



# Designing emotional support messages tailored to stressors



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## ABSTRACT

Although computers could offer emotional support as well as task support when aiding a user for a complex task, there is little current understanding of how they might do this. Moreover existing demonstrations of emotional support, though promising, only cover a small number of types of support and investigate a limited number of algorithms designed by hand. In this paper, we present an empirical investigation that starts from first principles, determining different categories of stressors for which emotional support might be useful, different categories of emotional support utterances and promising algorithms for deciding the content and form of textual emotional support messages according to the stressors present. At each stage, the results are validated through empirical experiments with human participants who, for instance, are required to place statements into categories, evaluate possible support messages in different imagined situations and compose their own emotional support from options offered. This development methodology allows us to avoid potentially challenging ethical issues in presenting people with stressful situations. Although our algorithms are attempting to choose emotional support based on the general, “naive” competence of human speakers, we use as a running example situations that can arise when attending a medical emergency and awaiting expert help.

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## 1. Introduction

Computer systems nowadays support humans in many different tasks. Their superior abilities in searching, book-keeping and summarisation render them irreplaceable in many complex situations. However computer systems in general only address the informational needs of a human being. For a stressful task, a human supporter will not only provide information but also attempt to alleviate the undesirable emotions being experienced by the task performer. This is a feature that is only beginning to be addressed in computer systems, typically in the context of virtual agents. Virtual agents are computer-generated virtual characters that interact intelligently with users typically taking on roles that normally performed by humans such as coaches, tutors or customer representatives. By *emotional support* we refer to communications from a supporter to a task performer that do not provide concrete help with the details of the task but attempt to address the emotions that are being invoked by the task. We focus on emotions arising from the stressful nature of the task. For instance, a supporter might reassure “Don’t worry”, show empathy “I understand that you are feeling frustrated”, praise “you are doing a great job” or encourage “you can do this”. Human beings seem to be remarkably successful at giving emotional support. At least, we trust them to give emotional support in key situations, often with very little training. Moreover, they are able to adapt their support to the type of situation

being experienced, which is important as support provided in the wrong context can have a detrimental effect (cf. Lehman et al. (1986), as reported in Cutrona and Suhr (1992)). This paper is about initial attempts to produce a computer algorithm able to capture some aspects of this human behaviour, in particular able to adapt emotional support to different stressors.

In order to ask the question “what emotional support should be given in this situation?”, we start by addressing some more fundamental questions:

1. What kinds of stressful situations are there?
2. What kinds of emotional support are there?
3. How is it possible to elicit examples of human emotional support for multiple types of situations in an ethically appropriate way?

The task is then that of modelling the human behaviour as a computer algorithm<sup>1</sup> in particular deciding:

<sup>1</sup> One can argue about whether mimicking human behaviour is the right approach. In many fields of Artificial Intelligence, the focus has traditionally been on emulating humans, for example when modeling emotions (Gratch and Marsella, 2001) or generating natural language (see van Deemter (2016) for a discussion on this). Given emotional support in computers is still in its infancy and humans interact with computers in a social way (Nash et al., 1994), modelling human behaviour seems an appropriate first step. However, this will be combined with measuring the effectiveness of emotional support from the receiver’s point of view, similarly to the work in Paraboni et al. (2007) on measuring effects of natural language utterances on hearers.

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1. Which type(s) of statements should be included for each type of situation?
2. How should the material in the emotional support be ordered?

The work of this paper was inspired by the MIME project (MIME, 2013), which investigated the development of a computer aid for Community First Responders (CFRs) attending medical emergencies. CFRs are volunteers with limited medical training who attend medical emergencies, particularly in remote and rural areas, while an ambulance is en route. The computer aid enabled CFRs to measure and monitor the key medical parameters of the casualty, enter information about their observations and actions, and generated a handover report for the ambulance personnel when they arrived. Although the task of a CFR is known to be stressful in a number of ways, the MIME system only addressed the provision of factual information to the CFRs. Inspired by this, the research described in this paper asked the question “what sort of emotional support might a computer provide to people experiencing the kinds of stressors CFRs experience?”.

Following a review of related work in Section 2, in Section 3 we produce and validate textual scenarios depicting individual stressors, crowd source a corpus of emotional support statements, and reliably categorise these statements into emotional support categories. In Section 4, we use the statements and scenarios to investigate what emotional support people offer to other people experiencing different stressors. Based on this, we develop three emotional support algorithms and evaluate these, leading to a refined algorithm and a further evaluation. An overview of this process is illustrated in Fig. 1. Section 5 concludes the paper and provides indications for future work.

## 2. Background and related work

### 2.1. Types of stress

We assume in this paper that emotional support to a person is relevant when there is one or more *stressor* in the environment. A stressor is here just a cause of *stress*, where we use Selye's definition of stress as “the non specific (that is, common) result of any demand upon the body [...] be it a mental or somatic demand for survival and the accomplishments of our aims” (Selye, 1956). The APA categorizes stress into the following three categories (APA, 2013): (1) *acute stress* occurs over short durations of time and comes from pressures from the recent past or anticipated near future, (2) *episodic stress* is when an individual experiences one episode of acute stress which is then followed shortly and frequently by another episode, (3) *chronic stress* is a long term experience which is continuous over a long duration of time, such as months and years. We only consider emotional support for acute stress.

In previous work, to identify different stressors for CFRs, we started from the NASA-TLX (Hart, 2006), a multi-dimensional subjective scale for measuring task workload developed by the American National Aeronautics and Space Administration. The NASA-TLX had been used to record participants' perception of task demands, such as those experienced by firefighters (Young et al., 2013) and had been used in various domains due to its high reported levels of internal validity (Xiao et al., 2005) and simplicity. The NASA-TLX measures six workload facets: mental demand, temporal demand, physical demand, frustration, effort, and performance. We excluded effort and performance, as it was assumed that CFRs would always give their maximum effort and that to measure performance would be inappropriate. Based on focus groups with CFRs, we added the emotional aspects of what CFRs may experience while fulfilling their duties, namely ‘worries about

whether you were doing the right thing’, ‘irritation by external factors such as interruptions’, ‘feeling alone and isolated’, and ‘being upset about (anticipated) outcome’. The resulting set was used to investigate which stressors CFRs experience the most and during what moment of the call-outs (see Kindness et al., 2014 for the results of the survey). The current work takes this list of stressors as a starting point, and considers mental demand, temporal demand, physical demand, emotional demand, frustration, interruption and isolation (see Fig. 2 for informal glosses of these terms).

### 2.2. Emotional support

Emotional support is an important social construct and a skill which people develop from an early age. However, it is not entirely straightforward and without complications. The same emotional support may not be equally suitable in different situations. Some people, such as counselors, might be considered as being better at providing appropriate emotional support than others. As different stressors are present in different stressful events, it seems plausible that supportive messages should also vary, with some being considered better suited and more beneficial for one stressor than another (Cutrona and Suhr, 1992). Emotionally supportive actions are those aimed at increasing positive emotional states in conjunction with helping people overcome negative emotional states (Burlleson and Kunkel, 1996). Emotional support can be considered as a synonym for comforting support. Comforting support can be defined as being “messages having the intended function of alleviating or lessening emotional distress...” (Burlleson, 1985). We applied the same definition to emotional support and when the term *emotional support* is used in this research it refers to this definition.

When received, emotional support has been shown to impact a person's mental and physical wellbeing as well as reduce negative affect such as stress (Burlleson and Kunkel, 1996; Meyer and Turner, 2002; Goldsmith, 2004). Even the perception that emotional support is available to a person has been shown to be beneficial and can have important implications for stressors such as loneliness (Pierce et al., 1991).

Furthermore, as well as reducing stress, appropriate and sensitive support also strengthens the bond between the support provider and the receiver (Burlleson and Kunkel, 1996). This could be potentially important in strengthening the bond between a user and a virtual agent. However, Burlleson and Kunkel (1996) also warn that inappropriate support can exacerbate the recipients' stress and have detrimental effects on the relationship between provider and receiver. This is regardless of how good the intentions of the support provider are. This again promotes the need for further investigation into the different types of emotional support that a virtual agent should provide in different stressful circumstances.

The benefits of emotional support alongside its potential pitfalls accentuate the need for further exploration into the differing types of emotional support which could be provided by a system, such as a virtual agent, for different stressors. As discussed in more depth in Section 3, we will base our emotional support categories on those proposed by Dennis et al. (2013), namely Emotional Reflection, Praise, Emotional Advice, Reassurance, and Directed Action.

There is at present no literature on what types of emotional support would be most appropriate for the stressors investigated in this paper. In terms of the emotional support that embodied agents have provided in numerous studies to participants experiencing stress, there remains little to no distinction between the types of emotional support that should be given for different stressors. Researchers working on computer-generated emotional

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