underline the complex nature of social presence. In order to understand the concept and its impact as well as the influence it is prone to, a variety of considerations are of importance.

The experimental study is a good example to show that seemingly contradictory views of social presence can provide explanations to the concept at different levels. For one, Short et al.'s (1976) view on social presence as a medium's ability can provide insights into the optimal fit of task and medium. Secondly, the social perspective on social presence as a participant's potential delivers insights into the complex causal relationships of the concept and explains participants' potential to adapt to certain media.

6.2. Relevance of ICT and online media experience

Results revealed no statistically significant connection between prior experience of ICT and online media as a covariate to social presence affecting the task, medium or collaboration aspect.

However, correlations revealed a connection between prior experience and the three aspects of task, media and collaboration. While ICT experience was linked more closely to task aspects, the experience with online media was linked to all three aspects. The more experienced participants were with ICT and online media, the more they had a positive general attitude towards working in an online environment and the more favourable they judged the medium as well as the collaboration.

Concluding from these findings, the effects on social presence that have been found in former research (Hostetter & Busch, 2006; Mykota & Duncan, 2007; Wise et al., 2004) were more closely related to the experience with online media than the experience with ICT in general. Most of the research reported findings concerning former online course participation. This leaves to conclude that the more often participants experience the same situation, the more they experience social presence. This conclusion is also supported by research into social presence time patterns, which found that social presence in a group increases over time (e.g. Picciano, 2002).

Considering the definition of social presence as a participant's potential, this would mean that such a potential is not a fixed ability but can be trained over time. This is an important finding for understanding social presence. Some research already points to the fact that introducing participants to the concept of social presence alters their experience in a positive way. The above stated findings support and expand current research findings and hint to the fact that the introduction of social presence as a concept to online collaborators can be beneficial to its experience in online settings. Despite the fact that the findings do not support Hypothesis 4 and the experience of social presence might be independent of prior experience, it still seems to play an important role in the experience of online communication. Further research needs to be conducted to better understand the connection between prior experience and the perception of interaction in an online setting.

7. Conclusion

The experimental study revealed the influence of social presence on participants' perception of the medium and the interaction. It also supported research considerations into the optimal fit of task and medium. In addition, findings illustrate a different perspective of social presence: the idea of a threshold (Wise et al., 2004).

Findings also revealed that prior experience with online media is more closely linked to the concept of social presence than ICT experience in general. Presuming the definition of social presence as a participant's potential, this leads to the conclusion that social presence can be trained and in such a way teachers can positively influence participants' experience in an online setting.

The integration of findings from earlier research by Weinel and Hu (2007) and this experimental study delivers new insights into the reciprocal nature of social presence and associated concepts. Most of the investigated variables, e.g. the medium, are often influenced by the experience of social presence and this in turn influences participants perception of that same exact variable. These findings address a lack of research into the causal nature of social presence that the authors believe to be reciprocal.

Overall, this highlights the concept's complex nature and stresses the importance to not only consider it as a cause but also as an influenced variable in online settings. The concept of social presence is interwoven with a variety of variables, that are important to be considered in online settings; it plays an integral part in understanding dynamics in such an environment.

Due to technical problems, text-based chat data could not serve as a basis for a manipulation check, the missing data triangulation poses a limit to the interpretation of the study. However, concluding discussions between participants and the investigator hint at the circumstance that participants followed instructions. This fact in close consideration with research done by Wise et al. (2004), that sharing personal information within computer-mediated collaboration manipulates the level of presence felt, provides a good foundation for this further investigation of social presence as a causal factor.

References


