

# Chapter 7

## Artificial Intelligence Supported Non-Verbal Communication for Enriched Collaboration in Distributed E-Research Environments

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### ABSTRACT

*In face-to-face work, discussion and negotiation relies strongly on non-verbal feedback, which provides important clues to negotiation states such as agreement/disagreement and understanding/confusion, as well as indicating the emotional states and reactions of those around us. With the continued rise of virtual teams, collaboration increasingly requires tools to manage the reality of distributed e-research and remote work, which is often hampered by a lack of social cohesion and such phenomena as participant multitasking. This chapter discusses important concepts and current issues related to remote research teams and discusses current research in the use of Automatic Facial Expression Recognition Systems (AFERS) in solving some of the inherent problems of the existing online collaboration tools used to support collaborative and distributed research and work. The later half of this chapter describes a proof-of-concept artificial intelligence based software agent (Emotion Tracking Agent, or ETA) developed by the authors for the monitoring of presence and the emotional states of co-workers in virtual research meetings. The agent is intended as an innovative solution to the impaired awareness and attention resulting from continuous task switching or multitasking behaviours of collaborating remote team members. The ETA was developed and integrated into a CVE (Collaborative Virtual Environment), where an initial study was conducted to analyse its benefits and impact on the communicating participants. This chapter describes the results of this study and their implications for the future of distributed e-research and remote work.*

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## **INTRODUCTION**

In modern work/research environments, the activities of teleconferencing and other forms of virtual meetings have become increasingly important due to the growing number of businesses and research institutions using distributed workers based in many different countries and locations around the world (Lojeski, Reilly, & Dominick, 2007). Many companies such as Intel (70%), IBM (40%), and Sun Micro Systems (nearly 50%) already have high percentages of virtual and distributed workers and researchers (Lojeski, Reilly, & Dominick, 2007). Some of these workers are based at home or abroad or travel frequently and for these individuals, virtual conferencing is the most convenient and economical means of communication with colleagues and clients.

One of the inherent problems in remote meetings as described in the literature relates to multitasking in both traditional (Benbunan-Fich & Truman, 2009) and virtual work and research environments (Appelbaum, Marchionni, & Fernandez, 2008). Successfully managing worker multitasking and providing solutions to specific multitasking disadvantages is of key importance to future work practices (Black & Hearne, 2008).

Much consideration has been given to the effect of multitasking on a user's attention and performance in a virtual meeting. The problem lies in the fact that during virtual meetings (and to a lesser extent face-to-face meetings), participants often juggle more than one task, whether it be checking emails, browsing the internet or performing other work or non-work activities (Lojeski, Reilly, & Dominick, 2007). Our contention is that this is not a 'bad' thing that should be constrained but rather we seek to provide an innovative mechanism to assist users in these situations.

In this chapter we discuss the use of real-time Automatic Facial Expression Recognition Systems (AFERS) in solving some of the common and inherent problems associated with current online collaboration tools used in the support of

collaborative and distributed e-research. These problems include poorly supported non-verbal communication and an increased propensity of collaborators to engage in distracting multitasking or task switching behaviours. A prototype Emotion Tracking software Agent (ETA) of our own design is presented and discussed later in this chapter, along with a description of its integration and testing within an online research CVE (Collaborative Virtual Environment). This discussion is then used as a mechanism for further exploration of the issues obstructing the continued advancement of collaborative e-research and remote work tools and the potential benefits of an AFERS in reducing these issues. The developed ETA is aimed for use in remote work and online collaboration tools such as teleconferencing, video conferencing and a variety of groupware such as collaborative virtual environments (CVEs) and other forms of VEs. The main purpose of the agent is as a tool to help support online interactions by providing a real-time form of automatic non-verbal communication interface along with, by use of a number of methods, increasing online collaborators' attention and emotional awareness in virtual meetings.

## **REMOTE WORK/RESEARCH AND MULTITASKING**

In the last decade the popularity of remote work amongst employees in many diverse employment sectors has increased significantly. This is largely due to the increase in availability of specialised information technology software and hardware allowing virtual meetings between increasingly larger groups of people to become possible, removing the restrictions which once curbed the organisation of work activities. Modern companies are outsourcing work contracts throughout the world and are no longer limited by the boundaries of on-site employees. The same can be said for research institutions and the concept of "virtual

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