Direct Communication versus Virtual Communication in Virtual Teams

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Abstract

Several studies suggest that computer-mediated communication can lead to decreases in group effectiveness and reduce satisfaction levels in terms of trust and comfort of its users. Supported by an experiment, where the emotional or affective aspects of communication were tested with the experimentation of two architectures, Direct Communication Architecture (DCA) and the Virtual Communication Architecture (VCA) this paper validates the thesis that, from the users’ perspective, there is no opposition to the acceptance of virtual environments and interfaces for communication, and that these environments are able to cope with the reconfiguration dynamics requirements of virtual teams or client-server relations in a virtual enterprise operation.

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1. Introduction

Man communicates since the earliest signs of human life. From simple processes of exchange until speech, and later using symbols and written communication [1], today communication is a basilar process for business [2-6] and is a very important dimension of virtual team working [7]. The pace has accelerated the ways to communicate, overcoming time and space barriers, so communication has become computer-mediated: from videoconference or computer conferencing, which can be thought of as the “traditional” face-to-face communication of today, until virtual communication interfaces and environments, where there exists a computer simulated world between the interlocutors.

Even though there are many communication tools used to collaborate in virtual teams (VT), not many studies have suggested their global efficiency, therefore, the new challenge to cope with the business requirements relies on how to apply the philosophy of effective and efficient virtual communication. Paradoxally, existing research points to two conflicting findings: from one side some researchers pointed the advantages of computer mediated communication in VT, transcending the space and time limits while others mention the loss of cohesiveness, trust, comfort, confidence.

In this paper, the authors demonstrated that communication in VT can take place by using a Direct Communication Architecture (DCA) (simulating face-to-face communication) or by using a Virtual Communication Architecture (VCA).

The DCA consists of a computer-mediated face-to-face communication, through videoconferencing software, where the end-user is able to see and hear an interlocutor on the other side (on his/her computer screen). The interlocutor’s features such as physical appearance, age, race, and tone of voice are subject to the user’s perception (Fig. 1).

The VCA uses the virtual reality-based representation of the interlocutor’s image (software agent or avatar) as an interface, where the end-user cannot see or hear the real image of the human interlocutor because he is “masked” and emulated by the avatar interface; the end-user always sees the same interlocutor’s mask and hears the agent’s voice. The VCA hides or virtualizes the communicating people (Fig. 2).
The authors have studied the relevance of a VCA and its ability to cope with the requirements of reconfigurability in virtual teams or in client-server relations in virtual enterprises (VE) operation, and whether a VCA can be a solution both in (1) reducing adaptation time of the end-users to the new interlocutors and to eliminate socio-cultural and cognitive barriers, and in (2) maintaining simultaneously the user acceptance in terms of comfort and trust.

The central thesis of this study is that there is no opposition, from the end-users’ perspective, concerning the acceptance of a VCA against a DCA. The thesis is validated by an experiment confronting the use of a DCA and a VCA in client-server interactions both in static and dynamic situations (dynamic because it considers changes of the interlocutors) and the findings are precisely that a VCA does not affect the emotional or affective aspects of communication. The findings prove the positive acceptance of a VCA, which is one more argument that justifies the use of the VCA in dynamic and reconfigurable VT and VE. The study proves the acceptance of the VCA, evaluating the confidence and comfort parameters and confirming that both parameters are kept at the same levels in the DCA and the VCA.

2. The Direct and the Virtual Communication Architectures

Bartfield et al. [9] virtual environment defined it as a computer-simulated world, consisting of software representations of real agents, objects, and processes, and a human-computer interface for displaying and interacting with these models. A virtual environment has the potential to enhance collaborative VT, concurrent engineering, collaborative product design, etc., which are highly iterative and interactive activities undertaken in a distributed development environment [10-13].

The underlying idea is related to the problem of VT reconfiguration and VE reconfiguration, which lead to the fact that a user is frequently faced to a new interlocutor. If VT or VE were static structures, it would be highly probable that the interlocutor should remain the same along the business process interaction. However, by definition, VE and VT are dynamic structures (their configuration changes along time, to keep them aligned to the business or project and the origin of its creation), with consequent changes of interlocutors, which can lead to a set-up time and an adaptation every time there is a change. This justifies the importance of understanding the implications of the adoption of a VCA instead of a DCA in these dynamic environments.

At every reconfiguration moment of the system, some non-productive reconfiguration time (and costs) – a reconfiguration “set-up” time - occurs. The higher the frequency of reconfigurations (reconfiguration dynamics), the higher is the total non-productive time (the sum of reconfiguration “set-up” times).

Either using VCA or DCA, between the two entities of communication (client – server) there is a third entity, the technology interface.

The main role of the DCA is to be able to see and hear the person on the other side; physical appearance, age, race, and tone of voice are all subject to the user’s perception. Concerning communication in VE or VT, as dynamic
reconfiguration is reflected in the interlocutor changes, the end-user must have the capability to quickly adapt to these changes and continue to trust the person who appears on the screen. Thus, the role of the user-interface is to further improve the dynamics of the VE reconfiguration towards a closer alignment with the market. The DCA consists of face-to-face communication implemented through video conferencing software like MSN Messenger® or SKYPE®. In this case, it is possible for the end-user to hear and to see an interlocutor on the computer screen. In a VE the interlocutor will, on the limit, constantly change, requiring a constant adaptation of the end-user to the new interlocutor.

In the VCA the end-user cannot see or hear the human interlocutor because he is “masked” by an interface element that hides the interlocutors from each other, providing a “virtual” environment. End-users have both a visual (they can see the agents) and a sound interaction (they can hear one agent speak at a time). The end-user cannot see or hear the human interlocutor because he always sees the same software mask and hears the same (mask’s) voice. Conceptually, there is no need to adapt to a new face or to a new voice and the agents may be chosen by the user. The interlocutor change is represented in Fig. 3.

Fig. 3. VCA representation with reconfiguration [8]
3. User acceptance of virtual environments for communication

It is intended to demonstrate that the end-user is not affected by the use of a virtual environment for communication under the lens of the emotional aspects of communication, and hence the VCA does not affect negatively VT and VE reconfiguration dynamics.

3.1. Hypotheses

The hypotheses and sub hypotheses formulated concerning the emotional aspects of communication (cognitive aspects, which could be measured by reaction and answering time, are not considered here) are the following:

H1. There is no significant difference relative to the comfort demonstrated by the DCA and the VCA users.
   H1.a) There is no significant difference between the DCA and the VCA relative to the comfort when the interlocutor changes.
   H1.b) There is no significant difference between the DCA and the VCA relative to the comfort when the interlocutor remains the same.

H2. There is no significant difference relative to the confidence demonstrated by the DCA and the VCA users.
   H2.a) There is no significant difference between the DCA and the VCA relative to the confidence when the interlocutor changes.
   H2.b) There is no significant difference between the DCA and the VCA relative to the confidence when the interlocutor remains the same.

3.2. The experimental validation

To validate the thesis that communication based on the proposed VCA does not affect communication in a VT/VE, an experiment was prepared with the purpose of:

- Determining which architecture (DCA or VCA) had a better performance with end-users who were knowledgeable about the Internet (use of a browser and MSN Messenger) and had Windows XP (or later) experience.
- Obtaining audio recordings of end-users’ communication during pre-defined conversations using DCA and VCA.
- Determining which environment end-users better adapted to; in order to register end-users opinions about the experiment, three questionnaires were developed.

The experiment intended to assure that although the use of videoconferencing software is intuitive and broadly used in VE and VT communication environments, the use of the VCA does not introduce entropy nor complexity in communication, i.e., does not negatively affect the emotional dimension of communication, and hence, can be understood as the environment to cope with the reconfiguration requirement of VE/VT.

3.3. The sample

The experiment was undertaken with students and the sample consisted of ninety end-users ranging from 18 to 28 years of age.

- All end-users had similar levels of education (higher education) and come from various courses and years.
- All had basic Internet, Microsoft Windows XP® and MSN Messenger® experience.
- All participants were very willing to participate in the experiment, and no incentives were necessary.
- Instructions on how to enter and start using the VCA interface were also given prior to the experiment.
All of the statistical testing was performed using the SPSS version 17.0 software. The demographic items analysed were age and sex. The ninety participants in the experiment were, on average, 20.9 years old and were almost equally distributed by sex.

3.4. Methodology

Two experiments were performed. In both the experiments the end-users were divided into three groups:

- Group 1, consisted of 15 end-users, subjected to both the DCA and VCA;
- Group 2, consisted of 15 end-users, subjected to the DCA;
- Group 3, consisted of 15 end-users, subjected to the VCA.

This way, each of the architectures was tested by 60 different people, since there were two experiment sessions for the three groups. At the end of each experiment end-users were asked to complete a questionnaire.

3.5. Research hypotheses validation

In the DCA tested in both the first and the second experiment, end-users rated, among other questions, the following groups of questions:

1. How they felt about the change of the tutors during the conversation.
2. How they felt about the tutors change of voice and appearance.
3. If they felt they could trust the tutors by their appearance and by their voice.

In the VCA tested in both the first and the second experiment, end-users rated, among other questions related with cognitive aspects not addressed here, the following groups of questions:

1. How they felt about their interaction with one of the agents during the conversation.
2. How they felt about the voice and appearance of the agent they interacted with.
3. If they felt they could trust the agent by its appearance and its voice.

Both groups of questions envisaged to rate trust and comfort, measured in terms of several parameters traducing the feelings of the final users in relation to the interaction with the interlocutor(s): surprise face to the interlocutors image and/or voice; indifference to the interlocutors image and/or voice; confusion caused by change of interlocutors image or voice; happiness felt during the communication process; insecurity during the communication process; will to continue the conversation; preferences of voices in case of different interlocutors; changing of voices; preference for having always the same interlocutor; irritation caused by change of interlocutors; trust transmitted by the interlocutors.

A third questionnaire continued the questions about the interaction with a comparative analysis of the two architectures, also rated on a scale of 1 to 7, which consisted of:

1. Classifying DCA (easy to use – hard to use, slow reply – fast reply, would use again – would not use again, enjoyed the experience – did not enjoy the experience).
2. Classifying VCA (easy to use – hard to use, slow reply – fast reply, would use again – would not use again, enjoyed the experience – did not enjoy the experience).

After performing descriptive statistics of the three groups in relation to the two variables (comfort and confidence) with and without tutor change, the results indicate that there are differences between some of the items tested in comfort and confidence. We conducted a t-test for independent samples the results indicate that the differences in the means (p-value less than 5%) of the responses between the DCA and the VCA are significant only in the items described in table 1 for the comfort confidence variables.
Table 1. Items related with comfort and confidence – t-test.

<table>
<thead>
<tr>
<th>Items related with comfort</th>
<th>With tutor change</th>
<th>p-value</th>
<th>Mean</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continue the conversation with the tutor</td>
<td>0,000</td>
<td>1,73</td>
<td>3,70</td>
</tr>
<tr>
<td></td>
<td>Did not want to continue the conversation with the tutor</td>
<td>0,023</td>
<td>1,20</td>
<td>2,27</td>
</tr>
<tr>
<td></td>
<td>Enjoyed hearing the tutor’s voice</td>
<td>0,014</td>
<td>4,53</td>
<td>3,17</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Items related with confidence</th>
<th>With tutor change</th>
<th>Voice did not inspire confidence</th>
<th>0,001</th>
<th>2,23</th>
<th>2,53</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Appearance did not inspire confidence</td>
<td>0,006</td>
<td>1,53</td>
<td>2,83</td>
<td></td>
</tr>
</tbody>
</table>

| Without tutor change | Would like to see different tutors | 0,002 | 3,20 | 1,77 |

In order to verify if the observed difference in this descriptive analysis is or not statistically significant some hypothesis were formulated. The bilateral tests were realized with a 95% confidence level, rejecting the null hypothesis when the \( p\)-value is less than 5%, validating the initial hypotheses (Table 2).

Table 2. Summary table of the research hypotheses validation

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>True</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1. There is no significant difference relative to the comfort demonstrated by the DCA and the VCA users.</td>
<td>Yes</td>
<td>0,241</td>
</tr>
<tr>
<td>H1.a) There is no significant difference relative to the comfort demonstrated by the DCA users when the tutor changes and when the tutor remains the same.</td>
<td>Yes</td>
<td>0,988</td>
</tr>
<tr>
<td>H1.b) There is no significant difference relative to the comfort demonstrated by the VCA users when the tutor changes and when the tutor remains the same.</td>
<td>Yes</td>
<td>0,700</td>
</tr>
<tr>
<td>H2. There is no significant difference relative to the confidence demonstrated by the DCA and the VCA users.</td>
<td>Yes</td>
<td>0,358</td>
</tr>
<tr>
<td>H2.a) There is no significant difference relative to the confidence demonstrated by the DCA users when the tutor changes and when the tutor remains the same.</td>
<td>Yes</td>
<td>0,339</td>
</tr>
<tr>
<td>H2.b) There is no significant difference relative to the confidence demonstrated by the VCA users when the tutor changes and when the tutor remains the same.</td>
<td>Yes</td>
<td>0,599</td>
</tr>
</tbody>
</table>

4. Conclusions

The findings were that the VCA does not affect communication from the emotional perspective. This finding means that virtual environments can be used efficiently, and in future the totally virtual interfaces can be used particularly when dynamics is mandatory, as virtual interfaces and environments, as demonstrated, do not reduce confidence and comfort. Complementarily, the previous work of Putnik et al. [8] has already supported VCA effectiveness under the cognitive aspect, as the VCA usage led to shorter non-productive times (set-up times) when the interlocutor changes, given that the user does not lose time to adapt himself/herself to the physical appearance of a new interlocutor.

The main conclusion of this work is that the VCA is expected to be the “natural” environment to cope with the new generation of organizational environments and teams, characterized by intense reconfiguration dynamics.

References


