An empathic virtual buddy for social support



J.M. van der Zwaan

An Empathic Virtual Buddy for Social Support

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Janneke Margriet VAN DER ZWAAN

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Dit proefschrift is goedgekeurd door de promotor:
Prof. dr. C. M. Jonker

Copromotor: Dr. V. Dignum

Samenstelling promotiecommissie:

Rector Magnificus,	voorzitter
Prof. dr. C. M. Jonker,	Technische Universiteit Delft, promotor
Dr. V. Dignum,	Technische Universiteit Delft, copromotor
Prof. dr. M. A. Neerincx,	Technische Universiteit Delft
Prof. dr. S. van der Hof,	Universiteit Leiden
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Prof. dr. R. S. Aylett,	Heriot-Watt University
Dr. A. Paiva,	Universidade Técnica de Lisboa
Prof. dr. E. Eiseman,	Technische Universiteit Delft, reservelid





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Chapter 1

Introduction

Computing devices have become an integral part of human communication. Increasingly, these devices are not only used as tools to mediate communication between people, but also as conversation partners in their own right. For example, telephone calls to information lines used to be answered by people, but nowadays such calls are handled more and more by automated computer systems. Another example is Siri, an intelligent personal assistant launched by Apple Inc. in 2011 [164]. Siri allows users to send messages, schedule meetings, place phone calls, and search for information by asking it to perform these actions in spoken natural language.

To make interacting with computer systems as natural as face to face communication between people, researchers in Human-Computer Interaction have been working on interfaces featuring virtual characters that simulate verbal and non-verbal conversational behavior. This type of user interface is called an Embodied Conversational Agent (ECA) [47]. Research topics in ECA research reflect the complexity of human communication and include topics ranging from modeling conversation mechanisms (e.g., turn-taking behavior) to simulating skills required for smooth social interaction (e.g., small talk).

As emotions play an important role in social interactions [168, 170], increasingly, ECAs are equipped with the ability to understand and express emotions. This thesis presents work on endowing ECAs with a skill that requires understanding and expressing emotions. Social support or comforting refers to communicative attempts to alleviate the emotional distress of another person [41]. In this thesis, we propose a design for an 'empathic virtual buddy' that provides social support. We describe the underlying principles and an architecture for a prototype system, and provide both a quantitative and qualitative evaluation of the support conveyed by the empathic virtual buddy prototype.

In order to be able to provide social support, a context of emotional distress is required. The application domain we selected for the virtual buddy is cyberbullying, that is, bullying through electronic communication devices [138]. Research shows that cyberbullying has a high impact on victims [142], making it a suitable

environment to test the social support capacities of a virtual buddy.

This chapter is organized as follows. In Section 1.1, we introduce the Cyberbullying project, which is the context in which the work presented in this thesis was conducted. In Section 1.2, we motivate the our work. Section 1.3 presents the research aim and research questions addressed in this thesis. In Section 1.4, we discuss the scope and limitations of our work. Section 1.5 presents our general approach towards equipping ECAs with social support capacities. In Section 1.6, we discuss the contributions of this thesis. Finally, Section 1.7 presents the outline of this thesis.

1.1 Context: The Cyberbullying Project

The work presented in this thesis is part of the multi-disciplinary project 'Empowering and Protecting Children and Adolescents against Cyberbullying' (the Cyberbullying project). The goals of the Cyberbullying project were to chart the problem of cyberbullying in the Netherlands, and to design and analyze social, legal, and technological interventions to protect and empower children and adolescents against bullying in virtual environments. The work presented in this thesis explores how emotional ECAs can contribute to protecting and empowering cyberbullying victims.

The Cyberbullying project started from the observation that anti-social behavior such as cyberbullying can be regulated socially, legally, and/or technologically[1]. Social norms play an important role in regulating behavior in general. People may choose to adhere to social norms, but norms can also be violated. Law regulates behavior by holding out the prospect of sanctions to those who do not adhere to laws. Technology controls or steers social behavior through functionalities in the software design (coined 'code as law' by Lessig [134]) or through exerting social influence (persuasive technology [75]).

The different regulatory modalities are intertwined and interaction is complex [135]. This makes regulating cyberbullying a complicated issue, that can not be solved by designing technological interventions; better solutions require combinations of measures from different modalities. In Chapter 2, we present an exploration of the cyberbullying domain and review existing technology against cyberbullying. This study confirms the presumption that technological interventions alone are insufficient to protect users against cyberbullying.

While exploring the cyberbullying domain, we found that cyberbullying victims not only want information about how to deal with cyberbullying, but are also looking for moral support (i.e., psychological rather than physical support[2]) [191]. Additionally, cyberbullying victims are reluctant to talk to others, in particular to

[1] Instead of three, Lessig distinguishes four regulatory modalities: social norms, the law, architecture (technology) and the market [134]. In the Cyberbullying project, the market was not considered as a regulatory modality for the problem of cyberbullying.

[2] http://oxforddictionaries.com/definition/american_english/moral-support

adults, about their negative online experiences [64, 138, 150]. In addition to information presentation, which is a common application for ECAs (see Chapter 3), the virtual buddy needs to be equipped with the emotional skills required to provide emotional support.

In addition to cyberbullying victims' need for both informational and emotional (moral) support, and their reluctance to talk to adults, there are other reasons why children suffering from cyberbullying in particular might benefit from interaction with an empathic virtual buddy. This further motivation is provided in Section 1.2.

1.2 Motivation

In this section, we argue that providing social support is an important social skill for ECAs, in particular for companion and coaching ECAs that are currently gaining popularity in ECA research. Additionally, we motivate the research from the domain perspective; we show that the cyberbullying domain has certain characteristics as a result of which cyberbullying victims might be motivated to interact with an empathic virtual buddy that provides social support, and that they might benefit from this interaction.

1.2.1 Providing Social Support is an Important Skill for Embodied Conversational Agents

Providing social support or, to be more precise, comforting is a skill most people possess, at least to some extent; there is ample evidence that this type of informal support (i.e., support in non-therapeutic settings) can be effective [5, 6, 31]. Recent years have witnessed a growing interest in employing ECAs for tasks that are typically performed by humans [171]. Relevant for this thesis are the efforts towards developing ECAs that act as companions or coaches.

People performing the role of companion or coach exhibit certain social behaviors. One of these social behaviors is providing social support or comforting. For example, someone notices that a friend is feeling sad, and tries to make him feel better by providing a new perspective on issue that is bothering him[3]; or someone tells his coach that he was unable to achieve one of his goals and the coach tries to cheer him up, so next time, he will be able to reach his goal. For interactions to become truly social, providing social support is one of the tasks companion and coaching ECAs should be able to perform.

To demonstrate the importance of the task of providing social support for ECAs, we conclude this section by providing suggestions of scenarios or applications in which ECAs might be able to improve interaction or help users by comforting them. We do this by referring to past and ongoing work on companion and coaching ECAs. In Chapter 3, most of these references explored in more detail. The first scenario we mention is behavioral change. ECAs might be able to coach users

[3] In this thesis we refer to persons of unspecified gender with pronouns 'he', 'him' and 'his'.

that want to increase exercise behavior [25], lose weight or eat healthier [28], or stop excessive drinking [213]. By providing social support, these coaches might increase the users' chances of success. Comforting users might also be required in the scenario of providing companionship to users, example applications include reducing isolation in older adults [143, 167], and engaging children in personalized conversation [2]. Providing social support might also improve training and/or education outcomes, for example in a training application for job interviews [172], or teaching children to manage chronic diseases, such as diabetes [27]. Although most of the applications mentioned feature ECAs that try to respond constructively to users' negative emotional states in some ways, these studies lack an integral approach to providing users with social support. In Chapter 3, this issue is more thoroughly explicated.

1.2.2 Cyberbullying Victims in Particular Might Benefit From a Socially Supportive Embodied Conversational Agent

Research shows that cyberbullying has a high impact on victims [142]; 40 to 60% of cyberbullying victims is emotionally affected by cyberbullying incidents [142, 165]. As a consequence of being bullied, cyberbullying victims may experience physical, social, and psychosocial problems [64, 74, 165]. To deal with cyberbullying, victims not only require information, but are also in need of emotional support [191]. In other words, cyberbullying is a socially relevant, real world problem for which social support might be useful. In addition, cyberbullying seems especially suited to explore how ECAs can provide social support users for the following reasons. First of all, cyberbullying victims are using computing devices, such as desktop computers, tablets, or mobile phones, when they are being victimized. An ECA is a software application that can be made available on all these devices.

Additionally, a characteristic that distinguishes cyberbullying from traditional school bullying is that physical separation is no limitation for cyberbullying, meaning that cyberbullying can occur at any moment [119, 165]. This 24/7 attainability of cyberbullying calls for support that is available at any moment. Automated support provided by an ECA can be available whenever a cyberbullying victim needs it.

As mentioned before, cyberbullying can have a high negative impact on victims. At the same time, victims are reluctant to disclose cyberbullying events to others, mainly because they fear they will lose their computer privileges if they admit to being cyberbullied to their parents [64, 138, 150]. A socially supportive ECA able to provide assistance without running this risk, making it an attractive option for victims.

Even if a cyberbullying victim talks to someone about his negative online experiences, it is another question whether this person will be able to help the victim; teachers and parents often lack the technical know-how to advise victims on what to do about cyberbullying [74]. The technical knowledge required to deal cyberbullying can be stored in a software application. Furthermore, this information can

be kept up-to-date using software updates. ECAs are often used to present information to users (see Chapter 3). We assume that information is more effectively disseminated and users are more likely to take constructive action, if the socially supportive ECA addresses (and thereby reduces) users' negative emotions.

While this section justifies and motivates the development of an empathic virtual buddy that provides social support to cyberbullying victims, we would like to emphasize that the focus of our research is on designing supportive interactions between ECAs and users. We neither claim the virtual buddy is effective as a tool against cyberbullying, nor try to prove this. The work presented in this thesis solely concerns designing, implementing, and evaluating an ECAs capacity to provide social support. Section 1.4 further specifies the scope and limitations of our research.

1.3 Research Aim and Research Questions

The problem addressed in this thesis is how to endow ECAs with the skill of providing social, and in particular, emotional support. We would like to gain insight into what behavior needs to be exhibited, how to generate this behavior, and why this behavior is being experienced as supportive or not. These issues are investigated in the socially relevant domain of cyberbullying. The aim of our is formulated as follows:

Research aim: *To understand how ECAs can provide social support to users by designing, implementing, and evaluating a prototype of an empathic virtual buddy that provides social support to cyberbullying victims aged 10 to 14 years old.*

This aim can be divided in the following research questions:

Question 1: *What are the unique characteristics and challenges of cyberbullying, and to what extent are they addressed by existing Internet Safety Technology?* (Chapter 2)

Question 2: *What are existing methods for providing social support?* (Chapter 3)

Question 3: *What should be the structure and contents of a conversation during which an ECA provides social support to a cyberbullying victim?* (Chapter 4)

Question 4: *What are the important aspects of supportive behavior that need to be realized in an empathic virtual buddy against cyberbullying, and how can these aspects be implemented in a prototype?* (Chapter 5)

Question 5: *How is the virtual buddy's supportive behavior assessed by different types of users?* (Chapters 6, 7, and 8)

Research questions 1, and 2 provide the theoretical framework of our research.

We start with an exploration of the cyberbullying domain. Subsequently, we investigate how humans provide social support, and explore the social support potential of ECAs. Research questions 4 and 5 concern the design and implementation of the virtual buddy prototype. We start with the associated challenge of developing a conversation model for social support that specifies the structure and contents of social support conversations. Subsequently, the conversation model is combined with an emotion model that generates appropriate verbal and nonverbal behavior for the virtual buddy. Finally, research question 5 concerns the evaluation of the virtual buddy's supportive behavior. The behavior was assessed by students, pedagogical and anti-bullying experts, and the target age group of children between the ages of 10 and 14.

1.4 Scope and Limitations

We decided to explore how ECAs can provide social support in a socially relevant domain, i.e. cyberbullying. In addition, cyberbullying is a sensitive topic, and the virtual buddy's target age group of children between the ages of 10 and 14 is considered to be vulnerable. These issues lead to additional challenges that need to be solved. In this section, we specify the scope and limitations of our work, and explain the intended use of the virtual buddy.

We would like to emphasize that the empathic virtual buddy firstly was developed as a tool to explore how ECAs can provide social support. This implies that instead of creating a fully fledged software application, a prototype was implemented. The empathic virtual buddy prototype was designed to capture important aspects of comforting behavior exhibited by ECAs. As a result, several important aspects related to the use of the virtual buddy in real world settings have been ignored, including protection of privacy, prevention of adverse consequences due to misunderstanding the virtual buddy's advice, and dealing with extreme cases (e.g., severe bullying, and suicidal victims).

The starting point of the virtual buddy's design was the scenario of a victim sitting behind a computer and feeling upset because someone is cyberbullying him. The victim then turns to the virtual buddy for emotional support and practical advice. Specific convictions concerning cyberbullying and children underly this scenario. In particular, cyberbullying is considered a learning opportunity for victims (cf. [183]), and children are regarded as being resourceful enough to resolve problems associated with cyberbullying (cf. [21]), although they may need a little guidance from the virtual buddy.

The virtual buddy uses strategies employed by human counselors to provide social support. During interaction with the virtual buddy, the user is guided through a structured conversation; first, the incident is discussed, and after that the buddy suggests actions to resolve the situation. To ensure the victim does not become socially isolated, the user will always be encouraged to discuss the bullying with someone he trusts. The virtual buddy provides emotional support by expressing

What the virtual buddy is	What the virtual buddy is not
• **Tool to explore how ECAs can provide social support**	• Solution for the problem of cyberbullying
• Accessible first resort for light to average cases	• Replacement for human support (informal or professional)
• Additional support channel	• Therapy for cyberbullying victims

Table 1.1: What the virtual buddy is and what it is not.

sympathy, encouraging, complimenting the user.

Interaction with the virtual buddy should not be seen as a replacement for human support (either informal or professional). In that sense, it is an additional channel for support. Although the virtual buddy employs counseling techniques, it is not a form of 'automated psychotherapy'. Instead the virtual buddy should be seen as an accessible first resort for victims experiencing light to average cyberbullying, meaning that is not intended for severe cases of cyberbullying, or victims with suicidal thoughts. Table 1.1 summarizes the intended use of the virtual buddy, and what it is not intended to be.

The usage scenario we just outlined is based on two assumptions: 1) cyberbullying victims have access to the virtual buddy, and 2) cyberbullying victims accept the virtual buddy as a provider of support. Although the issue of how victims gain access to the virtual buddy is an important one, it is beyond the scope of our research. In addition, we assume that cyberbullying victims are motivated to use the virtual buddy and accept it as a provider of support, because they have something to gain from interacting with it. The extent to which other stakeholders in the cyberbullying domain, such as parents, teachers, and anti-bullying experts, look on the virtual buddy as an acceptable anti-cyberbullying intervention, was also considered to be beyond the scope of our work.

1.5 Approach

As specified in the research aim above, our work on equipping ECAs with the capacity to provide social support took place in three succesive stages: design, implementation, and evaluation. The first stage concerned the design of an empathic virtual buddy against cyberbullying. Important components of the design are a conversation model that specifies the structure and contents of social support conversations about cyberbullying, and an emotion model that generates supportive behavior. The design was implemented in a prototype system. Subsequently, the supportive behavior of the virtual buddy prototype was evaluated by different types of users.

The virtual buddy's supportive behavior is based on strategies employed by human counselors to provide social support. To understand how humans give support, we conducted a literature study and consulted human counselors. In par-

allel, a review of the ECA literature was conducted to determine what was already known about social support by ECAs. The results of these studies provided the foundation of the virtual buddy's design. In particular, we identified the need for further specification of the conversation structure and contents of social support conversations about cyberbullying. This resulted in the specification of a conversation model that was subsequently validated using chat conversations about bullying.

The virtual buddy's design also includes an emotion model for the generation of supportive behavior such as expressing sympathy, providing encouragement, and giving compliments. This model is based on Ortony, Collins, and Clore's specification of cognitive appraisal theories of emotions (the OCC model)[161]. In the OCC model, emotions are conceptualized as responses to events, agents, and objects. The virtual buddy's emotion model interprets the user's responses as actions and events, which are subsequently appraised. The emotions triggered by these appraisals are expressed both verbally and nonverbally.

The conversation model and emotion model were implemented in an empathic virtual buddy prototype. A prototype is a 'representation of all or part of an interactive system, that, although limited in some way, can be used for analysis, design and evaluation' [105]. A prototype is intentionally incomplete, but captures the essential features of the intended system [156]. The essential features of the virtual buddy concern conveying social support. Nass and colleagues found that people automatically apply social rules from human-human interaction to computers that provide social cues, even if these cues are relatively simple [151, 154]. Based on this theory, we hypothesize that people can feel supported by an ECA that emits the right social cues, and that these cues do not need to be complex. This provided the starting point for the implementation of the virtual buddy prototype.

The conversation model was implemented as a fixed script the virtual buddy uses to find out details about a cyberbullying incident, and to provide emotional support and practical advice. The domain knowledge used to fill in the details of the script came from our review of the cyberbullying literature, and conversations with human counselors. The implementation of the emotion model was based on FAtiMA, an emotion architecture for virtual agents [65]. Specifically, the virtual buddy's emotion model resembles FAtiMA's reactive layer that determines an agent's immediate responses to events, actions, and objects[4].

In the final stage of the research, the virtual buddy's supportive behavior was evaluated. In order to gain insight into the impact of the virtual buddy's supportive behavior on user's experience of support, and how and why the behavior was experienced as being supportive or not, both quantitative and qualitative studies of the behavior were conducted. The studies involved different types of participants, in particular students, pedagogical and bulling experts, and children (members from the virtual buddy's target age group (i.e., children between the ages of 10 and 14), and slightly older children). In all studies, interaction with the virtual buddy

[4]FAtiMA also contains a deliberative layer that determines an agent's goal-driven behavior. More details on FAtiMA can be found in Section 3.3.3.

was based on a scenario describing a common cyberbullying situation. Participants were asked to play the role of the scenario's main character when interacting with the virtual buddy.

We chose to use a scenario to evaluate the virtual buddy's supportive behavior, because this method allowed us to recruit participants without first-hand experience with being cyberbullied. Therefore, we we able to perform preliminary evaluations with students and experts. Also, the use of scenario-based evaluation eliminated the need to recruit bullying victims for the studies involving children. The procedures used for these studies have been approved by the ethical boards of the Erasmus University Rotterdam (pilot study described in Chapter 6), and Delft University of Technology (qualitative study with the target age group, see Chapter 8).

1.6 Contributions

The first main contribution of this research is that we demonstrate that an ECA system does not have to be complex in order to achieve a desired effect in users. We created a simple prototype of a virtual buddy that provides social support to cyberbullying victims. Using simple techniques such as scripted conversation, predefined verbal output messages, predefined response options for users, static images to simulate nonverbal behavior, a reactive emotion model, and limited domain knowledge, the virtual buddy prototype implements strategies used by human counselors to provide emotional support and practical advice. The resulting supportive behavior was evaluated by pedagogical and domain experts, bachelor students, and children between the ages of 10 and 16. The results of all studies show that the virtual buddy conveys social support. This means that we identified the right social cues to communicate social support, and that these cues were successfully implemented in the virtual buddy prototype. In conclusion, the virtual buddy prototype successfully captures the principles of providing social support.

The second main contribution is that we show that the expression of emotions is essential for the experience of support. The social support literature states that emotions expressed by support providers play an important role in the experience of feeling supported. The results from our evaluation studies confirm this fact; participants contribute the experience of social support to the virtual buddy's verbal expression of emotions, its nonverbal expression of emotions, and the combination of verbal and nonverbal expression of emotions.

The third contribution is a validated, domain-independent model for social support conversations. While charting the social support potential of ECAs, we found that existing ECA systems are predominantly task-oriented. Conversations with task-oriented ECAs are focused on the user's task, and geared towards functional instead of social support. The user's task provides a foundation for the conversation; the ECAs and the user discuss the user's task. In this thesis, we argue that looking for social support is not a concrete task, and that, therefore, it is unclear

what the virtual buddy and the user should talk about. The conversation model for social support fills this gap in the ECA literature by specifying the contents and structure of social support conversations.

Another contribution of this research is that we demonstrate that adult experts can replace children when evaluating aspects of an ECA's behavior. In particular, we invited pedagogical and bullying experts to try out the virtual buddy prototype, and evaluate its supportive behavior. The results of the expert evaluation were compared to the results of a subsequent study in which the virtual buddy's supportive behavior was evaluated by members from the virtual buddy's target age group (i.e., children between the ages of 10 and 14). We found a large overlap between experts' opinions and the target age group's evaluations of the prototype's user experience, and the supportive behaviors. This large overlap in results shows that aspects of socially supportive behavior designed for children can be successfully evaluated by pedagogical experts. The opinions of experts can be used to improve an ECA's behavioral strategies before involving vulnerable target audiences such as children.

The final contribution of this research concerns the cyberbullying domain. We found that existing work on technology against cyberbullying relies on the assumption that traditional, restrictive Internet safety technology, such as web filtering software, will also protect users against cyberbullying. Based on a review of the literature, we show that this assumption is unfounded, and that technology aimed at empowering users is more likely to be effective against cyberbullying.

1.7 Organization of the Thesis

In Chapter 2, we provide an overview of the cyberbullying domain, and review existing Internet Safety technology. This chapter is based on publication [11] from the list below. Chapter 3 presents a review of social support, provides an introduction to the ECA literature, and discusses the social support potential of ECAs. Chapter 4 is based on publications [5, 7, 9]. In this chapter, we present a domain-independent conversation model for social support. In Chapter 5, we describe how the conversation model was implemented in a prototype system. This chapter is based on publications [3, 5, 12]. The supportive behavior of the virtual buddy prototype is evaluated in Chapter 6, 7, and 8. Chapter 6 is based on publications [12, 13], and presents results of two quantitative studies. Chapter 7 and 8 present qualitative evaluations of the virtual buddy's supportive behavior. Chapter 7 is based on publication [10]. Finally, in Chapter 9, we present our conclusions, and provide suggestions for future research.

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Chapter 2

Cyberbullying and Technology against Cyberbullying

In 2010, 80% of Dutch children between the ages of 9 and 16 accessed the Internet on a daily basis [87]. One of the risks children run online is to become a victim of cyberbullying. Cyberbullying can be defined as 'any behavior performed through electronic or digital media by individuals or groups that repeatedly communicates hostile or aggressive messages intended to inflict harm or discomfort on others' [199]. Average victimization rates range between 20 to 40% [199] and findings from the EU Kids Online II survey indicate that cyberbullying has a high negative impact on victims [142]. As a result of being bullied, cyberbullying victims may experience physical, social, and psychosocial problems [64, 74, 165].

As mentioned in Section 1.1, cyberbullying can be regulated socially, legally, and/or technologically. The work presented in this thesis focuses on the use of technology to protect and empower children and adolescents against cyberbullying. This chapter provides an exploration of the cyberbullying domain, and reviews existing technology against cyberbullying. So far, the topic of using technology to regulate cyberbullying received little attention (exceptions are [106, 147, 197]). Recently different initiatives have started to investigate the potential of technology to regulate cyberbullying, such as AMiCA[1] and Friendly ATTAC[2]. Existing work [147, 197] seems to rely on the assumption that general Internet safety technologies can be used as protection against cyberbullying as well. In this chapter, we show that this assumption is unfounded and propose an alternative approach to addressing cyberbullying with technology.

This chapter is organized as follows. First, in Section 2.1, we provide a background on Internet safety technology and cyberbullying. In Section 2.2, we present the unique characteristics and challenges of cyberbullying we identified from the

This chapter is based on our contribution to Responsible Innovation Volume 1: Innovative Solutions for Global Issues, to appear [226].

[1] http://www.clips.ua.ac.be/amica/

[2] http://www.friendlyattac.be/en/

literature. Additionally, we construct a framework to discuss the expected effectiveness of existing Internet safety technology against cyberbullying based on these characteristics and challenges. In Section 2.3, we use the framework to discuss the expected effectiveness of existing Internet safety technologies against cyberbullying. The results indicate that these technologies are not effective against cyberbullying, mainly because they restrict online behavior that is not related to cyberbullying. The framework suggests that technology exerting social influence (persuasive technology) might be more effective. Therefore, in Section 2.4, we propose an alternative technology, that is, 'an empathic virtual buddy' that provides social support to cyberbullying victims. We would like to emphasize that the proposed technology should be regarded as an additional channel for support rather than a 'miracle solution' for cyberbullying. Finally, in Section 2.5, we present our conclusions.

2.1 Setting the Stage

In order to get an overview of the current situation and the issues concerning protecting youth online, the concept of internet safety for children and adolescents is explored in Section 2.1.1. Section 2.1.2 provides background information on cyberbullying, by comparing cyberbullying to traditional bullying, listing different types, media and methods of cyberbullying, discussing the perspectives of online victims, and bullies, and presenting existing approaches to tackling cyberbullying.

2.1.1 Internet Safety Technology

Online safety of children and adolescents concerns risks such as harassment, bullying, sexual solicitation, exposure to problematic and illegal content (including pornography, hate speech, or violence), malicious software (for instance viruses), hackers, and online delinquency (for example identity theft or fraud). In their review of existing Internet safety technology, the Technology Advisory Board of the Internet Safety Technical Task Force [106] distinguished the following functional goals:

- Limit harmful contact between adults and minors,
- Limit harmful contact between minors,
- Limit/prevent minors from accessing inappropriate content on the Internet,
- Limit/prevent minors from creating inappropriate content on the Internet,
- Limit the availability of illegal content on the Internet,
- Prevent minors from accessing particular sites without parental consent,
- Prevent harassment, unwanted solicitation, and bullying of minors on the Internet.

These goals show that Internet safety technology is restrictive; they clearly intend to restrict online behavior. This view on technology corresponds to the aforementioned 'code as law' perspective from Lessig (see Section 1.1). Web filtering software

is an example of restrictive technology; a web filter blocks access to websites based on certain criteria.

Different types of Internet safety technologies can be distinguished, including [106, 197]:

- Content and behavior analysis,
- Filtering,
- Monitoring,
- Blocking undesirable contacts,
- Reporting,
- Age/identity verification, and
- Educational technology.

Some technologies, such as age/identity verification, require storing personal data, which raises privacy concerns. Monitoring online behavior or automatically analyzing online communication might also invade privacy. In addition, restrictive technology could violate the right to freedom of expression. Children's privacy and their right to freedom of expression must be balanced against the potential benefits of Internet safety technologies. In some cases it might be appropriate to restrict behavior, for example to protect younger children, whereas for older children and adolescents protecting their privacy and/or freedom of expression might be more important.

2.1.2 Cyberbullying

Recently, cyberbullying gained a lot of attention. Cases involving online bullying with extreme consequences have received extensive media coverage. Additionally, in academia, studies mapping the problem of cyberbullying and its consequences for victims, bullies and bystanders have been conducted. This section provides an overview of relevant findings from cyberbullying research.

Compared to Traditional Bullying

Cyberbullying –by definition– is a type of bullying. According to Olweus, bullying is "characterized by the following three citeria: (1) it is aggressive behavior or intentional 'harm doing' (2) which is carried out 'repeatedly and over time' and (3) in an interpersonal relationship characterized by an imbalance of power" [160]. In addition to these criteria, cyberbullying has some specific characteristics. First, cyberbullies can remain anonymous relatively easy [119, 165, 183, 215]. Being bullied by an anonymous bully may be more distressing than being bullied by an acquaintance [120]. In addition, it is difficult to punish an anonymous bully and to prevent him/her from bullying again [165]. Another important difference is the lack of physical and social cues in online communication [119, 120, 165, 215]. This prevents the bully from being confronted with the consequences of the harassments [120]. However, it could also lead to misinterpreting messages as cyberbullying when in

fact they were not intended to be [214]. A third difference is the 24/7-attainability provided by online communication [119, 165]. Traditional bullying is usually characterized by a confined period of time during which bullies have access to their victims. In most cases, victims of traditional bullying are safe at home. However, physical separation is no limitation for cyberbullying. Other differences between traditional bullying and cyberbullying are the quick distribution of electronic messages to (potentially) infinite audiences [119, 120, 183] and the permanent nature of information on the Internet [183].

Types, Media and Methods

Cyberbullying refers to bullying through electronic communication devices. Various types of behavior fall within the definition of cyberbullying [204]:

- *Outing* - Very personal information (pictures, address, phone number, etc.) of individuals are broadcasted on the Internet without the victim's consent;
- *Trickery* - Individuals may be deceived into dispersing private information about themselves or others;
- *Impersonation* - The cyberbully acts as another person to deceive the victim;
- *Harassment* - The victim receives regular insulting and denigrating messages from the cyberbully;
- *Cyberstalking* - The victim is terrorised by frequent threatening and intimidating messages;
- *Denigration* - The cyberbully spreads online gossip and lies about a person;
- *Flaming* - The cyberbully provokes rude arguments against the victim;
- *Exclusion* - The victim is left out from participating in virtual groups or communities, e.g., by being blocked from buddy lists;

Cyberbullying happens through different media, such as e-mail, instant messenger applications, social networking websites, blogs, chat rooms, online games, virtual worlds, and mobile phones (sms). In addition, cyberbullying can be communication-based or content-based. Methods used for online bullying include name-calling, gossiping, ignoring, threatening, hacking (breaking in to computers or online accounts), spreading personal conversations, manipulating and spreading pictures, creating defamatory websites, and sending sexual comments [64, 202].

Victims

Prevalence rates of cyberbullying victimization vary among studies. In a recent review of existing research, [199] reports victimization rates of 20 to 40%. There appears to be a correlation between age and the likelihood of victimization: victimization rates peak around ages 14–15 [106, 199]. Reports regarding gender differences are inconclusive. Some studies report increased risk for females, other studies found no difference in gender with respect to cyberbullying victimization [106, 199].

Victims of cyberbullying tend to be heavier Internet users than youth that is not victimized [188]. Victims of traditional bullying and those that bully others online

are more likely to be cyberbullied [138, 217]. In addition, some online activities seem to be correlated with being cyberbullied. These activities include: having an active profile on social networking site [147], participating in public chat rooms [147, 217], instant messaging [217], blogging [217] and participating in clip sharing networks (e.g. YouTube[3]) [147].

Of the online risks investigated in the EU Kids Online II survey, cyberbullying is most likely to upset children [142]. About 60% of the cyberbullying victims participating in this study reported to be very or fairly upset after being bullied. In another study, 40% of victims reported to be emotionally affected by online bullying [165]. Consequences of cyberbullying tend to be similar to those of traditional bullying. Victims of cyberbullying may experience physical, social, and psychosocial problems, such as serious depressive symptoms and stress [74], feeling frustrated, angry, sad [64, 165], and not wanting to go to school [64].

Bullies

Online bullies are typically the same age as their victims [91, 119, 165, 210, 211]. And even though anonymity is often viewed as integral to cyberbullying, it seems that cyberbullying often takes place in the context of social groups and relationships [150]. Between 44%–82% of victims of cyberbullying know their bully or bullies offline [91, 210]. So, online bullying has a strong connection with the offline world. Perpetrators of traditional bullying tend to bully others online [138]. However, cyberbullies are not just traditional bullies, but also individuals that are afraid to bully others in real life [150]. Retaliation is also common. According to a study by Ybarra and Mitchell, 4 out of 5 harassers say their behavior was in response to online harassment initiated by someone else [216]. Most bullies cyberbully from their homes (85.6%) and are alone when engaging in bullying (62.97%) or with friends (24.6%) [64].

Tackling Cyberbulling

Because the phenomenon of cyberbullying emerged relatively recent, validated approaches to stop or prevent it do not yet exist. However, some researchers suggested strategies for tackling this problem. Two approaches can be distinguished: education and awareness, and improving social skills.

Many studies stress the importance of education and awareness to reduce and prevent cyberbullying. [217] support the idea to include cyberbullying prevention in conventional anti-bullying programs. It is important to educate both children and adults (e.g. teachers and parents) [64, 217]. Teaching technological skills –again, both to children and adults– deserves special attention [74, 188], so children and adults know what can be done about certain situations. Technological skills include protecting private information, blocking or deleting contacts, contacting website moderators or Internet Service Providers, gathering evidence, and tracking bullies.

[3] http://www.youtube.com/

While educating potential victims and other stakeholders seems a good idea, [149] could not establish a link between and increase in online safety knowledge and a reduction in risky behavior. So, knowing about online dangers does not mean that children and adolescents show more careful behavior when they are online.

Ybarra et al. suggest that those who have trouble communicating are more likely to be involved in online harassment [217]. In another study, Ybarra and Mitchell found that 80% of online harassers said they retaliated in response to someone harassing them [216]. Wright et al. found that cyberbullying often stems from 'misunderstandings' and 'mishearing stuff' [212]. Therefore, a possible way to tackle cyberbullying is by improving interpersonal communication and conflict management skills [216, 217].

Some researchers consulted children and adolescents to find ways of tackling cyberbullying. Education, both of themselves and teachers and parents, is also commonly advised [48, 191]. Children and adolescents too recognize that 'working on creating a positive self-esteem in students' may help reduce cyberbullying [48]. Finally, Stacey found that especially younger students could use some support when dealing with cyberbullying [191]. Two types of support were discussed: practical advice on how to get rid of bullies, offensive material etc., and moral support. Younger students thought senior students would be their best resource in dealing with cyberbullying.

2.2 A Framework for Assessing the Effectiveness of Technology against Cyberbullying

In this section, we construct a framework to discuss the expected effectiveness of existing Internet safety technology against cyberbullying. The framework is based on unique characteristics and challenges of cyberbullying derived from the Internet safety and cyberbullying literature discussed in Section 2.1. These characteristics and challenges are presented in Section 2.2.1. Section 2.2.2 presents the framework for assessing the effectiveness of technology against cyberbullying.

2.2.1 Unique Characteristics and Challenges Of Cyberbullying

For determining the unique characteristics and challenges of cyberbullying, we take the perspective of a (potential) cyberbullying victim and consider the direct consequences for his online experience. We take as a starting point the principle that all Internet users (including bullies and victims) should be restricted in their behavior as little as possible, and that it is better to teach victims to deal with cyberbullying, than to prevent them from coming into contact with it at all (cf. Shariff [183]). The unique characteristics and challenges were identified by answering basic questions about cyberbullying. These questions were: what are the online behaviors that can be characterized as cyberbullying?, who are the bullies?, and when do users need protection? Subsequently, we identified some risks associated

Characteristic/challenge
1. Online behaviors that can be characterized as cyberbullying are diverse. Important types are communication-based and content-based cyberbullying
2. Cyberbullying often takes place in the context of social groups and relationships
3. Cyberbullying is 24/7 attainable
4. Restrictive technology can be circumvented by computer-savvy users
5. Children's privacy and their right to freedom of expression should be balanced carefully against the potential benefits of technology against cyberbullying.

Table 2.1: Unique characteristics and challenges of cyberbullying.

with online technology in general. Table 2.1 presents the unique characteristics and challenges of cyberbullying we identified in the literature.

Online behaviors that can be characterized as cyberbullying are diverse; different types, media and methods can be used to cyberbully others. Like traditional bullying, cyberbullying usually is communication-based (for example, name calling in chat conversations or sending threatening e-mails), but content-based cyberbullying also occurs (for example, creating a fake profile on a social network or posting manipulated pictures).

Recent studies reveal that many of the online threats experienced by children and adolescents are perpetrated by peers, including sexual solicitation [210] and online harassment [91, 188]. Although anonymity is often viewed as integral to cyberbullying, it seems that cyberbullying often takes place in the context of social groups and relationships [150].

Cyberbullying can occur at any moment. This 24/7 attainability of cyberbullying is enabled by technology.

Technology in general has some risks that might limit their suitability to protect against cyberbullying. For example, in Section 2.1 we observed that existing Internet safety technology always restricts users in some way. A disadvantage of restrictive technology is that it can be circumvented relatively easily by computer-savvy users. Victims (and potentially bystanders) are motivated to use some technology if they have something to gain (they want to stop the bullying), while cyberbullies are less likely to participate voluntarily, because bullying is an intentional act. Additionally, technology might invade privacy and/or limit freedom of expression. Even though these issues are beyond the scope of the work presented in this thesis, they are very important.

2.2.2 The Framework

In order to discuss the expected effectiveness of existing technology against cyberbullying, we convert the characteristics and challenges of cyberbullying identified

Desired characteristic
• Suitable for different types, media and methods
• Take peer contact into account
• Real-time
• Voluntary use
• Protecting the user's privacy
• Protecting the user's freedom of speech

Table 2.2: Desired characteristics for technology against cyberbullying.

in Section 2.2.1 into a framework consisting desired characteristics of technology against cyberbullying. The framework is summarized in Table 2.2. These issues will be used to discuss the expected effectiveness of existing technology against cyberbullying in Section 2.3.

Because the online behaviors that can be characterized as cyberbullying are diverse, technology against cyberbullying should *take into account different types, media, and methods of cyberbullying and at least target online communication*. Because cyberbullying often takes place in the context of social groups and relationships, technology against cyberbullying should at least *take into account relationships with known and unknown peers*. In addition, because cyberbullying can occur at any moment, technology against cyberbullying should also be available at any moment and/or be able to intervene at any moment. In other words, technology against cyberbullying should *provide real-time support*. Additionally, because restrictive technologies can be circumvented by computer-savvy users, technology against cyberbullying should *rely on voluntary use*. Victims (and potentially bystanders) are motivated to use some technology if they have something to gain (i.e., they want to stop the bullying), while cyberbullies are less likely to participate voluntarily, because bullying is an intentional act. Finally, restrictive technology might invade privacy and/or limit freedom of expression. Because these issues are important, *protection of privacy and freedom of expression* are included in the framework.

2.3 Application of the Framework to Existing Internet Safety Technologies

This section reviews existing Internet Safety technologies and discusses their expected suitability against cyberbullying based on the framework proposed in the previous section. The following technologies are discussed: content and behavior analysis, filtering, monitoring, blocking undesirable contacts, reporting, age/identity verification, and educational technology. Most existing parental control applications, e.g., Net Nanny[4] or Cyber Patrol[5], combine multiple technologies, such as

[4]http://www.netnanny.com/
[5]http://www.cyberpatrol.com/

content and behavior analysis, filtering and monitoring in one product. Below, we focus on the separate technologies, not complete applications.

2.3.1 Content and Behavior Analysis

Content and behavior analysis are about automatically extracting meaningful information from data, such as text, images, video material, and network traffic. Content analysis can be applied to detect inappropriate content. Potentially, these techniques can also be used to detect cyberbullying in text based conversations.

Preliminary results on related tasks show that it is rather difficult to automatically recognize different types of harassment. Pendar used a statistical approach to automatically distinguish between communication of sexual predators and victims. Classifier performance ranged from 40%–95% [166]. Kontostathis et al. attempted to recognize sexual predation with a rule based approach and a model of the communication processes child sexual predators use in the real world. The resulting classifier correctly predicted predator speech 60% of the time [116]. These results seem promising, however, the studies reported have some limitations. First, the datasets used for the experiments were small (701 and 25 conversations respectively[6]). Standard corpora for text classification contain hundreds of thousands texts (e.g., the Reuters corpus [137]). Second, the data used consisted of conversations that were known to be malicious; most online conversations are not. Data imbalance (i.e., data sets containing only a few objects that need to be detected) is a well known problem in machine learning that leads to suboptimal classifier performance [50].

In 2009, the Content Analysis for the Web 2.0 Workshop (CAW2.0) offered a shared task on misbehavior detection[7]. Yin et al. trained classifiers to identify harassing messages in chat and online discussion forums [219]. Harassing was defined as 'intended to annoy one or more persons', which is related to, but not the same as cyberbullying. Performance was between 25%–40%, so, there is much room for improvement.

Automatically recognizing cyberbullying or other harmful content could be a first step in protecting children and adolescents against these threats. As mentioned before, most applications for parental control employ some form of content analysis. Content and behavior analysis can be used to detect different forms of cyberbullying, both communication-based and content-based. However, related work shows that detecting different types of harassment is not trivial and needs to be improved before it can be used as (partial) protection against cyberbullying. The technology can be applied to all communication, including peer communication. In addition, content and behavior analysis can be both used voluntary and non-voluntary. It can be applied in real-time. Because technology for content and behavior analysis stores and interprets online behavior, which can be considered personal data, the

[6] Both Pendar and Kontostathis et al. used data made available by Perverted Justice (http://www.perverted-justice.com/).

[7] http://caw2.barcelonamedia.org/

privacy of users might be invaded. Detecting inappropriate data does not limit the freedom of expression per se, but actions taken after something has been detected might.

2.3.2 Filtering

Web filtering software blocks access to websites with inappropriate content, such as pornography. Filtering techniques include white lists (lists of websites the user is allowed to visit), black lists (lists of websites the user is not allowed to visit), and content analysis (the content analysis algorithm decides whether the user is allowed to visit a website, e.g. based on the occurrence of certain key words). Common problems with web filtering are underblocking (i.e., websites with inappropriate material can still be accessed) and overblocking (i.e., websites that do not contain inappropriate material are blocked). Hunter evaluated four commercial web filtering applications. He found the applications blocked inappropriate material 75% of the time and appropriate material 21% of the time [102].

Filtering is a preventive measure. It does not specifically target communication, but filtering incoming and/or outgoing communication could limit or prevent harmful contact between minors and between minors and adults. However, automatically recognizing either communication-based or content-based cyberbullying is not a trivial task (see Section 2.3.1). Filtering technology does not exclude communication between peers. Because users do not get the choice to apply filtering or not before they go online, filtering does not rely on voluntary use. Filtering software may be circumvented. For example it is very easy to substitute terms that are filtered for unfiltered terms that are equally offending, for example 'loser' becomes 'l o s e r', 'L0S3R', 'looser', etc. Filtering software is real-time technology; websites are blocked and/or communication is filtered instantaneous. Since filtering software does not store personal data to block access to certain online resources, privacy is not at stake. However, blocking communication or preventing access to websites may affect freedom of expression.

2.3.3 Monitoring

Monitoring software informs parents about their children's online activities by recording websites addresses and online communication (for example instant messaging). Most parental control software allows monitoring online activities. A recent study found the use filtering and/or monitoring software does not correlate with less cyberbullying victimization [147].

Monitoring software is preventive and works based on the assumption that users will adapt their behavior if they know their online activities are being watched. Because all online activity is stored, monitoring software theoretically targets all types, media, and methods of cyberbullying. In practice, however, cyberbullying incidents will have to be extracted by hand or automatically (see Section 2.3.1). Since cyberbullying might be hard to recognize and cyberbullying may only be a

small part of all online activity, this is a tedious job. Because all online activities are recorded, peer communication is taken into account. Monitoring software does not rely on voluntary participation, users usually do not know or notice being monitored. Activities are recorded in real-time, however, action can be taken only after the records have been reviewed by an external party (for example a parent). For monitoring, privacy is an issue, because all online activities, which can be considered personal data, are recorded and stored for reviewing. Freedom of expression is not at stake.

2.3.4 Blocking Undesirable Contacts

Most instant messaging applications (e.g., Skype[8] and WhatsApp[9]), chat rooms, and social networking sites (e.g., Facebook[10] and MySpace[11]) give users the possibility to block other users, in order to prevent them from being contacted by these people. Many social networking sites also provide the possibility to restrict unknown users from contacting them and accessing their profile.

Blocking happens in response to incidents and limit harmful contact between minors and both minors and adults. Blocking contacts is suitable only for communication-based cyberbullying in applications where blocking options are available. It does take into account contact between peers. In fact, blocking bullies is a common advice for stopping cyberbullying[12]. Blocking is a voluntary act that allows users to control who can contact them. Users can block contacts whenever they want. In that sense blocking is real-time. Blocking users does not invade privacy or restrict freedom of expression.

2.3.5 Reporting Content

Many social web applications (e.g., Facebook and MySpace) provide the possibility to report inappropriate and illegal content, for instance, by clicking a button labeled 'report abuse'. Reports are send to community moderators that manually review reported content and decide whether or not to remove it. Some social networking sites, chat rooms, online games, and forums also allow users to report others when they break the rules, for example, by cyberbullying. Moderators decide whether and how to punish offenders.

Reporting tools can be useful for limiting access to inappropriate material, including some forms of content-based cyberbullying (for instance happy slapping videos or fake profiles on social networking sites). Reporting communication-based cyberbullying is only possible if moderators are available in the application and

[8] http://www.skype.com/en/
[9] http://www.whatsapp.com
[10] http://www.facebook.com/
[11] http://www.myspace.com/
[12] See for example http://cybermentors.org.uk/, http://www.stopcyberbullying.org/, and http://www.cybersmart.gov.au/.

communication records exist. Everybody can report content they feel is inappropriate, so this technology relies on voluntary use. Because moderators have to check reports manually, it may take some time before reported content is removed. Therefore, reporting is not real-time. Privacy is not at risk, since no personal data needs to be stored for reporting (reporters may be anonymous). Removing content might interfere with freedom of expression. Therefore, in the case of cyberbullying, content will only be removed in obvious and/or extreme cases of content-based cyberbullying.

2.3.6 Age/Identity Verification

Age and/or identity verification technologies aim at restricting inappropriate contact between minors and adults as well as preventing minors to access inappropriate content. For example, in Second Life[13], users must be 18 years old to view mature content. Age and/or identity verification often use public or private databases containing information on either minors (for example school records) or adults (such as known sex offenders). People in the database (for instance minors or sex offenders) or people of certain ages (for example adults) are either allowed or not allowed to contact certain other people (such as minors) or access certain material (for example pornography).

Age and/or identity verification technologies do not target various forms of cyberbullying, such as content-based cyberbullying and harmful contact between peers. Age and/or identity verification may rely on voluntary participation (for example by becoming a member of a social network that applies age restrictions). In other cases participation may not be voluntary, for example if a school only allows its pupils to use the school's social networking website. This technology works online. However, since verifying age or identity requires gathering and storing personal data, the privacy of users might be at risk. Freedom of speech is not threatened.

2.3.7 Educational Technology

Education is another approach to improving the online safety of minors. Because the topic of this chapter is technology, the discussion below is limited to educational technology, such as interactive computer games.

The first project described focused on traditional bullying instead of cyberbullying. FearNot! is an Intelligent Virtual Environment (IVE) in 3D, where synthetic characters act out bullying scenarios [163]. The application was designed for children between the ages of 8 and 12 to witness the events from a third-person perspective. After a bullying episode, the victimized character turns to the user to ask for advice. The IVE offers children a safe environment that supports social and emotional learning. Evaluation of the system revealed that children care about and believe in the characters, not only in a single interaction but also over several

[13] http://secondlife.com/

separated interactions [72]. A controlled trial conducted in Germany and the UK established a short-term effect of escaping victimization for a priory identified victims of bullying and a short-term overall prevention effect for UK children [179], demonstrating the potential of IVEs to support anti-bullying activities.

Other applications aimed at educating minors about online safety include Mr Ctrl[14] (not available anymore) and Internet Safety with Professor Garfield[15]. Mr Ctrl is a chatbot that answers questions about online safety. Internet Safety with Professor Garfield is a series of online interactive lessons about different topics concerning Internet safety. Both applications can be used individually, but also provide teaching material for classroom use. To the best of our knowledge, these applications have not been evaluated.

Because education is aimed at stimulating the right behavior in general, it basically targets all types, media and methods of cyberbullying. From the examples given here, it is not clear to what extend peer communication is explicitly taken into account. However, it would be easy to do so. Educational programs are usually mandatory, so there is no voluntary participation. Educational technology is designed to support traditional classroom teaching and not to protect or empower pupils at the same time they use the Internet. Finally, privacy and freedom of expression are not at risk in normal educational settings.

2.3.8 Summary: Technology against Cyberbullying should be Empowering

In this section we discussed the expected effectiveness of different existing Internet safety technologies against cyberbullying. The results of this discussion are summarized in Table 2.3. While all technologies satisfy at least some of the desired characteristics from the framework we proposed, we expect their effectiveness against cyberbullying to be limited. Technologies such as age/identity verification, filtering and monitoring, reporting, and blocking undesirable contacts have not been designed to protect against cyberbullying, but with other online risks in mind. Some of these technologies primarily target access to undesirable content. Their success in protecting against cyberbullying, which is mostly communication-based, is therefore limited. According to our criteria, blocking undesirable contacts is the most promising approach.

One of the most salient features of existing Internet safety technology is its attempt to steer the behavior users by restricting them. While in certain cases restricting bullies and/or victims might be useful, teaching them to deal with cyberbullying incidents seems a promising approach. This viewpoint is supported by the literature. For example, Shariff argues that incidents of cyberbullying potentially are valuable learning experiences [183]. This potential, however, is ignored by existing technologies. Additionally, Thierer claims education (media literacy)

[14] http://mrctrl.spaces.live.com/ (in Dutch)
[15] http://www.infinitelearninglab.org/

	Different forms	Peer communication	Voluntary use	Real-time	Protect privacy	Protect freed. of expr.
Content&behavior analysis	±	+	−	+	±	+
Filtering	±	+	−	+	+	−
Monitoring	±	+	−	−	−	−
Blocking contacts	−	+	+	+	+	+
Reporting	−	+	+	−	+	−
Age/identity verification	−	−	±	+	−	+
Educational technology	+	?	−	−	+	+

Table 2.3: Match between characteristics of existing technologies and the desired characteristics of technology against cyberbullying (+: good match; ±: partial match; −: no match; ?: unknown.

is the primary solution against online risks [198]. In his view, the role of technology is to supplement (but never to supplant) education. Educational technology (Section 2.3.7) is a primary example of using technology to supplement education.

Our discussion was focussed on the separate existing Internet safety technologies. One might argue that combining multiple technologies, as is done in existing parental control software, might increase performance compared to individual technologies. However, the main issues, i.e., using technology that has been designed for other risks and restricting users instead of empowering them, will not be tackled by combining restrictive technologies.

Finally, we would like to emphasize that our discussion is limited to the expected effectiveness of technologies against cyberbullying. We do not claim the technologies discussed in this section should not be used; they might be very effective against other online risks, such as exposure to problematic and illegal content or identity theft. However, based on the characteristics proposed in the framework, we expect that the effectiveness of existing Internet safety technology against cyberbullying is limited.

2.4 An Empathic Virtual Buddy to Empower Victims of Cyberbullying

In the previous section, we argued that technology that empowers users instead of restricting them might be more effective against cyberbullying. In fact, technology does not have to be restrictive to influence behavior. Persuasive technology steers behavior by exerting social influence [75]. Persuasive technology might also be

used to empower victims of cyberbullying. We propose to empower victims of cyberbullying by giving them access to an 'empathic virtual buddy'. The virtual buddy is a character that 'lives' on the screen of potential cyberbullying victims. At the user's request, the virtual buddy provides emotional support and practical advice on how to deal with the situation.

We agree with Thierer that technology should only be used to supplement education and mentoring and not to replace it [198]. Therefore, the virtual buddy should be seen as an additional channel for victims to find support, not as a 'miracle solution' against cyberbullying. Ideally, the virtual buddy is used as an extension of an educational program, child helpline, or embedded in an anti-bullying training. However, the current focus of our research is on developing and testing the virtual buddy as an autonomous system. More details on the design and implementation of the virtual buddy can be found in Chapter 5.

In the interaction with the child, the virtual buddy has the social role of a peer. This role has been chosen for several reasons. First, it has been shown that peer support can be effective against traditional bullying [57]. Second, to decrease high expectations of intelligence, the buddy is presented as a peer instead of an all-knowing expert. Finally, findings from the cyberbullying literature suggest that children do not like to talk to adults about their negative online experiences [64, 138, 150], therefore a peer is a more appropriate model for the virtual buddy than an adult-like figure.

The cyberbullying types, media, and methods the virtual buddy can advise about depends on its advice module. This advice module contains a mapping between characteristics of cyberbullying situations to specific pieces of advice. Depending on the contents of its advice module, the virtual buddy can provide advice on both communication-based and content-based cyberbullying. The goal of the virtual buddy is to empower its users. It does in no way restrict the online behavior of its users, so peer contact is taken into account. The virtual buddy provides support when requested by the user and aims at teaching the user to deal with future cyberbullying. In addition, the buddy's support is real-time. Since the virtual buddy will collect and store personal data, the user's privacy is at risk. To protect the user's privacy, the system will be implemented as a local application on the host computer; data will not be shared with (social) web applications the user might use. However, additional measures to protect the privacy of users might be necessary. Since the virtual buddy does not restrict user behavior, freedom of expression will not be violated.

While the virtual buddy matches almost all the desired characteristics of technology against cyberbullying, some additional concerns arise. First, the virtual buddy pretends to be a social being. It is important to make sure the victim does not become socially isolated as a result of interaction with the virtual buddy. In addition, it needs to be very clear that the virtual buddy is not a replacement for professional help. There have been cases of severe (cyber)bullying that resulted in victims committing suicide. While these extreme cases are rare, care has to be taken not to harm users of the buddy. To address these concerns, the virtual buddy has to be included

in a broader context of anti-cyberbullying measures, for example by employing the virtual buddy within the context of a specialized helpline. If the virtual buddy detects a case it cannot handle, it can refer the victim to the helpline or alert a human counselor that takes over the conversation.

2.5 Conclusion

This chapter makes three contributions. First, we identify the unique characteristics and challenges of cyberbullying, and present a framework of desired characteristics for technology against cyberbullying. Second, we use the framework to discuss the expected effectiveness of existing Internet safety technologies. The results indicate that existing Internet safety technology is not effective in protecting users against cyberbullying. Finally, we proposed an alternative technology that is aimed at empowering users instead of restricting them.

The framework consists of the following desired characteristics for technology against cyberbullying: it should be suitable for different types, media and methods of cyberbullying (at least communication-based cyberbullying), it should take into account peer contact, it should rely on voluntary use, it should be real-time, and user's privacy and freedom of expression should be balanced against restriction. This framework should be seen as a first step towards more formal criteria or requirements. The characteristics can be formalized and extended based on the results of experimental validation (for example by performing user studies and assessing the effectiveness of technologies in practice). The results of our review of existing technology indicates that prevention and detection of cyberbullying do not suffice. Five online safety task forces agree and conclude that empowerment, i.e. education and awareness, is a primary solution strategy to protect children and adolescents against online risks [198]. Technology can be used to supplement education and awareness. We would like to emphasize that technology alone can never solve a complex problem such as cyberbullying. A combination of social, legal, and technological measures is required for best results.

Our discussion of existing Internet safety technologies shows that all of them satisfy at least some the characteristics from our framework. However, we conclude that the effectiveness of these technologies against cyberbullying still is limited. Technologies such as age/identity verification, filtering and monitoring, reporting, and blocking undesirable contacts have not been designed to protect against cyberbullying, but with other online risks in mind. Some of these technologies primarily target access to undesirable content. Their success in protecting against cyberbullying, which is mostly communication-based, is therefore limited. Additionally, apart from education, none of the existing online safety technologies discussed are designed to empower children and adolescents. Rather, the technologies either restrict the behavior of bullies and/or victims (filtering and monitoring, age/identity verification, blocking undesirable contacts). While in some cases restricting the behavior of bullies and/or victims might be useful, incidents of cyberbullying potentially can

be valuable learning experiences [183], which are currently ignored by technology.

Instead of viewing technology from a restrictive 'code as law' perspective, this chapter proposes a socio-technological measure that does not restrict the possibilities of online communication and is aimed at empowering cyberbullying victims. The proposed virtual buddy provides emotional support and practical advice on how to deal with cyberbullying, and is available whenever victims need help. The remainder of this thesis presents the design and implementation of a virtual buddy prototype (Chapter 3, 4, and 5), and the evaluation of the virtual buddy's supportive behavior (Chapter 6, 7, and 8).

Chapter 3

Social Support

The previous chapter showed that cyberbullying victims are more likely to benefit from an ECA that provides emotional support and practical advice than from existing restrictive Internet safety technology. In order to be able to design the virtual buddy's supportive behaviors, this chapter discusses methods and strategies used by humans and ECAs to provide social support. In particular, our discussion is focused on the expression of emotions by support providers.

This chapter is organized as follows. In Section 3.2.6, we show that expressing emotions is important for conveying social support. Therefore, in Section 3.1, we start with a brief overview of the two emotion theories that are used in the virtual buddy prototype (see Chapter 5). Section 3.2 discusses strategies employed by humans to provide social support. Section 3.3 presents an introduction to embodied conversational agents. To gain insight into methods used by ECAs to provide social support, Section 3.4 provides a review of related work. Finally, Section 3.5 presents our conclusions.

3.1 Emotion Theories

Research on emotions has a long history and resulted in a multitude of theories about what emotions are, and how and why they arise [100, 168]. This section provides an introduction to two major strands of emotion theories. Both these theories are used in the virtual buddy prototype presented in Chapter 5. Section 3.1.1 presents dimensional theories of emotions. Dimensional theories of emotions concern the classification of emotions. In the virtual buddy prototype, a dimensional theory of emotion is used to interpret the user's emotional state. Section 3.1.2 introduces cognitive appraisal theories of emotion. Cognitive appraisal theories explain how and why emotions arise. In the virtual buddy prototype, cognitive appraisal theory is used to generate the virtual buddy's emotional responses to the user's situation.

3.1.1 Dimensional Emotion Theories

According to dimensional emotion theories, emotions are continuous functions of an arbitrary amount of dimensions of connotative meaning [81]. Dimensional emotion theories differ from each other by the number of dimensions included (usually two or three), and the meaning attached to each dimension. A well known dimensional model of emotions is the Pleasure, Arousal, Dominance (PAD) model, which assumes an emotion (more precisely: affect) can be defined as a coincidence of values on the dimensions pleasure, arousal and dominance [146, 162]. Pleasure (valence) determines how positive or negative the emotion, mood or attitude is. Arousal describes whether the emotion, mood or attitude involves activation or deactivation. Dominance refers to the degree to which the individual feels in control versus feels submissive with regards to the stimulus or situation. For example, anger would be low pleasure, high arousal, high dominance, while sadness would be a low pleasure, low arousal, low dominance.

3.1.2 Cognitive Appraisal Theories

Cognitive theories of emotions provide a clear causality of how emotions arise. The basic assumption is that emotions are triggered by the evaluation of a stimulus with respect to several criteria, including personality dimensions, characteristics of the situation, and other context variables. The evaluation of a stimulus is called appraisal. Lazarus specified two types of appraisal: primary and secondary appraisal [131]. Primary appraisal refers to evaluating the relevance and congruence of the stimulus to the individual's well-being. Secondary appraisal refers to bringing to mind a potential response to the stimulus. Negative emotions have similar primary appraisal patterns; the current situation is being appraised as relevant to and incongruent with an individual's goals [131].

Another important concept in cognitive appraisal theories of emotion is coping. Coping "consists of cognitive and behavioral efforts to manage specific external or internal demands (and conflicts between them) that are appraised as taxing or exceeding the resources of the person" [131, p. 112]. Coping behavior can be caused by (strong) emotions and can be aimed at changing the conditions of the emotion (problem focused coping) or the emotion itself (emotion focused coping) [131]. Additionally, coping directly and indirectly affects subsequent appraisals (reappraisal), and may therefore also elicit emotions [131].

3.2 Social Support by Humans

To alleviate stress and deal with negative emotions, people frequently turn to others to talk about their problems. Most people are more or less successful in comforting distressed friends and family members. This section explains how people provide social support in one-to-one situations where a support provider provides support to a support seeker (also called support recipient). We do not consider settings

involving multiple support providers and/or support seekers, settings in which the role of the support seeker and support provider (partially) overlap, or professional settings (i.e., psychotherapy).

This section is organized as follows. In Section 3.2.1, we specify the definition of social support used in this thesis. Next, social support is linked to cognitive appraisal theories of emotion (Section 3.2.2). Section 3.2.3 explains how topics for social support conversations can be derived from cognitive appraisal theories of emotions. Sections 3.2.4 and 3.2.5 subsequently present techniques people use to provide social support, and the contents and structure of social support conversations. Finally, the role of expressing emotions and empathy in social support conversations is discussed (Section 3.2.6).

3.2.1 Social Support Is Understood to Mean Comforting

Generally, social support refers to tangible and intangible assistance people receive from others. A large number of definitions is used in both research and practice which focus on different aspects of support, including [103]:

- Types of support (e.g., "information leading a person to believe that he is cared for and loved, esteemed and valued, and that he belongs to a network of communication and mutual obligation" [54]),
- Recipients' perceptions of support (e.g., "the extent to which an individual believes that his/her needs for support, information and feedback are fulfilled" [173]),
- Intentions or behaviors of support providers (e.g., "an exchange of between two individuals perceived by the provider or the recipient to be intended to enhance the well-being of the recipient" [186]), and
- Social networks (e.g., "support accessible to an individual through social ties to other individuals, groups, and the larger community" [139]).

In this thesis, social support is defined as *verbal and nonverbal forms of behavior intended to alleviate the emotional distress of another person* [41]. This definition refers to comforting, which can be considered a subset of social support behavior in general [41]. In this thesis, the term social support is used interchangeably with comforting. Following Burleson and Goldsmith, we only consider social support in non-therapeutic settings (i.e., between laypersons), and focus on dealing with relatively minor emotional distress, rather than sorting out severe emotional problems [41]. Also, we assume that the emotional distress was caused by cyberbullying.

3.2.2 Social Support as Conversationally Induced Reappraisal

Burleson and Goldsmith use Lazarus' cognitive appraisal theory of emotions to explain how the process of comforting works [41]. As explained in Section 3.1.2, negative emotions arise when an individual appraises his current situation as relevant to, and incongruent with his goals [131]. After observing emotions are elicited

by appraisals of situations and not by the situations themselves, Burleson and Goldsmith conclude "the only way a distressed emotional state can be altered is through an individual changing the appraisals that underlie and constitute the emotional distress" [41, p. 258]. They contend that a support provider can facilitate these reappraisals by encouraging the support seeker to explore and clarify thoughts and feelings that are relevant to the stressful situation. This may trigger reappraisals, as a result of which the support seeker may change his goals, views of the situation, and/or coping efforts, which, in turn, may lead to positive emotional change.

3.2.3 Topics in Social Support Conversations

As explained in Section 3.2.2, support providers can reduce negative emotions and induce positive ones by encouraging support seekers to talk about their negative emotions [41]. However, what exactly should support providers discuss with support seekers? Burleson and Goldsmith provide an answer to this question by deriving a set of topics for supportive conversations from cognitive appraisal theories of emotions. These topics are listed in Figure 3.1. First, the conversation should focus on getting a fuller appreciation of the support seeker's emotional state, the reasons for its occurrence, and an assessment of its appropriateness. When the support seeker's emotional state is sufficiently understood, Burleson and Goldsmith suggest to move on to discussing the current coping strategy and assess its effectiveness. Finally, if the current coping strategy does not seem to solve the problem, alternative coping strategies can be explored [41].

3.2.4 Types of Social Support

People use different techniques to provide social support. Many researchers have constructed typologies of these techniques, see for example [16, 59, 83, 98, 185]. Braithwaite et al.'s typology of social support is based on the one by Cutrona and Suhr; it was modified to cover support in online settings. In this thesis, Braithwaite et al.'s typology is adopted. This typology consist of five main support categories that break down in multiple subcategories [34]:

- Information support: messages that convey instructions (includes advice, referral to experts, situation appraisal, and teaching),
- Tangible assistance: offers to take concrete, physical action in support of the recipient (includes loans, perform task, active participation, and express willingness to help),
- Network support: messages that appear to broaden the recipient's social network (includes provision of access to new companions, emphasizing the presence of listeners, and encouraging the use of someone's support network),
- Esteem support: messages that validate the recipient's self-concept, importance, competence, and rights as a person (includes compliments, validation, and relief from blame), and

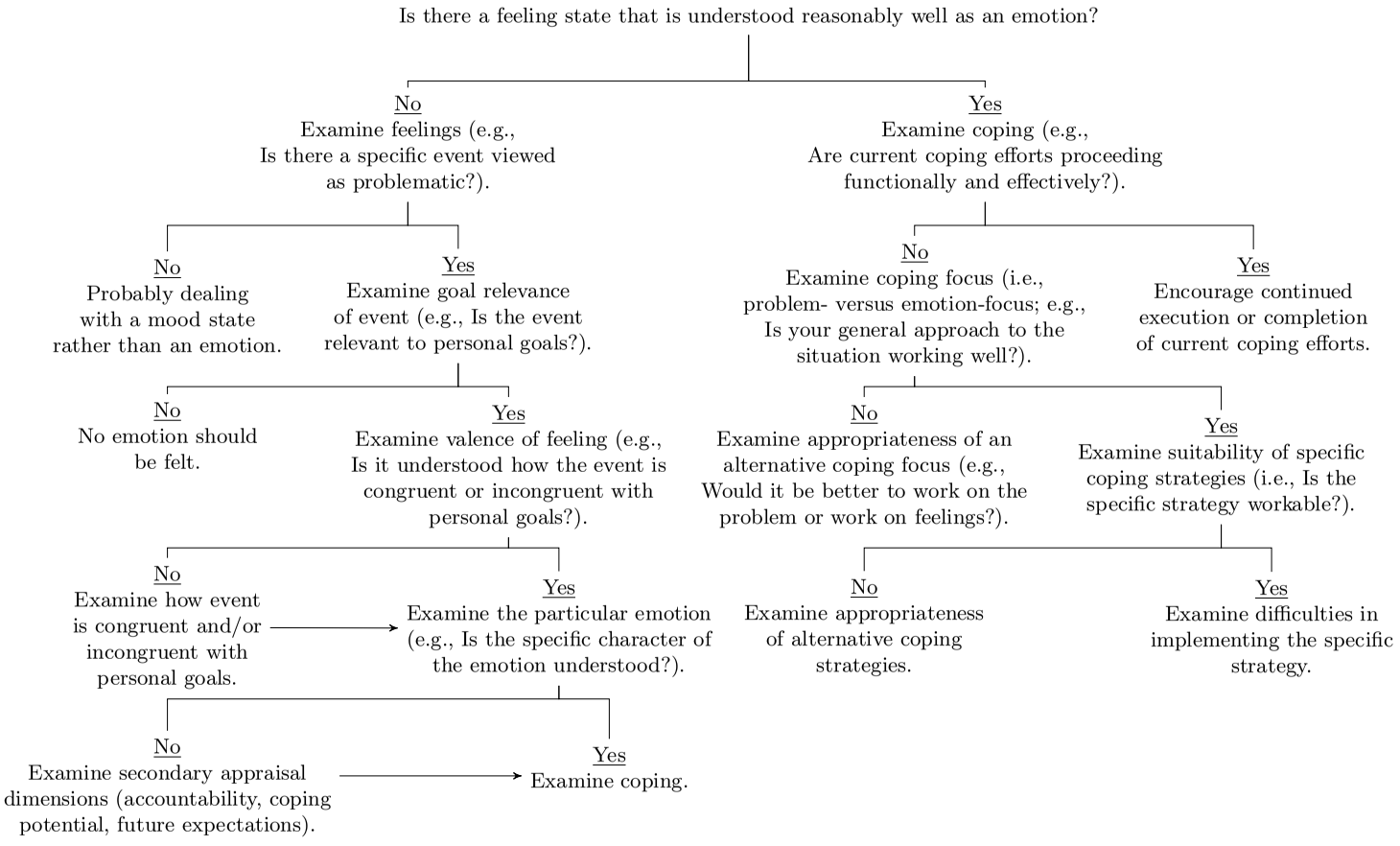


Figure 3.1: Potential topics in supportive conversations derived from appraisal theory (taken from [41]).

- Emotional support: attempts by the sender to express empathy, support the emotional expressions of the recipient or reciprocate emotion (stressing the importance of love and relationships, physical affection (e.g., hugs), confidentiality, sympathy, understanding, encouragement, and prayer).

The topology shows that many types of social support consist of verbal messages support providers communicate to support seekers. It also shows that conveying emotional support involves the expression of emotions. In Section 3.2.6 the role of expressing emotions and empathy is further discussed. Research shows that variations in types of support can be used to predict conversation quality; conversations with more variation in social support types receive higher quality ratings [78].

3.2.5 The 5-Phase Model

In Section 3.2.3, we clarified the contents of social support conversations. This section addresses the structure of these conversations. The 5-phase model was developed as a methodology to structure counseling conversations via telephone and chat by *De Kindertelefoon*[1], a Dutch helpline for children and adolescents between the ages of 8 and 18.

The 5-phase model specifies that the phases of a conversation are [21]:

1. Warm welcome: the support provider connects with the support seeker and invites him to explain what he wants to talk about
2. Gather information: the support provider asks questions to try to establish the problem of the support seeker
3. Determine the objective of the session: the support provider and the support seeker determine the goal of the conversation (e.g., to tell my story, or to get tips on how to deal with bullying)
4. Work out the objective: the support provider stimulates the support seeker to come up with a solution
5. Round off: the support provider actively rounds off the conversation

In the Netherlands, a number of organizations use the 5-phase model to provide support to children and adolescents. The provision of support is informal and short-term (i.e., typically limited to a single telephone call or chat conversation); generally, support is provided by trained volunteers. Structuring conversations according to the 5-phase model helps support providers to monitor the course of conversations, and encourages support seekers to actively engage with their problems, instead of remaining stuck in them. Research shows that support seekers effectively feel supported when conversations are structured according to the 5-phase model [79]; this is true for both telephone calls and chat conversations.

[1] http://www.kindertelefoon.nl/

3.2.6 The Role of Emotions and Empathy in Social Support Conversations

This section discusses the role of expressing emotions and empathy in social support conversations. In particular, we focus on expression of emotions and/or empathy by support providers, and only consider emotions that are expressed in order to reduce the negative emotions experienced by support seekers, or to induce positive ones[2]. Empathy can be defined as "the capacity to (a) be affected by and share the emotional state of another, (b) assess the reasons for the other's state, and (c) identify with the other, adopting his or her perspective" [206, p. 281]. In other word, empathy involves sharing of the support seeker's negative emotions by the support provider. Subsequently, empathic sharing of emotions can trigger supportive behaviors [71].

As indicated by the description of emotional support in Braithwaite et al.'s typology of social support, support providers can provide support by expressing emotions (see Section 3.2.4). One category of nonverbal responses used to provide social support is 'showing an emotional reaction through one's face', which refers to behavior such as showing empathy, or looking concerned or sad [69]. Support providers also display positive nonverbal behavior, such as smiling, eye contact, and orienting the body towards the support seeker [109]. Research shows that emotional support or empathic responses in particular appear to be helpful to support seekers [40, 41].

3.3 Introduction to Embodied Conversational Agents

In this section, we provide an introduction to embodied conversational agents. As mentioned in the introduction of this thesis, an embodied conversational agent (ECA) is a virtual character that interacts with users based on the principles of human face-to-face conversation [47]. In this thesis, physical characters (i.e., robots) that simulate (aspects of) human communication are also considered ECAs. ECAs appear in different conversational settings, that focus on different aspects of communication between ECAs and users. In Section 3.3.1, we discuss different conversational settings in which ECAs appear. In Section 3.3.2, we introduce theories that explain users' social responses to ECAs. Because the expression of emotions and empathy is important for ECAs that provide social support (see Section 3.2.6), Section 3.3.3 discusses emotional and empathic ECAs. Section 3.3.4 presents our conclusions.

[2]There are other emotions that support providers may experience; for example, he may feel threatened if the support seeker's problem seems insoluble [17]. These kinds of emotions, and their impact support provided are beyond the scope of our discussion.

3.3.1 Conversational Settings

ECAs are used in a variety of forms or conversational settings. Four conversational settings can be distinguished: TV-style presenters, virtual dialogue partners, virtual role-plays, and multi-party conversations [7]. These conversational settings can be characterized based on the degree of user interaction and the number of agents and users involved. In order to provide a general overview of the types of systems that are considered to be embodied conversational agents, we will discuss the different conversational settings, and illustrate each setting with notable examples of ECA systems. There is some overlap between some of the conversational settings. ECA systems are discussed in the setting where we consider them to be most relevant.

TV-style Presenters

The first conversational setting is the TV-style presenter. In this case, there is a single agent that presents information to one or more users. Information is presented in spoken or written natural language, possibly accompanied with gestures and/or facial expressions. There is no interaction between the agent and the user; the agent delivers a monologue. Examples of TV-style presenters include the virtual human presenter [159] and DFKI's PPP persona [9]. The virtual human presenter presents information to users based on an input script that consists of the text to be pronounced by the agent and commands that describe gestures, and other nonverbal behavior to be displayed during the presentation [159]. DFKI's PPP persona is another presenter agent that uses generated speech, pointing gestures, and facial expressions to present information to the user [9].

Virtual Dialogue Partners

The conversational setting of virtual dialogue partners involves emulating one-on-one conversations between a user and an ECA. Challenges posed in this setting include simulating turn-taking behavior, dealing with input errors, generating realistic nonverbal behavior (body posture, gaze, gestures, and facial expressions), and synchronizing multi-modal input and output.

An example of a virtual dialogue partner is REA, an ECA that acts as a real-estate agent [45]. REA actively manages conversations with users (e.g., she is able to handle interruptions by the user, displays listening behavior, and asks clarifying questions if she does not understand what the user is saying) [46], and uses small talk to make users feel comfortable before asking questions about sensitive topics such as money [23]. Max is a virtual dialogue partner that assists the user in performing Virtual Reality construction tasks (e.g., constructing a propellor from virtual building blocks) [118]. During conversations, Max uses a wide range of gestures, directs eye gaze, and changes facial expressions. Kenny et al. created Justine, a virtual patient that displays symptoms of Post Traumatic Stress Disorder (PTSD) [110]. Justine was developed as a training application for clinicians to learn how

to diagnose PTSD. During conversations, Justine generates verbal and nonverbal responses designed to elicit domain relevant questions from the user.

Virtual Role-Plays

In virtual role-plays, multiple ECAs converse with each other while displaying human-like conversational behavior. The role of the user varies; there are virtual role-plays in which the user only observes the interaction between agents and there are virtual role-plays in which the user can participate. Virtual role-plays without user interaction have been inspired by TV commercials as a means for information presentation [8]. André and colleagues implemented a prototype for generating sales dialogues between a virtual car salesman and buyer agents [8]. Conversations between the agents vary based on parameters, including the agents' personality traits, and preferences for specific aspects of cars. Another virtual role-play system without user interaction is the Agneta and Frida system [94]. Agneta and Frida are two 2D cartoon-style animated characters that watch the browser as if it were a TV. When the user visits a website or performs certain actions with the mouse, Agneta and Frida make humorous comments.

FearNot! is an example of a virtual role-play with user interaction [163]. As mentioned in Section 2.3.7, Fearnot! is an Intelligent Virtual Environment (IVE), where ECAs act out bullying scenarios. Users witness the events from a third-person perspective. Between bullying episodes, the victimized ECA turns to the user to ask for advice. By suggesting actions, the user affects its behavior, and, subsequently, what happens in the next episode. In ORIENT, an interactive virtual role-playing game designed to enhance the intercultural sensitivity of teenagers, the user has a more prominent role [124, 125]. In the game, users interact directly with ECAs that represent members from an alien race. The goal of the game is to overcome cultural differences, and help the aliens to save their planet.

Multi-party Conversations

In case of multi-party conversations, one or more virtual agents interact with one or more users. An exception is the case where one virtual agent interacts with one user; this is the virtual dialogue partner setting discussed previously in this section. Multi-party conversations can be distinguished from virtual role-playing systems by a focus on addressing specific challenges raised by the need to coordinate actions between agents and human users, such as turn taking in conversations with more than two conversation partners, recognizing which conversation partners are addressed by the person or agent that is speaking, and generating appropriate nonverbal behavior when addressing more than one listener.

In the context of the Mission Rehearsal Exercise project, Traum and Rickel developed a dialogue system that is capable of generating multi-party dialogues both between multiple ECAs, and between multiple ECAs and a human user [201]. Another example of multi-party ECAs are museum guides Ada and Grace [196, 200].

Ada and Grace are a pair of life-sized, photo-realistic characters that are capable of natural language interaction, and nonverbal communication. They interact with museum visitors, museum staff, and each other in order to create an engaging experience. Furhat is spoken dialogue system for multi-party conversations that consists of a human-like, back-projected robot head that renders accurate facial movements in real-time [3]. The 3D display enables Furhat to direct its gaze more accurately, thereby making it easier to establish exclusive mutual gaze, which in turn, facilitates turn-taking behavior [4]. This allows for a more natural interaction between the ECA and multiple human users.

3.3.2 Explaining Social Responses to ECAs

Empirical studies on interactions between users and ECAs show that users exhibit the same social responses that are observed in human-human interaction. For example, use personalized speech to address ECAs (i.e., address ECAs as if they are people) [121], apply politeness strategies [117], report increased anxiety and perform worse when being watched by an animated character that appears to be monitoring their actions when completing a complex task [177], and exhibit socially desirable behavior [123]. To explain social responses towards ECAs and other non-human entities different theories have been put forward. Two influential theories are the 'Computers Are Social Actors' (CASA) paradigm by Nass and colleagues [155, 175] and the Threshold Model of Social Influence by Blascovich and colleagues [29, 30].

The 'Computers Are Social Actors' (CASA) Paradigm

The CASA paradigm (later referred to as Ethopoeia [151, 154]) states that people apply social rules from human-human interaction to computers that provide social cues during interaction [155, 175]. These cues trigger behavioral scripts that are executed without checking whether the behavior is appropriate in the current situation. To establish this theory Nass and colleagues replicated well-known experiments from Social Psychology that were used to derive the rules of human-human interaction. Instead of interacting with a real person, participants in Nass and colleagues' experiments interacted with computers that provided social cues. The social cues consisted either of textual messages on the computer screen or pre-recorded verbal messages. Nass et al. found that people are polite to computers [152], reciprocate a computer's helpful behavior [76], and apply gender stereotypes [153].

Nass and colleagues claim that social responses to computers occur without thinking and support this by ruling out alternative explanations for participants' behavior during the experiments [151]. An alternative explanation is that people believe that computers warrant human treatment. However, since participants were adult, experienced computer users, and because they explicitly denied they would act socially towards computers even if their behavior shows otherwise, Nass and Moon rule out this alternative explanation of their results [151]. Another alternative

explanation is that people do not respond socially to a computer, but to a person 'behind' the computer (typically a programmer). However, Nass and Sundar performed experiments that disproved this explanation [195]. A third alternative explanation is that participants responded socially, because they figured out that was what the experimenters wanted. However, in many of the experiments, the social cues were very simple, which made it hard to figure out the goal of the experiments. Additionally, debriefing interviews with participants showed they were unaware of their social responses.

The Treshold Model of Social Influence

The Threshold Model of Social Influence claims that people's social responses to virtual characters depend on two factors: agency (i.e., whether the user believes the virtual character is controlled by a person or by a computer program), and behavior realism [29, 30]. The theory predicts that people respond socially to autonomous virtual agents only if the behavior of these agents has a sufficient level of realism. In other words, there is a threshold that needs to be crossed before people show social responses to autonomous virtual agents. This threshold does not exist if someone knows that a virtual character is controlled by a person. In this case, the person observing the virtual character will respond socially even if the behavior of the virtual character is not realistic. There are results indicating that agency affects people's social responses [86, 99]. Additionally, there is evidence that more realistic behavior triggers a greater social response [14, 15, 174].

3.3.3 Emotional and Empathic ECAs

The goal of the work presented in this thesis is to understand how ECAs can provide social support by developing a virtual buddy ECA for cyberbullying victims. As shown in Section 3.2, the expression of emotions by support providers is important for conveying support. In addition to their role communication, emotions also affect processes such as problem solving, rational decision making, perception, and learning [61, 168]. Awareness of the importance of emotions inspired efforts to equip computers with the capacity to detect, understand, and influence users' emotions [168]. One branch of research on affective computing concerns equipping ECAs with emotional and empathic capacities.

This section provide an introduction to emotional and empathic ECAs. As mentioned before, two functions of emotions in ECAs can be distinguished; to mediate cognitive processes, and to facilitate social interaction. These two functions are discussed next. Emotions in ECAs are often generated by emotion models. This section also explains the OCC model, one of the standard models for computerized emotion. The OCC model provides a specification of cognitive appraisal theory of emotions. As mentioned in Section 3.1, cognitive appraisal theory is one of the emotion theories used in the virtual buddy prototype. Subsequently, we discuss FAtiMA, an agent architecture that implements the OCC model. The emotion model

of the virtual buddy prototype is based on the implementation of the OCC model in FAtiMA (see Section 5.4.3). Empirical results for emotional and empathic ECAs are presented in Section 3.4.

The Functions of Emotions in ECAs

As for humans, two functions of emotions for ECAs can be distinguished: to mediate cognitive processes (intra-ECA), and to facilitate social interaction (inter-ECA) [85]. Although in humans these two functions are intertwined, in ECAs it is relatively easy to distinguish between the two. In this section we focus on ECAs. An important cognitive function of emotions is action selection. An ECA can be equipped with an emotion model that determines what action should be selected for execution (see also the discussion of the OCC model and agent architecture FAtiMA below). This process is usually modeled as a simulation; the goal is to have an ECA 'experience' emotions in a psychologically plausible way and adapt its actions accordingly.

Social functions of emotions include communication of a mental state and social manipulation. Emotional states can be communicated verbally and nonverbally. Communication of emotional states helps the user understand an ECA's behavior. Also, ECAs can express emotions strategically to achieve certain effects in users. In Section 3.3.2, we cited studies demonstrating that people socially respond to social cues emitted by ECAs (and other computational systems). Therefore, by strategically communicating emotions, ECAs can trigger certain behaviors in humans. Although the term 'social manipulation' has a negative connotation, it can also be used in a positive way, for example to improve adherence to diets or exercise programs.

Cognitive Appraisal Theories Revisited: the OCC Model

Cognitive theories of emotions provide a clear causality of how emotions arise. This causality is convenient from a computer science perspective, because it provides a foundation for implementing emotional models. The OCC model of emotions provides a formalization of cognitive appraisal theories [161] and has become one of the standard models of computerized emotion. Several implementations of OCC exist, for instance FAtiMA [65], and PLEIAD [1]. Figure 3.2 shows a graphical representation of the OCC model. In OCC, emotions are conceptualized as valenced reactions to events, agents, and objects. OCC distinguishes 22 emotion types in 6 groups (well-being, fortunes of others, prospect-based, attribution, attraction and well-being/attribution compounds).

The OCC model specifies eliciting conditions for each of the 22 emotion types. As shown in Figure 3.2, consequences of events are appraised with regard to the desirableness of the event (which is evaluated with respect to an individual's goals); actions of agents are appraised with regard to the praiseworthiness of an action (which is evaluated with respect to an individual's standards); and aspects of ob-

jects are appraised with regard to their appealingness (which is evaluated with respect to an individual's attitudes). For example, the well-being emotion joy is elicited when an individual is pleased about a desirable event.

The intensity of the emotion that is elicited depends on the value of different variables, all of which are available in the construal of the situation that gives rise to the emotion. For example, for the prospect-based emotions (such as hope and fear) these variables include the likelihood of the event, the effort and the realization. Whether an individual actually feels an emotion type depends on the individual's threshold for this emotion, which is considered a personality trait.

FAtiMA, an Implementation of the OCC Model

FAtiMA (Fearnot! Affective Mind Architecture) is a domain-independent agent architecture that implements the OCC model of emotions [65]. It was developed to generate believable behavior of agents in Fearnot!, a virtual role-playing system in which virtual agents act out bullying scenarios (see Section 2.3.7 and 3.3.1). FAtiMA agents have goals and perform actions to achieve those goals. Additionally, agents have emotional reaction rules, action tendencies, emotional thresholds and emotion decay rates.

An agent's emotional state is updated based on the appraisal of events, actions and objects in the current scenario. All OCC emotion types, except prospect based emotions, are generated by emotional reaction rules. Emotional thresholds and decay rates for each of the 22 OCC emotion types specify which emotions are felt by the agent and the duration for which emotions remain active in the agent's emotional state.

Actions are selected based on the outcome of appraisal and coping. After all current events, actions and objects have been appraised, FAtiMA's reactive layer determines the agent's immediate responses to its current emotional state. The deliberative layer maintains the agent's active goals and develops plans to achieve those goals. During planning, prospect-based emotions hope and fear are generated, which may trigger problem-focused or emotion-focused coping strategies. These coping strategies may cause the agent to drop certain goals and/or to change its plans.

3.3.4 Conclusion of the Introduction to Embodied Conversational Agents

This section provided an introduction to embodied conversational agents. We have shown that ECA systems can be quite diverse, and systems created for different conversational settings focus on different aspects of communication between ECAs and/or between ECAs and users. Research shows that people respond socially to ECAs that provide social cues. According to the theories explaining these social responses that were discussed in this section, providing the right social cues is essential to elicit these social responses. From this perspective, providing social

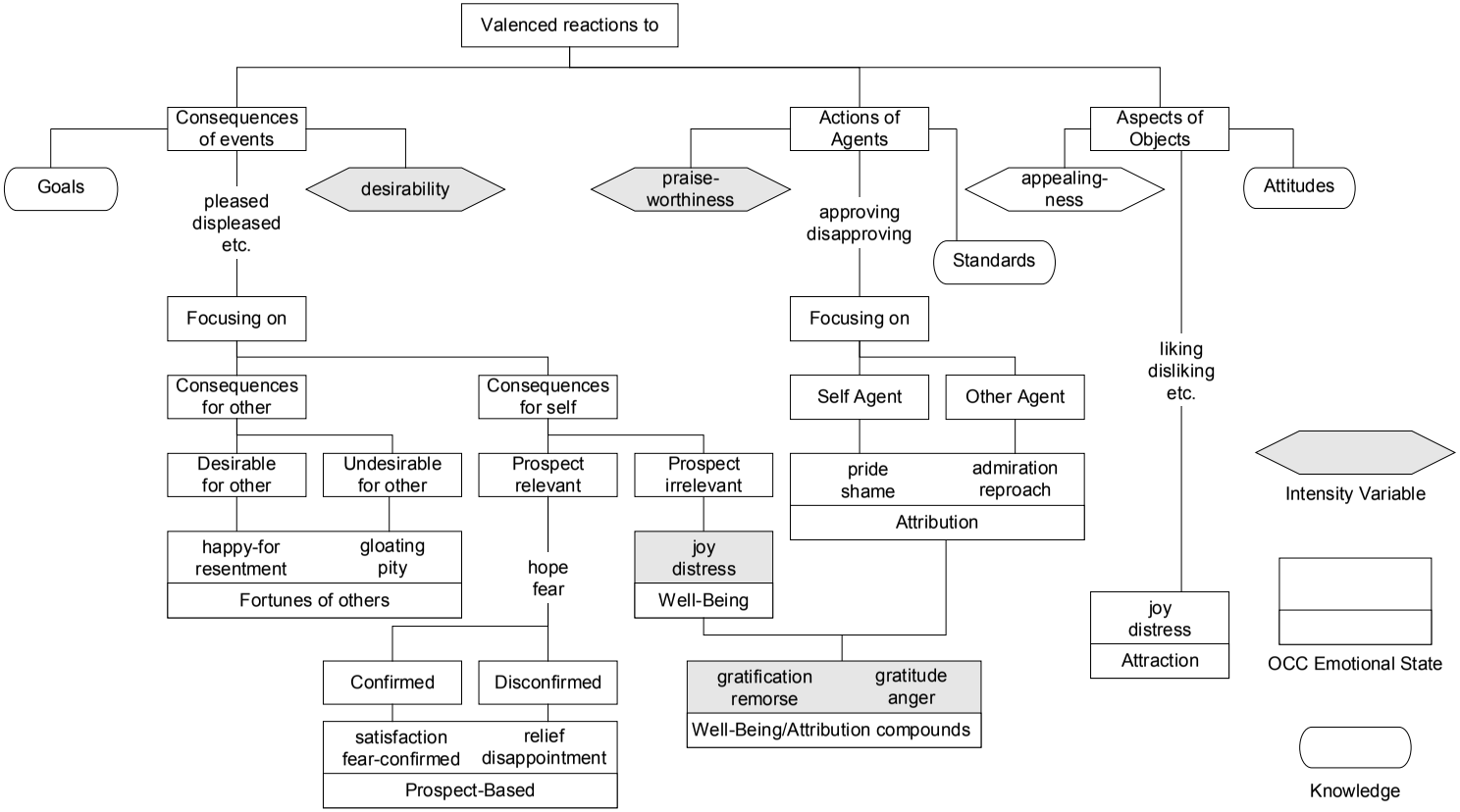


Figure 3.2: Potential topics in supportive conversations derived from appraisal theory (taken from [18]).

support to cyberbullying victims can be treated as exhibiting the right social cues. Because expressing emotions are important social cues for conveying support (see Section 3.2.6), this section also discussed emotional and empathic ECAs. ECAs can use emotions to mediate cognitive processes, and to facilitate social interaction. The influential OCC model of emotion, and the implementation of this theory in agent architecture FAtiMA provide the foundation for the virtual buddy's emotion model (see Section 5.4.3). In Section 3.4, we explore the potential of emotional and empathic ECAs to provide social support.

3.4 The Potential of ECAs to Provide Social Support

The previous section provided an introduction to ECAs. In this section, we focus on a specific aspect of an ECA's behavior, that is its potential to provide social support. In Section 3.2.1, social support was defined as 'verbal and nonverbal forms of behavior intended to alleviate the emotional distress of another person' [41]. We operationalize this definition as reducing a user's negative emotions and/or inducing positive ones. In order to gain insight into the methods used by ECAs to provide support to users, this sections reviews related work on ECAs that reduce users' negative emotions and/or induce positive ones. As mentioned in Section 3.2, a social support conversation refers to a one-on-one conversational setting. Therefore, the review of related work only considers virtual dialogue partners (see Section 3.3.1). Additionally, the review is not exhaustive, but provides a detailed discussion of a number of influential ECA systems.

ECA systems are discussed according to our analysis of social support by humans (Section 3.2). For every ECA discussed, we examine structure and contents of interactions between the ECA and the user, support types or strategies the ECA uses, and the use of emotional expressions (e.g., verbally or nonverbally). In case user studies have been conducted, we also report the effects found on users' perceptions, attitudes, and/or behavior. The review is divided into four parts; the first three parts consider different types of ECA systems: pedagogical agents in Section 3.4.1, coaching ECAs in Section 3.4.2, and companion agents in Section 3.4.3. ECAs discussed in these sections typically are attempts to create complete ECA systems. Section 3.4.4 contains a discussion of studies conducted with simpler agents to investigate effects of expressing empathy. Section 3.4.5 presents our conclusions.

3.4.1 Pedagogical Agents

Pedagogical agents are ECAs that foster learning in interactive learning environments. Such assistants can take on different roles; for example, they can act as a tutors, or learning companions. Recently, attention for pedagogical agents was extended from a focus on cognitive learning outcomes (e.g., increasing performance on tests) to include motivational and emotional effects [122]. This section discusses a number of studies featuring pedagogical agents that do not only provide users

with cognitive feedback, but take into account motivational and affective aspects as well.

Affect-Sensitive AutoTutor

AutoTutor is a pedagogical agent that teaches students physics, computer literacy, and critical thinking by engaging them in dialogue [84]. Dialogues are organized around problems that students have to solve. After a student provides a first, tentative answer to the current question, AutoTutor actively and adaptively helps the student to improve his answer by providing feedback, requesting more information, giving hints, correcting misconceptions, answering questions, and summarizing topics.

Recently, AutoTutor was extended with capabilities to detect and respond to boredom, frustration, and confusion [66]. Affect-Sensitive AutoTutor is represented by a 3D animated character of which the head and shoulders are visible. The affective AutoTutor monitors the user's facial expressions, body language, and conversational cues in order to detect boredom, frustration, confusion, and the neutral emotional state. Dynamic assessments of the student's cognitive and affective state were mapped onto appropriate tutor responses using production rules.

Strategies employed to motivate students are short feedback, emotional or motivational feedback, emotionally expressive facial display, and emotionally modulated speech. Short feedback consists of a verbal approval or disapproval message. After delivering feedback, the affective AutoTutor addresses the student's emotional state if it senses that the student is bored, confused, or frustrated. Supportive messages are always uttered with an appropriate facial expression, emotionally expressive synthesized speech.

The affective AutoTutor was compared to the regular AutoTutor [67]. 84 participants were randomly assigned to interact with either the regular or affective AutoTutor. In two training sessions, participants used AutoTutor to learn about two computer literacy topics. Computer literacy knowledge was tested before and after the two training sessions. The results show that affective AutoTutor was more effective than the regular AutoTutor for students with low-domain knowledge in the second training session, but not in the first. And students with more domain knowledge did not benefit from affective support. The authors conclude that not all students need affective support and that affective support should only be given to students that need it, when they need it.

Wayang Outpost

Wayang Outpost is an intelligent tutoring system that teaches students between the ages of 14 and 16 to solve math problems. [11]. The system presents students with a sequence of multiple choice geometry problems, and features a virtual learning companion that provides both cognitive help as well as a wide range of affective support. While cognitive help is provided at the student's request, affective sup-

port is provided autonomously, based on a model of the student's effort invested in solving the current problem. The learning companion is a 2D human-like character, that displays verbal and nonverbal behavior. It uses attribution interventions to teach students that failure is the result of a lack of effort rather than a lack of ability. Attribution interventions are started occasionally when a student starts a new problem. Another type of interventions used by the learning companion are effort-affirmation interventions that acknowledge effort after students correctly solved a problem. A third type of interventions used are strategic interventions. These interventions aim to motivate students by improving their problem solving skills.

A user study was conducted to assess the impact of the learning companions on cognitive and affective outcomes. A total of 108 students used Wayang Outpost during their regular mathematics lessons for three consecutive days. Two-thirds of the participants used the system with either a male or female learning companion, and one-third worked without a companion present. Participants completed pre- and post-test questionnaires measuring math ability and general attitude towards mathematics. The results show that interacting with a learning companions improved affective learning outcomes; participants who interacted with a learning companion reported significantly less frustration and significant improvements in confidence compared to participants that used the tutoring system without a learning companion. There were no statistically significant differences for cognitive learning outcomes.

Towers of Hanoi Pedagogical Agent

Burleson and Picard's affective pedagogical agent helps children solve the Towers of Hanoi problem [42]. The agent is embodied by an abstract 3D human-like representation, that is projected on a large screen. Users are monitored with an array of real-time sensors, including a facial expression camera, skin conductance sensor, and posture chair. The agents nonbehaviors include nodding, fidgeting the mouth, shifting it posture, changing its color, and slightly fidgeting its body. In addition, it is capable of speech. Users use predefined response options to communicate with the agent.

Interaction between the user and the agent was structured as follows. The agent starts by introducing itself. Next, it presented a slide show that helps children understand their brains can be trained to solve difficult problems. After that, the agent explains the Towers of Hanoi problem. It also states that the user can ask the agent for help. After the user tries solving the problem for four minutes, the agent intervenes with either an affect-support intervention dialogue, during which the agent employs active listening techniques, and tells the user his brains can be trained like a muscle, or a task support intervention, during which the agent only provides task support. After the intervention, the agent tells the user it has to leave, and that he is allowed to continue working on the Towers of Hanoi problem for as long as he likes. Finally, the agent leaves the screen. During the interaction, the agent mirrors the user's nonverbal behavior as obtained through sensors.

To evaluate the agent's effectiveness, an experiment was conducted [43]. Two independent variables were manipulated: 1) either the agent mirrored the user's nonverbal behavior or used prerecorded nonverbal behavior, and 2) either the agent used the affect support intervention, or a task support intervention. The four experimental conditions were: 1) the agent used the affect support intervention and mirrored the user's nonverbal behavior; 2) the agent used a task support intervention and mirrored the user's nonverbal behavior; 3) the agent used the affect support intervention and prerecorded nonverbal behavior; and 4) the agent used the task support intervention and prerecorded nonverbal behavior. A total of 76 children between the ages of 11 and 13 years old participated in the experiment.

The results show there were no statistical significant differences between conditions for participants' frustration level, perseverance, intrinsic motivation, and learning ability. Upon further analysis of the results, Burleson and Picard found evidence for several gender differences. Boys were significantly more positive about the task support agent than about the affect support agent. In contrast, girls were more positive about the affect support agent than about the task support agent. Girls also reported lower frustration level when interacting with the affect support agent that used nonverbal mirroring compared to girls that interacted with the affect support agent that used prerecorded nonverbal behavior, or girls that interacted with the task support agent that used nonverbal mirroring. For boys a similar effect was found.

Conclusion Pedagogical Agents

Pedagocial agents help users to perform learning tasks. The contents and structure of conversations between pedagogical agents and users are based on these learning tasks. All pedagogical agents discussed in this section provide users with both task-based and affective support. The agents use various techniques to provide affective support. These techniques involve verbal and nonverbal expression of emotions. Studies investigating the pedagogical agents' affective strategies indicate that users' negative emotions can be reduced by providing affective support.

3.4.2 Coaches: ECAs for Behavioral Change

Coaching agents are ECAs that help users change their behavior, such as attaining a healthy lifestyle, or to quit smoking. To achieve the beneficial outcomes coaching ECAs aim for, they need advanced social skills. In this section, we discuss a number of coaching ECAs that express emotions in order to motivate users.

Virtual Exercise Coach Laura

Bickmore and Picard created virtual exercise coach Laura that guided users through a behavior change program aimed at increasing their physical activity levels [25]. In order to achieve this goal, Laura tried to build a relationship with the user by applying a wide variety of relationship building and empathic behavior. The agent's

embodiment is a 2D animated character of which the torso with arms and head are displayed. Laura gestures to the user and shows different facial expressions. Additionally, the camera zooms in and out on Laura's face, to give the users a sense of proximity. Laura builds a relationship with the users based on a fixed trajectory of relationship change in 30 scripted conversations. During interactions with the user, Laura uses different strategies, including social dialogue, empathic dialogue, meta-relational communication, humor, continuity behavior (e.g., referring to the next conversation), politeness strategies, addressing the user as a friend, and high immediacy nonverbal behavior (e.g., using more nonverbal behavior, and zooming in on Laura's face).

In an experiment, the physical activity of three groups of participants (control, relational and non-relational) was monitored. A total of 101 participants, who were mostly university students, were randomly assigned to one of the three conditions. Participants in the relational and non-relational conditions interacted with Laura. Laura either used relational strategies, or not. Participants in the experimental conditions had daily 10 minute conversations with Laura on their home computers over the course of 30 days. Participants in the control conditions were asked to report their physical activity daily, and had access to educational content on exercise. The relationship between Laura and the user was assessed using the Working Alliance Inventory (WAI) [97]. Participants were asked to complete the WAI on day 7 and day 27 of the experiment.

The results show that a lasting change in exercising behavior did not occur. Nevertheless, the relational agent was rated more positively than the non-relational agent. Also, participants in the relational condition reported that they would like to continue working with Laura significantly more often than participants in the non-relational condition. On the bond subscale of the WAI were some statistically significant differences between the relational and the non-relational groups. The bond subscale concerns assesses the emotional bond between coach and protégé, and includes questions that specifically address the protégé's feeling cared for. The results show that participants in the relational condition felt significantly more cared for than participants in the non-relational condition [26].

Affective Nutritional Coach

Creed and Beale developed an affective nutritional coach called Rachael [58]. The agent's embodiment consists of a 3D realistically looking female talking head that is capable of expressing different emotional facial expressions. Additionally, she uses her voice to express emotions. Conversations are modeled after intake interviews conducted by health professionals [101], and their contents were based on work by Bickmore [22] and other sources.

The conversation starts with an introduction during which Rachael uses small talk. After that, she explains her role and that of the user. Next, she asks the user about his eating behavior and current diet. Subsequently, she moves on to discuss the pros and cons of the user's current diet, and the pros and cons of changing diet.

After that, Rachael provides information on what makes up a healthy diet and gives the user practical tips to improve his diet. Finally, she tries to get a commitment from the user when he will start to improve his diet, and closes the conversation.

At the start and end of the conversation, and during social talk Rachael expresses happy and warm emotions, both by showing an appropriate facial expression and by adapting the speech rate, pitch average, and pitch range. When Rachael provides information, she uses a neutral facial expression and voice. Concern is expressed when the agent is empathic towards the user. Transitions between different facial expressions are smoothed by displaying intermediary expressions when changing from one to the other. Rachael's verbal messages were all prerecorded. The user communicates with the agent by selecting predefined response options.

A study was conducted to evaluate the impact of expressions of emotions on users' perceptions of the agent, and the extent to which users feel positive and supported after interacting with Rachael. The affective agent was compared to a neutral agent that displayed a neutral facial expression and used a neutral voice during the entire conversation. The structure and contents of the conversation were equivalent for both agents. 50 participants interacted with either the affective or the neutral agent. The results of the experiment show that participants liked the affective Rachael significantly more than the neutral agent. They also thought the affective agent was more caring. There were no significant differences for trustworthiness and perceived intelligence. Also, participants in both groups felt equally positive and supported after interacting with the agent.

Personal Lifestyle Assistant

Blanson et al. created an online lifestyle assistant that was incorporated in a lifestyle diary website [28]. On this website, users can create a personal lifestyle diary, keep track of personal goals regarding diary use, diet, and exercise, and find nutritional information about food. The goal of the assistant is to help users of the lifestyle diary achieve their goals by keeping them engaged. The assistant provides support to users by monitoring the user's personal goals, and giving cooperative feedback. The personal assistant is represented on the screen by the virtual iCat, an animated 3D character that resembles Philip's iCat robot [36].

Strategies used by the assistant are based on principles of the Motivational Interviewing method [148]. The lifestyle assistant expresses empathy by being mindful that the user may have other priorities, cheers and compliments the user when he achieves his goals, explores discrepancies between lifestyle goals and current lifestyle by pointing out goals that have not been achieved and suggesting how to improve, and support self-efficacy and optimism by remaining optimistic about achieving goals and emphasizing that it is acceptable to make mistakes. The virtual assistant is able to display three different facial expressions: neutral, happy, and sad. Whenever a user updates progress on his personal goals, the lifestyle assistant displays an appropriate facial expression (i.e., happy if the user achieved a goal, and sad if he did not achieve it), and provides verbal feedback by displaying a

supportive message.

The added value of the lifestyle assistant was assessed in a randomized controlled trail. 118 Dutch overweight adults participated in the study. Participants were instructed to use the lifestyle diary website for 4 weeks, and half of them were given access to the website without the personal assistant, while the other half used the website with assistant. During the four weeks, use of the website was logged, and at certain moments, participants were asked to complete questionnaires in order to gain information about their experience.

The results show that participants that used the website with assistant not only filled in their diary with significantly higher frequency and kept using the diary over a longer period of time than participants that used the website without assistant, but also achieved their daily goals significantly more often. Although self-reported motivation to fill in the diary significantly dropped for both groups of participants, motivation of participants using the diary with assistant dropped significantly less.

Additionally, both groups of participants reported significant decreases in BMI[3], but again participants that used the website with assistant reported significantly larger decreases. Finally, participants that used the website with the assistant found it significantly easier to use than participants that used the website without assistant. The questionnaires did not contain questions on to what extent participants felt supported by the website.

Conclusion Coaching ECAs

Coaching ECAs help users with behavior change. For coaching ECAs, the contents and structure of conversations with users evolve around the user's goals for changed behavior; the ECAs discussed in this section help users to increase exercize behavior, to get information on a healthy diet, and to manage their diet. The coaching ECAs use various verbal and nonverbal strategies employed by human coaches. The results of user studies indicate that users who interact with empathic coaching ECAs feel more cared for than users that interact with non-empathic coaching ECAs.

3.4.3 Companions

Companion ECAs are virtual dialogue partners that build a social relationship with users. Companions are designed to stay with users for longer time periods, and should therefore be able to engage them over multiple interactions. In order build a relationship, companion ECAs use social and emotional behavior, and relationship building strategies employed by humans, such as remembering names and user preferences, expressing empathy, observing etiquette, and using humor. The social relationship between companion ECAs and users call for social support skills. In

[3]Body Mass Index, a measure of how much a person's body weight differs from what is considered to be desirable.

this section, we discuss a number of companions that try to affect the emotional state of users.

Empathic Chess Companion

Leite et al. developed an empathic chess companion for children [132]. The chess companion has a physical embodiment (the iCat from Philips [36]), and is capable of showing different facial expressions and uttering verbal messages. In order to support long-term interaction, the chess companion uses an empathic model. The empathic model detects the user's current affective state and uses the valence of this affective state to appraise the current game situation, and to generate empathic responses (e.g., a facial expression). When the user is in a negative affective state (e.g., if he is losing the game), the chess companion uses supportive strategies to try to improve his affective state. Additionally, it remembers aspects of previous interactions with the user and uses this information to generate caring remarks (e.g., 'You are doing very well, in the 4 times we played together, you could beat me 3 times!').

The interaction starts by the chess companion inviting the user to play (first game only) or greeting the user and making a remark about the previous game(s). After every move played by the child, the chess companion provides feedback on the move by showing an empathic facial expression. If the user is in a negative emotional state (e.g., because it played a bad move), the iCat uses a social support strategy that consists of a verbal message that matches its nonverbal behavior. After the user's move the chess companion plays a move by asking the user to move one of its pieces. This sequence continues until the game ends. To close the interaction, the chess companion comments on the game result and/or the number of games the user was able to win so far.

During a game the chess companion uses the following support strategies: suggesting a move (advice), and explaining a bad move (teaching) (information support); playing a bad move (perform direct task), and reducing tension (e.g., by suggesting to restart the game) (tangible assistance); complimenting the user, validating the user, relieving the user from blame, and reassuring him (esteem support); and making remarks about its relationship with the user, expressing understanding, and encouraging the user (emotional support).

A study was conducted to asses to what extent users feel supported by the chess companion. For five consecutive weeks, 16 children between 8 and 9 years old weekly played a chess exercise against the chess companion. After the five weeks, perceived social support was measured. Perceived social support was defined as "the belief that, if the need arose, at least one person in the individual's circle would be available to serve one or more specific functions" [60]. The results show that the participants felt supported by the chess companion and that emotion-oriented support (i.e., esteem support and emotional support) was preferred over task-oriented support (i.e., information support and tangible support).

The 'How was your day' ECA

The 'How was your day' (HWYD) system, developed in the context of the COMPANIONS project[4], is a non task-oriented ECA that allows users to talk about their day at the office [49, 187]. The ECA has a virtual 3D anthropomorphic animated embodiment that uses multimodal input and output modalities. The ECA detects information about the user's emotional state from the sound of his voice and from the contents of his verbal messages. The ECA's verbal utterances are accompanied by nonverbal behavior, comprising affective Text-To-Speech, gestures, and facial expressions. The HWYD ECA tries to influence the user's attitudes as a part of a conversation on work related topics, such as office mergers, promotion and workloads. The ECA does not impose a structure on the conversation; one of the unique characteristics of this ECA is that the conversation is completely free (within the domain of working at an office).

The system alternates between employing clarification dialogue (i.e., asking questions to find out details) and generating appropriate affective responses to the information gathered. In addition to short sympathetic responses to the user's input, the system may start a 'comforting tirade', a longer utterance aimed at providing advice and support in order to encourage, comfort or warn the user. Comforting tirades are generated based on consequences for the user of the event under discussion the ECA has derived. Although the goal of the ECA is to influence user attitudes, we were unable to locate user studies that investigated the ECA's impact on their attitudes.

Engaging Toy for Children

Adam and Ye proposed an emotional dialogue module for an intelligent interactive toy aimed at engaging children [2]. To the best of our knowledge, this ECA has not been implemented or evaluated with children. The proposal contains no details on the content and structure of conversations between the toy and users. However, an example conversation is given during which a child's activities are discussed. The toy responds to the child's input and keeps the conversation going by asking questions.

According to the proposal, the toy will be able to help children cope with negative emotions. To reason about the child's emotions and to select appropriate emotional strategies, the toy will use PLEIAD, a formalization of the OCC model of emotions [1]. The toy's emotional strategies are expressing empathy, expressing its own emotions, asking the user about its emotions regarding the current subject (curiosity), and showing understanding by asking the user to confirm deduced emotions.

These emotional strategies will employed when children need help to cope with negative emotions. To this end, the following coping strategies will be used: emotional support by expressing empathy and understanding the user's emotion, using

[4]http://www.companions-project.org

common sense reasoning for positive reinterpretation of the situation causing the negative emotions, taking actions to do something about the situation causing negative emotions (problem-focused coping), encouraging the child to take action, and distract ing the child from the situation causing the negative emotions (emotion-focused coping).

The toy will have a physical embodiment. It is unknown how emotions will be expressed nonverbally, but the will at least be capable of expressing emotions verbally, as becomes apparent from the description of its emotional strategies. Because the toy has not been implemented yet, there are no results regarding the effects of the emotional strategies on users.

Conclusion Companion ECAs

Companion ECAs try to keep users engaged over multiple interactions by building a social relationship. The contents and structure of conversations between the companions discussed in this section and users either follow the user's task (chess companion) or are freer (HWYD companion and engaging toy). Companion ECAs use different strategies involving the verbal and nonverbal expression of emotions. One of the companions discussed was evaluated by users. The results of this evaluation show that users felt supported by the empathic chess companion, and preferred the emotional support provided by the companion over information and tangible support.

3.4.4 Effects of Expressing Empathy

Over the years various studies have been conducted to investigate effects of agents using empathic strategies on user perceptions and behavior. These studies differ from the work discussed in Section 3.4.1, 3.4.2, and 3.4.3 in the sense that relatively simple agents were used to investigate specific aspects of interactions. These agents were usually build specifically to perform these studies, and, therefore, have no other function than providing support in somewhat artificial settings. However, because these studies resulted in valuable insight on how agents can affect users' emotional state, they are relevant to the work presented in this thesis.

Empathic Agents can Reduce Computer-Induced Frustration

Various experiments have shown that empathic agents are capable of relieving computer-induced frustration. In the first experiment reported, there was no embodied agent present. It is, however, mentioned here, because it is one of the first experiments investigating the effect of empathy on users' emotional state. Klein et al. performed an experiment during which participants were asked to play a computer game, during which half of the participants experienced seemingly random delays [114].

After playing for five minutes, participants were subjected to one of three interactive questionnaires. In the IGNORE condition, the questions asked did not refer

to the participant's emotions, or anything about delays in the game. The VENT questionnaire was similar to the IGNORE questionnaire, but it allowed participants to report problems with the game and their emotional state in open-ended form. The AFFECT–SUPPORT questionnaire gave empathic feedback on the reported frustration level. After filling out the questionnaire, participants were asked to play a non-delay version of the game for 3 to 20 minutes. After 3 minutes, participants could end the game or continue playing if they wanted. When participants stopped playing, they were asked to fill out a paper questionnaire that asked about how they felt during the experiment.

The experiment was conducted among a total of 70 participants. The results show that participants that experienced delays when playing the game for the first time reported higher levels of frustration after playing the game. Participants in the AFFECTIVE–SUPPORT condition continued playing the game significantly longer than participants in the IGNORE or VENT conditions. This was true for both participants that experienced delays during the initial game and participants that did not. There was no significant correlation between the results of the self-report questionnaire and the time spend playing the game the second time. The researchers conclude that carefully crafted text-only interaction can relieve negative emotional states related to frustration.

In 2006, Hone performed a series of three experiments that build upon the work performed by Klein et al. [92]. For the first experiment, 12 participants were asked to play a frustrating computer game. Self-reported frustration was measured twice; while playing and when the participant finished playing. After reporting their frustration level during the game, participants interacted either with a text-based agent that responded empathically to reported frustration levels or with an agent that just confirmed the participant's input. The empathic agent was significantly more effective at reducing reported frustration levels than the agent that just confirmed the user's input.

In the second experiment, Hone compared an embodied empathic agent to the text-based empathic agent from the first experiment. There were 10 participants. Both agents significantly decreased self-reported frustration level, and the embodied agent was significantly more successful in decreasing frustration than the text-based agent. The third experiment investigated the role of agent gender. The setup of the experiment, and the behavior of the agent was the same as in the first two experiments. A total of 20 participants either interacted with a male or female agent. The results show that both the male and female agent significantly reduced frustration levels. Additionally, the female agent was significantly more effective in reducing frustration levels than the male agent.

Accurate Empathic Feedback is More Important Than a User's Expressivity

Bickmore and Schulman investigated the importance of accurate empathic feedback versus user expressivity [26]. They created two versions of an agent that was designed to comfort users. The first version was capable of providing accurate em-

pathic feedback through tailored scripts, while the second version allowed users to express their emotions freely, and gave a neutral response to all input. Before interacting with one of the agents, participants underwent a mood induction procedure designed to induce mild anxiety. After a brief period of rest, the agent asked the participant: 'How are you feeling right now?'. The empathic accuracy version of the agent gave the participant response options and provided accurate empathic feedback to the response selected. The expressivity version of the agent allowed the participant to respond freely, and neutrally responded to all input. All participants interacted with both versions of the agent.

The results show that the change in positive affect measured before and after interacting with the agent was significantly greater for the empathy condition than for the expressivity condition. Additionally, participants were more satisfied with the agent in the empathy condition than in the expressivity condition. The authors conclude that empathic accuracy is more important than user expressivity.

Non-Empathic Support is Better than No Support at All?

Nguyen and Masthof performed an experiment to investigate the effects of an agent's modality (ANIMATED vs. NO VISUAL) and type of feedback (EMPATHY AND EXPRESSIVITY vs. EMPATHY vs. NON-EMPATHY) on participants' self-rated mood and perceptions of the agent [157]. In total, 84 university students and staff members participated in the study. After performing a mood manipulation task that induced a mild negative emotional state, participants were asked to assess the credibility of two websites. They were guided through this task by an ECA named Mary. Mary was either visible as a 3D animated agent displaying nonverbal behavior, including gesturing and changing facial expressions, or she was not visible (i.e., there was a text-based conversation between Mary and the participant).

Additionally, Mary either gave no empathic feedback, gave empathic feedback, or gave empathic feedback and allowed the user to to freely express their feelings. In this last condition, Mary responded neutrally to to all input generated by this question. Strategies used in the empathy conditions were: small talk to build trust and relationship, being polite and friendly, acknowledging the participant's mood change, offering means to enable participants to correct the agent's empathic feedback, uttering empathic and sympathetic statements if participants feel bad, and validating the participant's emotional state.

Participants' mood was measured before mood induction, after mood induction, and after performing the web credibility task. The results show that mood induction was successful; participants felt significantly worse after the mood induction. Also, participants felt significantly better after performing the web credibility task during which they received support from Mary. However, there were no statistically significant differences between the conditions, meaning that all versions of the agent were equally successful in reducing negative emotions. The authors hypothesize this is caused by the fact that participants appreciated any support, no matter how small. In addition, participants in either EMPATHIC conditions reported a more

positive attitude towards Mary; they thought her more likeable and trustworthy, and reported greater perceived caring and enjoyment, regardless of the modality of the ECA.

Empathic Emotion Positively Affects Perceived Caring of an Agent

In an experiment during which participants played 10 rounds of casino-style blackjack against a virtual agent, Brave et al. investigated the effect of self-oriented and/or empathic (other-oriented) emotion on perceptions of the agent and aspects of user experience [35]. After each round of blackjack, the virtual agent commented on its own performance in the game, followed by a comment regarding the participant's performance. The comment on its own performance either were neutral (e.g., 'I won.'), or the agent expressed self-oriented emotion (e.g., 'I'm happy. I won this time.'). The comment on the participant's performance also was either neutral (e.g., 'You won.'), or the agent expressed empathic (other-oriented) emotion (e.g., 'You won! That's wonderful!'). The virtual agent's embodiment consisted of static photos of facial expression. When the agent did not express emotions, its facial expression was neutral. When the agent expressed an emotion, its facial expression matched the content of its verbal message (e.g., happiness if the agent won).

In total, 96 students participated in the study. After playing 10 rounds of blackjack, the participants gave their opinions on the agent and rated their user experience by filling out a questionnaire. The results show that the presence of self-oriented emotion had little or no effects on participants' opinions of the agent, and user experience. The presence of empathic emotion was found to have a positive effect on liking, trustworthiness, and perceived caring of the agent, as well as on felt support.

Empathic Messages Not Significantly Better Than No Messages in a Virtual Job Interview Scenario

Prendinger and Ishizuka developed an empathic companion that tries to calm users down in the context of a virtual job interview training scenario [172]. The user is being asked potentially unpleasant job interview questions by a virtual agent. The empathic companion is present in a separate window on the screen, and users are told that the companion is there for their comfort only, and that the virtual interviewer cannot see the companion. Strategies used by the companion to calm users down are verbally express empathy, encouraging, and congratulating the user. The companion detects the user's emotional state by monitoring his heart rate and skin conductance.

An interview episode consists of the virtual job interviewer asking the user a question, the user answering this question, and the job interviewer responding to the user's answer. Afterwards, the companion agent responds to the user's emotion using one of its strategies. The effectiveness of the empathic companion was tested in an experiment. The empathic companion was compared to a

non-supportive companion that did not address the user's emotional state after an interview episode, but gave a neutral comment, e.g., it suggested to move on to the next question. 10 participants interacted either with the empathic companion, or the non-supportive companion. The results show that the empathic companion was no more successful than the non-supportive companion at calming participants down.

Conclusion Empathy Studies

Studies on the effects of (embodied) agents that express empathy show that empathic agents are able to reduce computer-induced frustration. Another study provides evidence that accurate empathic feedback to users that experience negative emotions is more important than allow users to express themselves freely. Two of the six studies discussed in this section reported no significant differences between empathic agents that try to reduce the user's negative emotions and non-empathic agents performing the same task. Three out of six studies explored user perceptions of empathic agents; the results show that users generally have more positive perceptions of the agents that express empathy.

3.4.5 Discussion and Conclusion: ECAs Are Able to Provide Social Support in Task-Oriented Settings

This section provided an overview of ECAs that reduce users' negative emotions and/or induce positive ones. We discussed pedagogical agents, coaching ECAs, companions, and six studies that focused on the effects of expressions of empathy by ECAs. The results of user studies indicate that ECAs are capable of affecting users' emotions as desired. Most of the ECAs discussed are task-oriented systems. A task-oriented system is a system that helps users perform certain concrete tasks and/or activities. The task that a task-oriented ECA provides assistance to is the user's. The provision of support by an ECA can be considered a task in itself; however, the task that is referred to in the word 'task-oriented' belongs to the user.

Table 3.1 lists the user's tasks in the systems discussed. The user's task during interaction with pedagogical agents is learning. Coaching ECAs help users to manage (and change) certain behaviors, and provide users with information. Two of the three companion ECAs discussed are not task-oriented; interaction with the HWYD system and the engaging toy does not involve concrete tasks. The Empathic Chess companion plays a game with the user. And despite the somewhat artificial settings in which some of the empathy studies were conducted, these also mostly evolved around concrete user tasks, such as playing games or learning.

For task-oriented ECAs, the structure and contents of conversations is determined to a large extent by the user's task. As a result, in most cases, it is very clear what the ECA and the user talk about. Often conversations are scripted (i.e., the structure and contents are predetermined). In some cases, there is no real conversation; the ECA only responds to the user or his actions. For the non-task oriented HWYD ECA, the structure and contents of the conversation are free (within the do-

Type of agent (study)	System (study)	User's task
Pedagogical agent	Affect-Sensitive AutoTutor (Graesser et al. [67, 84])	Learning (physics, computer literacy, critical thinking)
	Wayang Outpost (Arroyo et al. [11])	Learning (geometry)
	Towers of Hanoi Agent (Burleson and Picard [43])	Learning (problem solving)
Coaching ECA	Virtual exercise coach (Bickmore and Picard [25])	Manage physical activity
	Nutritional Coach (Creed and Beale [58])	Get information on diet
	Personal lifestyle assistant (Blanson et al. [28])	Manage diet
Companion	Empathic Chess Companion (Leite et al. [132])	Play game (chess)
	HWYD System (Cavazza et al. [49, 187])	No task
	Engaging Toy (Adam and Ye [2])	No task
Focused study	Empathic agents (Klein et al. [114] & Hone [92])	Play game
	Comforting agent (Bickmore and Schulman [26])	No task, but artificial setting
	Empathic agent (Nguyen and Masthof [157])	Web credibility task
	Blackjack agent (Brave et al. [35])	Play game (blackjack)
	Empathic companion (Prendinger and Ishizuka [172])	Learning (Train for job interviews)

Table 3.1: The user's tasks in the ECAs and studies discussed in this section.

main of working at an office) and determined to a large extent by the user; the ECA mostly responds to the user. For the engaging toy it is the other way around; in the example dialogue, the toy leads the conversation by asking the user questions and suggesting a new joint activity.

Our review of related work shows that ECAs use a wide variety of social support types and strategies in order to try to reduce users' negative emotions and/or induce positive ones. For task-oriented ECAs, attempts to affect the user's emotional state are a means to reach a certain goal. This goal often concerns helping the user to complete his task in a more efficient manner (e.g., more efficient learning,

attaining a faster or more painless lasting change in behavior, increasing motivation and/or engagement). An important social support strategy that most ECA systems use is expressing empathy. Empathy and other emotions are usually expressed both verbally and nonverbally. In order to try to reduce users' negative emotions and/or induce positive ones, ECAs express both positive emotions (e.g., happiness) and negative ones (e.g., sadness, or concern).

User studies have been performed for most of the ECA systems discussed in this section. However, only few of them directly investigated to what extent users felt supported by interaction with the ECA. In most cases, user perceptions of emotional and/or empathic agents are explored. The results show that users generally have more positive perceptions of emotional and/or empathic agents. In some studies, evidence was found that users feel more supported and/or cared for by empathic agents; however, this was not always the case. Also, users seem inclined to spend longer on tasks when they receive support from empathic agents. Usually, no statistically significant differences in (learning) performance were found between users that interact with an empathic ECA and users that interact with an ECA that does not provide affective support. Finally, the studies focused on the effects of expressing empathy (Section 3.4.4) confirm that users can be affected by interactions with relatively simple agents.

3.5 Conclusion

In this chapter, we provided an introduction to social support and to ECAs. The definition of social support used in this thesis is: verbal and nonverbal forms of behavior intended to alleviate the emotional distress of another person [41]. In other words, social support is understood to mean comforting. To comfort others, people use various techniques, including providing emotional and information support. Expressions of emotions and empathy by the support provider play an important role in social support conversations.

Research shows that people respond socially to computers and, more specifically, ECAs that exhibit social cues. From this perspective, providing social support, i.e., reducing someone's negative emotions or inducing positive ones, is a matter of generating the right social cues. Related work on ECAs that try to change the user's emotional state shows that ECAs use comforting strategies and social cues similar to the ones employed by people.

Additionally, we presented related work on ECAs that aim to affect the emotional state of users. These systems are predominantly task-oriented, i.e., they help users perform concrete tasks, such as finding information, or performing learning tasks. In this context, an ECA's attempts to affect the user's emotional state as a means to reach the goal of helping the user complete his task more efficiently. Therefore, the user's task determines the course of conversations between ECAs and users.

An ECA that provides social support to cyberbullying victims is not a task-

oriented system, because a user that is looking for social or, in particular, emotional support does not have a concrete task to perform. This is what sets our work apart from existing approaches towards social support by ECAs. Because there is no task in social support conversations about cyberbullying, it is unclear what exactly the virtual buddy and the user should talk about. In Chapter 4, we construct a conceptual model for social support conversations based on theory about social support by humans. This model is applied in the virtual buddy prototype (Chapter 5).

Additionally, little is known about the extent to which users feel supported by an ECA's supportive behavior in non task-oriented contexts such as cyberbullying. In Chapter 6, 7, and 8, we present user studies of the virtual buddy's supportive behavior.

Chapter 4

A Conceptual Model for Social Support Conversations

Chapter 3 shows that ECAs that provide emotional support are predominantly task-oriented systems, and that in these systems the user's task determines the course of the conversation between a user and an ECA. Since looking for social support is not a concrete task that allows us to infer the course of a conversation between a cyberbullying victim and the virtual buddy, it is not clear what the contents and structure of such a conversation should be. The next step in the development of a virtual buddy that provides social support to victims of cyberbullying consists of determining the structure and contents of social support conversations. In this chapter, we will construct a conceptual model for social support conversations based on the literature review of social support presented in Section 3.2. To ensure that the conversation model can be used in other contexts of emotional distress as well, we aim to keep it domain-independent. The conversation model provides a specification of social support conversations in phases, topics, and sequences.

This chapter is organized as follows. In Section 4.1, we provide a theoretical background on dialogues. In Section 4.2, we construct an initial conversation model, that is validated in Section 4.3 using real world chat conversations about bullying. Based on the validation, we make some changes to the conversation model. Section 4.4 presents the final model for social support conversations. Section 4.5 provides our conclusions.

Parts of this chapter have been published. Section 4.2.1 is based on our contribution to Modern Advances in Intelligent Systems and Tools, pp. 47–52, 2012 [223]. Section 4.2.2 is based on our contribution to the 3rd workshop on Emotional and Empathic Agents @ AAMAS 2012, pp. 1–8, 2012 [222]. Section 4.3 is based on our contribution to Proceedings of the 24th Benelux Conference on Artificial Intelligence (BNAIC), pp. 258–265, 2012 [224].

4.1 Conversation Basics

Before presenting the conversation model, we briefly introduce relevant concepts from linguistics. A *conversation* is an informal talk in between two or more people in which ideas are exchanged[1]. As mentioned in Section 3.2, we only consider the setting in which there are two conversation partners (i.e., a support provider and a support seeker). A conversation consists of turns; a conversation *turn* is the time during which a single speaker speaks [136].

During a conversation turn, a speaker may produce one or more speech acts. A *speech act* is a functional unit in communication [55]. According to Austin, speech acts have three different levels of meaning: locutionary, illocutionary, and perlocutionary [12]. The locutionary act refers to the performance of an utterance and its literal meaning. The illocutionary act refers to the action performed by the speaker, e.g., asserting, suggesting, demanding, promising, or vowing. Searle distinguishes the following types of illocutionary speech acts [182]:

- Representatives: The speaker commits to the truth of the expressed proposition (e.g., asserting, claiming, or reporting),
- Directives: The speaker attempts to get the hearer to do something (e.g., requesting, commanding, or advising),
- Commissives: The speaker commits to some future course of action (e.g., promising, threatening, and offering),
- Expressives: The speaker expresses attitudes and emotions towards the expressed proposition (e.g., apologizing, thanking, and congratulating),
- Declarations: The speaker effects a change of state (e.g., declaring war, pronouncing someone guilty, or pronouncing someone husband and wife).

The perlocutionary act refers to the effect of the utterance on the addressee, including persuading, convincing, scaring, inspiring, insulting him, or otherwise getting him to do something, either intentional or not.

Conversation turns are typically arranged in sequences. A conversation *sequence* is a set of adjacent and functionally related conversation turns [96, 145]. Examples of sequences include adjacency pairs (e.g., greeting–greeting, or question–answer), but longer sequences also exist (e.g., question–answer–acknowledgment).

Some sequences used in our conversation model for social support are based on Schneider's model for small talk [180]. Small talk has a social function in conversations, and is not used for content exchange. In this respect, small talk is similar to providing social support by expressing sympathy, giving compliments, or providing encouragement[2]. Schneider's model describes small talk as a four step process:

1. A query,
2. An answer to the query,

[1] http://oxforddictionaries.com/definition/english/conversation

[2] There are more similarities between small talk and social support. For example, almost all social support types from Braithwaite's typology [34] can be found in the small talk taxonomy presented by Klüwer [115].

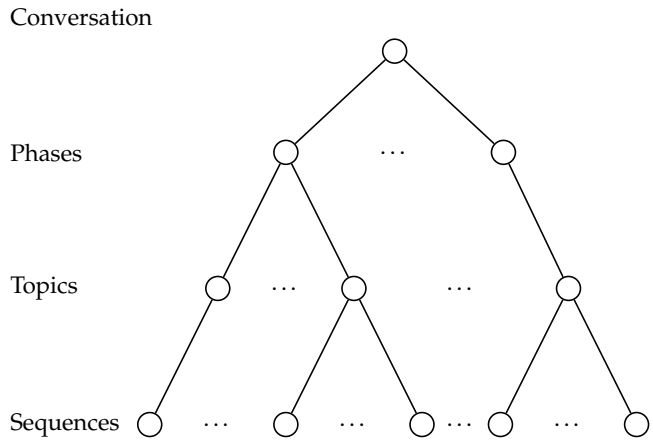


Figure 4.1: Hierarchical organization of phases, topics, and sequences in a social support conversation.

3. A response to the answer, consisting of one of the following possibilities: echo-question, check-back, acknowledgement, confirming an unexpected response, positive evaluation,
4. An unrestricted number of null steps or idling behavior.

Another sequence used in our conversation model for social support is based on the sequence for instructional dialogue presented by Vergunst [205]. In Vergunst's framework tasks are represented as nested lists of instructions. The instructor (in Vergunst's work the instructor is a recipe assistant) instructs the user to perform all subtasks in a list. If a subtask can be deconstructed further, and the user does not know how to perform the subtask, the instructor recursively explains the subtasks. After explaining a step from the current list of instructions, the instructor waits for confirmation from the user before moving on to the next step.

4.2 Construction of the Conversation Model

This section presents the conversation model for social support. The model consists of phases, topics, and sequences. Figure 4.1 illustrates the organization of phases, topics, and sequences in the model. A conversation is composed of conversation phases, during which one or more topics are discussed. Topics are discussed using one or more sequences. To improve the readability of the text, we use *italics* to refer to topics, and **bold face** to refer to sequences.

4.2.1 Phases and Topics

The conversation model for social support combines De Beyn's 5-phase model with Burleson and Goldsmith's topics (see Section 3.2). Conversation phases in De

Conversation phase	Topic(s)
1. Welcome	Hello
2. Gather information	Event (general)
	Emotional state
	Personal goal
	Event (details)
	Coping (current)
3. Determine conversation objective	Conversation objective
4. Work out objective	Coping (future)
	Advice
5. Round off	Goodbye

Table 4.1: Conversation phases and topics.

Beyn's 5-phase model are: 1) Welcome, 2) Gather information, 3) Determine the conversation objective, 4) Work out objective, and 5) Round off. In addition, Burleson and Goldsmith suggested topics that can be discussed in the course of comforting conversations [41]. The topics are:(details about) the situation eliciting negative emotions, the emotions elicited, the personal goals that are being threatened by the situation, current coping strategies, and additional coping strategies the individual might try (advice). Table 4.1 lists the phases and topics in these phases of the conversation model for social support.

In the first conversation phase (welcome) the support provider greets the support seeker. After that, phase 2 (gather information) starts, in which the support provider asks the support seeker questions to identify facts about the event that elicits negative emotions. In this stage, the discussion of the event is kept general, because the support provider still needs to confirm (or establish) how the support seeker feels about the event. Therefore, the emotional state is the second topic in conversation phase 2. If the emotional state is negative, appraisal theory suggests a personal goal is threatened. Subsequently, the support provider will ask the support seeker to specify which goal is threatened. Additionally, the support provider registers the intensity of the emotion to determine whether the support seeker needs to cope. After that, the support provider will ask more details about the event. These details (and the information acquired in the beginning of the second conversation phase) are used to determine which advice the support provider can give the support seeker in phase 4 (work out objective), given that the support seeker's conversation objective is to get advice on how to deal with the negative event. Which details are relevant and how these details are linked to advice depends on the domain. When the support provider has gathered sufficient information (what is sufficient depends on domain knowledge) and believes the support seeker needs to cope, it moves on to discussing the support seeker's current coping strategy. This concludes the second conversation phase. In phase 3 (determine conversation objective), the support provider asks the support seeker what he or she wants to accomplish with the conversation. Multiple objectives are possible; for simplicity

Support type	Description	Example
Emotional & esteem support		
Sympathy	Express feelings of compassion or concern	*How awful that you are being bullied!*
Encouragement	Provide recipient with hope and confidence	*There is no easy solution for bullying, but there are some things you can do to try to make it stop.*
Compliment	Positive assessments of the recipient and his or her abilities	*Blocking the bully was a smart thing to do!*
Information support		
Advice	Suggestions for coping with a problem	*Give your contact information only to people you know and trust.*
Teaching	Factual or technical information	*You can block a contact by clicking the 'block' button.*

Table 4.2: The types of social support included in the conversation model.

we assume the support seeker either wants to tell his story or get advice to deal with the problem. For both conversation objectives, in the next phase, the support provider discusses with the support seeker future coping options (future). If the support seeker wants advice on how to deal with his problem, the support provider also gives advice in this conversation phase. Finally, in phase 5 (round off), the support provider says goodbye to the support seeker.

4.2.2 Social Support Types

During the conversation, the virtual buddy shows supportive behavior by responding to the user's story. Specifically, we selected five social support types from Braithwaite's typology of social support [34] (see Section 3.2.4); sympathy (emotional support), compliment (esteem support), encouragement (emotional support), advice (information support) and teaching (information support). Table 4.2 lists descriptions and examples of these support types. We selected these five types of social support, because they frequently occur in social support conversations by chat [78]. This initial selection of social support types can be extended later on.

For simplicity, the conversation model assumes that the social support types are used only during conversation phase 2 (Gather information) and 4 (Work out objective). We now explain each of the five selected social support types and provide examples of their use in the conversation model. In Section 4.2.3, we further specify sequences used to apply these support types during the conversation.

Sympathy refers to expressions of compassion or concern. During conversation phases 2 and 4, the conversation model specifies that the virtual buddy can respond sympathetically to answers given by the user. For example,

Virtual buddy: *Can you tell me what happened?*
User: *Someone is calling me names on MSN*[3]*...*
Virtual buddy: *That's awful!* (sympathy)

Compliments are positive assessments of the recipient and his abilities. In the context of a social support conversation about an upsetting event, there are two possibilities for the support provider to give compliments: 1) the support recipient tells the support provider he performed a constructive, positive or otherwise positive action (e.g., in response to being bullied, the the support recipient did not retaliate), and 2) the support recipient performs well as a dialogue partner (e.g., the support recipient gives a clear explanation of something). Currently, only the first type of compliment is included in the conversation model. The following example illustrates giving compliments.

Virtual buddy: *How did you respond when you were being called names on msn?*
User: *I told the bully to stop, but he didn't listen...*
Virtual buddy: *That was very brave of you!* (compliment)

Encouragement concerns providing the recipient with hope and confidence. The process of encouraging the user closely resembles the the way in which compliments are given. Again, the conversation model assumes that encouragement is always provided in response to a user utterance. Encouragement is triggered by utterances that indicate the user's situation is severe. The circumstances under which a situation can be considered severe depend on domain knowledge. The following conversation snippet illustrates encouragement:

Virtual buddy: *Has he bullied you before?*
User: *Yes, he does it all the time*
Virtual buddy: *I'm sorry to hear that* (sympathy)
Virtual buddy: *Let's try to stop the bullies!* (encouragement)

In phase 4 of the conversation model, the user is provided with advice. Which advice is given depends on domain knowledge and the specific situation of the user (i.e., the information that was gathered during conversation phase 2). The conversation model assumes the user confirms all advice:

Virtual buddy: *Do not respond to abusive messages. Many bullies bully to provoke a response.* (advice)

[3]MSN Messenger was an Instant Messaging service provided by Microsoft. It was discontinued in 2013 [209].

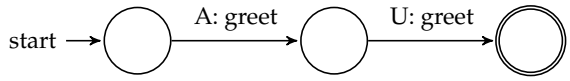


Figure 4.2: Sequence **GG** for topics *Hello* (phase 1); and *Goodbye* (phase 5).

User: *OK*

In the domain of cyberbullying, many measures the user can take to protect himself require technical know-how, such as blocking users, changing accounts, and reporting inappropriate content. Since the user may not possess the knowledge on how to perform these actions, the conversation model includes teaching of this information. Teaching concerns conveying factual or technical information:

Virtual buddy: *Block the bully on MSN, so he can't harass you anymore.* (advice)
User: *OK*
Virtual buddy: *Do you want me to explain to you how to do that?* (teaching)
User: *Yes, please!*
Virtual buddy: *First, you login to MSN.* (teaching)
User: *Yes*
Virtual buddy: *Next, locate the contact you want to block in your contact list.* (teaching)
User: *OK*
...
Virtual buddy: *Okay, now you know how to block a contact on MSN.* (teaching)

4.2.3 Sequences

According to the conversation model, a social support conversation consists of five phases. Each phase is completed by discussing one or more topics. To further specify the course of social support conversations, this section details sequences used to discuss a topic. These sequences are depicted in figures 4.2 to 4.6. The sequences are specified in speech acts, and we use A to refer to the *agent* (i.e., the virtual buddy), which is the support provider, and U to refer to the user, which is the support seeker. Currently, the conversation model lacks the option for the user to ask the agent to repeat its messages (e.g., questions).

Figure 4.2 shows the sequence for topics *Hello* (phase 1) and *Goodbye* (phase 5). It consists of the greeting–greeting adjacency pair. First, the agent greets the user and after that, the user greets the agent. The type of greeting for phase 1 and phase 5 differs; in phase 1 the agent welcomes the user, and in phase 5 the agent says goodbye to the user.

Figure 4.3 specifies the sequence used to complete topics *Event (general)*, *Emotional state*, *Personal goal*, *Event (details)*, *Coping (current)* (phase 2), *Conversation objective* (phase 3), and *Coping (future)* (phase 4). It consists of the adjacency pair question–answer, that has been extended to incorporate providing emotional and

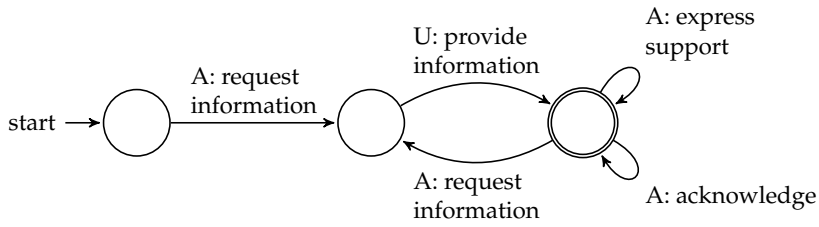


Figure 4.3: Sequence **QA** for topics *Event (general)*, *Emotional state*, *Personal goal*, *Event (details)*, *Coping (current)* (phase 2), *Conversation objective* (phase 3), and *Coping (future)* (phase 4).

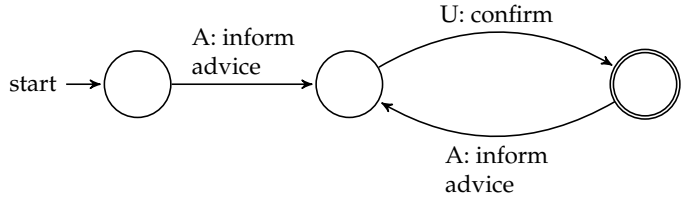


Figure 4.4: Sequence **Advice** for topic *Advice* (phase 4).

esteem support. The sequence is based on Schneider's model for small talk [180] (see Section 4.1). In our sequence, we have removed Schneider's fourth step and made expressing support optional. Instead of expressing support, the agent can also give a neutral response (i.e., acknowledge the user's answer). After the user answered a question, and the agent optionally expressed support and/or acknowledged the user's answer, the agent can ask another question. This process repeats until the agent gathered all information required to complete the current topic.

Finally, Figure 4.4 specifies the sequence for giving advice. The agent gives a piece of advice and the user confirms this advice. Next, the agent can give another piece of advice. This loop continues until all advice has been given.

In the cyberbullying domain, the user needs technical know-how to execute some pieces of advice (e.g., blocking a contact on a social networking site). The agent is able to explain pieces of advice that require technical know-how (teaching). Figure 4.5 shows the sequence for teaching, and Figure 4.6 show the combined sequence for advice+teaching. If an explanation is available for a piece of advice, the agent offers to teach the user how to execute the advice. The user may accept of reject this offer. If the user rejects, the agent confirms the rejection, moves on to the next piece of advice. If the user accepts, the agent teaches the user how to execute the advice.

The sequence for teaching (Figure 4.5) is based on the work by Vergunst [205] (see Section 4.1). The explanation of an advice consists of a list of instructions or steps. After the explanation of a step, the agent waits for confirmation from the user before moving on to the next step. When all steps have been explained and confirmed, the agent states that the user now knows how to perform the advice.

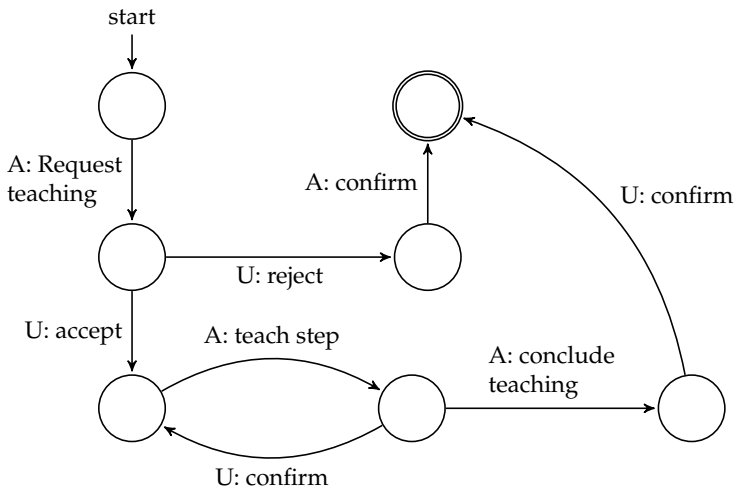


Figure 4.5: Sequence **Teaching** for topic *Advice* (phase 4).

When the user confirms this statement, the teaching is completed. In the current model, there is no option for the user to ask the agent to repeat an instruction or the set of instructions.

4.2.4 The Model

The conversation model for social support is displayed in Figure 4.7. The conversation model specifies a social support conversation consists of phases (first level of nodes), in which one or more topics are discussed (second level of nodes). A topic is discussed using one or more sequences (third level of nodes). The conversation model is domain-independent, because none of the individual phases, topics, or sequences refers to domain-specific information (e.g., about (cyber)bullying). However, before it can be used, the model needs to be instantiated; for example the questions asked during conversation phase 2 need to be specified. This does require domain knowledge, and is, therefore, not domain-independent.

In Section 4.3, the model is compared to real world data, i.e. actual chat conversations about bullying. Based on this comparison some minor changes will be made to the model. The final conversation model is presented in Section 4.4.

4.3 Validation of the Model

In the previous section, we presented a conceptual model for social support conversations. The model was constructed based on psychological literature. Therefore, it is unclear to what extent it provides an accurate representation of social support conversations. In order to assess the validity of the conversation model, the model was compared to a corpus of chat conversations with bullying victims. To this end,

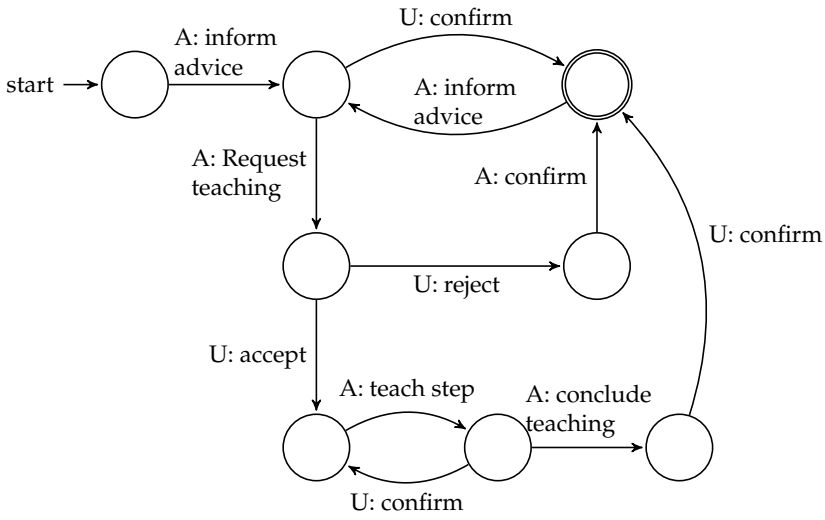


Figure 4.6: Combined sequence **Advice+Teaching** for topic *Advice* (phase 4).

we conducted a content analysis of the chat conversations and compared the results to the conversation model. This section presents the results of the content analysis and the comparison between these results and the conversation model.

An ECA's supportive strategies are often based on psychological literature (e.g., [140, 143]) or expert opinions (e.g., [10]). To the best of our knowledge, these strategies have not been validated, even though ECA systems employing these strategies have been subjected to user studies. We believe it is important to validate the conversation strategies used by ECAs, especially when dealing with sensitive application domains (e.g., cyberbullying) and/or vulnerable target audiences (e.g., children).

The corpus of chat conversations was gathered by an online helpline for children and adolescents. Because the usage scenario for the virtual buddy is similar to the setting of chatting (anonymously) with a counselor (see Section 1.4), chat conversations about bullying are a suitable basis for comparison. In the comparison of the model with the chat conversations, the chat conversations are considered a 'gold standard'.

4.3.1 Method: Content Analysis

To validate the conversation model proposed in Section 4.2, a content analysis of chat conversations about bullying was conducted. In this section, we describe the corpus of chat conversations, and the method that was used to analyze the corpus.

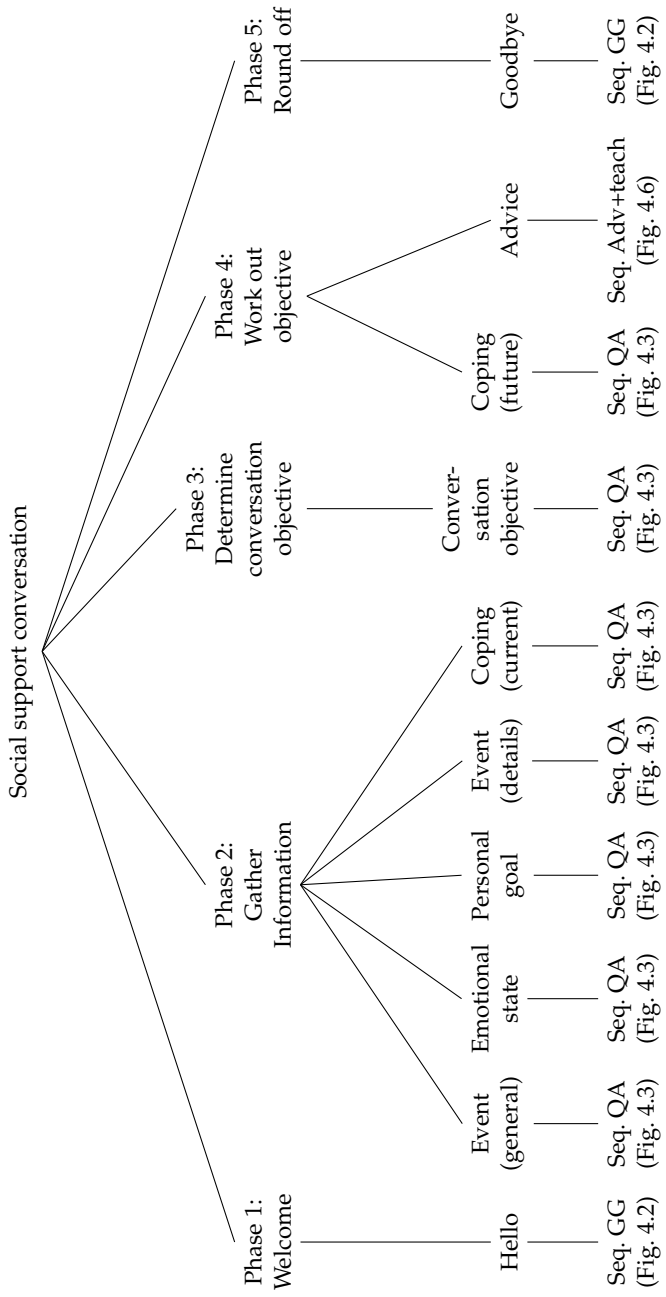


Figure 4.7: The conversation model for social support (initial version).

Description of the Data

Pestweb[4] is the Dutch center of expertise for bullying. As part of their services, they offer support to victims via telephone, chat and e-mail. The topic and setting of chat conversations conducted by Pestweb is similar to the usage scenario we have in mind for the virtual buddy. Additionally, Pestweb counselors use the 5-phase model to structure conversations. For these reasons, Pestweb's chat conversations are appropriate and suitable to validate the conversation model for social support.

Chat conversations such as the conversations between Pestweb counselors and bullying victims are private and confidential. Pestweb stores al chat conversations for one month. The archive is used to look up information shared in previous conversations (e.g., to prevent that people who contact Pestweb for a second time have to tell their complete story again), and for quality control. Normally, only counselors working at Pestweb have access to the conversation archive. Pestweb gave permission to use the contents of their archive for the purpose of validating the conversation model on the condition of protecting the privacy of children and adolescents that contacted the helpline.

To protect the privacy of people that contacted the helpline the following measures were adopted: 1) only the counselor's side of the conversations was made available, and 2) all utterances were anonymized by replacing identifying information, including the counselor's name, with generic labels; for example, proper names were replaced by <name>. Additionally, we only used conversations conducted by counselors that gave consent to use their conversations for the validation of the conversation model. The procedure of obtaining the data and its usage for the validation of the conversation model was approved by the ethical board of Delft University of Technology.

Because only the counselor's side of the conversations was made available, the question arises to what extent these conversations can be understood, and whether they contain sufficient information to permit a content analysis. Generally, the conversations were easy to follow based on counselor utterances only, because the counselors frequently request feedback from their conversation partners and summarize their input. To demonstrate that the conversations were easy to follow based on the counselor's side of the conversations alone, one of the conversations was translated from Dutch to English and included as an appendix to this thesis (see Appendix A). As shown in the example conversation and the conversation snippets used as examples in this section, the data did contain the positions of the conversation partners's utterances. In other words, we know *when* something was said, but not *what* was said.

Three counselors gave consent to use their conversations. We obtained 66 conversations from the Pestweb archive. Not all of these were usable for the analysis: 17 conversations appeared to be non-serious (e.g., people trying out the helpline using fake stories); 19 conversations were off-topic (e.g., conversations just before closing time during which the counselor explained there was not enough time to discuss

[4]http://www.pestweb.nl/

Description	# of conversations
Total	66
Non-serious conversations	17
Off-topic conversations	19
Mixed conversation phases	7
Used in the content analysis	23
Complete conversations analyzed	10
Partial conversations analyzed	13

Table 4.3: Conversations retrieved from the Pestweb archive.

Procedure
1. Dividing conversations into phases.
2. Dividing phases into sequences.
3. Assigning a topic to all sequences.
4. Marking social support types in sequences of conversation phase 2 (Gather information) and 4 (Work out objective).
5. Extracting sequence patterns from sequences of conversation phase 2 (Gather information) and 4 (Work out objective).

Table 4.4: Coding procedure.

someone's problem, and conversations where one of the conversation partners was experiencing technical difficulties); and the conversation phases in 7 conversations were not clearly separated. The remaining 23 conversations have been analyzed. Of these, 10 were complete and 13 ended before the conversation was completed (e.g., because the user stopped responding). Table 4.3 provides a summary of the data retrieved from the Pestweb archive.

Data Analysis

All data was coded by a single coder, and part of the coding process was repeated by a second coder. Data was coded according to method proposed by Chi [51]. The procedure used for analyzing the data is listed in Table 4.4. Before starting the analysis, we made some assumptions about the data. We assumed a counselor or user turn can consist of one or more speech acts. Because the user utterances were not available, the contents of a user turn were determined based on the response of the counselor. We also assumed that a user utterance is relevant only if the counselor explicitly responds to it.

The coder started by dividing the conversations into the phases of the 5-phase model. Phase boundaries were determined based on the conversation contents. The second step consisted of dividing all phases into sequences of utterances. In step 3, all sequences were assigned a topic. Coding started from the topics proposed by the model and codes were added for topics not covered by the model.

Existing topics	#	Additional topics	#
Hello	99	Social support other	25
Event	167	Conversation management	25
Emotional state	12	Chat management	18
Personal goal	1	Off-topic	35
Coping (current)	98		
Conversation objective	19		
Coping (future)	30		
Advice	28		
Goodbye	42		
Total	*496*	*Total*	*103*

Table 4.5: Codes used to assign topics to sequences.

Step 3 of the coding process was repeated by a second coder for the 10 complete conversations. Inter-rater reliability was determined using Cohen's Kappa. The measured Cohen's Kappa was 0.72 (95% CI: [0.71, 0.77]), indicating a substantial agreement [128]. This result demonstrates the topics from Table 4.5 are meaningful and can reliably be assigned to the sequences in the data.

In step 4 of the coding process, the coder marked social support types in the sequences. We decided to only mark the social support types in phases 2 and 4, because in the conversation model these two phases are most important for giving support. To code the social support types, we used the same approach as for the topics; we started with the support types proposed by the model and added codes for additional support types.

Finally, sequence patterns occurring in phase 2 and 4 of the conversations were extracted. Again, we started with the sequence patterns as proposed by the dialogue model and added codes for new patterns were added.

4.3.2 Results

In this section, we describe the results of the content analysis. First, we specify the topics found in the data. After that, we assess to what extent topics occur in the phases prescribed by the conversation model. Subsequently, we assess to what extent the sequence patterns specified by the model occur in the data and specify all new patterns found. Finally, we quantify the frequency of social support types in the corpus.

Topics

A total 599 sequences were found in the data. Table 4.5 lists all codes used for assigning topics to the sequences and the numbers of sequences that were coded with a particular topic. The first column contains the existing topics, i.e., the topics specified by the conversation model (see Section 4.2). Because in practice it proved

	H	E	ES	PG	CC	CO	CF	A	G	Total
Phase 1	23									23
Phase 2		23	10	0	17					23
Phase 3		1				13				13
Phase 4		5		1	4	1	12	11		14
Phase 5							1	1	16	16

Table 4.6: Occurrence of topics in the different phases. Grey cells indicate that, according to the model, the topic occurs in this phase. (H: *H*ello, E: *Event*, ES: *Emotional state*, PG: *Personal goal*, CC: *Coping current*, CO: *Conversation objective*, CF: *Coping (future)*, A: *Advice*, G: *Goodbye*, Total: Total number of conversations containing this phase (at least partial))

to be difficult to distinguish between topics *Event (general)* and *Event (details)*, these two topics have been merged into a single code. The table shows that 496 of the 599 sequences (82.8%) were coded with one of the topics from the model.

The third column of Table 4.5 contains the topics that were added during the coding process. A code was added for sequences in which social support was provided in a different way than specified by the conversation model. The majority of the sequences that was assigned the label 'Social support other' were comforting tirades (cf. [49, 187]). Comforting tirades are longer utterances to provide support. These utterances can be characterized as advice nor teaching, but, as for advice and teaching, the whole sequence is dedicated to giving support. An example of such a sequence is *'You know bullying is really complicated, let me explain something to you. Bullies want to stand out. Sometimes by bossing people around. Or by making fun of others. They think others look up to them for what they do. But usually that's not true (...)'* (conversation 39).

Additionally, codes were invented for conversation and chat management. Conversation management includes feedback requests, summaries and other techniques, whereas chat management refers to sequences dealing with technical difficulties during the chat. Since the topics proposed by the model are not discussed in these kinds of sequences, they have been separated from the sequences in which topics proposed by the model were discussed. Finally, the code off-topic was added. Sequences coded as off-topic deal with topics that are outside the scope of a chat conversation about bullying. For example, the counselors asked some of the children to fill out a questionnaire about their experiences during the conversation.

Phases and Topics

Table 4.6 shows the number of conversations in which a topic is discussed for each of the 5 conversation phases. As shown by the grey cells, topics occur generally in the phases where they belong according to the model. Only in phase 4 topics from other phases occur regularly.

The topic *Hello* (H) occurs exclusively in phase 1 of all conversations. The topics

that belong in phase 2 are: *Event* (E), *Emotional state* (ES), *Personal goal* (PG) and *Coping (current)* (CC). The *Event* is discussed in phase 2 of all conversations, in some conversations in phase 4, and once in phase 3. The data shows that the *Emotional state* (ES) is discussed in phase 2 of about half of the conversations. *Personal goal* (PG) is hardly discussed. There are no occurrences in phase 2 and only in one conversation in phase 4. Apparently, this is not a common topic. As expected, *Coping (current)* (CC) occurs in phase 2 of most conversations, but this topic also occurs in phase 4. The *Conversation objective* (CO) is discussed almost exclusively in phase 3. *Coping (future)* (CF) is discussed almost exclusively in phase 4 and it occurs in most conversations, as is *Advice* (A). Finally, the topic *Goodbye* (G) is discussed in all conversations that include a phase 5.

Sequence Patterns in Phase 2 and 4

The results so far gave a general impression of the sequences that occur in the conversations. Topics are discussed by one or more sequences. The proposed model specifies patterns for the sequences used to discuss topics. Since we are mainly interested in providing social support, our analysis is focused on phase 2 and 4, the phases during which support is provided. In this section we explore to what extent the sequence patterns specified for phase 2 and 4 can be found in the data.

Table 4.7 contains all sequence patterns that were found in phase 2 and 4. All sequences with topics *Event*, *Emotional state*, *Personal goal*, *Coping (current)*, *Coping (future)*, *Advice*, and *Social support other* were included in the analysis. A total number of 342 sequences were analyzed; 244 from phase 2 and 98 from phase 4 (see Table 4.10). The sequence patterns for new sequences are specified in Figure 4.8 to 4.14. The second column of Table 4.7 contains conversation snippets to illustrate the sequence patterns found in the data. In the examples, we use C to refer to the counselor and U to refer to the counselor's conversation partner (i.e., the child looking for support).

We will now briefly discuss each of the new sequence patterns. Again, we use C to refer to the counselor and U for the child looking for support. Since the child's utterances are unknown, they are replaced by a general speech act in the specification of the sequences (indicated by 'U: speech act'). In cases where the counselor explicitly asks a question or requests feedback, and the conversation contains a user turn afterwards, we assume the child answers the question (indicated by 'U: provide information') or provides this feedback (indicated by 'U: provide feedback').

Sequence **QA 2**, which is a variation of the sequence **QA 1**, is displayed in Figure 4.8. In sequence **QA 2**, before asking a question, the counselor optionally expresses support. After the child answered the question, the counselor optionally acknowledges the child's answer and optionally expresses support. Figure 4.9 shows the sequence for **Advice 2**. In this sequence the counselor gives advice by suggesting a number of future coping strategies. The sequence is always followed by a **QA 1** sequence in which the counselor asks the child to select one of the future coping strategies.

Sequence	Example	
QA 1 Fig. 4.3	C: *What names are they calling you?* U: *[. . .]* C: *Oh, they say nasty things!*	(C3)
QA 2 Fig. 4.8	C: *I'm sorry you are being bullied that bad!* C: *Can you tell me something about it?* U: *[. . .]* C: *Gosh, that's annoying!*	(C56)
RtU 1 Fig. 4.10	U: *[. . .]* C: *Yes, that's a good idea!* C: *You can also try to ignore the bullies*	(C43)
RtU 2 Fig. 4.11	U: *[. . .]* C: *And how did that go?* U: *[. . .]* C: *Parents often find it hard to believe their child is a bully*	(C33)
RtU 3 Fig. 4.12	U: *[. . .]* C: *Yes, you can tell me* U: *[. . .]*	(C39)
Advice 1 Fig. 4.4	C: *You can go talk to a teacher* C: *How about that?* U: *[. . .]* C: *It is difficult, I know*	(C46)
Advice 2 Fig. 4.9	C: *There are four things you can do* C: *I will name them. And then you can tell me what suits you, okay?* U: *[. . .]* C: *1: continue to ignore it* C: *2: seek help* C: *3: stand up for yourself* C: *4: wait until it passes*	(C1)
Teaching Fig. 4.5	C: *You could try to ignore the bullies* C: *do you know how to ignore people?* U: *[. . .]* C: *Exactly!*	(C61)
Other 1 Fig. 4.13	C: *You shouldn't keep it to yourself for too long*	(C61)
Other 2 Fig. 4.14	C: *Is that it? Or is it even worse?* C: *You can safely tell me how you feel*	(C46)

Table 4.7: Sequence patterns found in phase 2 and 4. Grey rows indicate patterns specified in the conversation model.

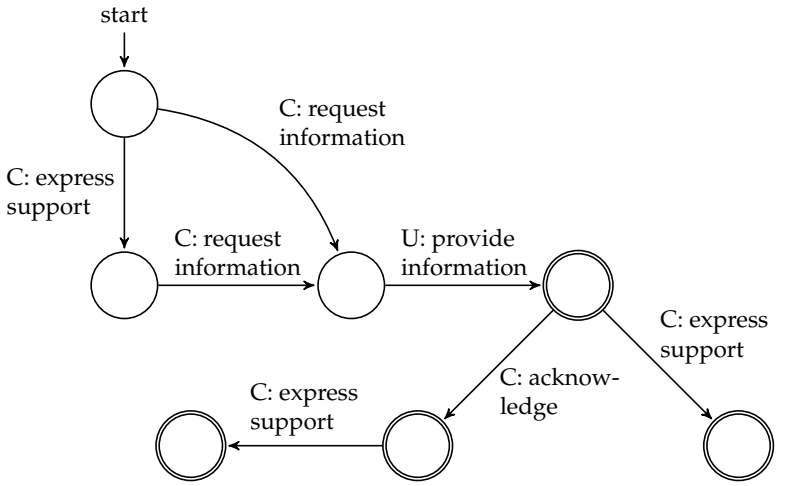


Figure 4.8: Sequence for **QA 2**.

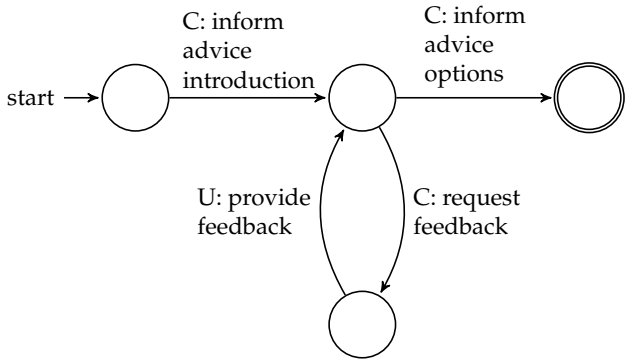


Figure 4.9: Sequence for **Advice 2**.

Three other new sequence patterns that were found in the data can be characterized as responses to user input ('RtU'). Sequence **RtU 1** is depicted in Figure 4.10. First the child says something, after which the counselor optionally expresses support, and subsequently gives advice. Figure 4.11 shows the sequence **RtU 2**. First the child says something, in response to which the counselor asks a question. Subsequently, the child answers the question. Sequence **RtU 3** is displayed in Figure 4.12. In this sequence the counselor answers a question of the child, and after that, the child says something.

Finally, we found two sequences that were hard to interpret. These have been called **Other**. Figure 4.13 shows the sequence **Other 1**. The sequence starts with the child saying something, or the counselor expressing support and than the child saying something. After that, the counselor optionally expresses support. Sequence **Other 2** is displayed in Figure 4.14. The sequence consists of the counselor asking a question and saying something afterwards. There is no response from the child.

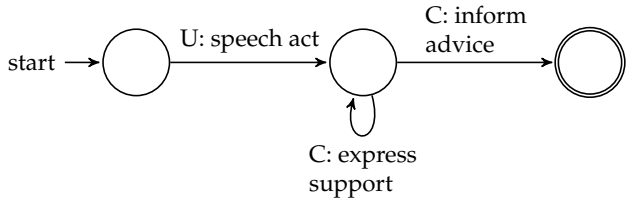


Figure 4.10: Sequence **RtU 1**.

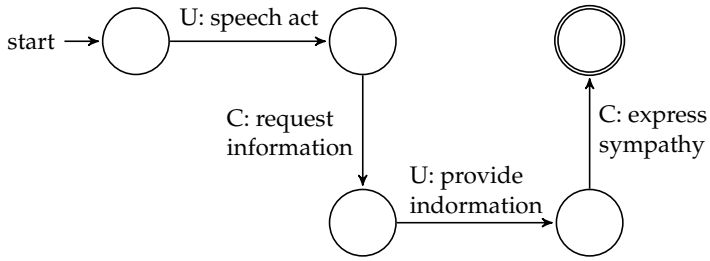


Figure 4.11: Sequence for **RtU 2**.

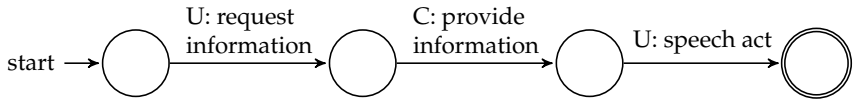


Figure 4.12: Sequence **RtU 3**.

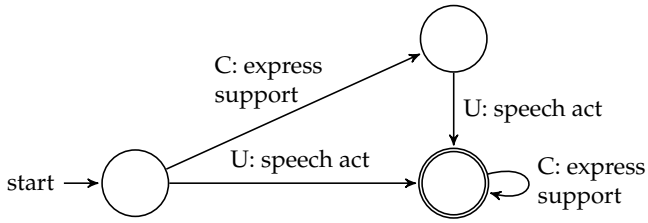


Figure 4.13: Sequence **Other 1**.

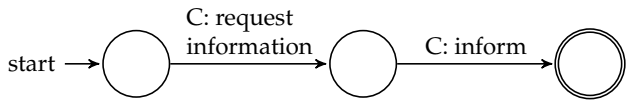


Figure 4.14: Sequence **Other 2**.

	QA 1	RtU 1	RtU 2	QA 2	RtU 3	Other 1	Other 2
# Seq.	230	6	3	2	1	1	1
# Conv.	23	3	3	2	1	1	1

Table 4.8: Occurrence of the sequence patterns in phase 2. Grey columns indicate patterns expected in phase 2.

	QA 1	Advice 1	RtU 1	Other 1	Advice 2	Teaching
# Seq.	47	21	13	11	5	1
# Conv.	13	9	3	4	5	1

Table 4.9: Occurrence of the sequence patterns in phase 4. Grey columns indicate patterns expected in phase 4.

Finally, we report the frequencies of the sequences in phase 2 and 4. All 23 conversations in the corpus contain a (partial) phase 2. In this data, we found 7 different sequence patterns; the one specified by the model (**QA 1**) and 6 new ones (**QA 2**, **RtU 1-3**, **Other 1** and **Other 2**). Table 4.8 shows the frequency of each of these sequences in phase 2. Clearly, pattern **QA 1** is the most important pattern; it occurs in al 23 conversations and accounts for 94.2% of the sequences. There are only a few deviations of this pattern, so the data matches the model very well.

The corpus contains 14 conversations with a (partial) phase 4. In this data, we found 6 different sequence patterns; the three specified by the model (**QA 1**, **Advice 1** and **Teaching**), a new one (**Advice 2**) and 2 patterns that were also found in phase 2 (**RtU 1** and **Other 1**). Table 4.9 shows the frequencies of these patterns in phase 4. Patterns **QA 1**, **RtU 1** and **Other 1** are 'general' conversation patterns used to discuss coping future and other topics in phase 4, whereas **Advice 1**, **Advice 2** and **Teaching** are used to give advice. Pattern **QA 1** accounts for 66.2% of the general conversation sequences and patterns **Advice 1** and **Teaching** account for 66.7% of the advice giving sequences. Again we conclude that there is a good match between the data and the model.

Social Support Types in Phase 2 and 4

In order to gain a better understanding of the ways in which counselors verbally support their conversation partners, we report the social support types and the frequency with which they occur in the corpus. To this end, we analyzed all sequences from phase 2 and 4 that had been assigned topic *Event*, *Emotional state*, *Personal goal*, *Coping (current)*, *Coping (future)*, *Advice*, or *Social support other*. The results are presented in Table 4.10.

The results show that the social support types included in the conversation model (i.e., sympathy, compliment, encouragement, advice, and teaching) account for 94% of the sequences that contain a social support type in phase 2, and 84%

Support type	# of sequences in Phase 2	Phase 4
Sympathy	66	4
Encouragement	10	11
Compliment	18	8
Advice	0	27
Teaching	0	1
Other	6	10
Total social support	100	61
Acknowledgement	8	13
Total sequences	244	98

Table 4.10: Sequences containing social support types in phase 2 and 4.

in phase 4. Other types of support are used (e.g., comforting tirades, validation, and situation appraisal), but the selected support types are clearly used most often. Table 4.10 also shows that in phase 2 about 40% of the sequences contains a social support type, and in phase 4 about 60% (including advice and teaching).

4.3.3 Match between the Data and the Model

Generally, there is a good match between the conversation model and the data. Over 80% of the sequences in the data could be assigned one of the topics from the model. Six additional codes were needed to code the remaining 20% of the sequences. None of these additional codes refer to substantial topics in social support conversations; in fact, over 2/3 of the sequences that was assigned one of the additional topics can be considered conversation management to deal with situations when the conversation does not proceed as expected (e.g., topics *conversation* and *chat management*, and some sequences that were coded as *off-topic*). Vergunst proposes to use two dialogue models in conversational agents; "one for the standard (errorless) dialogue and one for error handling" [205, p. 19]. From this perspective our conversation model is the standard model. To deal with errors and unexpected input a second model is required.

The conversation model also predicts the occurrence of topics in phases very well. Only in phase 4 some topics not expected in this phase were discussed. This suggests social support conversations sometimes follow a cycle instead of a sequence of phases. In some cases, the counselor apparently needs additional information in phase 4 in order to allow the the conversation to continue. More research is needed to determine under what circumstances additional information is needed in phase 4.

We also analyzed the patterns in conversation sequences for phases 2 and 4

that had been assigned topic *Event*, *Emotional state*, *Personal goal*, *Coping (current)*, *Coping (future)*, *Advice*, or *Social support other*. We found that a large majority of the sequences followed the sequence patterns specified in the model (94.2% for phase 2 and over 66% for phase 4). In total, 7 additional sequence patterns were found, all of which occurred ≤ 13 times and four of them once or twice in the 342 sequences analyzed. We conclude that the social support conversations show a lot of regularity and that this regularity is captured very well in the conversation model.

The content analysis presented in this section confirms the proposed conversation model for social support is a valid specification of successful comforting conversations in the domain of (cyber)bullying. However, as mentioned before, the model is not equipped to deal with communication errors. We analyzed the successful parts of successful social support conversation. The initial data set contained many more 'unsuccessful' conversations. By unsuccessful we mean that the goal of these conversations was not to provide social support to a bullying victim. In order to be able to deal with communication errors and other conversation goals, the conversation model needs to be extended, or new conversation models should be constructed to deal with these conversation goals. This is beyond the scope of the current work.

In addition, our analysis did not take into account the order in which topics are discussed, even though the conversation model does specify a particular order. The order of topics in the conversation model makes sense from a theoretical perspective (i.e., it follows cognitive appraisal theories of emotion) and enforces a minimum level of consistency in the conversations. In practice, people maintain this level of consistency without necessarily sticking to discussing topics in a particular order. Therefore, we did not analyze the order in which topics were discussed in the social support conversations.

4.4 The Final Model

Based on the content analysis of social support conversations about bullying presented in Section 4.3, we made some changes to our initial conversation model (see Section 4.2.4). The final conversation model for social support is depicted in Figure 4.15. Table 4.11 lists the changes between the initial model and the final model. The topic *Personal goal* was removed from the model, because it occurred only once in the corpus of social support conversations about bullying (see Section 4.3.2). Also, because the difference between topics *Event (general)* and *Event (details)* is arbitrary, these two topics have been merged. Finally, the sequence for *Coping (future)* was changed from **QA 1** to **Advice 2** followed by **QA 1** (which is referred to as **QA** in the figure). We decided to include sequence **Advice 1** to make the conversations more varied.

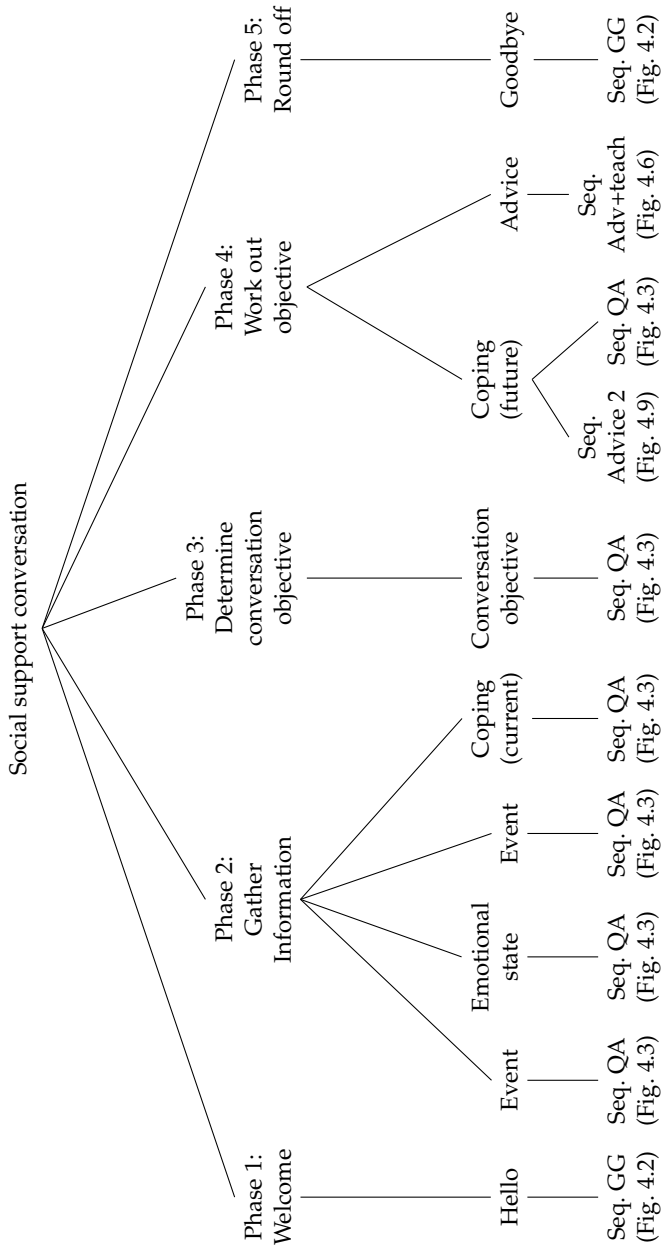


Figure 4.15: The conversation model for social support (final version).

Changes
• Removed topic *Personal goal*. • Merged topics *Event (general)* and *Event (details)*. • Changed sequence for *Coping (future)* to **Advice 2** followed by **QA**.

Table 4.11: Changes made to the initial conversation model.

4.5 Conclusion

Because it is unknown what the virtual buddy and the user should talk about during a social support conversation about cyberbullying, in this chapter we constructed a conversation model for social support. The model was based on the literature review of social support by humans presented in Section 3.2. The resulting conversation model combines De Beyn's 5-phase model for structuring counseling conversations by telephone and chat [21], topics suggested by Burleson and Goldsmith [41], and social support types from Bratithwaite's typology of social support [34]. The conversation model specifies that a social support conversation consists of phases, during which one or more topics are discussed. To discuss a topic, the model specifies conversation sequences that may contain expressions of support.

Seeing that the conversation model was constructed based on psychological literature, it is unclear to what extent it provides an accurate representation of social support conversations. In order to assess the validity of the model, it was compared to a corpus of chat conversations about bullying. The analysis of the data shows that the conversations in the corpus are quite regular. The comparison between the data and the model shows that the model captures the regularity of the data very well. We conclude that the proposed conversation model for social support is a valid specification of social support conversations without communication errors in the domain of (cyber)bullying. Based on the analysis of the data, three minor changes were made to the initial model for social support conversations.

One of our aims for the conversation model was to make it as domain-independent as possible. We claim that the model is domain-independent, because none of the individual phases, topics, or sequences refers to domain-specific information (e.g., about (cyber)bullying). The validity of the conversation model can be increased by analyzing social support conversations from other domains and assess to what extent they are represented by the conversation model.

To summarize, the contents and structure of social support conversations about bullying are relatively fixed; the majority of sequences that occur in these conversations follow one of a few conversation patterns. Therefore, it is possible to capture this type of conversations in a computational model. The validated model of social support conversations fills the gap in the ECA literature that was identified in Chapter 3. The next chapter describes the design and implementation of the virtual buddy prototype in which the conversation model was incorporated.

Chapter 5

Robin, the Virtual Buddy Prototype

In Section 1.2, we argued that providing social support is an important skill for companion and coaching ECAs. Our review of related work in Chapter 3 shows that an ECA aiming to reduce a user's negative emotions and/or to induce positive ones in non task-oriented settings does not exist. In particular, because because the user's task provides the foundation of conversations between ECAs and users in task oriented systems, and looking for social support is not a concrete task, it was unclear what the virtual buddy could discuss with a cyberbullying victim. This problem was solved by the conversation model for social support presented in Chapter 4. The next step is to implement the conversation model in an ECA system.

Because we are interested in understanding the principles that enable ECAs to provide social support, the design and implementation of the virtual buddy prototype is focused on these principles. Other aspects of the virtual buddy prototype are kept simple. The reasoning behind this approach is that developing a fully fledged ECA system, including modules for cognitive reasoning, reasoning about emotions, theory of mind, reasoning with emotions, natural language understanding and generation, synchronizing multimodal input and output, and realistically looking animated behavior, takes a lot of time and effort. A simple prototype can be build relatively fast and it is easier to adapt a simple prototype based on feedback from users and other stakeholders than a fully fledged ECA system.

In addition, it is easier to pinpoint why behavioral strategies of a simple ECA prototype trigger certain responses in users than it is to explain responses to ECAs using complex reasoning processes and collections of (advanced) behavioral strate-

Parts of this chapter have been published. An abbreviated version of section 5.3 was published in Proceedings of the 3rd Workshop on Emotional and Empathic Agents @ AAMAS 2012, pp. 1–8, 2012 [222]. An extended version of section 5.4.1 was published in Proceedings of the 15th Portuguese Conference on Artificial Intelligence (EPIA), pp. 1–15, 2011 [221]. Abbreviated versions of section 5.4.2 and 5.4.3 have been published in the proceedings of the 2013 Workshop on Computers as Social Actors (associated to IVA 2013), to appear [227].

gies. When the underlying principles of its behavior have been validated, simple prototypes can be used as starting points for more complex ECA systems. Our evaluation studies of the virtual buddy's supportive behavior presented in Chapter 6, 7, and 8 show that the simple virtual buddy prototype captures important principles of providing social support.

This chapter is organized as follows. Section 5.1 presents requirements for the virtual buddy prototype. In Section 5.2, we detail design decisions made during the design and implementation of the virtual buddy prototype. Section 5.3 presents the virtual buddy's architecture. Important components of the virtual buddy prototype are discussed in Section 5.4. Section 5.5 presents our conclusions.

5.1 Requirements

Based on the theory presented in Chapter 2 and 3, seven requirements for the virtual buddy prototype were formulated. These requirements are enumerated in Table 5.1. The first column lists the requirements, the second column shows on what material requirements are based, and the third column specifies the section in this chapter in which a requirement is addressed. Requirements for the virtual buddy prototype are divided into three groups; requirements for the conversation, requirements related to emotions, and requirements on the look and feel of the prototype.

The first set of requirements concerns the conversation between the user and the virtual buddy. We assume that during the conversation an upsetting event is discussed, and that the upsetting event is a cyberbullying situation. The requirements concerning the conversation are addressed in the conversation model for social support (Chapter 4). First, the conversation must progress and not remain stuck on discussing the user's problem. This requirement is met by applying De Beyn's 5-phase model [21] to conversations (see Section 3.2.5). Requirement 1.2 is based on the cyberbullying literature (see Section 2.1); the virtual buddy should provide both information and moral support (i.e., emotional and esteem support). The conversation model for social support includes these and other support types (Section 3.2.4). This also satisfies requirement 1.3.

The second set of requirements concerns emotions. First, seeing that the user's emotional state is one of the topics that will be discussed during a social support conversation, the virtual buddy will be able to determine the user's emotional state. To meet this requirement, we use an existing interface component for affective feedback (see also Section 5.2). The emotion input component is discussed in Section 5.4.1. In Section 3.2.6, we established that support providers express emotions both verbally and nonverbally. The virtual buddy's nonverbal expressions of emotions are discussed in Section 5.4.2, and verbal expressions of emotions in Section 5.4.4. Section 3.2.6 also emphasizes the importance of expressing empathy for the experience of social support. Therefore, the last requirement concerning emotions states that the virtual buddy must be empathetic to the user's emotional state. To this end the virtual buddy prototype is equipped with an emotion model that is explained

Requirement	Source	Solution
1. Conversation		
1.1 The conversation should progress and not get stuck on discussing the user's problem	Social support (Section 3.2.5)	Conversation model (Section 4.2.1)
1.2 The virtual buddy should provide information and emotional support	Cyberbullying (Section 2.1)	Conversation model (Section 4.2.2)
1.3 The virtual buddy should use multiple types of social support	Social support (Section 3.2.4)	Conversation model (Section 4.2.2)
2. Emotions		
2.1 The virtual buddy should be able to determine the user's emotional state	Social support (Section 3.2.3)	Emotion input (Section 5.4.1)
2.2 The virtual buddy should be able to express emotions, both verbally and nonverbally	Social support (Section 3.2.6)	Embodiment and emotion model (Section 5.4.2 and 5.4.3)
2.3 The virtual buddy should be empathic to the user's emotional state	Social support (Section 3.2.6)	Embodiment and emotion model (Section 5.4.2 and 5.4.3)
3. 'Look and feel'		
3.1 The virtual buddy's social role should be that of a peer	Cyberbullying (Section 2.1)	Conversation script and embodiment (Section 5.4.4 and 5.4.2)

Table 5.1: Requirements for the virtual buddy prototype.

in Section 5.4.3.

The last requirement refers to the virtual buddy's embodiment and the way its messages are expressed. The cyberbullying literature shows that cyberbullying victims do not like to talk to adults about being bullied online [64, 138, 150], and that cyberbullying victims see slightly older peers as the best resource for support on dealing with cyberbullying [191] (see also Section 2.1). Therefore, we require the virtual buddy's social role should be that of a peer. The appearance of the virtual buddy's embodiment is discussed in Section 5.4.2, and the way its messages are expressed in Section 5.4.4.

5.2 Design Decisions

The implementation of the virtual buddy prototype is based on the requirements discussed in Section 5.1. In addition, we made a number of design decisions that af-

Design decision
1. Single conversation
2. Scripted dialogue
3. Pre-defined response options
4. Pre-defined text messages for verbal output
5. Static pictures for nonverbal behavior
6. The virtual buddy's facial expressions are based on the AffectButton
7. The user communicates his emotional state with the AffectButton

Table 5.2: Design decisions for the virtual buddy prototype.

fected the design and implementation. The design decisions are presented in Table 5.2. As mentioned in the introduction of this chapter, our goal is to build a simple prototype that captures important principles of social support to cyberbullying victims. The underlying design principle of the virtual buddy prototype is KISS ('keep it simple stupid' [176]); most of the design decisions are simplifications. This section explains the motivation behind the design decisions listed in Table 5.2.

In order to keep the prototype as simple as possible, the first design decision is that we assume the user has a single conversation with the virtual buddy. The virtual buddy prototype presented in this chapter is the first step in the development of a virtual buddy that provides social support to cyberbullying victims. It is unlikely that a single conversation with the virtual buddy solves a bullying situation. However, allowing users to have multiple conversations requires a complex prototype. For example, the virtual buddy needs to store information between conversations and incorporate this information in subsequent conversations. If a simple prototype is not able to provide social support, it is unlikely that a more complex prototype will be successful. Therefore, we focus on the provision of support during a single conversation.

The design decision we made regarding conversation management is that we use a finite model. This means that the structure and contents of conversations are fixed in advance (i.e., scripted) and that there is little variation between conversations. The design decision to script conversations between the user and the virtual buddy is a simplification that results from the design decision to model a single conversation; because the user only has a single conversation with the virtual buddy, there is no need to make the conversation flexible or adaptive. There are different approaches to dialogue management (for reviews see e.g., [39, 53]). When focussing on the extent to which the structure of conversations is fixed in advance, three main approaches can be distinguished: dialogue grammars (including finite state models), plan-based approaches, and collaborative approaches (cf. [53]). These approaches range from a conversation structure that is completely fixed to increasingly more flexibility. Also, it is important to point out that these approaches are not necessarily mutually exclusive. For more details, the reader is referred to [39, 53].

Dialogue grammars provide prescriptive rules of the structure of conversations. The rules can describe a conversation from beginning to end, but there are also approaches that allow for more flexibility in the conversation structure (e.g., finite state models). Plan-based approaches attempt to model the communicative goals and sub-goals of conversation partners. The task of the listener (i.e., ECA) is to detect and respond appropriately to the speaker's (i.e., user's) underlying plan. This requires more flexibility in the conversation structure. In collaborative approaches, conversations are regarded as collaborative processes where both conversation partners work together to achieve a shared goal. Whereas dialogue grammars and plan-based approaches focus on the structure of the task the conversation partners try to perform, collaborative approaches to dialogue management try to capture the motivations behind a conversation and the mechanisms of the conversation itself. This requires a flexible conversation structure.

In order to interact with a virtual dialogue partner, users must be able to communicate with ECAs. We decided the user uses predefined response options to communicate with the virtual buddy. Various types of input devices are used in different ECA systems, ranging from spoken language (e.g., [45, 49, 118]), typed natural language text messages (e.g., [207, 208]), or selecting predefined response options (e.g., [25, 58]). Understanding spoken or written natural language requires natural language processing. Automatic interpretation of spoken or written language is not trivial. In addition, in conversations where the user is allowed to use spoken language or written messages to communicate with an ECA, the ECA must simulate different aspects of human conversational behavior, such as managing turn taking, dealing with interruptions, taking care of input the ECA does not understand, and communication errors. In order to keep managing turn taking, and input interpretation simple, we decided to use predefined response options as the means for the user to communicate with the virtual buddy.

In addition to being able to 'listen' to users, virtual dialogue partners need to be able to convey messages to users. We decided that the virtual buddy prototype uses a library of predefined text messages for verbal communication with the user. More specifically, we used a one-to-one mapping of speech acts to natural language sentences. In Section 3.3 and 3.4 different output modalities used in ECAs have been introduced (e.g., spoken language, written text, facial expressions, and gestures). Verbal output can consist of text messages (e.g., in speech balloons or through a chat interface) or spoken language. Verbal expressions can be predefined (a library of 'canned sentences'), or generated by a natural language generator. Spoken language can also be pre-recorded or generated on the fly (speech synthesis). Again, to avoid unnecessary complexity, the virtual buddy uses predefined text messages to convey verbal messages to the user.

An ECA's nonverbal behavior is displayed by its embodiment. The appearance of embodiments and the quality of nonverbal behavior vary between ECA systems, and range from static cartoon-like representations to highly realistic human-like appearances and animated nonverbal behavior (see for example the work presented in Section 3.3 and 3.4). From the options available, we selected static pictures of

different facial expressions to generate the virtual buddy's nonverbal behavior. This is the most simple alternative. Beale and Creed emphasize the importance of validating an ECA's facial expressions before using them in applications [19]. We ensured the validity of the virtual buddy's facial expressions by basing them on the expressions of the AffectButton, an interface component for affective feedback consisting of a gender-neutral face that is capable of displaying a wide range of facial expressions [37] (see also Section 5.4.1). The expressions of the AffectButton have been validated in multiple studies [37, 38].

The final design decision is to use the AffectButton to allow users to communicate their emotional state to the virtual buddy. We chose to use the AffectButton, because selecting facial expressions representing an emotional state seems easier and more meaningful than using words or predefined response options (especially for children), and because the AffectButton provides a compact representation of many different affective states. In affective computing, a wide range of methods for affect detection is used, including recognition of facial expressions and body posture (e.g., [133, 181]), speech sounds (e.g., [20, 181]), physiological data (e.g., [172]), and self-report (e.g., [92, 114]). More details can be found in Calvo and D'Mello's review of methods for affect detection [44]. Because the conversation model for social support specifies the user's emotional state as a conversation topic, the user's emotional state is explicitly discussed during the conversation. The AffectButton is a compact and intuitive interface component for emotion input.

5.3 Architecture

Figure 5.1 shows the virtual buddy's architecture. The architecture is based on the generic architecture for companion agents and robots by Steunebrink et al. [192]. The reasoning engine is modeled according to the Belief-Desire-Intention (BDI) paradigm [56]. This means the virtual buddy has beliefs (e.g., about what advice to give in which situations), goals (e.g., to give social support), and plans (e.g., the 5-phase model). Next, the different components of the architecture are discussed. A Prolog-like notation is used to provide examples to clarify technical details.

5.3.1 Input/Output

The virtual buddy and the user communicate through natural language text messages. In addition, the user communicates his emotional state in PAD values (see Section 5.4.1), and the virtual buddy displays different facial expressions (see Section 5.4.2). The virtual buddy's emotion model is discussed briefly in Section 5.3.3 and in more detail in Section 5.4.3. In the reasoning engine, natural language text messages are represented as speech acts. In particular, FIPA-ACL communicative acts [77] inform and request are used to represent the virtual buddy's and the user's utterances. Inform is used to notify the receiver of a message that a given proposition is true. Request is used by the sender of a message to request the receiver to

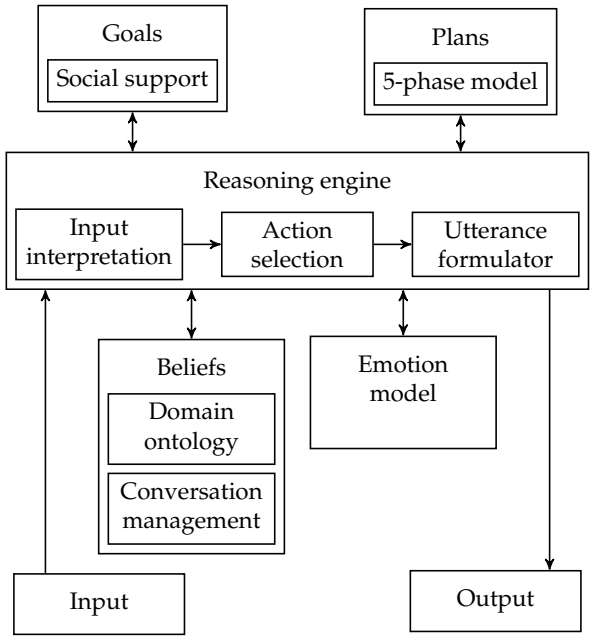


Figure 5.1: The architecture of the virtual buddy prototype. Output is produced by the action selection engine based on the input and the virtual buddy's beliefs.

perform some action, for example to perform another speech act (i.e., to answer a question). An example of a speech act in which social support is expressed is:

```
send(user, inform, compliment( incident(response,
    confronted_bully), courageous) )
```

This speech act represents a compliment given to the user for being courageous because he confronted the bully. A translation of this communicative act to natural language could be: *I think it was very brave of you to confront the bully!* The implementation of the virtual buddy prototype contains a one-to-one mapping of speech acts to natural language sentences (cf. design decision 3).

5.3.2 Beliefs

The virtual buddy's beliefs are stored in the belief base. The virtual buddy has beliefs regarding the domain (e.g., what questions to ask the user and what advice to give in different situations), and conversation management (e.g., how to open and close conversations). Additionally, the virtual buddy stores beliefs about the current conversation phase, for example

```
conversation(phase, welcome)
```

and facts about the incident it has learned from the user, for example

```
incident(incident_type, cyberbullying)
```

The contents of the speech acts (and thus of the conversation) are defined by the contents of the belief base. To enable reuse in other domains, the knowledge in the belief base is kept as generic as possible. This is achieved by separating conversation management rules from domain specific knowledge. The action selection engine requests and updates information from the belief base.

5.3.3 Emotion Model

The emotion model generates the virtual buddy's emotions that are subsequently expressed both verbally and nonverbally. Social support types sympathy, compliment and encouragement are triggered by emotions. Emotions are generated by interpreting the user's speech acts and PAD values representing the user's emotional state. More details about the emotion model can be found in Section 5.4.3.

5.3.4 Reasoning Engine

The reasoning engine is based on the BDI paradigm. In the reasoning engine, beliefs are combined to select actions, which, in case of the virtual buddy, are speech acts and facial expressions. The main goal of the virtual buddy is to give social support. Giving social support is operationalized as completing the conversation with the user. The virtual buddy has a single plan to reach this goal, that is following the conversation model for social support presented in Chapter 4. Beliefs about the current conversation phase trigger subgoals and subsequently the virtual buddy's actions. In phase 1 (welcome), the goal is to have greeted the user. In phase 2 (gather information), the virtual buddy has the goal of knowing certain facts about the cyberbullying incident. In the third phase of the 5-phase model (determine conversation objective), the goal is to know the user's conversation objective. In phase 4 (work out objective) the virtual buddy's goal is to have delivered all relevant advice. The advice is based on the information the virtual buddy gathered in the second phase. Finally, in phase 5 (close conversation), the virtual buddy has the goal to have said goodbye to the user. During the conversation, the emotion model generates emotions that are expressed by the virtual buddy both verbally and nonverbally. The virtual buddy provides emotional and esteem support (i.e., sympathy, compliment and encouragement) by expressing emotions.

5.4 The Prototype

Figure 5.2 shows a screenshot of the virtual buddy prototype. The interface resembles an instant messenger application. The virtual buddy's embodiment is displayed in the top left, the message history on the right, and the user's response options on the bottom of the interface. The virtual buddy was given the gender-neutral name Robin.

The architecture was modeled according to the BDI paradigm (see in Section 5.3). In line with this, the virtual buddy prototype was implemented in agent pro-

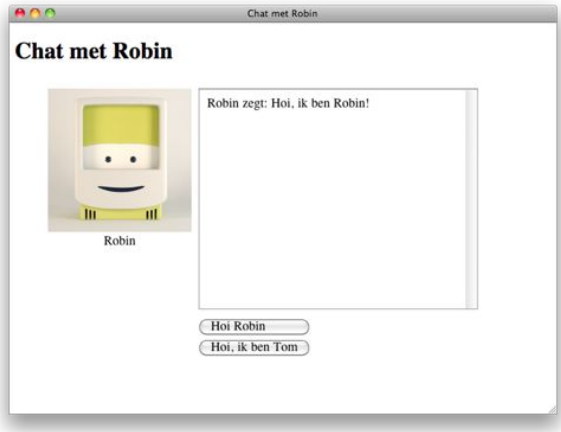


Figure 5.2: Screen shot of Robin, the empathic virtual buddy.

gramming language GOAL [90]. Implementing the prototype in GOAL allowed us to gain insight in and experience with the BDI paradigm for conversational agents. However, running GOAL agents requires particular, uncommon software to be installed. Because we were planning to evaluate the virtual buddy's supportive behavior in an online survey, the prototype was reimplemented in Java. Chapter 6, 7, and 8 present evaluation studies of the virtual buddy's supportive behavior. All studies, except the pilot experiment presented in Section 6.1, have been conducted with the Java prototype. For the pilot study, we used an earlier version of the prototype that was also implemented in Java.

This section describes the different components of the virtual buddy prototype. Section 5.4.1 explains the AffectButton, an existing interface component for affective feedback [37] (not depicted in Figure 5.2). In Section 5.4.2, the appearance of the virtual buddy's embodiment and the different facial expressions it is able to display are discussed. Section 5.4.3 presents the virtual buddy's emotion model that generates its supportive behavior. A Prolog-like notation is used to specify the workings of the emotion model. Finally, Section 5.4.4 presents an example social support conversation that illustrates the instantiation of the conversation model and the tone of voice of the verbal messages.

5.4.1 Emotion Input

One of the topics discussed during a conversation between the virtual buddy and the user is the user's emotional state. The user uses the AffectButton [37] to communicate his emotional state to the virtual buddy. The AffectButton is displayed in Figure 5.3. It is a button with a rudimentary and gender-neutral face that changes its expression based on the position of the mouse cursor. By clicking the button when it shows the emotional expression the user wants to communicate, a Pleasure,

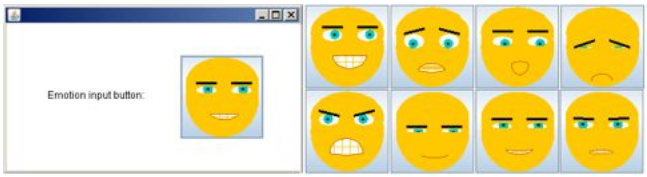


Figure 5.3: The AffectButton and its extreme affective states: elated (PAD=1,1,1), afraid (-1,1,-1), surprised (1,1,-1), sad (-1,-1,-1), angry (-1,1,1), relaxed (1,-1,-1), content (1,-1,1), frustrated (-1,-1,1). Labels are exemplary. The AffectButton allows for continuous input in the PAD space.

Arousal, Dominance (PAD) triplet representing the button's current facial expression is send to the virtual buddy's reasoning engine. The virtual buddy responds to this input by showing understanding of the user's emotional state (see Section 5.4.3).

We conducted an experiment to gather normative ratings of cyberbullying situations, which can be considered complex stimuli. In addition, we assessed the validity and usability of the AffectButton. In the remainder of this section, the results of this experiment are discussed. More details can be found in [221].

Emotion Input Experiment: Design and Setup

A between subject design was used to gather affective ratings from participants. Each participant rated 12 stimuli: 2 randomly selected cyberbullying situations and 10 randomly selected texts from ANET, a standard collection of brief situation descriptions with associated normative PAD ratings [33]. A total of six sentences describing common cyberbullying situations were created by the author. The 60 texts from ANET set A were translated to Dutch.

Rating situations with the AffectButton (AB) was compared to rating situations with the Self-Assessment Manikins (SAM) scale [32]. SAM is a well-validated method to acquire emotional responses to different stimuli (e.g., text [33] and images [129]). The method is based on the PAD model, and is depicted in Figure 5.4. The SAM scale consists of three rows of pictures, one for each PAD dimension. Each row contains five pictures, resulting in a 9-point scale (five pictures and four intermediary spaces). Participants select the point on the scale that best describes their emotion for each dimension separately. A rating consists of a PAD triplet with values ranging from -1 to 1.

Usability of the affective feedback interface was measured by four items on a 7-point Likert scale: 1) the interface is easy to use, 2) the interface is pleasant to use, 3) the interface is easy to understand, 4) it takes little effort to rate emotions with the interface. In addition, the participants were asked to report demographic information; age, and gender. Finally, the time needed by each participant to complete the ratings was recorded.

In total, 202 participants rated situations using either the AffectButton or SAM.

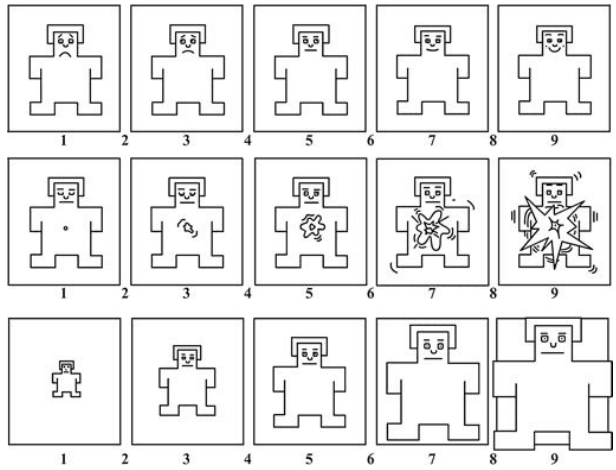


Figure 5.4: Self-Assessment Manikins (SAM) (taken from [189]).

Participants were predominantly female (97.5%). 25.5% of the participants were younger than 25, 11.5% were between 26-35 years old, 25.5% between 36-45, 23.5% between 46-55, and 14% were over 65 years old. On average, it took participants 4 minutes to complete rating 12 situations.

Emotion Input Experiment: Validity of the AffectButton

The validity, reliability and usability of the AffectButton has been shown previously [37, 38]. Here we focus on two things: first, affective feedback gathered with the AffectButton should correlate with original ANET values, and second, correlate with SAM feedback. A correlation analysis resulted in the following. AffectButton ratings obtained during the experiment and existing ANET ratings correlated strongly for P ($r(60)=0.94$, $p<0.000$) and D ($r(60)=0.86$, $p<0.000$), and moderately for A ($r(60)=0.55$, $p<0.000$). This indicates the AffectButton results in valid measurements as compared to the existing values for the ANET texts. Further, ratings obtained with the AffectButton and ratings obtained with SAM during the experiment also correlated strongly for P ($r(60)=0.93$, $p<0.000$), D ($r(60)=0.90$, $p<0.000$) and moderately for A ($r(60)=0.55$, $p<0.000$). These results indicate that the AffectButton shows convergent validity, and can therefore be used to obtain PAD values in approximately the same way as intended with SAM in this particular setting.

Emotion Input Experiment: Usability of the AffectButton

Results from the usability questionnaire indicate that participants felt SAM was easier to use than the AffectButton ($M_{AB}=4.85$, $SD_{AB}=1.60$; $M_{SAM}=5.44$, $SD_{SAM}=1.43$; $t(200)=2.77$, $p=0.006$), and that using the AffectButton took more effort ($M_{AB}=4.50$, $SD_{AB}=1.71$; $M_{SAM}=5.21$, $SD_{SAM}=1.37$; $t(200)=3.25$, $p=0.001$). There were no statisti-

cally significant differences between the ratings on pleasantness of use (M_{AB}=5.13, SD_{AB}=1.50; M_{SAM}=5.42, SD_{SAM}=1.36; t(200)=1.45, p=0.15), and on ease of understanding (M_{AB}=5.52, SD_{AB}=1.41;
M_{SAM}=5.60, SD_{SAM}=1.54; t(200)=0.38, p=0.71). Rating a situation with the AffectButton took on average 12.1 seconds (SD=4.00), whereas rating with SAM took on average 16 seconds (SD=4.67). This difference is statistically significant (t(200)=4.93, p=0.000). Overall, usability scores of the AffectButton are acceptable (> 4) and indicate users are able to use it.

Emotion Input Experiment: Normative Ratings of Cyberbullying Situations

For al but one of the cyberbullying texts, the PAD values obtained with both the AffectButton and SAM were similar: pleasure is low (<0), arousal is high (>0) and dominance is low (>0)). Low P values indicate that the cyberbullying situations mostly evoked negative emotions. This is as expected, because being (cyber)bullied is generally considered to be a negative experience. Overall, the common pattern in all PAD values obtained using SAM and the AffectButton can be characterized as low pleasure, high arousal and low dominance, which indicates an affective state of fear or worry.

The PAD values obtained for one of the texts were spread over the entire PAD space. This particular text described a situation in which a friendship request on Facebook was rejected. A possible explanation for this wide range of scores is that adults misjudged the severity of the situation, possibly caused by their failure to understand the importance of online contacts for children and adolescents. It is expected that members of the virtual buddy's target audience will predominantly rate this situation as negative (low pleasure). This underscores the importance of experimenting with the actual target group in these kind of applications. The text was excluded from further analysis.

In the three-dimensional PAD space, there are four negative emotions, which are all characterized by low pleasure: sadness (low pleasure, low arousal and low dominance), fear (low pleasure, high arousal and low dominance), frustration (low pleasure, low arousal and high dominance), and anger (low pleasure, high arousal and high dominance). Because pleasure was low for the five texts that were analyzed, we examined results of the AD values. The ratings of two texts were predominantly found in the fear-quadrant of the AD plane. For three texts there multiple clusters of emotions could be distinguished: sadness, anger and fear. The virtual buddy needs to be able to provide appropriate supportive responses to these types of emotional states.

Emotion Input Experiment: Conclusion

The results of the experiment show that the AffectButton produces valid PAD ratings. In addition, the AffectButton's usability is acceptable. The main goal of the experiment was to gather normative ratings of cyberbullying situations. In-

spection of the results for individual texts revealed that all texts (except one that was probably misinterpreted by the participants) were perceived to be negative. SAM and AffectButton ratings are predominantly found in the fear quadrant of the arousal/dominance (AD) plane, whereas for three texts different clusters were found in the ratings obtained with the AffectButton, i.e., sadness, anger, and fear. The virtual buddy's reasoning engine should be able to provide appropriate responses to these emotional states (mainly sadness, anger, and fear), and in general respond to the feeling of fear or worry. In Section 5.4.3, we describe the virtual buddy's emotion model, and explain how the virtual buddy responds to input from the AffectButton.

An important limitation of this study is that the experiment was conducted among adults and not the virtual buddy's actual target audience (i.e., children between the ages of 10 and 14). Nevertheless, the results provide a generic evaluation of the AffectButton's functioning. For one of the cyberbullying texts, ratings obtained with the AffectButton were spread out over the entire PAD space. This indicates that adults sometimes misjudge cyberbullying situations. Further, the main trend of the affective attribution to these situations was one of fear/worry, while one would expect sadness to be at least as dominant. This could also be an indication of the fact that the raters were predominantly mothers, who would experience fear and worry instead of sadness when their child is being cyberbullied. Our results underscore the need to evaluate this kind of application using the actual target group.

5.4.2 Embodiment

The term 'embodiment' refers to the visual representation of an ECA. A meta-analysis of research on conversational agents with and without embodiments shows that "a visual representation of an agent leads to more positive social interaction than not having a visual representation" [218, p. 6]. Many ECAs presented in related work look like humans (see for example the work presented in Section 3.3 and 3.4), although non-anthropomorphic ECAs also exist (see for example [108]).

The virtual buddy's embodiment is depicted in Figure 5.2. It is designed to look like an old computer. We deliberately chose not to have a human-like embodiment to represent the virtual buddy, because we wanted to emphasize the virtual buddy is a software application that is not controlled by humans. There were three arguments that motivated this preference. First, we wanted to reduce users' expectations of the virtual buddy's capabilities and intelligence. Second, we wanted to satisfy potential ethical concerns with respect to empathic ECAs that pretend to care about users (cf. [169]). And third, we expect that cyberbullying victims are more willing to use the virtual buddy when they know it is not controlled by a human, because they are reluctant to talk about cyberbullying to adults (see Section 2.1.2). The appearance of an old computer was adopted to make it look like an expert on digital matters such as cyberbullying.

Figure 5.5 shows the different facial expressions the virtual buddy is capable

of displaying. The virtual buddy can expres eight different emotions at either high or low intensity, and a neutral facial expression (center picture of Figure 5.5). The virtual buddy's facial expressions are based on the facial expressions that can be produced with the AffectButton (see Section 5.4.1). The neutral facial expression in the center of Figure 5.5, has PAD values of 0. The PAD values of the expressions around the neutral expression are ± 0.66. The outer facial expressions are the 'extremes' of the AffectButton (i.e., PAD values of ± 1).

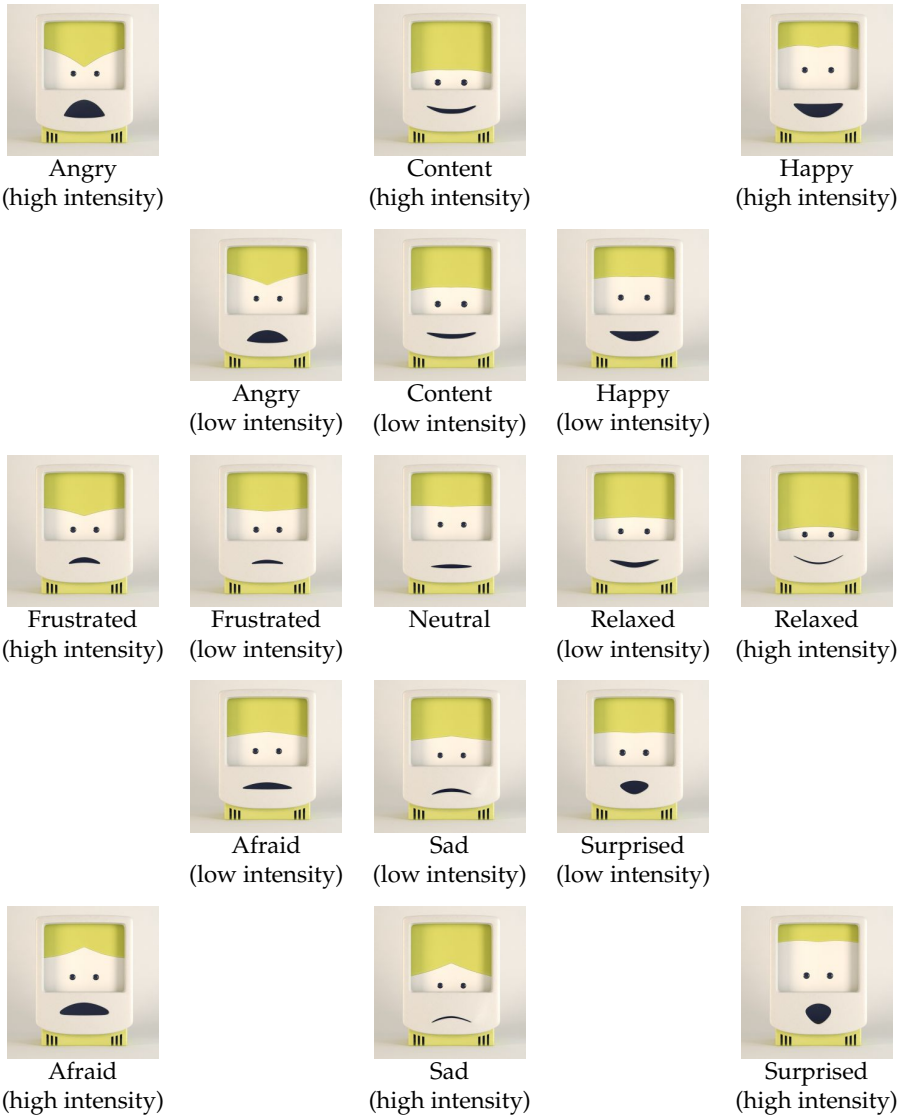


Figure 5.5: The virtual buddy's facial expressions.

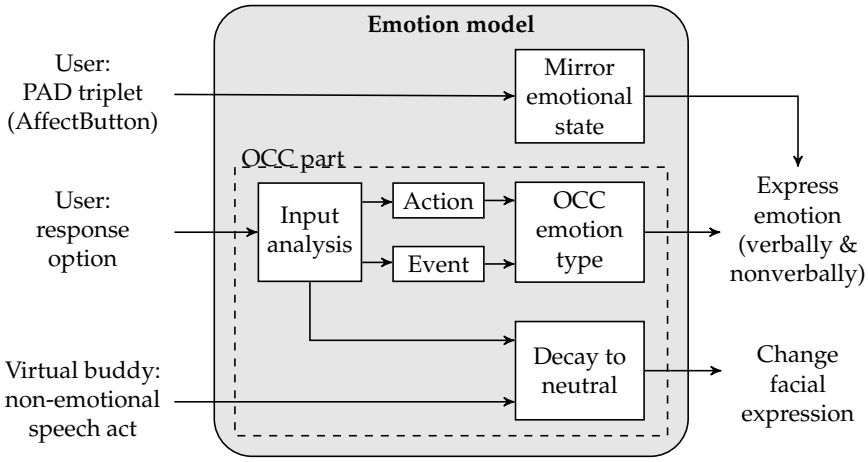


Figure 5.6: The virtual buddy's emotion model.

5.4.3 Emotion Model

The emotion model generates the virtual buddy's emotions. It is depicted in Figure 5.6. The virtual buddy's emotional state is determined based on input from the AffectButton, response options selected by the user, and non-emotional utterances of the virtual buddy. Emotions are generated in response to user input. Input from the AffectButton is mirrored. Alternatively, if a response option represents an action or event, an emotion is generated and subsequently expressed both verbally and nonverbally. If a response option does not represent an action or event, or if a speech act was sent by the virtual buddy, the emotional state gradually decays to neutral. The flowchart depicted in Figure 5.7 specifies how speech acts uttered by the user and the virtual buddy are processed in the emotion model.

The part of the emotion model marked 'OCC part' is based on the OCC model of emotions [161]. The virtual buddy's emotional state consists of an OCC emotion type $\in$ {joy, distress, happy-for, pity, admiration, reproach, neutral} and intensity $\in$ {high, low}. For example,

```
current_emotional_state(happy-for, high)
```

specifies that the virtual buddy's current emotional state is 'happy-for' with a high intensity. We would like to point out that 'neutral' is not an OCC emotion type; the label 'neutral' is used to indicate the absence of an emotion type (i.e., there is no current emotion). By definition, the neutral emotional state always has a high intensity.

In this section, we first explain the OCC part of the emotion model. Next, we specify how triggered OCC emotion types elicit emotional and esteem support, and what other OCC emotion tyes are expressed. Finally, we discuss the part that mirrors input from the AffectButton.

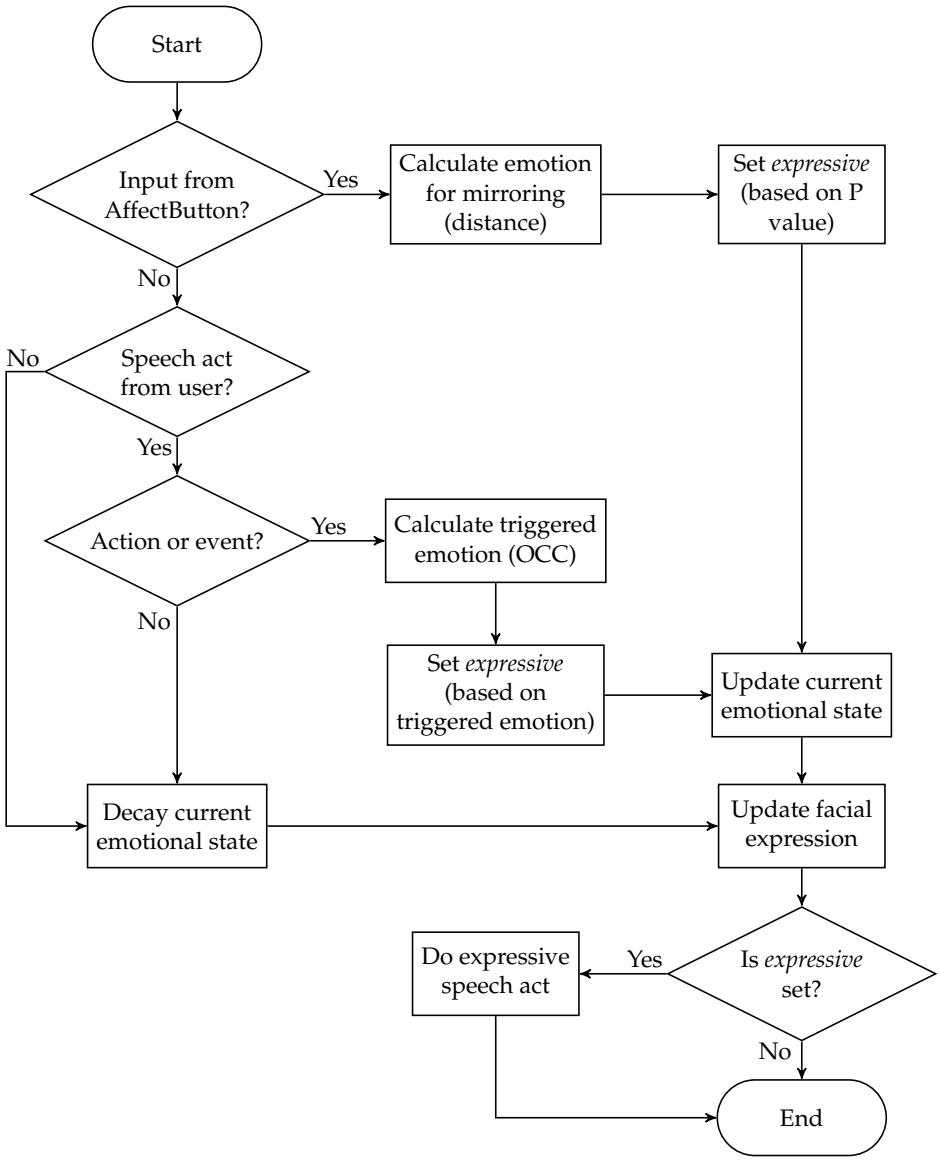


Figure 5.7: Algorithm used by the emotion model to process speech acts that are uttered during the conversation.

Eliciting OCC Emotion Types

The OCC part of the virtual buddy's emotion model is based on the implementation of the OCC model in domain-independent agent architecture FAtiMA [65]. In particular, it closely resembles FAtiMA's reactive layer (see also Section 3.3.3). However, whereas FAtiMA uses domain specific emotional reaction rules, the rules in this part of the virtual buddy's emotional model are (largely) domain-independent.

As mentioned before, in this part of the emotion model, the user's response options are interpreted as actions or events. An action or event triggers an OCC emotion type, that is subsequently expressed. Although OCC also specifies emotional responses to objects, emotional responses to objects are not included in the current emotion model.

A response option triggers zero or one emotion types (see also Figure 5.7). Emotions are expressed verbally and nonverbally. If an emotion is triggered, the virtual buddy sets the next speech act to be an *expressive* (i.e., a verbal expression of emotions (see Section 4.1)). The mapping between OCC emotion types and speech acts is discussed later. First, we focus on updating the virtual buddy's current emotional state. In the emotion model, the triggered emotion replaces the virtual buddy's current emotional state:

```
current_emotional_state(Emotion, Intensity) :-
    triggered_emotion_type(Emotion, Intensity),
    user_speech_act_is_action_or_event.
```

The predicate `user_speech_act_is_action_or_event` is true, if the speech act that is currently being processed by the emotion model was send by the user and represents an action or event.

After the current emotional state is updated, the virtual buddy's facial expression is changed to reflect its current emotional state. Table 5.3 shows the facial expressions the virtual buddy uses to express the different emotional states it is capable of expressing. The facial expression for the neutral emotional state corresponds to PAD values (0.66, -0.66, 0.66). This facial expression was selected to give the virtual buddy a more positive outlook.

If a response option does not trigger an emotion, or if the speech act that is being processed was send by the virtual buddy, the virtual buddy's current emotional state is decayed to neutral:

```
current_emotional_state(Emotion, Intensity) :-
    previous_emotional_state(PrevEmotion, PrevIntensity),
    decay(PrevEmotion, PrevIntensity, Emotion, Intensity),
    decay.
```

Table 5.4 specifies the `decay(Emotion, Intensity)`-predicate. The `decay`-predicate is true, if the speech act that is currently being processed by the emotion model was send by the user and does not represent an action or event, or if the speech act that is currently being processed by the emotion model was send by the virtual buddy.

The virtual buddy learns what happened to the user through the response options selected by the user. Subsequently, the buddy responds to the actions and events represented by the selected response options by expressing its own emotions (i.e., the emotions of an observer). In the remainder of this section, we first specify the role of the emotion model in expressing emotional and esteem support. Next, we explain how the virtual buddy responds to input from the AffectButton. Finally, the expression of other OCC emotion types is discussed.

OCC emotion type	Facial expression: High intensity	Facial expression: Low intensity
Joy, happy-for, admiration		
Distress, pity		
Reproach		
Neutral		

Table 5.3: Facial expressions used to express OCC emotion types.

Previous emotional state		Decayed	
Previous Emotion Type	Previous Intensity	Emotion Type	Intensity
joy	high	joy	low
joy	low	neutral	high
distress	high	distress	low
distress	low	neutral	high
happy-for	high	happy-for	low
happy-for	low	neutral	high
pity	high	pity	low
pity	low	neutral	high
admiration	high	admiration	low
admiration	low	neutral	high
reproach	high	reproach	low
reproach	low	neutral	high
neutral	high	neutral	high

Table 5.4: Specification of `decay(PrevEmotion, PrevIntensity, Emotion, Intensity)`-predicate.

Social support type	OCC emotion type
Sympathy	Pity
Compliment	Admiration
Encouragement	Happy-for

Table 5.5: Mapping between social support types and OCC emotion types.

OCC emotion type	Trigger	Example
Reproach	The user performed an unpraiseworthy action	The user retaliated
Joy	Occurrence of an event that is pleasant for the virtual buddy	The user thought the conversation was useful
Distress	Occurrence of an event that is unpleasant for the virtual buddy	The user thought the conversation was not useful

Table 5.6: Other emotions the virtual buddy can express during a social support conversation.

Verbally Expressing Emotional Support, Esteem Support, and Other OCC Emotion Types

As mentioned before, triggered emotions are expressed both both verbally and non-verbally by the virtual buddy. If an emotion is triggered, an expressive representing the triggered emotion is queued for expression. There is a fixed mapping between OCC emotion types and types of speech acts. For social support types sympathy, compliment, and encouragement the mapping between OCC emotion types and types of speech acts are listed in Table 5.5. Sympathy is triggered by events that are unpleasant for the user (OCC emotion type pity). Compliment is triggered by praiseworthy actions performed by the user (OCC emotion type admiration). Encouragement is triggered by events that are pleasant for the user (OCC emotion type happy-for). This operationalization of encouragement is slightly different from the interpretation proposed in the conversation model for social support (see Section 4.2.2).

During the conversation, there are a few other moments when the virtual buddy expresses emotions. The OCC emotion types and associated triggers are listed in Table 5.6. When the user admits performing an action that was unpraiseworthy, the virtual buddy expresses reproach. This is the inverse of giving a compliment. When rounding off the conversation, the virtual buddy asks the user whether the conversation was useful to him. If the user says 'yes' the virtual buddy expresses joy, and if the user says 'no' the virtual buddy expresses distress.

High intensity			Low intensity			
P	A	D	P	A	D	Emotional state
0	0	0	0	0	0	Neutral
1	1	1	0.5	0.5	0.5	Happy
-1	-1	-1	-0.5	-0.5	-0.5	Sad
-1	1	1	-0.5	0.5	0.5	Angry
1	-1	1	0.5	-0.5	0.5	Content
1	-1	-1	0.5	-0.5	-0.5	Relaxed
1	1	-1	0.5	0.5	-0.5	Surprised
-1	1	-1	-0.5	0.5	0.5	Afraid
-1	-1	1	-0.5	-0.5	0.5	Frustrated

Table 5.7: PAD coordinates of facial expressions used to calculate distances between input PAD values and the facial expression displayed for mirroring.

Mirroring Input from the AffectButton

During the conversation, the virtual buddy asks the user how he feels about being bullied. The user specifies his emotional state by manipulating the AffectButton. When the user clicks the AffectButton, PAD values representing an emotional state are send to the emotion model. To convey understanding of the user's emotional state, the virtual buddy mirrors the emotional state that is communicated. In order to mirror the user's emotional state, the virtual buddy's current emotional state is changed the state that is closest to the PAD values communicated by the user:

```
current_emotional_state(Emotion, Intensity) :-
    affectbutton(InputP, InputA, InputD, Emotion, Intensity)
```

The `affectbutton(InputP, InputA, InputD, Emotion, Intensity)`-predicate returns the emotional state that is closest to the input PAD values by calculating the Euclidian distance between the input PAD coordinates and reference PAD coordinates listed in Table 5.7. The change in the virtual buddy's emotional state is communicated to the user by displaying the associated facial expression.

In addition to visually mirroring the user's emotional state, the virtual buddy gives a verbal response. This verbal response is determined based on the P value that was communicated through the AffectButton. Table 5.8 lists the virtual buddy's verbal responses to different P values. If the P value is negative, the virtual buddy expresses sympathy. If the P value is low, the virtual buddy remarks that the bullying doesn't seem to bother the user that much. If the P value is high, the virtual buddy is glad that the user remains positive.

5.4.4 Conversation Script

This section presents an example social support conversation. The example conversation shows the conversation script and illustrates the instantiation of the con-

P	Verbal response
$P < 0$	*I'm sorry you are upset!*
$0 \leq P < 0.3$	*It doesn't seem to bother you that much...*
$P \geq 0.3$	*I'm glad you remain positive!*

Table 5.8: Verbal responses to different P-values.

versation model from Chapter 4. In addition, the conversation demonstrates the virtual buddy's verbal support strategies, and the tone of voice of the verbal messages. The messages' tone of voice is based on a conversation script written by three Master students in Developmental Psychology that was used in an evaluation of an early version of the virtual buddy prototype (see Section 6.1). In addition, the chat conversations about bullying used to validate the conversation model (see Section 4.3) have also influenced the contents of the conversation and the tone of voice of the verbal messages.

The example conversation follows the conversation model for social support. In order to increase the naturalness of the conversations some utterances have been added. Additionally, some domain specific information was added. The changes include:

- The virtual buddy explains the usage of the AffectButton,
- The virtual buddy provides feedback on the coping strategy selected by the user in phase 4 (Work out objective),
- If the user does not know whom to talk to, the virtual buddy suggests the user to contact a Pestweb counselor,
- The virtual buddy informs the user it is about to give advice and concludes the topic Advice by stating all advice has been given,
- In conversation phases 5 (Round off), the virtual buddy asks feedback about the usefulness of the conversation, and confirms the selected coping strategy or recommends the user to talk to a Pestweb counselor (the goal is to emphasize that the user should talk about the bullying).

In the example conversation, the natural language utterances have been translated from Dutch by the author. Information about the conversation phases, topics, social support types, and PAD values communicated have been added between square brackets. The name Robin refers to the virtual buddy, and the user in the example conversation is called Tom.

Robin says: *Hi, my name is Robin!* [Phase 1: Welcome; topic: Hello]
Tom says: *Hi, my name is Tom*
Robin says: *What is the matter?* [Phase 2: Gather information; topic: Event]
Tom says: *I'm being cyberbullied*
Robin says: *How are you being bullied?*
Tom says: *Someone is calling me names*

Robin says: *I'm sorry you are being called names!* [Support type: Sympathy]
Robin says: *Where are you being bullied?*
Tom says: *On MSN*
Robin says: *How do you feel when that happens?* [Topic: Emotional state]
Robin says: *(Move the mouse over the yellow face below and click when you have found the correct facial expression.)*
Tom clicks the AffectButton [P: -0.64; A: -0.60; D: -0.34]
Robin says: *I'm sorry you are upset!* [Support type: Sympathy]
Robin says: *Do you know who is bullying you?* [Topic: Event]
Tom says: *Someone I know in real life*
Robin says: *How long have you been bullied?*
Tom says: *A couple of weeks or months*
Robin says: *How do you respond to bullying?* [Topic: Coping (current)]
Tom says: *I stand up to the bully*
Robin says: *I think it is very brave of you to stand up to the bully!* [Support type: Compliment]
Robin says: *Does that help?*
Tom says: *Yes, I felt better after I did that*
Robin says: *I'm glad you felt better!* [Support type: Encouragement]
Robin says: *Did you talk to someone about the bullying?*
Tom says: *No*
Robin says: *How can I help you?* [Phase 3: Determine conversation objective, topic: Conversation objective]
Tom says: *I would like tips to stop the bullying*
Robin says: *There are different ways to respond to bullying; let's try to find something that suits you* [Phase 4: Work out objective, topic: Coping (future)]
Robin says: *You can ignore it*
Robin says: *You can stand up for yourself*
Robin says: *You can ask for help*
Robin says: *Which option do you like best?*
Tom says: *Ask for help*
Robin says: *Whom could you ask for help?*
Tom says: *A teacher or school counselor*
Robin says: *That's a good idea!*
Robin says: *Now I'll give some tips to (temporarily) stop the bullies.* [Topic: Advice]
Robin says: *To prevent people you do not know from harassing you, you should only accept invitations from people you know and trust* [Support type: Advice]
Tom says: *OK*
Robin says: *If you print abusive messages (or save them on your computer), you can show them to someone.* [Support type: Advice]
Tom says: *OK*
Robin says: *Block the bully on MSN, so he can't harass you anymore.* [Support type: Advice]
Tom says: *OK*

Robin says: *Do you want me to explain how to block someone on MSN?* [Support type: Teaching]
Tom says: *Yes*
Robin says: *Start MSN.*
Tom says: *OK*
Robin says: *Right click on the name of the person you want to block.*
Tom says: *OK*
Robin says: *Select 'block'.*
Tom says: *OK*
Robin says: *Now you know how to block someone on MSN.*
Robin says: *Those were my tips.*
Robin says: *Did you find this conversation useful?* [Phase 5: Round off; topic: Goodbye]
Tom says: *Yes*
Robin says: *I'm glad to hear that!*
Robin says: *I think you should talk to someone at school, as we have talked about.*
Robin says: *Bye Tom*

5.5 Conclusion

In this chapter, we presented the design and implementation of the virtual buddy prototype. Our goal was to create a simple prototype that allows us to understand the underlying principles of social support by ECAs. The design and implementation of the virtual buddy prototype was influenced by requirements and design decisions. Based on the theory in Chapter 2 and 3, we formulated the following requirements for a virtual buddy against cyberbullying: the conversation should progress and not get stuck on discussing the user's problem; the virtual buddy should use multiple types of social support, including information and emotional support; the virtual buddy should be able to determine the user's emotional state; the virtual buddy should be empathic to the user's emotional state; the virtual buddy should be able to express emotions, both verbally and nonverbally; and the virtual buddy should play the social role of a peer.

The conversation model for social support presented in Chapter 4 satisfies the first three requirements. The requirement regarding determining the user's emotional state is satisfied by the design decision to use an existing interface component for affective feedback. In order to be empathic to the user's emotional state, the virtual buddy uses an emotional model that triggers emotional and esteem support. The emotions generated by the emotion model are expressed both verbally and nonverbally, which satisfies the third requirement regarding emotions. Finally, the appearance of the virtual buddy and the tone of voice of its verbal messages were designed to give users the impression that the virtual buddy is a peer (i.e., aged between 10 and 14).

Additionally, the virtual buddy's design and implementation was influenced by a set of seven design decisions. First, we assume the user has a single conversation with the virtual buddy. Second, the conversation between the user and the buddy is scripted (i.e., fixed). Third, the user communicates with the virtual buddy by selecting predefined response options. Fourth, both the user's and the virtual buddy's verbal messages predefined (i.e., 'canned'). Fifth, the AffectButton, an existing interface component for affective feedback is used to gather information on the user's emotional state. Sixth, the virtual buddy's nonverbal behavior is simulated by using static pictures of different facial expressions. And finally, the virtual buddy's facial expressions are based on the facial expressions of the AffectButton, which are based on the Pleasure Arousal Dominance (PAD) representation of emotions.

The virtual buddy's supportive behavior is generated by the conversation model (conversation structure plus advice and teaching (information support)), and a simple reactive emotion model based on the OCC model of emotions (sympathy (emotional support), compliment (esteem support), and encouragement (emotional support)). If the simple virtual buddy prototype is successful in providing social support (in Chapter 6, 7, and 8, we show that the behavior of the simple virtual buddy prototype is experienced as being supportive), the next step is to add more complexity to the virtual buddy prototype and assess how these changes affect the experience of support. In particular, because bullying refers to a series of events rather than a single upsetting situation [160], we propose to start extending the virtual buddy prototype by removing the restriction of having a single conversation with the virtual buddy. Since many of the simplifications have been derived from this assumption, removing this assumption means that many design decisions need to be revised. To start with, knowledge from previous conversations needs to be preserved between conversations. In addition, this knowledge needs to be included in the current conversation. Modeling these knowledge updates, and taking into account their effects on the conversation structure are interesting lines for future research.

Chapter 6

Quantitative Evaluation of the Virtual Buddy's Supportive Behavior

In the previous chapters, we presented the design and implementation of Robin, a virtual buddy that provides social support to cyberbullying victims. The virtual buddy's supportive behavior consists of different strategies; the virtual buddy guides the user through a structured conversation, and provides emotional support, esteem support, and information support during the conversation. This chapter presents two quantitative evaluations of the virtual buddy's supportive behavior. The first study compares interaction with the virtual buddy to reading an informative text with the same information content. The second study compares four versions of the virtual buddy prototype with different levels of emotional expressiveness (i.e., no emotions, verbal emotions only, nonverbal emotions only, and verbal&nonverbal emotions), and investigates the influence of emotional expressiveness on user experience, effectiveness of the support, and perceptions of social support. Additionally, we gathered feedback on improving the virtual buddy prototype.

This chapter is organized as follows. Section 6.1 presents the pilot study and Section 6.2 the study into the effects of the virtual buddy emotional expressiveness on user experience, effectiveness of the support, and perceptions of social support. In section sec:quantitative-conclusion, we present our conclusions.

Parts of this chapter have been published. An abbreviated version of section 6.1 was published in Annual Review of Cybertherapy and Telemedicine 2012, pp. 243–247, 2012 [228]. An abbreviated version of section 6.2 was published in the proceedings of the 2013 Workshop on Computers as Social Actors (associated to IVA 2013), to appear [227].

6.1 Wizard of Oz Pilot Study

To validate our approach in providing social support and to gather feedback from potential users, we performed an experiment in which interaction with the virtual buddy was compared to reading an informative text. In this pilot study, we used an early version of the virtual buddy system. There are two differences between this pilot buddy and the implemented prototype presented in Chapter 5. The first difference is that the virtual buddy's actions (i.e., changing facial expressions and the messages send to the user) are selected by a person, instead of the buddy's reasoning engine. In other words, we used a Wizard of Oz (WoZ) version of the virtual buddy. The second difference is that the structure and contents of the conversation are based on the validated anti-bullying training 'Fun at School' [73] instead of the conversation model introduced in Chapter 4.

We decided not to use the 'Fun at school' anti-bullying training in the conversation script of the virtual buddy prototype, because De Beyn's 5-phase model [21] provides more details on the contents and structure of social support conversations than the 'Fun at school' anti-bullying training. In addition, online helplines do not use cognitive restructuring, the main technique taught to participants of the 'Fun at school' anti-bullying training (see also Section 6.1.1), because it is very hard to properly teach children to use this technique in a single chat conversation (personal communication, Laura Mol, July 8, 2012).

This section is organized as follows. Section 6.1.1 describes the WoZ buddy. In Section 6.1.2, we explain the experimental design and setup. Results are presented in Section 6.1.3. The conclusions of this study are presented in Section 6.1.4.

6.1.1 The Wizard of Oz Buddy

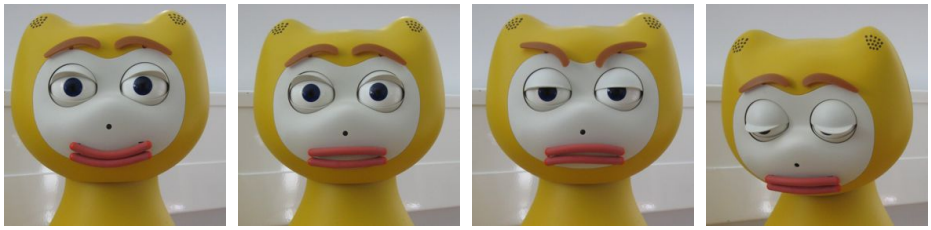
Figure 6.1 shows a screenshot of the virtual buddy that was used in the study. The embodiment of the virtual character (in the top left of the interface) consists of pictures of the iCat, an emotionally expressive robot from Philips [36]. Figure 6.2 shows the facial expressions the WoZ buddy can display.

Users communicate with the buddy by typing free text messages in the box below the message history. These messages are interpreted by the person controlling the buddy's actions (the wizard) and used to select a verbal and/or nonverbal response. All verbal and nonverbal expressions were predefined; at run-time, they are selected from a list by the person controlling the buddy. The contents and structure of the conversation were defined in a script.

During the conversation, the buddy asks the user how he feels about being bullied. For the response to this question, the text input field is replaced by four buttons depicting emoticons representing different emotional states. The emotions are displayed in Figure 6.3.



Figure 6.1: Screenshot of the empathic virtual buddy used in the WoZ pilot experiment.



(a) Happy (b) Afraid (c) Angry (d) Sad

Figure 6.2: The WoZ buddy's facial expressions.



Figure 6.3: Emoticons the user can choose from to select an emotional state.

The 'Fun at School' Anti-Bullying Training

The information content of conversation between the user and the buddy is based on the validated anti-bullying and social competence training named 'Fun at school' [73]. 'Fun at School' is a two-day summer course aimed at children aged 11-13 suffering from social anxiety, social-behavioral problems, or classroom bullying. One of the techniques participants of the 'fun at School' training are being taught is cognitive restructuring. Cognitive restructuring is a method to correct maladaptive thoughts that elicit negative emotions which subsequently evoke negative behavior [104]. During the training, participants learn they can not change events, but they can change the way they deal with the thoughts and feelings that stem from these events. To remind the participants of our experiment of the interaction between thoughts and behavior, a diagram visualizing this interaction was included in the informative text and depicted on the right side of the chat window (see Figure 6.1).

Contents and Structure of the Conversation

As mentioned before, the contents and structure of the conversation were defined in a script. All the buddy's messages were predefined, and the script specified which response should be given to certain user input. The script also specified changes in facial expression.

After saying hello to the user, the buddy asks him what happened. This allows the user give his account of the events. Next, the buddy asks the user what he thinks about the event and how he feels. Then the buddy explains the interaction between events, thoughts, feelings, behavior and consequences. After explaining the theory, the buddy asks the user to come up with a helping thought about his situation. If the user comes up with an unhelpful thought instead of a helpful one, the buddy implicitly corrects the user by saying: *I also thought of an example:* and includes a relevant helpful thought. Finally, before saying goodbye to the user, the buddy gives some practical tips the user can try to (temporarily) stop the cyberbullying. The tips are always the same, regardless of what the user told the buddy about his situation. During the conversation, the buddy responds sympathetically to input from the user, gives compliments, and mirrors the user's emotion.

6.1.2 Method

A between subjects design was used to gather user perceptions of the empathic virtual buddy. Participants in the experimental group interacted with the buddy and participants in the control group read an informative text containing the same information as the conversation with the buddy. Participants were randomly assigned to either the experimental group or the control group.

Participants

Thirty children aged 14-16 took part in the experiment (mean age = 14.9, SD = 0.7). 63% of the participants was male and all of them were experienced Internet users. Since bullying and cyberbullying are sensitive topics, and a minority of children and adolescents is a victim of bullying or cyberbullying (recent statistics from the Netherlands give prevalence rates of 35% for traditional bullying and 17% for cyberbullying [194]), being (cyber)bullied was not a criterium to participate in the study. Participants were selected from different high schools in the Netherlands. Prior to the experiment, written permission from the participants' parents was obtained.

Scenario

Since being bullied was not a criterium to participate in the study, participants may not know what it is like to be bullied. Therefore, interaction with the buddy (or reading the text) was based on a fictitious scenario. The scenario was based on literature describing common forms of cyberbullying [203], and tells the story of René, a fourteen-year-old boy that is being cyberbullied by his classmates on MSN[1]. One day he accepts an invitation to chat with a person he does not know and is subsequently verbally abused and threatened by this new contact. Participants were explicitly told to take the perspective of René when interacting with the buddy or reading the text, and filling out questionnaires.

Measures

Users' perceptions of the support provided was measured by seven Likert items. The items and corresponding statements are listed in Table 6.1. For the control group, the statements were rephrased to pertain to the text instead of the buddy. To determine the quality of the information provided by the buddy or in the text, we inquired about the relevance, trustworthiness, and understandability of the information that was provided by the buddy or in the text. The item persuasiveness was included to determine the extent to which participants were inclined to follow the advice given by the buddy or in the text. Geared toward situation referred to the extent to which the support provided by the buddy or in the text was geared towards the situation of the scenarios main character. The feelings item was included to determine the extent to which the participant's feelings were taken into account by the buddy or in the text. Finally, the item perceived support referred to the overall experience of support. Participants were asked to rate their agreement to the statements on a 5-point scale (1=completely disagree and 5=completely agree). In order to gather additional feedback, the questionnaire also contained two open questions: *How useful do you think the buddy is?* and *How can the buddy be improved?* Again, these questions were rephrased for participants in the control condition.

[1]MSN Messenger was an Instant Messaging service provided by Microsoft. It was discontinued in 2013 [209]. In 2011, when the experiment was conducted, MSN was still frequently used by children and adolescents.

Item	Statement
Relevance	The information Robin gave is relevant for victims of cyberbullying.
Trustworthiness	The information Robin gave is trustworthy.
Understandability	The information Robin gave is easy to understand.
Persuasiveness	If I were René I would follow Robin's advice.
Geared towards situation	The information Robin gave is geared towards the specific situation of René.
Feelings	Robin took into account René's feelings.
Perceived support	I think René would feel supported by having a chat with Robin.

Table 6.1: Statements used to measure user perceptions. (Statements were rephrased for users in the control group.)

Procedure

Participants were tested individually. First, one of the experimenters explained the goal of the study. After that, participants completed a questionnaire asking for name, age, gender and Internet use. Next, they received the scenario on paper and were told to empathize with the main character and take his perspective. The scenario was available to the participants for the duration of the experiment.

After reading the scenario, participants in the control group ($N = 14$) received a printed text with information on how to deal with cyberbullying. This text was presented in the scenario as information found on the Internet by the main character. The text did not address negative emotions that may be aroused as a result of being bullied.

Participants in the experimental group ($N = 16$) interacted with the virtual buddy, that was presented to them as 'a computer program that offers assistance to children that are victims of online bullying' the main character found on the Internet. The conversation was conducted according to a script specifying the buddy's response to input from participants. During the experiment, the experimenter controlling the buddy was hidden from view.

Finally, when participants had finished reading the text or the conversation with the buddy, they were asked to fill out the social support questionnaire.

6.1.3 Results

This section presents the results of the WoZ pilot experiment. First, the results of the user perceptions are discussed. Next, we discuss results concerning the usefulness of the virtual buddy. Finally, improvements suggested by participants are discussed.

	Control		Experiment		
Item	M	SD	M	SD	p
Relevance	4.50	1.05	4.75	0.56	0.43
Trustworthiness	4.21	1.08	4.44	0.70	0.60
Understandability	4.14	1.30	4.69	0.58	0.16
Persuasiveness	4.36	1.04	4.40	0.71	0.90
Geared towards situation	4.00	0.85	4.13	0.99	0.72
Feelings	3.64	1.17	4.44	0.61	0.03*
Perceived support	4.07	0.80	4.44	0.70	0.21

Table 6.2: Mean scores and standard deviations for the seven statements (1=completely disagree and 5=completely agree). * $p < 0.05$.

User Perceptions

Table 6.2 show the mean scores for each of the seven statements. Both the text and buddy were evaluated positively on all statements; mean scores range between 3.64 and 4.75. Scores for the buddy were consistently higher than scores for the text. The difference was significant for the feelings statement ($t(28) = 2.05, p = 0.03$). This indicates that the emotional cues emitted by the buddy are recognized and accepted.

Usefulness

Answers to the open questions also demonstrated the participants' positive attitude towards the buddy and the text. The main reason for the usefulness of the buddy or text was the fact that information and tips were given. Ten out of 14 participants in the control group and 8 of 16 in the experiment group used this argument to substantiate the usefulness of the buddy or text. Three participants in the control group stated that they think a text alone will not help to stop cyberbullying. Two participants in the experiment group liked the fact that users can tell their story to the buddy. One participant was impressed by the buddy's social skills:

> *He gives good advice. He really wants to know how you feel, what you think about it. And he has clear answers and asks follow up questions.* (P21)

However, the user experience clearly varies, as another participant said the buddy should empathize better with the victim's situation.

The fact that nobody could read along with the conversation was seen as an advantage by a participant in the experiment group. Some concerns were also expressed: two participants refer to the lack of context when discussing upsetting events:

> *You don't know what other things some one may have experienced* (P5)

Another participant mentions the user may be lying to the buddy. Only one participant was explicitly negative about the buddy, he suggested victims of cyberbullying should talk to a person instead of a computer program.

Improvements

Two participants in the control group and one in the experiment group mentioned the language used by the buddy or in the text was too difficult. Simplifying the language is therefore an obvious improvement of the buddy or text. Other suggested improvements concerned the amount of information or tips (three participants wanted more information or tips) and one participants suggested to include an explanation why bullies bully. Also spreading the word about the buddy and educating people in schools were mentioned as improvements.

6.1.4 Conclusion Wizard of Oz Study

Interaction with the virtual buddy was rated at least as high as reading an informative text with the same information content. Also, the subjective feedback gathered from open questions was generally positive for both the buddy and the text. Based on these results we conclude that children between the ages of 14 and 16 generally have a positive attitude towards the idea of an empathic virtual buddy against cyberbullying. The significant difference between the buddy and the text on the feelings statement indicates that the emotional cues emitted by the buddy are recognized and accepted, thus validating our approach. This result also provides evidence for our hypothesis that ECAs are able to provide social support.

The high scores and positive feedback for both the buddy and the text might indicate the participants' appreciation for the information on cyberbullying (regardless of how this information was presented). Possibly, schools do not educate students on cyberbullying, even though there is a need for more knowledge. Some answers to the open questions pointed in this direction; for example, a participant in the control group suggested that schools should provide education on cyberbullying. This is consistent with findings from Sharples et al. on e-safety education in the UK; only 11% of the teachers interviewed by the researchers said they frequently taught students about online safety issues [184]. More research is needed to investigate this issue.

An important improvement of the virtual buddy (and the text) concerns the language used in the text or by the buddy; some participants stated that the language was too difficult. Therefore, we will simplify the buddy's lines. We are cooperating with online counselors that regularly chat with children and adolescents to reach an acceptable level of complexity.

6.2 A Study into the Effects of Variations in Emotional Expressiveness

The results of the WoZ pilot study indicate that participants feel supported by the social and emotional cues the virtual buddy emits. The goal of the study presented in this section is to gain insight into how verbal and/or nonverbal expression of emotions contributes to the perceived effectiveness of the support and how these variations in emotional expressiveness affect user perceptions of social support. For this study, the prototype presented in Chapter 5 was used.

A second goal of the study is to measure the user experience of the virtual buddy prototype. User experience refers to "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" [105]. It is a broad, multidimensional concept that includes pragmatic, emotional, affective, experiential, hedonic, and aesthetic attributes [130]. Poorly designed user interfaces may cause confusion and frustration [13]. These negative emotions may block the positive emotions the virtual buddy aims to evoke. Therefore, we assume that an acceptable level of user experience is required for a user to experience and be able to benefit from the social support communicated by the virtual buddy. To determine the level of the virtual buddy's user experience, we administered the AttrakDiff questionnaire [89].

AttrakDiff is based on a model of user experience that consists of four dimensions: Pragmatic Quality (PQ), Hedonic Quality-Identity (HQI), Hedonic Quality-Stimulation (HQS), and Attractiveness (ATT). PQ refers to the utility and usability of products. Terms to describe pragmatic software are useful, clear, practical, predictable, and structured. HQI refers to the identity that is communicated by using certain products. Terms that can be used to describe identity include stylish, tacky, alienating, connective, and cheap. HQS refers to personal development (e.g., development of new skills) triggered by stimulating products. Stimulation can be provided by novel, interesting, or exciting functionality, content, presentation, or interaction style [89]. Different levels of stimulation can be described with terms such as conservative, challenging, novel, dull, and captivating. ATT refers to the overall evaluation of the perceived qualities of a product. To describe attractiveness, terms such as good, bad, beautiful, and ugly can be used.

The AttrakDiff dimensions that are particularly relevant are PQ (we want users to be able to use the software), HQS (we believe the virtual buddy's emotional expressiveness is a stimulating way of presenting content), and ATT (we do not want users to reject the system because of its appearance and associated qualities). HQI is less relevant, because use of the buddy is designed to be private. On the other hand, using a product that is associated with bullying victimization may be stigmatizing. However, since our main research goal is to explore how conversational agents can provide social support, these issues are considered to be less relevant.

In general, we expect that expression of emotions improves user experience, in particular the HQS and ATT dimensions, the effectiveness of the support, and

perceived social support. Additionally, we expect that verbal expression of emotion has a higher impact than nonverbal emotion, because verbally expressed emotions are more visible during the conversation. We also expect that the combination of verbal and nonverbal expression of emotion has a higher impact than verbal only and nonverbal only, because the combination of verbal and nonverbal expression of emotion is more natural.

This section is organized as follows. Section 6.2.1 describes our evaluation method. In Section 6.2.2, we present the results. The results are discussed in Section 6.2.3. The conclusions are presented in Section 6.2.4.

6.2.1 Method

The study was conducted according to a between subjects design. Participants interacted with the virtual buddy prototype presented in Chapter 5. The buddy had four modes of behavior, corresponding to four experimental conditions:

1. The buddy did not express emotions (control condition; No-EM)
2. The buddy expressed emotions verbally (verbal only condition; V-EM)
3. The buddy expressed emotions by changing its facial expression (nonverbal only condition; NV-EM)
4. The buddy expressed emotions both verbally and nonverbally (verbal and nonverbal condition; NV&V-EM)

The virtual buddy's embodiment was displayed in all four conditions. Participants were randomly assigned to one of the four conditions.

Participants

Before involving members of the virtual buddy's target age group (i.e., children between the ages of 10 and 14), we decided to perform an experiment with university students. In general, students are experienced users of online technology, which makes them more suitable participants than for example parents. Additionally, students usually are relatively young (below 24 years), which makes them sufficiently close to the target audience of the virtual buddy.

The survey was completed by 100 students from different universities in the Netherlands. There were 25 participants in each condition. Of the 100 participants, 32% were female; the average age was 19.5 (SD=2.0).

Scenario

As in the pilot experiment, having experience with being (cyber)bullied was not a criterium to participate in the study. Therefore, participants were again provided with a fictive scenario to base their interaction on. We used the same scenario as in the pilot experiment (see Section 6.1.2 for details) with one small difference; the name of the main character was changed to Tom.

Measures

In the experiment several measures were used to capture different aspects of interacting with the virtual buddy and its supportive capacities. User experience was measured using the AttrakDiff questionnaire [89]. In addition, we measured the effectiveness of the support and perceptions of social support provided by the virtual buddy. Finally, participants provided feedback on the virtual buddy and its supportive behavior by answering open questions. Each of the measures used is explained below.

User Experience User experience was measured by the AttrakDiff questionnaire [89]. AttrakDiff consists of four scales: Pragmatic Quality (PQ), Hedonic Quality-Identity (HQI), Hedonic Quality-Stimulation (HQS), and Attractiveness (ATT). Each scale consists of 7 semantic differentials on a 7-point scale. Semantic differentials for PQ include 'unruly – manageble', and 'unpredictable – predictable'. Example questions for HQI are 'cheap – premium', and 'isolating – connective'. HQS is measured by word pairs including 'undemanding – challenging', and 'unimaginative – creative'. ATT's semantic differentials include 'repelling – appealing', and 'discouraging – motivating'. The words on the right side of the differentials are indicators of a positive user experience, whereas the words on the left side of the differential refer to characteristics indicating a negative user experience.

AttrakDiff was developed in German, and translated to English. For this study, a Dutch translation of the English version of AttrakDiff was created.

Effectiveness of the Support In order to determine the virtual buddy's effectiveness in providing social support, participants were asked to indicate on a 9-point scale how they think Tom feels (well-being; 1=feeling bad, 9=feeling good) and how severe they think Tom's problem is (perceived burden of the problem; 1=the problem is not severe, 9=the problem is severe) prior to interacting with the virtual buddy and after the conversation is completed. This measure has been used before to assess the effectiveness of support provided by a Dutch child help line [79].

Perceptions of Social Support Users' perceptions of social support was measured using a questionnaire containing 8 Likert items on a 7-point scale (1 = completely disagree and 7 = completely agree). The questionnaire listed in Table 6.3. The item *Support attempt* was used to determine whether the participants recognized Robin's attempt to provide support. To get an indication of to what extent the support attempt was realized, we included the item *Perceived support*. One of the goals of a social support conversation is to give the conversation partner the feeling he is being understood. We inquired about the level of understanding shown by the buddy by means of the items *Understood problem* and *Understood emotions*. The item *Compassion* was used to determine the level of emotional support. The last three items inquire about the quality of the advice; *Advice general*, to determine the quality of the advice in general, *Advice situation*, to determine the quality of the

Item	Statement
Support attempt	Robin tried to cheer Tom up
Perceived support	During the conversation, Tom felt supported by Robin
Understood problem	Robin understood Tom's problem
Understood emotions	Robin understood what Tom was feeling
Compassion	Robin was compassionate with Tom
Advice general	Robin's advice is applicable
Advice situation	Robin's advice is applicable in Tom's situation
Persuasion	If I were Tom, I would follow Robin's advice

Table 6.3: The social support questionnaire (Tom refers to the main character in the scenario; Robin is the empathic virtual buddy).

advice in Tom's situation, and *Persuasiveness*, to determine the extent to which the advice would be followed.

Open Feedback To gather additional feedback, two open questions were included in the survey. The questions were: *How can we improve the emotional support provided by Robin?* and *Do you have other suggestions to improve Robin?* Finally, participants were given the opportunity to comment on the study.

Procedure

The experiment was conducted online. Participants were recruited by e-mail and through social media. First, participants were given the scenario (see Section 6.2.1) with the instructions to empathize with the main character. After reading the scenario, participants were asked to report their expected value for Tom's well-being and perceived burden of his problem. After that, a screen explaining the virtual buddy's interface was shown. Next, participants were randomly assigned to one of the four conditions and interacted with the corresponding virtual buddy. After the conversation was finished, participants were asked to report Tom's well-being and perceived burden of the problem again. Next, they filled out the social support and AttrakDiff questionnaire. Subsequently, participants were given the opportunity to provide feedback on the emotional support and the virtual buddy in general. Finally, participants specified personal details, including age, gender, and the university at which they were studying. Additionally, participants were allowed to leave feedback on the study.

Interacting with the virtual buddy and filling out the questionnaire took about 30 minutes. Participants were rewarded 10 Euros for their time.

6.2.2 Results

We examined whether the buddy's emotional expressiveness (No-EM, V-EM, NV-EM, and NV&V-EM) affected participants' user experience, the effectiveness of the

	No-EM		V-EM		NV-EM		NV&V-EM	
Measure	M	SD	M	SD	M	SD	M	SD
PQ	5.17	0.49	5.33	0.50	5.18	0.63	5.17	0.46
HQI	4.54	0.68	4.61	0.58	4.57	0.75	4.47	0.73
HQS	4.21	0.93	4.39	0.72	4.15	0.90	4.15	0.87
ATT	5.05	0.68	5.25	0.59	5.18	0.76	5.00	0.76

Table 6.4: Descriptive statistics for results of the AttrakDiff questionnaire.

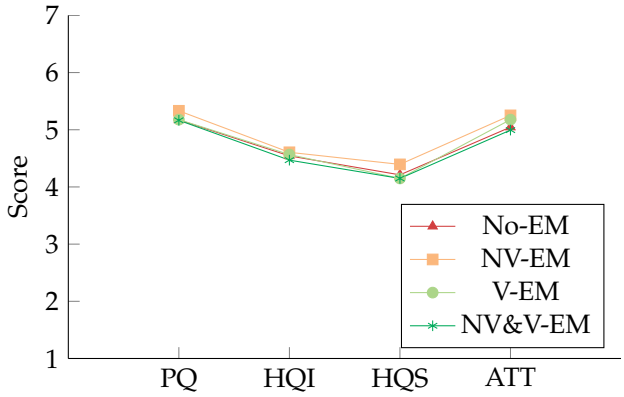


Figure 6.4: Mean scores for AttrakDiff scales PQ, HQI, HQS, and ATT.

support, and/or perceptions of support.

User Experience

Because we used a custom translation of the AttrakDiff questionnaire, internal consistency of the results was calculated prior to analysis of the results. Cronbach's α for the four scales were: PQ, $\alpha = 0.40$; HQI, $\alpha = 0.72$; HQS, $\alpha = 0.82$; and ATT, $\alpha = 0.80$. Reliability is acceptable (> 0.7) to good (> 0.8) for all scales except PQ.

PQ (pragmatic quality) refers to characteristics such as utility and usability. Since the virtual buddy is non task-oriented software (i.e., there is no concrete task for the user to perform), the terms used in the semantic differentials of this scale may not be valid to describe software such as the virtual buddy. For example, one of the semantic differentials of the PQ scale is 'technical – human' with higher scores for ratings closer to 'human'. The virtual buddy is a conversational agent that mimics some aspects of human-human communication. 'Human' in this context might be interpreted differently than the same term in the context of task-oriented software, such as an MP3-player.

Table 6.4 presents the mean scores and standard deviations of PQ, HQI, HQS and ATT between conditions. The mean scores are depicted in Figure 6.4. When

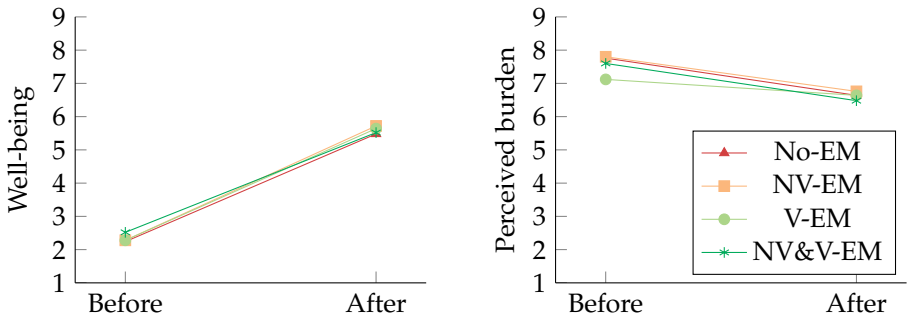


Figure 6.5: Well-being and perceived burden of the problem before and after interaction with the virtual buddy.

examining the mean scores, we see that HQI and HQS are close to 4 (the 'neutral' score on a 7-point scale); $4.47 < \text{HQI} < 4.61$ and $4.15 < \text{HQS} < 4.39$. This indicates that hedonic identification and hedonic stimulation qualities of the virtual buddy are neutral. PQ and ATT are slightly higher; $5.16 < \text{PQ} < 5.33$, and $4.99 < \text{ATT} < 5.25$. These neutral and slightly positive scores can be explained by the fact that we kept the interface as simple as possible. We conclude that the user experience provided by the virtual buddy is acceptable and does not hamper the provision of social support.

Because the reliability of PQ was too low, we have not subjected the results from this scale to further analysis. Oneway between subjects ANOVA was conducted to compare the effects of variations in the virtual buddy's emotional expressiveness (No-EM, V-EM, NV-EM, and NV&V-EM) on HQI, HQS, and ATT. There were no statistically significant differences between the four conditions; HQI $F(3, 96) = 0.176$, $p = 0.91$, HQS $F(3, 96) = 0.459, p = 0.71$, and ATT $F(3, 96) = 0.708, p = 0.55$. These results indicate that expressing emotions does not contribute to the user experience as measured by HQI, HQS, and ATT; a virtual buddy that does not express emotions is rated equally to a virtual buddy that expresses emotions either verbally, or nonverbally; or both verbally and nonverbally.

To summarize, user experience is acceptable for the simple prototype we implemented. There were no statistically significant differences between conditions. We conclude that expressing emotions does not contribute to the user experience of the virtual buddy prototype.

Effectiveness of the Support

A mixed between-within subjects ANOVA was conducted to assess the impact of four levels of emotional expressiveness of the virtual buddy (No-EM, V-EM, NV-EM, and NV&V-EM) on participants' scores for well-being and perceived burden of the problem before interacting with the buddy and after interacting with the buddy.

	No-EM		V-EM		NV-EM		NV&V-EM	
Measure	M	SD	M	SD	M	SD	M	SD
Well-Being								
Pre	2.24	2.00	2.28	0.84	2.28	0.68	2.52	1.33
Post	5.48	1.00	5.64	1.41	5.72	1.21	5.52	1.66
Perceived burden								
Pre	7.76	1.74	7.12	2.17	7.80	1.23	7.60	2.06
Post	6.64	1.71	6.64	1.44	6.76	1.69	6.48	1.71

Table 6.5: Descriptive statistics for well-being (1=feeling bad, 9=feeling good), and perceived burden of the problem (1=the problem is not severe, 9=the problem is severe).

There was no significant interaction between emotional expressiveness and well-being over time, $F(3, 96) = 0.298$, $p = 0.827$. However, there was a substantial main effect for well-being over time, $F(1, 96) = 344.12$, $p < .0005$, with all four groups reporting an increase in well-being after interacting with the virtual buddy (see Table 6.5 and Figure 6.5 (left)). There was a non-significant main effect of the buddy's expressiveness, $F(3, 96) = 0.132$, $p = 0.941$. This means there was no difference in effectiveness of increasing well-being between the four levels of emotional expressiveness.

There was no significant interaction between emotional expressiveness and perceived burden of the problem over time, $F(3, 96) = 0.654$, $p = 0.583$. There was a substantial main effect for well-being over time, $F(1, 96) = 24.203$, $p < .0005$, with all four groups reporting a decrease in perceived burden of the problem after interacting with the virtual buddy (see Table 6.5 and Figure 6.5 (right)). There was a non-significant main effect of the buddy's emotional expressiveness, $F(3, 96) = 0.372$, $p = 0.774$. This means there was no difference in effectiveness of decreasing perceived burden between the different levels of emotional expressiveness.

In summary, the support provided by the virtual buddy is effective as measured by the increase in well-being and the decrease in perceived burden of the problem after interaction with the virtual buddy. There were no statistically significant differences between conditions. We conclude that emotional expressiveness does not contribute to the effectiveness of the support provided by the virtual buddy prototype.

Perceptions of Social Support

We also examined whether the buddy's emotional expressiveness (No-EM, V-EM, NV-EM, and NV&V-EM) affected participants' perceptions of social support. Internal consistency of the questionnaire was acceptable; Cronbach's $\alpha = 0.72$. Mean scores and standard deviations of the results are presented in Table 6.6. Oneway

	No-EM		V-EM		NV-EM		NV&V-EM	
Item	M	SD	M	SD	M	SD	M	SD
Support attempt	5.20	0.91	5.16	1.21	5.48	1.23	5.16	1.31
Perceived support	4.96	1.40	5.24	1.52	5.36	1.38	5.16	1.07
Understood problem	5.36	1.25	5.08	1.32	5.08	1.47	5.04	1.14
Understood emotions	4.52	1.39	4.84	1.34	4.80	1.58	4.68	1.60
Compassion	4.24	1.81	4.48	1.58	5.20	1.35	5.08	1.38
Advice general	5.92	1.35	6.32	0.99	6.08	0.95	5.68	1.38
Advice situation	5.88	1.05	5.72	1.06	5.68	1.22	5.64	1.04
Persuasion	6.00	1.29	6.40	0.76	5.60	1.61	5.96	1.14

Table 6.6: Descriptive statistics for results of the perceptions of support questionnaire.

between subjects ANOVA was conducted to compare the effects of variations in the virtual buddy's emotional expressiveness (No-EM, V-EM, NV-EM, and NV&V-EM) on the perceptions of support ratings. There were no statistically significant differences between the four conditions (Support attempt: $F(3, 96) = 0.431$, $p = 0.731$; Perceived support: $F(3, 96) = 0.433$, $p = 0.730$; Understanding of problem: $F(3, 96) = 0.323$, $p = 0.809$; Understanding of emotions: $F(3, 96) = 0.235$, $p = 0.872$; Compassion: $F(3, 96) = 2.255$, $p = 0.087$; Advice general: $F(3, 96) = 1.294$, $p = 0.281$; Advice situation: $F(3, 96) = 0.231$, $p = 0.874$; Persuasiveness: $F(3, 96) = 1.794$, $p = 0.162$). The results are depicted in Figure 6.6.

The mean perceived social support scores were generally high (mean scores for each item > 4 on a 7-point scale). Compared to other items, the mean scores for items referring to emotional support (Understood emotions, and Compassion) were lowest ($4.2 <$ mean scores < 5.2), while the mean scores for items referring to information support (Advice general, Advice situation, and Persuasion) were highest ($5.6 <$ mean scores < 6.4). These results indicate that participants valued the buddy's information support more than its emotional support. This corresponds with the traditional role of computers as 'expert systems'. Providing emotional support is not an activity that is associated with computers. The relatively low scores for emotional support also suggest that the virtual buddy's emotional behavior might not have been sufficiently convincing. It also raises the question to what extent expressing emotions is required for or contributes to users' perception of social support. These issues are explored further in Section 6.2.3.

To summarize, the mean perceptions of support scores were relatively (> 4.2 for emotional support and > 5.6 for information support). There were no statistically significant differences between conditions. We conclude that emotional expressiveness does not affect perceptions of the support conveyed during a conversation with the virtual buddy prototype.

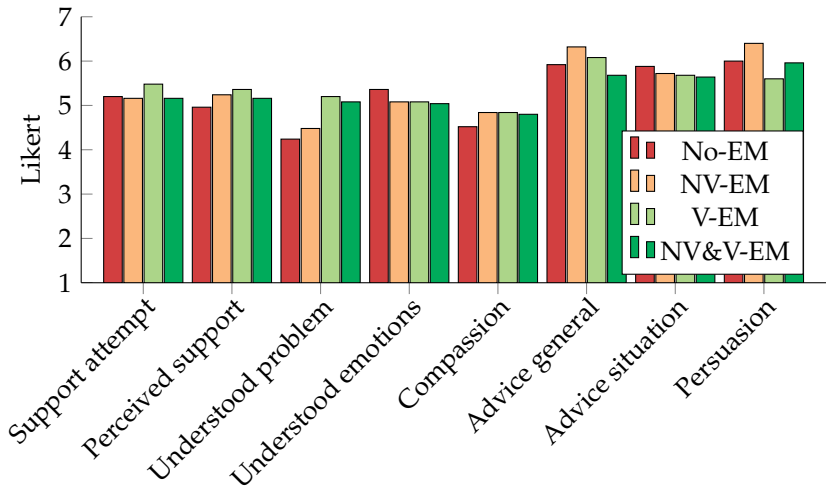


Figure 6.6: Mean social support ratings.

Open Feedback

At the end of the survey, participants were invited to suggest improvements for emotional support, to suggest other improvements, and to give feedback on the study. In total 93 of the 100 participants provided one or more remarks. In this section, we discuss the participants' feedback. First of all, we are interested in the feedback on how to improve the buddy's emotional support skills. In addition, participants left remarks on technical aspects of the buddy and feedback indicating moral approval or disapproval of the virtual buddy as a tool to help cyberbullying victims. As these issues might affect users' subjective experience of social support, this feedback is also presented.

Suggestions for Improving Emotional Support Three participants asserted that, in their view, a computer cannot give emotional support. One of the participants wrote:

> *A computer program cannot give emotional support. This requires at least a real person to chat with, but a real person that can be contacted by phone would be even better.* (P27)

However, As many other participants came up with concrete suggestions on how to improve the experience of emotional support, they apparently did believe a computer can give emotional support. Table 6.7 lists the participants' suggestions and the number of participants from each condition that made them.

About half of the participants in the no emotion condition that left feedback (12 of 25 participants) suggested to add supportive verbal utterances to the conversation. As formulated by one of the participants:

	No-EM	V-EM	NV-EM	NV&V-EM
Add verbal expressions	12	0	6	3
Add facial expressions	1	5	1	0
Facial expression mismatch	0	0	1	2
Add other support types	8	4	8	7
Ask more/follow up questions	4	2	7	6
Inappropriate verbal expressions	2	4	0	3
Left feedback	24	23	22	24
Total participants	25	25	25	25

Table 6.7: Suggestions left by participants on how to improve the experience of emotional support.

> *In addition to suggesting a practical solution, Robin should show compassion and say nice things that may not directly resolve the situation, but give the impression that Robin is sympathetic and cares about the fact that its conversation partner is being bullied.* (P47)

Also, 6 participants in the nonverbal emotion only recognized verbal support was missing and suggested to include supportive remarks. Additionally, 3 of 25 participants in the nonverbal and verbal emotion condition suggested to add more supportive verbal expressions. Remarkably, while many participants in the no emotion condition recognized verbal support was missing, this did not lead to significant differences in perceptions of support scores between the different conditions (see Table 6.6 and Figure 6.6).

Five participants in the verbal emotion only condition suggested to have the virtual buddy change its facial expression during the conversation. Three participants, one in the NV-EM condition and two in the NV&V-EM condition, noticed emotion mismatches. For example, one participant thought the virtual buddy's neutral expression was too cheerful:

> *Robin should look less happy; he was smiling when I told my story. That's rather tactless.* (P68)

One participant in the NV&V-EM condition thought the buddy's facial expression changed too quickly back to happy after expressing a negative emotion:

> *Robin's face resets to happy too fast when he asks neutral questions. This creates an artificial impression. The facial expressions expressed in response to input, however, are accurate.* (P14)

This means it may be necessary to include a neutral facial expression and to slow down the decay rate of emotions in the emotional model.

Participants from all conditions suggested other types of support should be added to the conversation, such as explaining why bullies bully, that bullies sometimes randomly select a victim, that Tom is a good person despite what other people

Remark	# participants
Negative about interface design	8
Positive about interface design	2
Negative about virtual buddy's embodiment	13
More human-like system	13
Typing instead of response options	6
More response options	7
Select multiple response options	11
Go back in conversation	3

Table 6.8: Feedback left by participants on technical limitations of the prototype.

say, and that bullying can only be stopped by taking action. Four participants suggested the virtual buddy should be more empathic, without specifying how or what that means according to them. Additionally, nine participants stated that they felt discouraged by some of the messages conveyed by the virtual buddy.

Another suggestion that was made by participants in all conditions was to ask more (follow-up) questions during the conversation. One participant wrote:

> *By asking more questions about Tom's problem and the way he is bullied, the conversation will be more personal and Tom will feel better understood.* (P98)

This indicates participants would like to see a more personalized conversation.

Technical Limitations of the Prototype Table 6.8 presents participants' feedback on the technical limitations of the virtual buddy prototype. As these limitations were the same in each condition, we only report the total number of participants that made some remark.

Eight participants expressed dissatisfaction with the design of the interface, while two participants were positive about the design. Thirteen participants criticized the virtual character's appearance; they thought it was too robot-like, and/or static. In addition, thirteen participants suggested to make the system (and not just the virtual character) more human-like.

Another recurring topic in the feedback were the response options. Six participants asked for the possibility to type responses instead of selecting them. Seven participants wanted to more response options to choose from. In addition, eleven participants wanted to be able to select multiple response options instead of just one. Finally, three participants would have liked to have the possibility to go back in the conversation or to repeat parts of the dialogue, or see the virtual buddy's responses to other response options.

Domain specific (Dis)Approval In addition to suggestions for improvements, many participants left feedback in which they expressed approval or disapproval of the virtual buddy as a tool to support cyberbullying victims. These comments are

Remark	# participants
Explicit disapproval of virtual buddy	7
Implicit disapproval of virtual buddy	8
Positive about virtual buddy and/or domain	26
Conversation with the buddy is insufficient help	2

Table 6.9: Feedback on domain specific (dis)approval of the virtual buddy.

presented in table 6.9. Seven participants explicitly disapproved of the idea of having a computer program provide support to children and/or the implementation of support in the prototype:

> *I believe giving emotional support to bullying victims might be useful, but I think more can be expected from teaching parents and teachers to deal with bullying, victims, and (important) bullies, in a constructive way. If you want to focus exclusively on victims, I think it's quite useless to make them talk to a superficial computer.* (P34)

Eight participants implicitly expressed disapproval of the application by suggesting alternative ways of helping cyberbullying victims; mostly by asserting victims should talk to real people instead of a computer program, and that technology can better be used to bring bullying victims into contact with other bullying victims and/or helpers.

A total of 26 participants explicitly expressed positive opinions of the application and/or the domain, for example:

> *I was a bit skeptical when I heard about the concept of the system, but the implementation is fair and could help bullied children*. (P46)

Two participants expressed the concern that a conversation with Robin is not sufficient to help victims.

In summary, almost all participants provided feedback on the virtual buddy prototype. The feedback consisted of suggestions for improvement of the emotional support, technical limitations of the virtual buddy prototype, and domain specific (dis)approval of the virtual buddy as a tool against cyberbullying.

Many participants suggested to improve the experience of emotional support by increasing the virtual buddy's emotional expressiveness. In all conditions there were participants that suggested additional support strategies to increase the overall experience of social support. Even though the feedback indicates that shortcomings in the virtual buddy's emotional expressiveness were recognized by many participants, these shortcomings did not result in lower social support ratings. Possible explanations for this outcome will be discussed in Section 6.2.3.

In addition, the participants identified several technical limitations of the prototype. The results suggest that the simple prototype used in the experiment may

have been too limited in some respects, including too mechanical behavior, and concerns about the use of response options.

While most participants were generally positive about the idea of the virtual buddy, the implementation of the prototype, and the application domain, a small number of participants expressed strong criticism. The objections raised give insight into why people are inclined to reject a virtual buddy for social support against cyberbullying. In most cases, this amounts to moral disapproval of providing automated support to a vulnerable target audience.

6.2.3 Discussion Emotional Expressiveness Study

Our study revealed no significant differences between the four conditions in user experience, effectiveness of the support, and perceived social support. Additionally, the mean perceived social support ratings were relatively high (> 4.2 for emotional support and > 5.6 for information support). In this section, we explore explanations for the lack of significant differences between conditions and the high social support ratings.

In order to make an impact on user perceptions, the virtual buddy should be believable and display behavior with the right level of complexity. Feedback from participants suggests that the prototype we used in the experiment fell somewhat short in this respect. Issues raised included the occurrence of inappropriate verbal expressions, facial expression mismatches, and robot-like or mechanical behavior. Even though participants from all conditions were very well able to point out weaknesses in the virtual buddy's behavior, this critical attitude was not reflected in the perceived social support scores. The mean scores were relatively high (> 4.2 for emotional support and > 5.6 for information support).

The high scores could have been caused by socially desirable behavior triggered by the fact that cyberbullying is a socially relevant topic. Because we used a between-subjects design to evaluate the virtual buddy's supportive behavior, participants were unable to compare the support they received to an alternative. Compared to nothing, any support may be rated positively (cf. Nguyen and Masthof's hypothesis that non-empathic support is better than no support at all [157] (see also Section 3.4.4)). By repeating the emotional expressiveness experiment using a within-subjects design, participants interact with more than one version of the virtual buddy prototype. This allows them to compare their experience to experiences with other levels of emotional expressiveness. Based on the results of comparative rankings, we can create a global ranking of the virtual buddies and determine what level of emotional expressiveness is best according to the participants. However, based on our experience of working on the virtual buddy prototype, we suspect that there are more factors that affect users' perceptions of the virtual buddy's behavior, such as personality traits (cf. [24, 25, 177]), personal experience with (cyber)bullying, and preconceived ideas regarding the domain and the idea of supporting cyberbullying victims by giving them access to a virtual buddy. We suspect that in particular these preconceptions have affected the perceptions

of support ratings. This issue is discussed next in more detail. A solution would be to identify the factors that may have affected perceptions of the virtual buddy prototypes, and design new experiments that properly quantify and/or address these factors. However, we believe that many of these factors are domain-specific and do not contribute to our goal of understanding how ECAs can provide social support. Therefore, we opted for an alternative approach to evaluating the support provided by the virtual buddy. Chapter 7 and 8 present qualitative studies of the virtual buddy's supportive behavior.

Cyberbullying is a sensitive topic, and supporting children –a particular vulnerable target audience– with a software application that manipulates emotions might be a controversial idea. The feedback left by participants supports this hypothesis; 17 of 100 participants left disapproving remarks, while 26 of them were positive about the virtual buddy as a tool to support cyberbullying victims (see Table 6.9). In order to investigate whether the perceptions of support ratings have been affected by approval or disapproval of the idea of supporting cyberbullying victims with a virtual buddy, a cluster analysis was conducted. The cluster analysis revealed three clusters of participants: 1) participants that assigned low scores to the buddy's emotional skills, 2) neutral participants, and 3) participants that were very positive about the virtual buddy's social support skills [220]. The existence of these clusters are consistent with our hypothesis that the idea of supporting cyberbullying victims with a virtual buddy is controversial and evokes (extreme) positive and negative responses. The results of the cluster analysis do not reveal why different clusters of participants could be distinguished. Participants may have rated the virtual buddy's behavior, or their ratings may have been affected by preconceptions regarding the domain or the idea of of supporting cyberbullying victims with a virtual buddy application. Based on our experience with people's responses to the idea of supporting cyberbullying victims with a virtual buddy, we believe that the perceptions of support ratings have been affected by preconceived ideas. In order to determine to what extent the perceptions of support ratings have been affected by preconceptions the experiment must be repeated using a pretest–posttest setup. In this setup, all participants fill out the perceptions of support questionnaire before (pretest) and after (posttest) interacting with the virtual buddy. Varying scores in the pretest are evidence for different preconceptions regarding the domain and the idea of support cyberbullying victims with a virtual buddy. By comparing the scores of the pretest to the scores of the posttest it is possible to quantify the impact of the prototype on perceptions of support.

As mentioned before, we suspect that the perceptions of support ratings have been affected by participants' preconceptions regarding the domain and the idea of support cyberbullying victims with a virtual buddy. In view of the fact that more applications are being developed for sensitive domains and vulnerable target audiences, such as in health care, it is important to explore the potential effects of preconceptions. By anticipating preconceptions, their effects can be reduced or might be used to create more efficient applications for different types of users. To this end, more research is required on the occurrence and effects of these precon-

ceptions.

6.2.4 Conclusion Emotional Expressiveness Study

The goals of the study presented in this section were 1) to determine to what extent verbal and/or nonverbal expression of emotions contribute to the effectiveness of social support by the virtual buddy, and 2) to verify the user experience of the virtual buddy does not hamper the provision of social support. The results show that the user experience of the virtual buddy prototypes is acceptable; and, therefore, does not impede its potential for providing social support. It was also shown that the social support provided by the virtual buddy prototypes is effective. Additionally, perceptions of support were generally high.

We found no significant differences between four levels of emotional expressiveness (i.e., no emotions, verbal emotions only, nonverbal emotions only, and verbal&nonverbal emotions) for user experience, effectiveness of the support, and perceptions of social support. However, the large number of participants suggesting to increase the virtual buddy's emotional expressiveness in order to improve the experience of emotional support, indicate that this is an important factor in the perception of support. For future work, we propose to repeat the emotional expressiveness study using a within-subjects design, and pretest–posttest questionnaires for perceptions of support. In addition, the questionnaires should be extended to include other factors that may have affected perceptions of support, such as personality traits and personal experience with (cyber)bullying.

The feedback from participants indicated limitations of the virtual buddy prototype. We will further investigate these limitations and to what extent social support is conveyed by conducting qualitative studies of the virtual buddy's supportive behavior. The results of these studies are reported in Chapter 7 and 8.

6.3 Conclusion

This chapter presented two quantitative evaluations of the virtual buddy's supportive behavior. The first study was a WoZ study that compared interacting with the virtual buddy to reading an informative text. Table 6.10 summarizes the results. The results show that participants liked to interact with the virtual buddy and that they recognized the emotional cues emitted by the virtual buddy, thus validating our approach to comforting users. The second study compared four versions of the virtual buddy prototype with different levels of emotional expressiveness (i.e., no emotions, verbal emotions only, nonverbal emotions only, and verbal&nonverbal emotions), and investigated the influence of variations in emotional expressiveness on user experience, effectiveness of the support, and perceptions of social support. The results are summarized in Table 6.11. Although the results show that the user experience of all versions of the virtual buddy prototype is acceptable, and that all versions of the virtual buddy prototype are successful in providing social support,

Item	Result	Sign.
Relevance	Text = Buddy	×
Trustworthiness	Text = Buddy	×
Understandability	Text = Buddy	×
Persuasiveness	Text = Buddy	×
Geared toward situation	Text = Buddy	×
Feelings	Text < Buddy	✓
Perceived support	Text = Buddy	×

Table 6.10: Summary of the results of the WOZ pilot study (see Section 6.1).

Measure	Result	Sign.
User Experience		
PQ	No-EM = V-EM = NV-EM = NV&V-EM	×
HQI	No-EM = V-EM = NV-EM = NV&V-EM	×
HQS	No-EM = V-EM = NV-EM = NV&V-EM	×
ATT	No-EM = V-EM = NV-EM = NV&V-EM	×
Effectiveness of support		
Wellbeing (W)	All conditions: $W_{pre} < W_{post}$	✓
W_{pre}	No-EM = V-EM = NV-EM = NV&V-EM	×
W_{post}	No-EM = V-EM = NV-EM = NV&V-EM	×
Perceived burden (PB)	All conditions: $PB_{pre} > PB_{post}$	✓
PB_{pre}	No-EM = V-EM = NV-EM = NV&V-EM	×
PB_{post}	No-EM = V-EM = NV-EM = NV&V-EM	×
Perceptions of support		
Support attempt	No-EM = V-EM = NV-EM = NV&V-EM	×
Perceived support	No-EM = V-EM = NV-EM = NV&V-EM	×
Understood problem	No-EM = V-EM = NV-EM = NV&V-EM	×
Understood emotions	No-EM = V-EM = NV-EM = NV&V-EM	×
Compassion	No-EM = V-EM = NV-EM = NV&V-EM	×
Advice general	No-EM = V-EM = NV-EM = NV&V-EM	×
Advice situation	No-EM = V-EM = NV-EM = NV&V-EM	×
Persuasion	No-EM = V-EM = NV-EM = NV&V-EM	×

Table 6.11: Summary of the results of the emotional expressiveness study (see Section 6.2).

there were no significant differences between the different levels of emotional expressiveness for user experience, effectiveness of the support, and perceptions of support. In addition, perception of support ratings were generally high (> 4.24 on a 7-point scale).

The results of the two studies show that the virtual buddy is able to convey

social support; the WoZ buddy was judged to be significantly better at taking into account feelings than an informative text, and the results of the second study show that well-being significantly increases and perceived burden of the problem significantly decreases after interaction with the virtual buddy prototype. The results of the WoZ pilot study point to the importance to emotional cues. However, in the second study, we found no effect of variations in the virtual buddy's emotionally expressiveness on the effectiveness of support, or perceptions of support.

An explanation of the lack of significant differences in the perceptions of support ratings gathered during the second experiment is that these ratings may have been affected by preconceived ideas about the domain or the idea of supporting cyberbullying victims by giving them access to a virtual buddy. On the one hand, cyberbullying is an appealing and socially relevant domain, which may have triggered higher ratings than the behavior of the simple prototype justifies. On the other hand, cyberbullying is a sensitive topic, and children are a vulnerable target audience. Providing support to cyberbullying victims by giving them access to an emotion manipulating software application is a controversial idea. Although the results of our studies provide no definite evidence of the existence of these preconceived ideas or their impact on evaluations of the virtual buddy's behavior, we found clues that that the perceptions of support ratings have been affected by these preconceived ideas. Existence of these preconceived ideas and their potential impact on ratings of the virtual buddy's behavior, complicate performing quantitative studies of this behavior and the interpretation of the results.

In addition, the virtual buddy uses multiple strategies to convey support. The fact that many participants suggested new ways in which the virtual buddy could support cyberbullying victims indicates that there are more factors that affect the perception of support than just expressing emotions. In other words, feeling supported is the result of a complex combination of different interacting factors, including the structure of the conversation, the quality of the advice, the way in which verbal utterances are formulated, and the visual style of the interface and the virtual buddy's embodiment. Although the results from the WoZ study and the feedback given by participants of the second study clearly demonstrate expressing emotions is an important factor in the perception of support, the question to what extent emotional expressiveness contributed to conveying social support may have been too simplistic and too much focussed on a single aspect.

All in all, the results of the quantitative studies presented in this chapter do not provide a satisfactory explanation as to why the behavior of the virtual buddy is perceived as supportive. In order to zoom in on different aspects of the virtual buddy's supportive behavior, and to unravel the underlying principles of social support by ECAs, Chapter 7 and 8 present qualitative studies of the virtual buddy's supportive behavior.

Chapter 7

Qualitative Evaluation of the Virtual Buddy's Supportive Behavior: Expert Focus Group

The previous chapter demonstrated that the virtual buddy successfully conveys social support in the cyberbullying scenario. However, the results did not provide insight into why the virtual buddy's behavior was experienced as supportive. Additionally, participants of the studies presented in Chapter 6 identified limitations of the virtual buddy prototype. In order to determine wether these limitations affect perceptions of support, and to gain more insight into the principles of social support by ECAs, this chapter presents a qualitative study of the user experience provided by the virtual buddy prototype, and the virtual buddy's supportive behavior. In particular, we invited six pedagogical and bullying experts to try out the virtual buddy prototype and discuss their opinions during a focus group session.

This chapter is organized as follows. Section 7.1 explains the evaluation method used to gather feedback from experts. Section 7.2 presents the results of the focus group discussion. In Section 7.3, we discuss the results. Section 7.4 presents our conclusions.

7.1 Method: Focus Group

In order to explore different aspects of the virtual buddy's behavior, we organized a focus group. A focus group is a group discussion in which individual's views and experiences are explored through group interaction [141]. In Section 7.1.1, we provide more detailed background information on focus groups. Section 7.1.2 describes the participants we invited for the focus group. In Section 7.1.3, we specify

An abbreviated version of this chapter was published in Proceedings of Intelligent Virtual Agents (IVA) 2013, pp. 358–367, 2013 [225].

the focus group plan and organization of the discussion.

7.1.1 Gathering Detailed Information through Group Interaction

A focus group can be defined as 'a carefully planned discussion, designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment' [126, p.6]. A focus group is a group discussion in which individual's views and experiences are explored through group interaction [141]. Group interaction is a key feature that distinguishes focus groups from other forms of group interviews [112]. The goal of a focus group discussion is not to reach consensus on the topic of interest, but to gather and explore different opinions that exist among participants [141]. Focus groups are not only used to gain insight into what people think about the topic of interest, but also how they think and why they think that way [113].

Focus group discussions are conducted based on a guide of open questions or topics, that are ordered from general to more specific [111]. A focus group is led by a moderator. The moderator plays an important role in maintaining the focus of the discussion, keeping the discussion on track, guiding, stimulating, facilitating the discussion, and putting participants at ease [141]. In order to ensure that information gathered during focus groups, and conclusions drawn from this information are valid and reliable, it is advised to organize multiple focus groups on the same subject, either with the same or different groups of participants [141].

Focus groups are common in marketing research, science communication, and other social sciences. However, their use in Human-Computer Interaction is controversial [178].

7.1.2 Participants and Moderator

Six pedagogical experts were invited to try the prototype of the virtual buddy and discuss their opinions. Because we were interested in exploring different views on the virtual buddy, experts with different backgrounds were selected to participate. Four of the six participants are experts from practice (i.e., two anti-bullying trainers, an online counselor, and an expert on online counseling and therapy) and the other two have an academic background (a PhD student working on an online training for cyberbullying victims and a Master student interested in the topic). Additionally, two experts from practice and one from academia can be characterized as having experience with Internet technology and online interventions aimed at (cyber)bullying victims, while the other experts were less experienced with technology.

The discussion was led by an experienced moderator (11 years' experience in qualitative research methods and conducting (group)interviews). Additionally, the author was present as an observant and to introduce the virtual buddy to the participants.

7.1.3 Focus Group Plan and Organization

The focus group plan was designed based on the feedback gathered during the emotional expressiveness study (see Section 6.2). One category of feedback gathered during this study concerned moral (dis)approval of a virtual buddy that provides social support to cyberbullying victims. We assume that convictions like these impede the evaluation of the virtual buddy's supportive behavior. In order to neutralize the impact of these convictions on evaluations of the virtual buddy supportive behavior, we decided to ask the experts about their associations with a virtual buddy that provides social support to cyberbullying victims before they interacted with the system.

Additionally, the feedback gathered during the emotional expressiveness study identified important technical limitations of the virtual buddy prototype; 61 of 93 participants that provided feedback referred to one or more technical limitations (see Section 6.2.2). In particular, the experts were prompted on the appearance of the virtual buddy's embodiment and the use of response options instead of typing text.

The main objective of the focus group was, however, to gain insight into aspects of the interaction that are perceived as being supportive, aspects that disrupt the perception of support, and suggestions to improve the overall experience of social support. Taking into account these factors, the session was conducted according to the following plan:

1. Welcome and introduction of the participants
2. Introduction of the virtual buddy
3. Associations triggered by the idea of a virtual buddy
4. Interaction with the virtual buddy
5. The virtual buddy in general
6. The virtual buddy's supportive behavior
7. Final remarks

After the moderator welcomed all participants and asked them to introduce themselves, the observant briefly introduced the virtual buddy by showing a screen shot of the prototype (see Figure 5.2) and explaining how it works. In addition, the observant emphasized that, in this stage of the research, the goal was to gain insight into the virtual buddy's supportive behavior rather than assess its effectiveness against cyberbullying.

After that, the moderator introduced the first topic 'associations triggered by the idea of a virtual buddy'. Participants were given a sheet of paper and ten minutes to write down their thoughts. When the discussion on associations was finished, the experts tried the virtual buddy individually, each on their own laptop. For the interaction, the participants received a scenario on paper. They were asked to have two conversations with the virtual buddy prototype, one where they selected *to get tips on how to deal with cyberbullying* as conversation objective and one where they selected *to tell my story* (see Chapter 4 for more details on the conversation

Topic	Categories
Associations	Existing technologies and associated risks
	The virtual buddy's added value
	Conditions for the experience of social support
	Context of use
User experience	The virtual buddy's appearance
	The virtual buddy's language
	Response options
	AffectButton
	Overall impression
Social support	Emotional and esteem support
	Information support
	Conversation structure
	Other ways to communicate support

Table 7.1: Code categories for the focus group topics.

structure). The experts also received two sheets of paper, one to write down their responses to the virtual buddy in general and one to write down their responses to the buddy's supportive behavior.

To make sure feedback was collected on all important components of the virtual buddy, the moderator prompted the participants to give feedback on the impression of the program as a whole, the appearance of the virtual buddy's embodiment, the domain knowledge, the quality of the advice, the conversation structure, and the use of predefined response options instead of free text; and for the discussion on the virtual buddy's supportive behavior the participants were prompted on how the virtual buddy gave advice, how some advice was explained (teaching), and the its expressions of sympathy, compliment, and encouraging remarks.

The focus group was concluded by one final round of remarks. In total, the focus group took approximately three hours. The whole session was audiotaped and typed out verbatim for analysis.

7.1.4 Data Analysis

The transcript of the focus group discussion was coded in iterative rounds of open coding (i.e., labeling words and phrases found in the transcript [193]), followed by axial coding (i.e., grouping codes into categories [193]). The focus group transcript was coded by a single coder. The initial coding scheme was based on concepts found during the first read trough the transcript. In subsequent rounds of reading the transcript and coding concepts, the coding scheme was iteratively refined. Finally, the codes were grouped into categories. Table 7.1 lists the categories found for each of the topics discussed during the focus group session.

7.2 Results

During the focus group, many different aspects of the prototype were discussed. The results of the focus group are presented in three parts corresponding to the topic of the discussion. Section 7.2.1 presents the experts associations with a virtual buddy that provides social support to cyberbullying victims. In Section 7.2.2, we discuss the experts' user experience and their overall impression of the virtual buddy prototype. Finally, Section 7.2.3 presents the experts' evaluations of the virtual buddy's supportive behavior.

7.2.1 Associations Triggered by the Idea of a Virtual Buddy

In the discussion of the experts' associations with a virtual buddy against cyberbullying, four themes could be distinguished: references to existing technology and associated risks, the added value of the virtual buddy as a tool against cyberbullying, conditions for the experience of social support, and the virtual buddy's context of use. These themes are discussed in this section.

Existing Technology and Associated Risks

The first theme identified in the discussion of the experts' associations is existing technology and the risks presented by these technologies. The virtual buddy was compared to a chatbot and one of the experts pointed out the risk that people may feel deceived if they find out they have been talking to a bot instead of a human:

> *. . . because I think it is in fact a form of a chatbot. What I know about chatbots is that people sometimes think they are talking to a real person. [. . .] The question, then, is, of course, what happens to a youth's experience when he discovers that he is not talking to a person.*[1] (Expert 2; practice)

. This expert also mentioned that existing chatbots mainly function as search engines that refer users to information on websites. This reminded another expert of chatbot Anna of Ikea[2], which seems to be considered the prime example of a simple, information presenting chatbot.

One of the experts was familiar with self-learning systems and hypothesized the virtual buddy is such a self-learning system, with the disadvantage of possible mismatches in advice:

> *Other chatbots often are self-learning systems. This means that depending on the type of question information is added to their databases whenever someone asks something. Perhaps the virtual buddy is also a self-learning system. But in the early stages of such a system, there is a real chance mismatches occur, so*

[1] All quotes have been translated from Dutch by the author.
[2] http://www.ikea.com/nl/nl/

> *a chatbot may give advice that doesn't match the input. And that is, of course, very annoying.* (Expert 2; practice)

Another expert compared the virtual buddy to a game or quiz and asserted that that makes it a suitable tool for children:

> *I think the system ties in very well with the curious nature of children; they want to know what Robin is going to say. [. . .] It is almost a game or a quiz; children like to do these kind of quizes.* (Expert 1; practice)

The Virtual Buddy's Added Value

The second theme that was discussed during the first topic is the added value of the virtual buddy compared to the availability of help lines offering the possibility to talk to a human counselor by telephone or chat. The participants agreed that the buddy might be more accessible than the services currently offered by helplines, although it was also recognized that existing services are fairly accessible already. One of the experts mentioned:

> *I think an important question is what additional value can be offered by the the virtual buddy; what can the virtual buddy offer to victims that they can not get from their parents, or a friend, or a help line they can call where they can talk to an actual person? And the first thing I thought about was anonymity, but then* 'De Kindertelefoon[3]' offers anonymous help as well. (Expert 6; practice)

Two potential advantages discussed referred to (expected) properties of computing devices. One expert mentioned victims might feel safe when talking to a computing device, because it is unable to take action:

> *A computer certainly is incapable of taking action; people working at* 'De Kindertelefoon' might try to persuade you to go and actually do something. (Expert 6; practice)

One of the experts remarked that from this perspective, the virtual buddy can be regarded a tool that provides self-insight rather than a software application that mimics a human counselor[4].

The second potential advantage of the virtual buddy over a human counselor is that a computer can never judge a person. This might be another reason for cyberbullying victims to prefer talking to the virtual buddy over talking to a person.

Other advantages of an autonomous virtual agent over a conversation with a real person that were mentioned during the discussion included the availability of the help (a computer program is always available, whereas most help lines only offer help during specific hours of the day), and cost effectiveness.

[3] http://www.kindertelefoon.nl/

[4] We would like to emphasize that the virtual buddy is not intended as an 'automatic counselor' (see also Section 1.4).

Conditions for the Experience of Social support

The experts discussed some conditions the virtual buddy must meet in order to be able to give support. First, the virtual buddy must create a safe and inviting atmosphere. In this context both technical safety and subjective safety were mentioned:

> *I thought about the safety of the system, so things like privacy and the technical safety of the system. [...] But what is also very important is the perceived safety of the user, not so much the objective safety, but the subjective safety. To what extent does this tool invite you put yourself in a vulnerable position, because that is necessary to be able to tell your story.* (Expert 2; practice)

The experts came up with several suggestions to improve the subjective safety of the system. First, the virtual buddy has to explain to the user that the conversation is confidential. Second, the virtual buddy has to explain that it is an autonomous system. And third, the language used by the buddy has to be adapted to the target audience.

Additionally, the experts discussed the virtual buddy's strategy to give advice. One expert emphasized the importance of adapting advice to the user's current situation:

> *In addition to social support, you should indeed give advice about what you can do. And I'm thinking it is very important that Robin asks the user what he is doing now and how that can be turned into more effective behavior; the advice should be tailored.* (Expert 4; academia)

Other experts warned that giving advice can be risky, because the advice might not match the situation of the user, for example when he has already tried that to solve his problem.

Context of Use

The final theme that emerged from the discussion of associations with a virtual buddy against cyberbullying was the virtual buddy's context of use. This theme comprised the target audience of the virtual buddy, the stage during which the virtual buddy should be used, and the context in which the virtual buddy should be embedded.

With regard to the target audience, the experts first discussed their age. One of the experts mentioned that bullying most frequently occurs at the age of 13-14, so it would be a good idea to target that group. Another expert mentioned that the virtual buddy might be considered childish by people over 15 years old. Another aspect of the target audience that was discussed concerned the potential of the virtual buddy for victims of traditional bullying. The experts asserted that virtual buddy might be useful for victims of traditional bullying as well, because for children and adolescents there is no real difference between the offline world and the online world; cyberbullying is often connected to traditional bullying; and children

and adolescents do not use the term cyberbullying to describe their negative online experiences.

The experts also discussed in the stage of bullying during which the virtual buddy can be useful. The experts agreed that the virtual buddy probably is most useful in the early stages of cyberbullying.

> *We often get children that have had a single negative online experience, for example, I have been called names one time, or someone created a fake account one time, or whatever; these cases can be solved by some kind of 'Anna of Ikea'. And if Robin detects that there might be more to a case, he can redirect that person to Pestweb or De Kindertelefoon or another organization. That's how I saw him, a solution for the early stages of cyberbullying.* (Expert 1; practice)

The problem of suicidal victims was also briefly discussed. The experts quickly agreed that the virtual buddy is not a tool that should be used in extreme cases.

Finally, the experts discussed the context in which an application such as the virtual buddy should be employed. The buddy could be a standalone application available on the Web or as an app on mobile devices. Another possibility is to embed the virtual buddy into specific online communities, such as virtual worlds (e.g. Habbo Hotel[5]) or social networking sites. Alternatively, the virtual buddy could be embedded in an existing online environment that provides support to (cyber)bullying victims, such as Pestweb[6]. One expert argued for embedding the virtual buddy in a wider context of (online) support:

> *If we are talking about different forms of online support, and I think the buddy can be considered a form of online support, it is always a good idea to see how you can give members of the audience the freedom to choose the form of support they prefer; someone may prefer to talk to peers on a forum, someone else may prefer to chat with an online counselor, and a third person may prefer to talk to the buddy. That would be an argument to embed Robin in a wider context and present him as an option among different forms of help. I don't think he will be of much use as a standalone application.* (Expert 2; practice)

Conclusion

During the discussion of associations, (the idea) of a virtual buddy that provides social support to cyberbullying victims was compared to existing technology. Most importantly, the experts mentioned risks associated with existing technology, including the risk that users might feel deceived if they find out that they have been talking to an autonomous system instead of a person. Additionally, the experts discussed the added value of a virtual buddy compared to existing (online) support channels. The most important advantage of the virtual buddy that was mentioned was that it is even more accessible than (online) support provided by human counselors. The third theme discussed was conditions for the experience of support. In

[5]http://www.habbo.com/
[6]http://www.pestweb.nl/

addition to technical, objective safety, the experts asserted that a sense of subjective safety is also required. In order to create the right atmosphere for a conversation during which social support can be provided, the virtual buddy needs to properly explain certain things, including making clear that the conversation is confidential, and that the user is talking to an autonomous system. The last theme that emerged from the discussion of associations was the context in which the virtual buddy could be used. The experts emphasized that a virtual buddy probably would be most suitable in the early stages of bullying, and that they recommended to embed the virtual buddy in a wider context of (online) support.

The discussion of the experts' associations shows that the experts have little difficulty with the idea of an ECA that provides social support, and that their concerns, reservations, and objections have to do with the domain and target audience. The topic associations was included in the focus group discussion to ensure that these concerns, reservations, and objections do not impede the evaluation of the virtual buddy's behavior. Because the concerns, reservations, and objections that were mentioned in this stage of the focus group, did not resurface in the later stages (see Section 7.2.2 and 7.2.3), we conclude that we have successfully eliminated the effects of the experts' concerns, reservations, and objections on the evaluation of the virtual buddy's supportive behavior.

7.2.2 User Experience and Overall Impression

During the topic 'the virtual buddy in general', several themes were discussed, most importantly, the user experience of the virtual buddy prototype. Regarding user experience, the following issues were discussed: the virtual buddy's appearance, its language, the use of response options, and the AffectButton. Finally, in this section, we report some of the experts' concluding remarks concerning their overall impression of the virtual buddy prototype.

Appearance

The participants also commented on the virtual buddy's appearance. They did not recognize its embodiment as an old computer. They thought he looked like a robot, a vacuum cleaner, a bus with wheels, and a character from Cars[7]. In general, the experts suggested to make the virtual buddy rounder and/or more human-like (but not photo-realistic).

Also, because one of the experts missed some changes in facial expressions, she suggested to make the embodiment bigger. Another expert remarked the embodiment was too static and yet another expert thought the different facial expressions were too similar and suggested to enlarge the differences between facial expressions.

[7] Cars is a computer-animated comedy-adventure film from 2006.

Language

One of the experts mentioned the virtual buddy's language was too decent. In response to this remark, another expert asserted that children and adolescents do not like it when adults try to use 'young people's language'. However, if the virtual buddy plays the role of a peer and is considered an equal by members of the target audience, adapting the virtual buddy's speech might be appropriate.

Other remarks about virtual buddy's language included the use of words that might be too difficult for the target audience (e.g., 'ignore'), and words the target audience does not use (e.g., 'cyberbullying').

Response Options

When asked their opinion about the usa of response options instead of typing free text, the experts agreed that the response options were acceptable.

> *Actually, I thought it was quite nice. I didn't miss the possibility of typing. You get used to it.* (Expert 2; practice)

Another participant remarked that the use of response options turns the conversation into a quiz or a self test:

> *The conversations becomes some kind of quiz and I think children will like that.* (Expert 1; practice)

A disadvantage of the current setup is that the user can not go back to correct mistakes once he has selected a response option:

> *At one point, I again selected MSN and then I thought, I would like to try something else, to see whether Robin has a different response, and I couldn't go back. Then I thought, that's not very convenient, because you can also make a mistake and then you can't go back.* (Expert 6; practice)

The experts also missed the possibility to select multiple responses to answer a question:

> *A couple of times I missed the option to select multiple response options, for example multiple bullying types or having talked about it with multiple people.* (Expert 6; practice)

Allowing the user to select multiple response options also gives the buddy the opportunity to ask follow up questions and show understanding of the situation.

Some response options were considered unnecessary by the experts; for example, there were two response options for the user to greet the virtual buddy when the conversation starts. According to the experts this does not make sense, because the buddy's response to each of these two options was the same. This indicates that the experts expected unique responses to every response option. A similar situation occurred when the virtual buddy's question about how the user is being bullied was answered by selecting 'I'm being threatened':

> *Yes, you expect that after selecting 'I'm being threatened' Robin says something about that, whereas he says exactly the same thing as before 'I'm sorry that you are being bullied'* (Expert 1; practice)

This suggests virtual buddy's responses to different response options should be unique and tailored towards the response option that is responded to:

> *If it is possible, it would be better if Robin repeats these words. In case of the question about how you are being bullied, I said I'm being threatened; it would be better if Robin also uses the word threatened.* (Expert 3; practice)

AffectButton

Most participants enjoyed using the AffectButton to communicate their emotional state. One expert was expecting a text-based conversation and was startled by the AffectButton. Also, some experts had were unable finding the right facial expression to send to the virtual buddy:

> *And then I tried to select the right expression, but I couldn't find it. I mostly saw angry expressions, but I thought, I'm frightened and I don't know what to do, so I'm more scared or sad than angry. Only I couldn't find the right expression and it took me quite a long time.* (Expert 2; practice)

The experts who were unable to find an appropriate expression, were also dissatisfied with the buddy's verbal response to clicking the AffectButton. Because these experts selected emotional expressions with low intensity (i.e., P value; see Section 5.4.3 for details on the virtual buddy's response to input from the AffectButton), the virtual buddy responded by saying: 'It doesn't seem to bother you that much'. To solve this problem, one of the experts suggested that the buddy should request feedback when it interprets feedback from the AffectButton, e.g., 'It doesn't seem to bother you that much, is that correct?', and allow the user to correct the buddy's beliefs about his emotional state.

Because some experts experienced difficulties using the AffectButton, other experts suggested alternatives for the AffectButton. The first alternative was using a procedure that consists of two steps: first the user selects a basic emotion and in the second step the user specifies the intensity of the emotion. The second alternative was to allow the user to choose between the AffectButton and selecting response options with emotion labels.

Overall Impression

While the experts were critical and provided a lot of constructive feedback, they generally were quite positive about the prototype. In particular, the buddy's non-verbal behavior was considered an improvement over text-only chat conversations with human counselors:

> *Now that I have seen the program, I think it is so much more than an emoticon. When I'm chatting with children, part of the interaction is missing, and the buddy brings back that part. In my opinion it is a kind of intermediate form.* (Expert 1; practice)

> *I really liked to see that a visual representation of emotions was added to text; I've never seen that before. In an anonymous chat conversation, because the nonverbal cues are missing, you try to compensate with conversation techniques, or you throw in a lot of emoticons, but this is a new kind of solution where you really try to bring back nonverbal communication. I think it is very interesting, and I do believe it works, because when I tried the program I really felt it worked and that you get more out of the conversation than by just using emoticons. I think it is a new form, and I am really excited about it.* (Expert 2; practice)

Another expert added that she found the buddy especially suitable as a first step for children that do not know how to deal with cyberbullying:

> *I really liked it, especially as an initial step. When I think of children who do not know where to go, if you can give them some consolation and provide them with information on further steps, yes, that would be really nice.* (Expert 3; practice)

One expert found another advantage of the virtual buddy over help by a human counselor; a conversation with the buddy is very fast whereas a chat conversation with a human counselor takes longer:

> *It is going very fast, I mean, I think it took me 10 minutes to finish the conversation, while chatting with a human counselor usually takes half an hour.* (Expert 1; practice)

Another expert agreed and added that children tend prefer speedy solutions.

Conclusion

Generally, the experts enjoyed using the virtual buddy prototype. However, they did not like its appearance and suggested to make it rounder and/or more human-like. On the whole, the virtual buddy's language was considered appropriate for the target audience. Also, using response options instead of typing text was considered to be acceptable. Nevertheless, the experts did suggest improvements for the response options, including removing superfluous response options, allowing users to select more than one response at the same time, allowing users to go back in the conversation, providing tailored responses to all possible user response options. Some experts struggled with the AffectButton, and were dissatisfied with the virtual buddy's response to the emotional state they communicated to the virtual buddy. The virtual buddy's response can be improved by allowing users to correct the virtual buddy's interpretation of their emotional state.

Overall, the experts were quite positive about the virtual buddy prototype; in particular, its nonverbal behavior was considered an improvement over text-only chat conversations. In line with the quantitative results presented in Section 6.2, we conclude that the user experience of the virtual buddy prototype is satisfactory.

7.2.3 Social Support

The discussion of the virtual buddy's supportive behavior revolved around four themes: emotional and esteem support, information support, the conversation structure, and other way in which the virtual buddy can provide support to cyberbullying victims. Each of these themes is discussed below.

Emotional and Esteem Support

Multiple participants expressed they felt supported by interacting with the virtual buddy:

> *I think the conversation is very comforting, it is a safe way to get support, even though it is just a computer that says these nice things, like 'I'm sorry for you' and things like that. I think it is very nice to hear these things.* (Expert 3; practice)

> *The emotional expressions were very understanding, I just felt I was being listened to, even if it was by a computer.* (Expert 5; academia)

The participants substantiated their claims about feeling supported by referring to specific behavior of the virtual buddy. Three different aspects were mentioned: the verbal expressions of emotions, the virtual buddy's facial expressions, and the combination of verbal and facial expressions. The verbal expression of emotions was commended:

> *I really liked that Robin said: 'It was brave of you to stand up to the bully', because things like that are very supportive of course.* (Expert 3; practice)

However, the participants agreed the number of verbal empathic responses should be increased:

> *It has already been said a few times that there should be more empathic responses, for example Robin asks, 'do you know the bully?' and after the response immediately there is another factual question, 'how long have you been bullied?' It is better to first give a response to every answer, such as 'that's annoying' or 'that's awful'.* (Expert 3; practice)

In particular, verbal empathic responses are required at the start of the conversation (e.g., '*Good of you to come here*'), at the end of the conversation (e.g., '*Good you came to talk to me*') and after the user tells the virtual buddy he is being bullied.

Additionally, the virtual buddy's facial expressions were mentioned in connection to feeling supported; see for example expert 5's statement that was quoted

at the beginning of this section. Also the virtual buddy's strategy of mirroring the emotion that is communicated using the AffectButton was assessed as being supportive:

> *Well, I liked the part where you could choose an emotion, and when you see Robin express the same emotion, I think that makes children feel that they are being understood.* (Expert 4; academia)

In general, the emotions selected for expression by the buddy's emotional model seem to be appropriate:

> *I have noticed that Robin is already quite adaptive, even in this version, he is flexible. He quickly adapts to the emotion content of what is being said. And I think that that's going very well.* (Expert 2; practice)

Nevertheless, the participants also reported a number of emotion mismatches. Most importantly, one participant felt the facial expressions change too quickly back to happy:

> *And after you answered a question, he responds to that and then he starts laughing again. But that's very strange! Because you've just told him that you are very sad and then he says, 'Oh, I don't like that you're sad' and then he laughs again. I think he should remain sad or neutral a little longer.* (Expert 1; practice)

Also, a sad face was considered an inappropriate response to being threatened:

> *I entered I was being threatened, then the corners of Robin's mouth went down, and I was wondering whether that is the right response, because when someone tells you he is being threatened you should show concern, but now it seems it makes him sad.* (Expert 3; practice)

At some point in the conversation, the virtual buddy asks the user what he did to try to stop the bullying. One of the response options to this question is *retaliate*. If this option is selected, the virtual buddy responds by saying that you should not retaliate. The virtual buddy's next question is about whether the user's actions helped to stop the bullying and if the user says the bullying stopped, he is happy for the user. One of the participants remarked this response is inconsistent:

> *First Robin says that you are not allowed to retaliate, but then he is glad it helped!* (Expert 1; practice)

To substantiate the social support felt during the interaction, the participants also referred to the added value of combining verbal utterances with facial expressions:

> *I find Robin left a very sympathetic impression, precisely because of the combination of language and those different expressions. [. . .] I say it works better than text-only; it really struck me that that did something more to me than just reading.* (Expert 2; practice)

Information Support

On the whole, the participants approved of the advice given by the virtual buddy.

> *I liked the practical advice.* (Expert 5; academia)

Furthermore, the explanation of how to block a contact on MSN was '*crystal clear*' (Expert 1; practice). Additionally, this expert suggested screen shots might be used to further clarify technical know-how when needed.

One participant suggested the contents of the advice should depend on the severity of the user's situation:

> *It can be very serious if you are being threatened. In this case ignoring it might not be a sensible solution. So, maybe you should allow the user to indicate the severity of the situation.* (Expert 5; academia)

The participants were also missing some domain-specific information in the conversation. An important way to comfort a bullying victim is to make clear he is not the only one who is being bullied. This '*subjective norm*' (Expert 4; academia) should be communicated to the victim. They also suggested the virtual buddy should explain that bullying is a complicated problem and that no perfect solution exists. Another comforting strategy is to explain to bullying victims that they can learn to deal with bullying (e.g., by giving assertive responses). Finally, advice should be presented as suggestions that might not work for every person.

Conversation Structure

Some experts were familiar with De Beyns's 5-phase model [21] for structuring counseling conversations and recognized components of this model during interaction with the virtual buddy. However, one of the participants mentioned some important parts were missing:

> *I clearly see elements of the 5-phase model in Robin, but perhaps a little unstructured. I would like to see a more systematic approach, I think this will improve the structure of the conversation.* (Expert 2; practice)

Suggestions to better adhere to the 5-phase model included: complimenting the user for starting the conversation (e.g. *Good of you to have come to talk to me*), summarizing the user's situation before moving on to phase 3 (conversation objective), and when rounding off, the buddy should 'keep the door open', even if the user indicates the conversation was of no use:

> *You could also say, 'I'm sorry I haven't been able to help you, but it's good you came here, I really hope someone else can help you', or something like that…* (Expert 1; practice)

Other feedback on the structure of the conversation referred to the order of the questions during the information gathering phase. One participant suggested to

ask the question '*how do you feel when you are being bullied?*' immediately after the user tells the virtual buddy he is being cyberbullied, so the amount of emotional support can be adapted to the intensity of the negative emotion. For example, if the user is not emotionally affected, but only wants to know what actions can be taken, he can quickly find his way to the tips.

Other Ways to Communicate Social Support

During the discussion, the participants came up with additional ways to express support. The first suggestion was to use humor to put things into perspective. When making this suggestion, the participants realized very well using humor is tricky:

> *I think you are right when you say humor is important, but it is so hard to do it right, you mess things up very quick.* (Expert 3; practice)

Also, it was recognized that it depends on the specific situation whether humor or other ways to put things into perspective are appropriate. To express humor and other '*dangerous emotions*' (Expert 2; practice) the participants suggested several visual means, including winks and other smileys, holding up signs, and giving a round of applause.

According to the experts, an important threat to the user experience is the certainty with which the virtual buddy assumes he is correct, when he responds to user input, for example when interpreting the emotional state that is communicated with the AffectButton (see also Section 7.2.2). The virtual buddy responds empathically to all negative emotions communicated with the AffectButton. One expert suggested the virtual buddy should check its interpretation of the emotional state communicated:

> *When I had to use the face to choose an emotion, I thought I selected a frightened expression and then Robin said: 'It doesn't seem to bother you that much'. [. . .] An I thought, to solve it you could ask, 'Is that correct or am I wrong?'* (Expert 3; practice)

Also, the virtual buddy should check whether a piece of advice it gives is acceptable to the user:

> *I think you can give advice, but you should always check whether it is helpful.* (Expert 3; practice)

Conclusion

This section addressed the experts' evaluations of the virtual buddy's supportive behavior. In particular, our goals were to assess what aspects of interaction with the virtual buddy prototype were perceived as being supportive, what aspects disrupt the perception of support, and how the overall experience of social support can be improved. The results demonstrate that the experts recognized the different social

support strategies employed by the virtual buddy, including the structure of the conversation (5-phase model), supportive statements (sympathy, compliments, and encouragement), different facial expressions, advice and teaching.

The experience of being supported was contributed to the virtual buddy's supportive verbal utterances, the different facial expressions, and the combination of verbal utterances and facial expressions. Most of the time, the emotions expressed verbally and nonverbally during the conversation were considered to be appropriate, although the experts did report a few emotion mismatches. Another threat to the experience of social support is the certainty with which the virtual buddy assumes he is correct when interpreting the user's emotional state and giving advice.

Additionally, we gathered detailed feedback on how to improve the virtual buddy's support skills. In particular, the experts suggested to add more supportive verbal utterances, to resolve the emotion mismatches, and to request feedback after interpreting the user's emotional state and giving advice. Additionally, the experts suggested to add a truly neutral facial expression, and to slow down the decay rate of emotions. Regarding the conversation structure, the experts' suggestions were somewhat contradictory; some experts suggested to better adhere to the 5-phase model, while others suggest changing the conversation structure. With regard to information support, the most important suggestion was to have the virtual buddy give more explanation about bullying. There were other suggestions for additional ways of communicating social support, including expressing humor and other, more 'dangerous' emotions, and using more visual means to express emotions.

7.3 Discussion

The results of the focus group discussion confirm the findings from the quantitative studies presented in Chapter 6. First, the results from the focus group discussion confirm that the user experience of the virtual buddy prototype is acceptable and does not hamper the provision of support. Regarding the technical limitations of the prototype identified by the participants of the emotional expressiveness study (see Section 6.2), the remarks uttered by the experts during the focus group discussion match the feedback provided by participants of this study to a large extent; for example, both the experts and participants of the focus group discussion did not like the appearance of the virtual buddy's embodiment and suggested to give it a more human-like appearance. In addition, despite the fact that all experts found using response options acceptable and some participants of the emotional expressiveness study did not, both the experts and participants of the emotional expressiveness study remarked that it would be useful to be able to select multiple response options at the same time and that it would be useful to be able to go back in the conversation.

The results from the focus group discussion also confirm that the support provided by the virtual buddy is effective; the experts explicitly claimed they felt

supported, and substantiated this claim by referring to the virtual buddy's verbal behavior, its nonverbal behavior, and the combination of verbal and nonverbal behavior. Both the experts and participants of the emotional expressiveness study (Section 6.2) suggested to include more supportive remarks in the conversation, and identified the same emotion mismatches (e.g., a neutral facial expression that was considered to be too cheerful, and the rate of changes in facial expressions that was considered to be too abrupt). They also made similar suggestions for other types of support that could be included in the conversation, in particular, they suggest to include more general information on the mechanisms underlying (cyber)bullying. Finally, participants of the emotional expressiveness study suggested to ask more follow-up questions. This is in line with the experts' feedback to include feedback requests in the conversation.

The results of the focus group discussion demonstrate the virtual buddy prototype successfully captures important principles of providing social support to cyberbullying victims, and provides insight into these principles. As mentioned before, the experts commended the virtual buddy's nonverbal expressions of emotions, and the combination of nonverbal and verbal expressions. The experts also identified threats to the experience of support, e.g., not requesting feedback when interpreting input from the AffectButton, or giving advice). They provided many suggestions to improve the virtual buddy's social support skills (see Section 7.2.3). An important category of improvements amounts to adapting conversations to individual users.

In order to prevent preconceptions from affecting evaluations of the virtual buddy's supportive behavior during the focus group session, the experts were asked to discuss their associations with a virtual buddy as a tool against cyberbullying, before trying out the system. The discussion of these associations shows that the experts' concerns, reservations, and objections mainly concern the domain and the target audience. During the discussion of the other topics, negative associations and/or disapproval of the virtual buddy as a tool to support cyberbullying victims did not surface in the discussion. Additionally, the experts provided constructive feedback on the virtual buddy's behavior. Therefore, we conclude that our approach to reducing the impact of preconceptions regarding the virtual buddy as a tool against cyberbullying was successful. This method of dealing with potentially harmful preconceptions, can be used for evaluating an ECA's behavior sensitive application domains, such as eHealth.

A limitation of the results presented in this chapter is that they are based on a single focus group. In order to ensure that information gathered during focus groups, and conclusions drawn from this information are valid and reliable, it is advised to organize multiple focus groups on the same subject [141]. However, based on the similarities of the focus group results with the quantitative results and open feedback gathered in the emotional expressiveness study (Section 6.2), and the experts' unanimous positive responses to the virtual buddy's supportive behavior, we decided to stop consulting experts after one focus group, and to move on to evaluating the virtual buddy's supportive behavior with members of the target age

group. The results of this study are presented in Chapter 8.

7.4 Conclusion

The results from the expert focus group show that the simple prototype successfully captures important principles of social support. The experts contributed their experience of social support to the virtual buddy's supportive verbal utterances, the accompanying facial expressions, and, in particular, the combination of verbal utterances and facial expressions. The results also confirm the conclusions of the emotional expressiveness study presented in Section 6.2; the user experience of the virtual buddy prototype is acceptable, and the support provided by the virtual buddy is effective. The results of the focus group provide additional insight into how support is conveyed. The results indicate that the nonverbal behavior generated by the emotion model and the conversation structure specified by the conversation model generally provide the right social cues for users to feel supported.

In addition to providing insight into the principles of social support by ECAs, the second contribution of this chapter is the demonstration of a method that can be used to evaluate the behavior of ECAs designed for vulnerable target audiences (e.g., children), and sensitive domains (e.g., cyberbullying). In particular, we invited adult experts to try out the system. The detailed feedback we gathered shows this qualitative method yields valuable insights in how a certain emotional experience –in our case the experience of social support– can be provided for. We believe that explicitly discussing the experts' associations with a virtual buddy against cyberbullying before actually trying out the system facilitated the process of collecting constructive feedback.

The results of the focus group discussion confirm that, despite some limitations of the prototype, the virtual buddy is able to communicate social support. The next step is to involve children from the virtual buddy's target age group in the evaluation of its supportive behavior. Chapter 8 presents the results of 12 in-depth interviews with children between the ages of 10 and 14.

Chapter 8

Qualitative Evaluation of the Virtual Buddy's Supportive Behavior: Interviews with the Target Age Group

In the previous chapter, the supportive behavior of the virtual buddy prototype was evaluated by a panel of pedagogical and (cyber)bullying experts. The results show that the virtual buddy is able to convey support and that the principles of social support are successfully implemented in the virtual buddy prototype. The next step of our evaluation process is to involve members from the virtual buddy's target age group, i.e., children between the ages of 10 and 14. This chapter presents the results of 12 in-depth interviews about the user experience provided by the virtual buddy prototype, and its supportive behavior. Because the experts were generally positive about the virtual buddy prototype and its supportive behavior, and in order to obtain results that can be compared with the opinions of the experts, we decided not to improve the prototype according to the experts' suggestions, but to use the same prototype during the evaluation with the target age group.

This chapter is organized as follows. In Section 8.1, we explain the method used to gather feedback from the target age group. Section 8.2 presents the results of the interviews. In Section 8.3, we compare the results of the interviews with the results of the expert focus group (see Chapter 7). Section 8.4 presents our conclusions.

8.1 Method: One-on-One In-depth Interviews

In order to gather feedback on the virtual buddy's supportive behavior from the target age group, 12 one-on-one in-depth interviews were conducted. In Section 8.1.1, we provide background information on interviewing children. The partic-

ipants and interviewers are described in Section 8.1.2. Section 8.1.3 presents our interview plan and interview procedure. Finally, in Section 8.1.4, we specify the procedure used to analyze the interview data.

8.1.1 Interviewing Children Demands Expertise

There is general consensus that from the age of 7 most children are capable of providing accurate and useful information in interviews [68, 107, 127]. So, the research method is appropriate for the virtual buddy's target age group. There are some factors that may influence the interviewee's answers, including the fact that children like to please adults [70, 80, 88, 190], and that they are sensitive to the perceived power and status of adults, and presumptions about what answers are expected [70, 80, 190]. Also, having to talk to an unfamiliar adult may inhibit some children [82]. In order to ensure that the influence of these factors is minimized, it is highly important that children are interviewed by interviewers whose skills and experience allow them to make participants feel at ease, establish trust, and make sure that the interview is a pleasant experience [82].

We opted for one-on-one interviews, because this setting allows us to closely monitor the interaction between the virtual buddy and the interviewee, and use this interaction to take into account and follow up on participants' individual experiences and responses. Using concrete materials, such as the virtual buddy prototype, as interview guide help creating a shared focus for the participant and the interviewer, allow participants to express nonverbal behavior, increase the amount of information volunteered, and provide the opportunity for elaboration [62, 158].

8.1.2 Interviewers and Participants

The interviews with the target age group were conducted at a communication agency specialized in communication with children and adolescents by one of two interviewers. Both interviewers were experienced (group)interviewers; the first interviewer had 8 years' experience and the second 2 years' experience.

Participants were recruited from the communication agency's response panel. In total 6 girls and 6 boys from primary school (aged 10–12) and high school (ages 12–14) were selected. Table 8.1 shows participants were equally spread over the two age groups. Because the focus of the present study was on the evaluation of the supportive qualities of the virtual buddy and not on the suitability of the virtual buddy as a tool against cyberbullying, being bullied was not a criterion to participate. Bullying victims were, however, not excluded from the study.

8.1.3 Interview Plan and Procedure

The interviews took place at the communication agency after school hours. Prior to the interviews, written permission from the participants' parents was obtained. During the interview, a minutes secretary was present in the interview room. The

Age	M	F
Primary school (ages 10–12)	3	3
High school (ages 12–14)	3	3
Total	6	6

Table 8.1: Number of male and female participants in two age groups.

author observed the interviews through closed-circuit TV from another room. The interviews were not recorded. The design of the study was approved by the ethical board of Delft University of Technology.

Because being bullied was not a criterium to participate in the study, interaction with the virtual buddy was based on a scenario. We used the same scenario as before (see Section 6.1.2), with minor modifications. The name of the main character was again changed to Tom. Additionally, the bullying incident took place on Facebook Chat[1] instead of MSN Messenger, because at the end of 2012 Microsoft announced that MSN Messenger was going to be discontinued [209].

The interviews were semi-structured; the setup closely resembled the setup of the expert focus group. The interview plan was as follows:

1. Introduction
2. Bullying and cyberbullying
3. Introduction of the virtual buddy (with scenario)
4. Expectations of the virtual buddy
5. First conversation with the virtual buddy
6. General impression of the virtual buddy
7. Second conversation with the virtual buddy
8. Detailed responses to the virtual buddy
    - Attractiveness
    - Trustworthiness
    - Social support
    - Advice
    - Interface design and appearance of virtual character
    - The virtual buddy's personality
    - Language of the conversation
    - Revisit expectations
    - Lessons learned
9. Closing

In the explanation of the interview plan, we will refer to the interviewer as 'she'; the participant is referred to as 'he'. Upon arrival at the communication agency, the participant was guided to the interview room by the interviewer. This room contained a desk with a desktop computer. The participant was instructed to take

[1] http://www.facebook.com/sitetour/chat.php

the seat behind the computer. The interviewer sat down next to the participant. The interview started with an informal introduction to make the participant feel at ease. After the interviewer and the participant introduced themselves to each other, the interviewer started with some questions to test the participant's knowledge on bullying and cyberbullying.

Next, the interviewer introduced the virtual buddy by reading the scenario to the participant. At the end of the scenario, the virtual buddy is introduced in the following manner: Tom (the main character) is fed up with being bullied and starts looking for a way to do something about it. Because he does not know what to do, Tom searches the Internet. He ends up on a website with a computer program. On this website, he chats with Robin. This computer program supports children that are being cyberbullied.

After checking whether the participant had understood the scenario, the interviewer emphasized that she had not created the virtual buddy and that she wanted to hear all his responses, both positive and negative. Next she asked the participant what kind of computer program he was expecting the virtual buddy to be. When the discussion of the participant's expectations was completed, the interviewer started the virtual buddy and told the participant without further instruction to start using the application. Additionally, the interviewer asked the participant to read aloud the virtual buddy's messages and the response options he selected. During the first conversation the interviewer asked in general terms what the participant liked and did not like about the application. Afterwards the interviewer asked the participant about how he thought Tom felt after the conversation and what Tom would do next. The participant was asked to explain all his answers.

Next the interviewer restarted the buddy and asked the participant to have a second conversation. Again, the participant was asked to read out the conversation. During the second conversation, the interviewer prompted the participant on the attractiveness of the application; the virtual buddy's trustworthiness; to what extent and why the participant felt supported (or not); the quality of the advice; the interface design and appearance of the virtual character; the virtual buddy's personality; and the language used by the virtual buddy. After the conversation was completed, the interviewer revisited the participant's expectations about the virtual buddy, asked him what he learned from the conversation, and discussed with him whether he would use the application or not, and what would be an appropriate context to use the virtual buddy.

The interview was ended by asking the participant whether he had questions about the virtual buddy and/or the study in which he was participating. Interviews took between 45 and 60 minutes. Participants were compensated for travel expenses and received a reward of 20 Euros.

8.1.4 Data Analysis

Based on notes made by the interviewers after each interview, the interviewers individually analyzed the interviews based on the topics of interest that were specified

in advance. As stated in the introduction of this chapter, we are mainly interested in the user experience of the virtual buddy prototype, and opinions on the virtual buddy's supportive behavior. During the initial analysis, special attention was paid to similarities and differences in the opinions of boys vs. girls, and younger vs. older participants. The notes taken during the interviews were consulted as needed, and important quotes were marked as such. After the individual analysis, the individual results were discussed and merged. The results of this session were used as an outline for the final analysis. During the final analysis, the results were specified in more detail and substantiated with quotes from the participants.

8.2 Results

During most interviews, the interviewers were able to create an open, relaxed atmosphere that allowed participants to speak freely. On a few occasions, participants were less talkative or kept looking into the camera. Generally, the participants felt comfortable to express both positive and negative comments on the virtual buddy. In this section we will first illustrate that the participants are well informed about bullying and cyberbullying. Next, the participants' expectations of the virtual buddy application are discussed. After that a discussion of the general feedback on the virtual buddy is presented. Finally, we go into participants' feedback on the virtual buddy's social support skills.

8.2.1 Bullying and Cyberbullying

Although the majority of participants has never been bullied, all of them have a good understanding of bullying and surrounding issues. Most participants also know what 'cyberbullying' or 'online bullying' is. Almost all participants know stories of peers that have experienced cyberbullying. Cyberbullying is usually explained by giving examples of cyberbullying incidents. According to one of the participants cyberbullying is bullying via social media:

> *At my school people have been bullied via social media. It's when someone puts pictures on the Internet or sends nasty emails and you can't see who did it.* (P10, 12 years old)

Generally, the participants do not distinguish between online and offline bullying. Online bullying is seen as a continuation of traditional bullying. As formulated by one of the participants:

> *If you are being bullied, you are not safe at home. After school the bullying continues on the Internet.* (P1, 12 years old)

The topic of bullying is often discussed at school. Most participants mention their schools have policies against bullying. Additionally, the topic is regularly discussed in the classroom, usually in response to bullying incidents. In another

example of a cyberbullying incident, one of the participants reports the teacher intervened to put an end to the bullying:

> *At my school a girl took a sexy photo of herself for her boyfriend. Everybody saw that picture. The girl was severely bullied and they called her 'slut'. The teacher talked about it in class and then it stopped.* (P7, 12 years old)

Bullying is a sensitive topic; because of this, participants find it difficult to talk to adults about bullying. One of the participants said she understands that bullying victims do not talk to adults. Participants see the virtual buddy as an alternative conversation partner for children that are afraid to talk to their parents or other adults.

> *If you do nothing about bullying, you keep on feeling bad. Some children are afraid to talk to people, in that case this [virtual buddy] can be of use.* (P2, 11 years old)

> *Sometimes you may not want to talk to your parents about bullying, then you can talk to Robin.* (P3, 11 years old)

To summarize, participants demonstrated a clear understanding of bullying and cyberbullying. Most participants were able to give examples of cyberbullying incidents that happened to classmates or other peers. As the scenario contains a story that is similar to these examples, the participants were very well able to empathize with Tom, the main character. A few participants had some difficulties with understanding Tom's story.

8.2.2 Expectations of the Virtual Buddy

After the interviewer read the scenario to the participant and checked whether the participant understood the scenario, the participant was asked about his expectations of the virtual buddy. The interviewer emphasized the virtual buddy was a computer program. Most of the participants expected a computer programs that gives practical advice on how to deal with bullying.

> *I think there will be a lot of tips and maybe a step-by-step plan on how to solve bullying. And maybe stories of children that are bullied too.* (P5, 13 years old)

> *I think there will be tips on how to outsmart bullies.* (P3, 11 years old)

Other participants mention asking questions as part of the functionality of the computer program.

> *I think the computer asks me what happened and maybe explains how you can find a solution. Or he just gives the solution.* (P2, 11 years old)

> *I think Robin asks questions and if you tell him what is going on, he explains what you can do about it.* (P10, 12 years old)

A few participants think that it is a program where bullying victims can tell their story or a program that helps to increase a person's confidence. Some others think it is a chat program that brings them into contact with peers or is moderated by adults. Additionally, participants usually expect that chatting with the virtual buddy involves typing.

In summary, participants' expectations are mostly in line with the prototype system. Apparently, the brief explanation of the system in the scenario is sufficient for the target age group to understand what it is. For the way in which the virtual buddy is controlled, participants' expectations (typing) do not match the system (response options). Section 8.2.3 discusses participants' opinions on response options versus typing.

8.2.3 User Experience

This section presents the feedback from participants on the user experience provided by the virtual buddy prototype. We subsequently present participants' opinions on the virtual buddy's embodiment, its personality, the language used during conversations, the overall experience of interacting with the virtual buddy prototype, the use of response options, the use of the AffectButton, and the virtual buddy's trustworthiness.

The Added Value of the Embodiment

The participants generally like the virtual buddy's appearance; the embodiment evokes responses such as '*a sweet character*', '*funny*' and '*cute eyes*'. The virtual buddy's appearance is associated with different things, including an old TV, a computer, and a frog. Participants think the visual style of the embodiment fits the application well. However, a few participants think the visual style is childish.

Participants think the embodiment complements the chat interface. One participant said she liked that the embodiment allowed her to see who she was talking to:

> *I don't like it when I don't know who I'm talking to, so it is a good thing you can see her.* (P9, 11 years old)

Participants were surprised when they noticed the virtual buddy's changing facial expressions. Although this was not mentioned explicitly by the participants, it became apparent from their physical responses when they noticed the changes in the facial expression. Participants like these changing facial expressions and think that it really adds something to the conversation. Without the embodiment, interaction with the virtual buddy is a normal chat conversation, that is visually less attractive.

> *I like that Robin feels for me. I would not want another character. Without Robin the window would be boring.* (P12, 13 years old)

The Virtual Buddy's Personality: Amiable, Cheerful, and Willing to Help

Participants think that the virtual buddy has a gentle nature; they use words such as helpful, sweet, patient, and nice to describe its personality:

> *I think he is a very nice and open guy, who likes to help people.* (P3, 11 years old)

> *Robin is an easy-going, sweet type. We had a pleasant conversation. It is not a patronizing tone.* (P8, 12 years old)

> *Robin smiles and looks happy. She has a helpful nature and really tries to help the victim.* (P12, 13 years old)

As becomes apparent from the quotes in this chapter, some participants refer to the virtual buddy as a 'he', while others use 'she' to refer to the buddy.

The Virtual Buddy Looks Young, but Talks like an Adult

On one hand, participants think the virtual buddy is their age. It is not always clear why participants think the virtual buddy is a peer:

> *I can't tell his age from the way he looks, but I think 12 or 13 years old. It's a young person.* (P4, 14 years old)

Other participants base their assumption that the virtual buddy is young primarily on the appearance of the embodiment. According to one of the participants, the virtual buddy's appearance does not match its language:

> *He looks 9 years old. He looks like he doesn't know a lot about it, but he does know a lot. So I think he is about 30 years old.* (P1, 12 years old)

The mature tone of the verbal messages makes participants ascribe authority to the virtual buddy. Sometimes the verbal messages are too mature; participants remark they would never say something like that.

The Virtual Buddy's Language is Clear and Motivating

For some participants reading the texts out loud took a lot of effort. This indicates that participants' language ability varied. Generally, the virtual buddy's language is properly attuned to the participants' language abilities. In addition, participants like the virtual buddy's language; they think it is clear and motivating. Also, the tone of voice is pleasant; neither childish nor pedantic. One of the participants says he likes the virtual buddy's language, because the words used are easy to understand and the tone of voice is mature:

> *The words Robin uses are not super difficult, but also not childish. I think it's okay.* (P2, 11 years old)

Another participant states he is motivated by the virtual buddy's language:

> *I like Robin's language. It is motivating.* (P6, 13 years old)

A few participants do not know the meaning of a small number of words, such as 'icon'.

Interacting with the Virtual Buddy Feels like a Conversation

For many participants interacting with the virtual buddy feels like a chat conversation with a person. Multiple participants state that talking to the virtual buddy is similar to talking to a person:

> *It's just like talking to a real person. Like a real person writes these messages.* (P5, 13 years old)

> *I was expecting a picture of a human. I never thought that talking to a character could feel like a conversation with a real person.* (P12, 13 years old)

Another participant remarks that the virtual buddy asks the right questions:

> *It is a computer, but he asks the right questions. For example, 'Who is bullying you?' and 'How long have you been bullied?' Maybe because the computer knows how long it's going on, he can do something about it.* (P2, 11 years old)

The participants also identified some limitations of the virtual buddy's conversational behavior. Most importantly, some transitions in the conversation are too abrupt; the virtual buddy asks a question about a topic an then moves on to another topic. Participants would like the virtual buddy to go deeper into some topics, for example by asking follow-up questions. Another limitation is the lack of variation in the virtual buddy's responses:

> *When I select a response, he often says the same.* (P6, 13 years old)

The length of the conversation is good; not too short and not too long. The partitioning of the information into sequences of verbal messages make taking in the content more manageable and less boring than when reading a continuous piece of text. The breaks between messages make the participants think that the virtual buddy is really typing. For some participants the breaks between the virtual buddy's message were too short:

> *Often while I was reading, an new message appeared, and I had to look for the message I was reading before.* (P10, 12 years old)

On the other hand, for participants that read faster, sometimes the messages do not appear fast enough. Some participants are annoyed because they have to wait before they can continue reading:

> *I think it is a slow program. Sometimes I had to wait for an answer.* (P6, 13 years old)

Response Options: Low Demand for Typing

Although participants expect interaction with the buddy involves typing, participants prefer selecting response options once they have tried it. Selecting response options works well; the demand for typing is low:

> *It works pretty well. I expected I had to type myself, but this is better. First you get choices and then you get tips.* (P12, 13 years old)

> *I like that you have to select response options. Often, children don't want to tell their story, because they are afraid of other people's reactions.* (P9, 11 years old)

An advantage of selecting pre-defined response options that was identified by one of the participants is the fact that users are forced to use the program as it is intended; users can not enter abusive terms:

> *If you have to type messages, people might start swearing; saying things like 'God damn it'. That's impossible with this program, so you stay calm.* (P8, 12 years old)

However, the participants also identified some limitations of response options. First, in some cases, participants miss certain response options. For example, after the virtual buddy gives advice, the user has to confirm this advice by clicking 'Okay'. For some participants this is not acceptable:

> *Here you can only say 'Okay'. I also want to be able to say I think it is a good idea to try that. Or tell him that I've already tried that.* (P1, 12 years old)

> *Currently, you can only say 'Yes', 'No', or 'Okay'. There should be more options to choose from, it needs to be extended.* (P6, 13 years old)

At the start of the conversation, the virtual buddy asks 'What happened?' and the only response option available is 'I'm being cyberbullied'. Some participants think it doesn't make sense to ask a question that has only one possible answer:

> *This program is for children that are cyberbullied. I think asking what happened is a bit strange and unnecessary. You can only select one answer!* (P5, 13 years old)

Even though according to the target age group there is no real difference between offline bullying and online bullying, participants suggest to add response options to this question to include traditional, offline bullying.

A second limitation of response options participants identified is the fact that users are forced to select a single response option. Participants would like to be able to select multiple response options, in particular to answer questions such as 'How are you being bullied?' and 'Who did you talk to about the bullying?':

> *What are you supposed to do if you are insulted ànd threatened? You can only select one option.* (P1, 12 years old)

Explanation and Interpretation of the AffectButton Needs to be Improved

At some point during the conversation, the virtual buddy asks the user how he feels. To answer this question, the AffectButton appears. Generally, participants like the change in interaction mode provided by the AffectButton:

> *I like it when that face appears. Good idea that you can move the mouse and the face changes.* (P10, 12 years old)

However, participants had some difficulty to select appropriate facial expressions with the AffectButton. First, participants did not explore the complete space of facial expressions, but kept the mouse cursor close to the vertical axis in the middle of the face. Expressions along this axis have a P value that is close to 0. In the emotion model, these P values are either interpreted as a positive emotional state, or as a negative emotional state with a low intensity (see also Section 5.4.3). The virtual buddy responds by saying: *'I'm glad you remain positive!'* for positive emotional states, and *'It doesn't seem to bother you that much...'* for negative emotions with low intensity. When participants selected an expression they thought represented a sad emotional state, they got one of these responses. Participants did not understand these responses:

> *'I'm glad you remain positive?' Why does Robin say that? I'm sad...* (P1, 12 years old)

> *That face wasn't quite right. I selected a sad face and then Robin said it didn't seem to bother me. What kind of face do I have to pull then?* (P2, 11 years old)

> *I clicked on a face with eyes closed and mouth shaped like a line, then he said I remained positive. I don't understand that. Why doesn't he say: 'Why are you sad? What is going on?'* (P9, 11 years old)

During the conversation, the virtual buddy explains how to use the AffectButton, but only after it appears. Probably many participants did not notice the explanation.

During interaction with the virtual buddy, the word 'AffectButton' used is when the user clicks the AffectButton. The target age group does not like this term. Some participants do not completely understand what it means:

> *I understand the word 'button' and what is meant by it, but I would use a different term.* (P8, 12 years old)

Alternatives suggested by the participants include 'smiley', 'face', and 'facial expression'.

The Virtual Buddy is (Not) Trustworthy

Trustworthiness was identified as an important issue by the participants. On the one hand, the virtual buddy is considered to be a safe and trustworthy computer program by some participants:

> *Robin is a nice conversation partner, so I would use him. It is a safe way.* (P5, 13 years old)

A reason given by participants to substantiate this claim is the fact that users can remain anonymous:

> *I think Tom feels better after the conversation, because he was able to tell his story anonymously.* (P6, 13 years old)

On the other hand, there are also participants that question the virtual buddy's trustworthiness. Currently, it is not clear who is behind the virtual buddy. One of the participants suggests to resolve this problem by including a logo in the interface:

> *It would be more reliable if a logo, or something like that, was included in the design.* (P10, 12 years old)

It is also not clear what happens to the information the virtual buddy gathers during a conversation. Participants are concerned that the virtual buddy is not an 'official' anti-bullying tool:

> *I think it should say somewhere 'Robin is a bullying helper'*[sic]*, so I know that I'm talking to a professional.* (P7, 12 years old)

Others are afraid that their personal information will be passed on to others:

> *Some children are afraid of what might happen if you tell your story online. Others might laugh about it and that makes you feel insecure.* (P9, 11 years old)

The virtual buddy's trustworthiness depends on the environment in which it is embedded. According to the participants, a virtual buddy that is placed on a separate (unknown) website or directly on social media is less trustworthy than when it is available on a specialized anti-bullying website. Additionally, participants think the virtual buddy could be used in anti-bullying programs at school:

> *Robin shouldn't just be available on social media. It should be used in lessons at school or on a special website about bullying.* (P11, 11 years old)

In its current form, not all participants feel the virtual buddy is trustworthy and suggested to increase its trustworthiness by embedding it in a specialized website about (cyber)bullying or usage during anti-bullying lessons at school.

Conclusion Regarding User Experience

First, the participants believe that the embodiment improves the application. Although a few participants think the virtual buddy looks childish, most of them like its appearance. Participants were surprized by the changing facial expressions. The participants think the virtual buddy has a pleasant personality; they think it is amiable, cheerful, and willing to help. The virtual buddy was designed as a member

of the target age group (i.e., a peer). A number of participants correctly estimated its age, while other participants think the virtual buddy's age is not in agreement with its appearance. In particular, the language is considered to be too mature.

Participants clearly accept the virtual buddy as a fully fledged conversation partner; they state that interacting with the virtual buddy feels like having an online conversation with a person. Additionally, none of the participants said it was strange to chat with a computer program. The most important improvements suggested by the participants were that the virtual buddy's verbal responses should be more varied, and that it should be able ask follow-up questions about certain topics.

Although some participants would like to have more response options to answer certain questions, and in response to other questions they want to be able to select multiple response options, they generally are in favor of using response options to talk to the virtual buddy. The demand for typing is low. Additionally, participants liked using the AffectButton, but had some trouble to select an emotional state that was interpreted by the virtual buddy as a negative emotional state. Participants were confused by the virtual buddy's response to emotional states incorrectly interpreted as as positive or neutral.

Based on these results, we conclude that the user experience provided by the virtual buddy prototype is satisfactory.

8.2.4 Feedback on the Virtual Buddy's Supportive Behavior

During the interviews, the participants were also asked to evaluate the virtual buddy's supportive behavior. This section presents participants' feedback on the information support, and the emotional and esteem support.

Information support

In the first place, participants refer to the tips when asked to explain what they liked about the virtual buddy:

> *I liked the tips, although they are kind of the basic tips, but yeah it's all true. For example ignoring, I liked that Robin said that.* (P5, 13 years old)

> *I like that he asks a lot of questions and that he gives a lot of tips. Now I know how to stop the bullying.* (P3, 11 years old)

Participants like that the virtual buddy allows them to choose their preferred response to bullying; it feels like the virtual buddy imposes nothing when the participant gets to decide which option suits them best:

> *I liked that Robin said he will try to find a response that suits you. He gave a lot of tips and you can choose the ones you like best.* (P9, 11 years old)

According to the participants, the tips provided during the conversation are valuable and useful:

> *I think the tips really work if you are bullied. Useful tips are 'only accept invitations from people you know and trust' and 'block the bully'.* (P10, 12 years old)

When asked what tips are most useful, participants refer to the practical tips (i.e., advice in which technical know-how is explained (teaching)) and new tips. One participant attributed the quality of the advice to the virtual buddy's history as a bullying victim (we would like to emphasize that the participant invented this story; the virtual buddy does not refer to bullying events it (supposedly) experienced):

> *I think Robin used to be bullied once and that's why he gives these good tips. He must have used them himself.* (P2, 11 years old)

Participants also suggested to further explain some advice, for example the advice to talk to someone:

> *It would be helpful if Robin explains why you should do certain things. For example, why is it good to talk to people?* (P5, 13 years old)

Many participants state the conversation motivates them to take action. When asked what Tom would do, most of them said they thought Tom would try some of the advice.

Emotional and Esteem Support

When asked how Tom feels after the conversation, most participants think he would feel better. To support this claim, participants refer to virtual buddy's supportive messages and the facial expressions in combination with the messages. The supportive messages make the participants feel like the virtual buddy understands them and their feelings:

> *I think it is sweet of Robin to sympathize with me. He is upset that I'm being called names; he doesn't just say: 'oh'.* (P5, 13 years old)

> *I like that Robin says: 'It was brave of you to stand up to the bully'. Nobody really tells me that online.* (P8, 12 years old)

> *I like that Robin says: 'It was smart of you to block the bully!' That makes me feel better, because he tells me I did the right thing.* (P9, 11 years old)

The virtual buddy's facial expressions play an important role in the experience of support. The supportive messages are easier to understand and accept, because the facial expressions reflect the emotions expressed in the verbal message. The following quotes illustrate that the participants are sensitive to the changing facial expressions:

> *I said something and then all of a sudden she was looking sad. I thought that was funny. Just like a human being, but in the form of a puppet.* (P2, 11 years old)

> *Robin can see that I don't like it. He looks sad and then goes to do something about it.* (P3, 11 years old)

> *I like that the character adapts to what I say.* (P4, 14 years old)

Generally, the virtual buddy's facial expressions match the emotions expressed in the verbal message:

> *I think it's funny that the face changes. If I do something good, he looks happy. If I don't feel well, he looks sad.* (P11, 11 years old)

However, some participants think that the virtual buddy's neutral expression is too cheerful to discuss bullying. They would rather see a more serious or neutral expression:

> *If a response is sad, her mouth should be a line and not a smile.* (P12, 13 years old)

Also, some participants think the virtual buddy exaggerates or overdoes the emotional support. Examples of exaggerated support include the repetition of comforting phrases and excessive use of exclamation marks:

> *I think sometimes he's a little fake. He has these big emotions. Robin keeps on saying: 'I'm sorry for you', 'That's sad', 'I'm so sorry'. And all the time he is using exclamation marks.* (P1, 12 years old)

According to the participants, the virtual buddy misses opportunities to give emotional support. The buddy does not respond to all input from the user and this is seen as a shortcoming:

> *Robin does not respond when I answer 'I don't know'. Doesn't she care about my answer?* (P1, 12 years old)

A similar concern expressed by participants is that transitions in the conversation are too abrupt; the virtual buddy shows compassion by uttering a verbal message and immediately continues with the next question, which is usually about a completely different topic. These participants would like the virtual buddy to go deeper into the topics that are discussed to allow victims to elaborate on their story:

> *If you select 'I want to tell my story', you still get tips. I think it is important to be able to tell your story. Then he knows what happened and how bad it is.* (P6, 14 years old)

Some older participants (> 12 years old) see through the virtual buddy's strategy for giving emotional support (question-answer-supportive statement). This makes the conversation unnatural and repetitive to them:

> *I thought it was rather predictable; each time you select an answer, you get a compliment and then again it's question-answer-compliment. The sequence is always the same, that's boring.* (P6, 14 years old)

Conclusion Regarding the Virtual Buddy's Supportive Behavior

Almost all participants like the virtual buddy because of the advice it provides. Although participants already knew most of the buddy's tips, the advice was highly valued, in particular new advice and practical tips. They also like that the buddy does not impose its advice, but allows them to choose the tips that suits them. Participants say that they felt motivated to take action by the conversation with the virtual buddy.

When prompted, participants also refer to the emotional support provided by the virtual buddy. They assert that they think Tom, the main character from the evaluation scenario, feels better after interacting with the virtual buddy. To substantiate this claim, most participants refer to the supportive messages and its facial expressions together with the supportive messages. Generally, the supportive messages and facial expression match. However, some participants remarked that the emotional expressions (both verbal and nonverbal) were exaggerated; this reduces the experience of support. A couple of participants suggested to make the conversation more personal by asking follow-up questions, and to include other types of support, such as giving bullying victims more room to tell their story, and explaining why they should take action.

8.3 Comparison between Evaluations by the Experts and the Target Age Group

The target age group evaluated the same prototype as the experts (see Chapter 5). This allows us to compare the results of the expert focus group and interviews with the target audience. This section compares the experts' evaluations of the virtual buddy prototype with those of the target age group. The comparison is focused on the user experience (Section 8.3.1), and the experience of social support (Section 8.3.2). Section 8.3.3 presents our conclusions.

8.3.1 User Experience

Table 8.2 provides an overview of the similarities and differences between the results from the expert focus group and the interviews with the target audience concerning the user experience (usability) of the virtual buddy prototype. Both the experts and the target audience are convinced that the virtual buddy's embodiment has added value over text-only chat conversations. Whereas the experts did not like the virtual buddy's appearance, most of the interviewed children did like its appearance. This result is in line with the evaluation of the visual style of Fearnot! [163] (see also Section 2.3.7 and 3.3.1); generally, adults were negative about the visual style of the application, while the target audience liked it.

Both the experts and the target audience generally liked the language used by the virtual buddy. In line with one expert who thought the virtual buddy's

Issue	Experts	Target Audience
Embodiment	Added value over text-only chat conversations	[Same]
	• Negative about the virtual buddy's appearance	• Positive about the virtual buddy's appearance (some think it looks childish)
	• Suggestion for more human-like embodiment	• No suggestions to improve the embodiment
Language	Acceptable, but also 'too decent'	Ranging from 'clear and motivating' to 'too mature'
	• Some words may be unknown, and not in use among the target audience	• Some words are too difficult
Response options	Acceptable	[Same]
	• Need possibility to select multiple response options	[Same]
	• Some response options are unnecessary	[Same]
	• Need for unique response to every response option	[Same]
	• Need to go back in conversation	.
	.	• Need for more response options to certain questions
AffectButton	Difficult to use	[Same]
	• Difficult to find the right expression	[Same]
	• Confusing response to input with low intensity	[Same]
	• Need for feedback request on emotional state	• Need for better interpretation of input
	.	• Need for better explanation of the AffectButton

Table 8.2: Comparison between results from the expert focus group and interviews with the target audience concerning the virtual buddy's user experience (usability).

language was 'too decent', the language was considered to be 'too mature' by some interviewed children. Both the experts and the target audience identified one or two terms that were too difficult for the target audience.

Using response options to communicate with the virtual buddy was considered to be acceptable by both the experts and the target audience. They also agreed that usability of the virtual buddy prototype could be improved by allowing users to select multiple response options, removing unnecessary response options, and having the virtual buddy provide a unique and tailored reaction to those response options. Additionally, the experts suggest allowing users to go back in the conver-

sation, and the target audience suggest adding more response options to certain questions, for which they gave concrete examples (see Section 8.2.3).

Both the experts and the target audience experienced difficulties when using the AffectButton to communicate their emotional state. They thought it was difficult to find the facial expression that represented the emotional state they wanted to communicate. Also, they were confused by the virtual buddy's response to input from the AffectButton representing low-intensity emotional states. The experts suggest to solve these problems by requesting feedback on the virtual buddy's interpretation of the user's emotional state, whereas the target audience suggests to improve the virtual buddy's interpretation of the user's emotional state, and to improve the explanation of the AffectButton.

8.3.2 The Virtual Buddy's Supportive Behavior

Table 8.3 provides an overview of the similarities and differences between the results from the expert focus group and the interviews with the target age group concerning the virtual buddy's supportive behavior. An important difference between the experts and the target age group is that the target age group exclusively refers to the information support when asked what they like about the virtual buddy, whereas the experts were most impressed by the virtual buddy's emotional and esteem support. Despite this difference in preferred support type, there is a large overlap in the claims and justifications of these claims made by the experts and the target audience.

Both the experts and the target age group claimed that the virtual buddy successfully conveys emotional and esteem support. The experts and children are congruent in the substantiation of this claim; they refer to the virtual buddy's verbal expressions of emotion, and its nonverbal expressions of emotion. The experts refer to the combination of verbal and nonverbal expression of emotions, the children do not. The experts and target age group agree that, generally, the virtual buddy's nonverbal expressions match its verbal responses. The experts identified some emotion mismatches, whereas the target age group did not mention emotion mismatches. In addition, the experts asserted that the virtual buddy's emotional state changes to quickly back to happy. The target age group also noticed that the changes between emotional states are too abrupt. Both the experts and the target age group thought the virtual buddy's neutral facial expression was too cheerful. The target age group supplied additional feedback regarding the virtual buddy's nonverbal behavior; one interviewee asserted that the virtual buddy's emotional behavior is exaggerated, and another stated that the virtual buddy's supportive behavior was predictable and, therefore, boring. In order to improve the virtual buddy's supportive behavior, the experts and target age group suggest adding more verbal supportive messages. To improve the virtual buddy's supportive behavior, the experts also suggest adding feedback requests to the conversation, while the target age group would like to see more room for the user to tell his story. To this end, they suggest to elaborate on the topics discussed in the conversation by

Issue	Experts	Target Audience
Preferred support type	Emotional & esteem support	Information support
Emotional and esteem support	Successfully conveyed	[Same]
	• Experience of support substantiated by verbal, nonverbal, and combination of verbal and nonverbal expressions of emotions	• Experience of support substantiated by verbal and nonverbal expression of emotions
	• Generally, facial expressions match verbal messages	[Same]
	• Emotion mismatches	.
	• Emotional state changes too quickly back to happy	• Changes between emotional states are too abrupt
	• Neutral expression is too cheerful	[Same]
	.	• Verbal and nonverbal behavior are exaggerated
	.	• The supportive behavior is too predictable
	• Need for more (verbal) supportive messages	[Same]
	• Need for feedback requests	• Need for victims to elaborate on their story
Information support	Tips are valuable and useful	[Same]
	• Suggestion to provide additional explanations	[Same]
	• Suggestion to adapt advice to the user's situation	.
Other ways to convey support	• Suggestion to use humor	.
	• Suggestion to use other visual means to express emotions	.

Table 8.3: Comparison between results from the expert focus group and interviews with the target audience concerning the virtual buddy supportive behavior.

asking follow-up questions.

The experts and target age group agree that the virtual buddy's advice is valuable and useful. Both the experts and the target age group suggest to include more explanations in the conversation; the experts had more suggestions for explanations that could be included (see Section 7.2.3) than the target age group (see Section 8.2.4). Also, the experts suggest adapting the advice to the severity of the user's situation. In addition, the experts suggest including other types of support, including expressing humor and other emotions, and using additional visual means to communicate emotions (see Section 7.2.3). The target age group made no sugges-

tions with regard to other types of support, apart from the suggestion to include additional explanations (see Section 8.2.4).

8.3.3 Conclusion

The comparison between the results of the expert focus group and interviews with the target age group show that the experts' evaluations of the user experience (usability) of the virtual buddy prototype, and evaluations of the virtual buddy's supportive behavior largely correspond to those of the target age group. The comparison revealed only two contradictory results; 1) the experts dislike the virtual buddy's appearance whereas the target age group likes its appearance, and 2) the experts prefer the emotional and esteem support provided by the virtual buddy, while the target age group prefers the information support. In addition, the justifications provided for certain claims differ slightly between the experts and the target age group, the experts provide somewhat different suggestions to solve limitations or to improve the experience of support, and the experts focus on other details than the target age group. Also, we found that the experts generally provided more details. This might be due to the method used to gather information; focus groups generally yield more details than interviews [113].

In summary, there is a large overlap between the evaluations of the target age group and the experts with regard to user experience (usability) of the virtual buddy prototype, and the virtual buddy's supportive behavior. Based on these results, we conclude that the information gathered during the interviews is valid and reliable. These results also provide further evidence for our conclusion that the virtual buddy prototype successfully captures the underlying principles of providing social support to cyberbullying victims. Additionally, the results of the comparison between the target age group's and the experts' evaluations of the virtual buddy's supportive behavior demonstrates that aspects of an ECA's behavior designed to evoke certain responses in children can be successfully evaluated by pedagogical and domain experts. The method of evaluating with pedagogical and domain experts can be used to provide a preliminary evaluation of an ECA's behavior for vulnerable target audiences (e.g., children), and in sensitive domains (e.g., cyberbullying).

8.4 Discussion and Conclusion

The goal of the study presented in this chapter was to gather feedback on the user experience provided by the virtual buddy prototype, and the virtual buddy's supportive behavior from the target age group, i.e. children between the ages of 10 and 14. Feedback from the target age group was gathered in twelve ono-on-one in-depth interviews. Because the experts were generally positive about the virtual buddy prototype and its supportive behavior, and in order to obtain results that could be compared with the opinions of the experts, the prototype that was used during the

focus group discussion was also used during the interviews. The interviews were conducted in turn by one of two interviewers specialized in interviewing children. Interaction with the virtual buddy was based on a fictitious scenario.

The results show that the participants generally enjoyed interacting with the virtual buddy. Although many participants were quite critical, they were positive about the virtual buddy as a tool to support cyberbullying victims. According to the participants, interaction with the virtual buddy felt like a real conversation. When asked to explain why they liked the virtual buddy, participants exclusively referred to the advice. However, when prompted, the participants also made reference to the emotional support strategies; almost all participants stated they thought Tom, the main character of the evaluation scenario, would feel better after the conversation. This claim was substantiated by referring to the virtual buddy's supportive messages and the facial expressions that co-occurred with these messages.

The participants' preference for information support clearly indicates that emotional support is less important to the participants than information support. Possibly this is due to the fact that most participants were not cyberbullying victims. This finding can be relevant for empathic agent researchers who develop applications for sensitive domains and/or vulnerable target audiences; how can emotional skills be measured or evaluated when the target audience cannot be directly involved? More research is required to answer this question.

The emotion model generally produced appropriate verbal and nonverbal responses. As mentioned before, participants attributed their experience of support to the supportive messages and the accompanying facial expressions. However, some participants saw through the question-answer-supportive message pattern in the conversation, and others thought the verbal messages and facial expressions were exaggerated. Additional threats to the experience of social support are the absence of a truly neutral facial expression, and concerns about the trustworthiness of the virtual buddy. To maximize the trustworthiness of the system, participants suggested to embed the virtual buddy in a specialized website about bullying and/or cyberbullying, or to include it in lessons about bullying at school. For the same reason, they advised against creating a dedicated website for the virtual buddy, or to support cyberbullying victims directly through social media.

Almost all participants were struggling with the AffectButton, and as a result of selecting emotional states with low intensity, most of them did not understand the virtual buddy's verbal response to input from the AffectButton. To get better input values, the explanation of the AffectButton should be improved or another emotion input method can be used. Additionally, the interpretation of the AffectButton needs to be improved. One way to do this is by changing the thresholds of 'high intensity' and 'low intensity' emotions. This requires further testing. A complementary way of improving the interpretation of input from the AffectButton is to have the virtual buddy ask for feedback when it responds to an emotional state, and allow users to correct their input if the virtual buddy is wrong.

A comparison between the target age group's and the experts' evaluations of the user experience (usability) provided by the virtual buddy prototype and eval-

uations of the virtual buddy's supportive behavior revealed a large overlap of the results. This means that the interviewed children and the experts, to a large extent, have the same opinions on the prototype's user experience, and the supportive behaviors. Although there were slight differences in the justifications provided for certain claims, the suggestions provided to solve limitations of the prototype, and the details that were focussed on, both groups asserted they felt supported by the virtual buddy and attributed feeling supported to the virtual buddy's verbal and nonverbal expressions of emotions. These results provide further evidence for our conclusion that the virtual buddy successfully captures important principles of providing social support to cyberbullying victims. Based on the large overlap between the results from the interviews and the focus group, we expect that the opinions on the virtual buddy's supportive behavior of actual (cyber)bullying victims will not differ much.

The target age group provided interesting suggestions for future work. In particular, they suggested to improve the prototype by personalizing conversations with the virtual buddy. This requires gathering more personal details from users, and a more flexible approach to structuring conversations than a script. In this thesis, cyberbullying was used as application domain to investigate social support by ECAs. As the evaluations of the virtual buddy's supportive behavior show that social support is conveyed, a next step could be to involve the virtual buddy's actual target audience of (cyber)bullying victims between the ages of 10 and 14. We propose to conduct evaluations in at least two steps; first, scenario-based evaluations, similar to the studies presented in this thesis, and after that evaluations based on participants' own experiences. Also, involving (cyber)bullying victims requires improvements to the virtual buddy prototype; for example, it needs more, and more sophisticated domain knowledge in order to be able to deal with a wide variety of cyberbullying situations. Additionally, to ensure the safety and well-being of (cyber)bulling victims involved in the evaluation of the virtual buddy prototype, these studies will have to be conducted in close cooperation with and under supervision of pedagogical experts (e.g., online counselors and/or psychologists).

Chapter 9

Conclusion

The work presented in this thesis concerns endowing Embodied Conversational Agents (ECAs) with the skill of providing social support. Social support consists of emotional and information support (advice). Our goals were to gain insight into what behavior needs to be exhibited, how to generate this behavior, and to what extent this behavior is being experienced as supportive or not. These issues have been investigated in the domain of cyberbullying. As stated in the introduction, the research aim that guided our work was:

> *To understand how ECAs can provide social support to users by designing, implementing, and evaluating a prototype of an empathic virtual buddy that provides social support to cyberbullying victims aged 10 to 14 years old.*

The design of the virtual buddy is based on literature studies of the cyberbullying domain and social support. These studies resulted in a conversation model that specifies the structure and contents of social support conversations between the user and the virtual buddy. The conversation model, together with an emotion model that generates the virtual buddy's supportive behavior, was implemented in a prototype. Subsequently, the virtual buddy's supportive behavior was evaluated by different groups of users.

In this chapter, we first provide an overview of the results of our work by answering the research questions. Section 9.2 presents the contributions of the work presented in this thesis. The results are discussed in Section 9.3. Finally, in Section 9.4, we provide suggestions for future work.

9.1 Overview of the Results

This section provides an overview of the work presented in this thesis by answering the research questions presented in Section 1.3.

9.1.1 Background on Cyberbullying

Question 1: *What are the unique characteristics and challenges of cyberbullying, and to what extent are they addressed by existing Internet Safety Technology?*

As discussed in Chapter 2, the cyberbullying domain was studied from the perspective of a cyberbullying victim and regarded the direct consequences for his online experience. We identified the following unique characteristics and challenges of cyberbullying:

- Online behaviors that can be characterized as cyberbullying are very diverse; cyberbullying can be communication-based and content-based,
- Cyberbullying often takes place in the context of social groups and relationships,
- Cyberbullying can occur at any moment. This 24/7 attainability of cyberbullying is enabled by technology,
- Internet safety technology is usually restrictive, and can be circumvented by computer-savvy users,
- Children's privacy and their right to freedom of expression should be balanced carefully against the potential benefits of technology against cyberbullying.

Next, we reviewed existing Internet safety technology to assess the extent to which they address these unique characteristics and challenges. The technologies reviewed are content and behavior analysis, filtering, monitoring, blocking undesirable contacts, reporting, age/identity verification, and educational technology.

The results of our review indicate that most technologies are not effective against cyberbullying, mainly because they restrict online behavior that is not related to cyberbullying. The exception is educational technology; teaching victims to deal with cyberbullying seems a promising approach.

9.1.2 Social Support by ECAs and humans

Question 2: *What are existing methods for providing social support?*

Most people are capable of proving support to others, at least to some extent. A review of related work shows that an integral approach of social support by ECAs does not exist. This mainly has to do with the fact that most ECAs are task-oriented systems, i.e., systems that help users perform certain concrete tasks. In conversations with task-oriented ECAs, these tasks provide the foundation of interactions between users and ECAs. For non task-oriented ECAs, such as the virtual buddy, this foundation is missing, meaning that it is unclear what non task-oriented ECAs and users should talk about.

To overcome this problem, we studied literature on how people comfort each other, and used the results as a starting point for conversations between users and

the virtual buddy. People use different strategies and techniques to provide social support, including discussing specific topics that help support receivers cope with upsetting events (Section 3.2.3), structuring conversations in such a way that they are constructive (Section 3.2.5), and by using social support types, such as emotional support and practical advice (Section 3.2.4). These insights provide the basis of a conceptual model for social support conversations. In addition, we found that the expression of emotions by support providers is an essential factor of social support (Section 3.2.6). This finding explains our focus on the expression of emotions.

9.1.3 A Conceptual Model for Social Support Conversations

Question 3: *What should be the structure and contents of a conversation during which an ECA provides social support to a cyberbullying victim?*

Based on the insights gathered from the social support literature, we constructed a conversation model for social support by non task-oriented ECAs. To this end, we combined the 5-phase model for structuring counseling conversations [21] (see Section 3.2.5) with the topics that help support receivers cope with upsetting events [41] (see Section 3.2.3). The resulting conversation model specifies that a social support conversation proceeds as follows:

1. Warm welcome: the virtual buddy greets the user and invites him to explain what he wants to talk about (topic: hello)
2. Gather information: the virtual buddy asks questions to try to establish the user's problem (topics: event, emotional state, coping (current))
3. Determine the objective of the session: the virtual buddy asks the user what he wants to achieve with the conversation (e.g., getting tips on how to deal with cyberbullying) (topic: conversation objective)
4. Work out the objective: the virtual buddy asks the user what he is going to do and gives advice if the users wants that (topics: coping future, and advice)
5. Round off: the virtual buddy rounds off the conversation (topic: goodbye)

As listed in Section 4.2.2, five social support types that frequently occur in counseling conversations by chat [78] were included in the conversation model: sympathy (emotional support), compliment (esteem support), encouragement (emotional support), advice (information support) and teaching (information support). Finally, we specified sequences (conversation patterns) that make up a social support conversation. The sequence question–answer is important in social support conversations, and covers topics event, emotional state, coping (current), conversation objective, and coping (future). Emotional and esteem support are defined as responses to the user's answers to the virtual buddy's questions. Additionally, we specified sequences for starting and ending conversations (topics hello and goodbye), and for giving advice and explaining how to execute advice (teaching) (topic advice).

The conversation model was validated by comparing the model to a corpus of real-world comforting chat conversations about bullying (Section 4.3). The results show that there are great similarities between the model and the data on the topics discussed, the phases in which these topics are discussed, and the sequence patterns used to discuss topics and give (verbal) social support. The analysis confirms the proposed model for social support is a valid specification of successful comforting conversations in the domain of (cyber)bullying.

9.1.4 The Virtual Buddy Prototype

Question 4: *What are the important aspects of supportive behavior that need to be realized in an empathic virtual buddy against cyberbullying, and how can these aspects be implemented in a prototype?*

Based on the theory in chapters 2 and 3, we formulated the following requirements for a virtual buddy against cyberbullying:

1. The conversation should progress and not get stuck on discussing the user's problem;
2. The virtual buddy should use multiple types of social support, including information and emotional support;
3. The virtual buddy should be able to determine the user's emotional state;
4. The virtual buddy should be empathic to the user's emotional state;
5. The virtual buddy should be able to express emotions, both verbally and nonverbally; and
6. The virtual buddy should play the social role of a peer (Section 5.1).

Additionally, the virtual buddy's design and implementation was influenced by a set of design decisions:

- We assume the user has a single conversation with the virtual buddy;
- The conversation between the user and the buddy is scripted (i.e., fixed);
- The user communicates with the virtual buddy by selecting predefined response options;
- Both the user's and the virtual buddy's verbal messages predefined;
- The AffectButton [37], an existing interface component for affective feedback, is used to gather information on the user's emotional state;
- The virtual buddy's nonverbal behavior is simulated by using static pictures of different facial expressions; and
- The virtual buddy's facial expressions are based on the facial expressions of the AffectButton (Section 5.2).

In first instance, the virtual buddy prototype was implemented in agent programming language GOAL [90]. The prototype combines the conversation model presented in Chapter 4, with an emotion model based on the OCC model of emotions to generate supportive behavior (Section 5.4.3). Running GOAL agents requires particular software to be installed. Because we were planning to evaluate the

virtual buddy's supportive behavior in an online survey, the prototype was reimplemented in Java. The Java prototype was used for all evaluations of the virtual buddy's supportive behavior, except the WoZ study presented in Section 6.1.

9.1.5 Evaluations of the Virtual Buddy's Supportive Behavior

Question 5: *How is the virtual buddy's supportive behavior assessed by different types of users?*

The virtual buddy prototype was evaluated by different groups of participants. The participants of subsequent studies were increasingly closer to the actual target audience of the virtual buddy, i.e., cyberbullying victims between the ages of 10 and 14. The prototype used in the studies was the same, except for the quantitative WoZ study (Section 6.1). For this study we used an earlier version of the virtual buddy prototype, and the virtual buddy's behavior was evaluated by children between the ages of 14 and 16 years old. For ethical reasons, we did not recruit (cyber)bullying victims to evaluate the virtual buddy's supportive behavior. Because being bullied was not a criterion to participate, interactions with the virtual buddy were based on a fictitious cyberbullying scenario. Participants were asked to play the role of the main character from the scenario when interacting with the virtual buddy. We used the same scenario for all of the studies.

The WoZ study presented in Section 6.1 was conducted to validate the idea of the virtual buddy and the underlying principles of its behavior. During this experiment, interacting with the virtual buddy was compared to reading an informative text with the same information content as the conversation with the virtual buddy. Thirty children between the ages of 14 and 16 took part in the experiment ($N_{Text} = 14$, $N_{Buddy} = 16$). The results suggest that the virtual buddy is at least as good at providing support as the text, and significantly better when it comes to taking into account the user's feelings. We conclude that children between the ages of 14 and 16 generally have a positive attitude towards the idea of an empathic virtual buddy against cyberbullying. Additionally, results show that the emotional cues emitted by the buddy are recognized and accepted, thus validating our approach.

The next study was designed to quantitatively assess the effect of variations in the virtual buddy's emotional expressiveness on user experience, the effectiveness of support, and perceptions of social support (Section 6.2). There were four conditions in the experiment: no emotion, verbal emotion only, nonverbal emotion only, or verbal & nonverbal emotion. In total, 100 bachelor students from different universities in the Netherlands participated in study. Participants were randomly assigned to one of the conditions; there were 25 participants in each condition.

The results show that the user experience of the virtual buddy prototype is acceptable, and does not impede the virtual buddy's potential for providing social support. The results also show the virtual buddy is effective at providing support support; all participants reported a significant increase in well-being and a significant decrease of perceived burden of the problem. In addition, perception

of support ratings were generally high (> 4.24 on a 7-point scale). There were no statistically significant differences between conditions for user experience, effectiveness of support and perceptions of social support. The large number of participants suggesting to increase the virtual buddy's emotional expressiveness in order to improve its emotional support skills (e.g., by expressing emotions more often than the virtual buddy currently does), confirm that expressing emotions is an important factor in the perception of support.

In order to gain more insight into how the virtual buddy's behavior was experienced, and why users feel supported or not, two qualitative studies were conducted. The first qualitative study was a focus group discussion among pedagogical and bullying experts (Chapter 7). Six experts were invited to try the virtual buddy prototype, and assess what aspects of the interaction were perceived as being supportive, what aspects disrupt the perception of support, and how the overall experience of social support can be improved. The results demonstrate that the experts recognized the different social support strategies employed by the virtual buddy, including the supportive statements (sympathy, compliments, and encouragement), different facial expressions, and advice and teaching. The experience of being supported was contributed to the virtual buddy's supportive verbal utterances, the different facial expressions, and the combination of verbal utterances and facial expressions. The embodiment clearly has added value for the application.

The second qualitative study was conducted among children between the ages of 10 and 14, the virtual buddy's target age group (Chapter 8). Feedback on the virtual buddy's supportive behavior was gathered in 12 one-on-one interviews. Participants generally enjoyed interacting with the virtual buddy, although some of them were quite critical. Participants justified liking the virtual buddy by referring to its advice giving skills (information support). When prompted, participants also admitted to experiencing emotional support. The experience of emotional support was attributed to the virtual buddy's supportive messages and the accompanying facial expressions. We conclude that the virtual buddy is able to convey support to the target age group. When comparing the results from the interviews to the results from the focus group, we found a large overlap. This suggests that when assessing aspects of an ECA's behavior evaluations by pedagogical and domain experts can be used to approximate children's opinions, thereby reducing the burden of performing evaluations in sensitive domains on vulnerable target audiences (e.g., children).

9.2 Contributions

The contributions resulting from the work presented in this thesis are:

1. We developed a prototype of a virtual buddy for cyberbullying victims and show that it is successful in that users feel supported by it (main contribution) (Section 9.2.1)

2. Expression of emotions is essential for the experience of support (main contribution) (Section 9.2.2)
3. We developed and validated a conversation model for social support (Section 9.2.3)
4. Experts can replace children to evaluate aspects of the virtual buddy's behavior (Section 9.2.4)
5. Technology against cyberbullying should be empowering (Section 9.2.5)

9.2.1 Users Feel Supported by the Virtual Buddy Prototype

The first main contribution of the work presented in this thesis is the conclusion that social support can be conveyed using simple means. When designing the virtual buddy's supportive behavior we used Nass and colleagues' Ethopoeia theory as a starting point. This theory suggests that an ECA can evoke the sense of being supported by giving the right social cues. Our results show that we identified the right social cues, and that they were successfully implemented in the prototype.

The virtual buddy prototype (Chapter 5) captures the principles of social support using simple techniques, such as scripted conversation, predefined verbal output messages, limited domain knowledge, a reactive emotion model, static images to simulate nonverbal behavior, and predefined response options for input. This means that practical applications featuring ECAs that comfort users are within reach[1]. ECAs that provide social support have many potential applications, including companionship, coaching, Internet therapy, and programs for behavioral change.

9.2.2 Expression of Emotions Is Essential for the Experience of Support

The second main contribution of the work presented in this thesis is the conclusion that expression of emotions is essential for the experience of social support. The virtual buddy expresses emotions verbally and nonverbally. Although we found no significant differences in our quantitative study of the effect of variations in the virtual buddy's emotional expressiveness on perceptions of social support (Section 6.2), the open feedback left by participants (Section 6.2.2), and our subsequent qualitative studies of the virtual buddy's supportive behavior (Chapter 7 and 8) clearly show that expressing emotions is essential to the experience of social support. Many participants of the quantitative study suggested to improve its emotional support skills by expressing emotions more often than the virtual buddy did. Additionally, participants of the qualitative studies contributed the experience of social support directly to the virtual buddy's verbal behavior, its nonverbal behavior, and the combination of verbal and nonverbal behavior.

[1] We would like to point out that there are many problems that need to be solved before applications featuring supportive ECAs in sensitive domains will be available for general use. Problems include acceptance (see Section 9.3.2), protection of privacy, and other ethical and legal issues.

9.2.3 A Validated Conversation Model for Social Support

This thesis presents a domain-independent conceptual model for social support conversations that was validated using real world chat conversations about bullying (Chapter 4). The model specifies conversational patterns used in counseling. It combines De Beyn's 5-phase model [21] (see also Section 3.2.5), topics that help support receivers reinterpret upsetting events suggested by Burleson and Goldsmith [41] (see also Section 3.2.3), and various social support types from Braithwaite et al.'s typology [34] (see also Section 3.2.4). Our review of the ECA literature shows that existing ECAs are predominantly task-oriented systems, and that conversations with task-oriented ECAs are focused on the user's task (Section 3.4). These task-oriented conversations are geared towards functional instead of social support. However, for non task-oriented ECAs, such as the virtual buddy, there is no task to discuss, meaning that is unclear how such a conversation should proceed. The conversation model fills this gap in the ECA literature by specifying what non task-oriented ECAs that provide social support should discuss with users.

9.2.4 Experts Can Replace Children To Evaluate User Experience and Aspects of Behavior

Before involving the target age group of children between the ages of 10 and 14 in the evaluation of the virtual buddy prototype (Chapter 8), we asked pedagogical and bullying experts to evaluate the user experience of the prototype and the virtual buddy's supportive behavior (Chapter 7). As shown in Section 8.3, the experts' evaluations largely correspond to the target age group's evaluations. Although there were slight differences in the justifications provided to substantiate claims, the suggestions made to solve limitations of the prototype or to improve the experience of support, and details provided by the experts and the target age group, both the experts and members of the target age group considered the user experience to be satisfactory, stated they felt supported by the virtual buddy, and used similar arguments to substantiate this claim.

The results of this comparison demonstrate that an evaluation by pedagogical and domain experts can provide an accurate estimate of children's opinions on user experience and aspects of an ECA's behavior. This estimate of children's opinions can be used to improve an ECA's user experience and its behavioral strategies before involving the target audience. Therefore, we recommend to evaluate ECAs designed for vulnerable target audiences (e.g., children) and in sensitive domains (e.g., cyberbullying) with experts before involving the actual target audience.

9.2.5 Technology against Cyberbullying Should Be Empowering

Our review of the cyberbullying domain revealed that existing work on cyberbullying, and technology against cyberbullying relies on the assumption that traditional, restrictive Internet safety technology, such as web filtering software, will also pro-

tect users against cyberbullying (Chapter 2). Based on a list of characteristics and challenges of cyberbullying, we show that this assumption is unfounded, and that technology aimed at empowering users is more likely to reduce cyberbullying.

9.3 Discussion: Threats and Opportunities

This thesis presented the design, implementation, and evaluation of a virtual dialogue partner for a vulnerable target audience (i.e., children between the ages of 10 and 14) in a sensitive domain (i.e., cyberbullying). During our work, we encountered challenges associated with the development and evaluation of such a system. In this section, we discuss these challenges, and our approach towards addressing them. In particular, this section discusses:

1. Consequences of developing and evaluating a virtual dialogue partner for a vulnerable target audience in a sensitive application domain (Section 9.3.1)
2. The probable impact of convictions about the virtual buddy's desirability and usefulness as a tool against cyberbullying on evaluations of its behavior (Section 9.3.2)
3. The usefulness of qualitative methods for ECA research (Section 9.3.3)
4. The role of simple prototypes in ECA research (Section 9.3.4)

9.3.1 The Evaluation of Virtual Dialogue Partners in Sensitive Domains Is Challenging

Our work on social support by ECAs was carried out by developing a virtual dialogue partner in a specific application domain. As shown in Chapter 3, developing applications is a common approach for ECA research. An important difference between existing work and our research is that the application domain is a socially relevant, but also a sensitive topic. Because the application domain is a socially relevant topic, the work presented in this thesis gained a lot of interest, both from within the scientific community, especially from psychological and pedagogical disciplines, and from outside academia. Studies generating interest from outside the ECA community are important, because they serve as showcases promoting the use ECAs in everyday settings. The other way around, this interest might spark new ECA research. However, a negative consequence of applying research to a socially relevant domain is that many interested parties claim to have a solution, whereas there usually are no easy solutions for these problems, and that, because they think they already know the answer, these parties are not interested in exploring other, let alone controversial, ideas.

In addition, cyberbullying is a sensitive topic. This was a conscious and necessary choice, because, investigating social support by ECAs is only possible in a context of emotional emotional distress (see Section 3.2.1). Generally, topics causing emotional distress are sensitive, and research applied to sensitive topics more often than not is considered controversial. Furthermore, children are considered to be a

vulnerable group, and many people have the tendency to want to protect them by preventing them from encountering potentially harmful and/or dangerous situations, such as cyberbullying (see Chapter 2 about technology against cyberbullying). In contrast, the virtual buddy was developed from a vision that advocates an opposite approach to protecting children, i.e., empowering them by teaching them to deal with cyberbullying. Accordingly, the idea of supporting cyberbullying victims by giving them access to a 'virtual buddy' was met with considerable resistance.

This resistance was possibly aggravated by our choice to develop a virtual dialogue partner. In Chapter 3 we show that ECA research has been successfully applied to the sensitive and socially relevant topic of traditional bullying. For example, Fearnot! is a virtual role-playing system in which ECAs act out bullying scenarios [65] (see also Section 2.3.7 and 3.3.1). Between bullying episodes, the bullied ECA turns to the user for advice on what to do. This setup provides users with a safe environment to explore consequences of different coping strategies. In contrast, the virtual buddy acts as a dialogue partner for cyberbullying victims that directly provides emotional support and practical advice. This conversational setting can be risky; for example, how can the virtual buddy ensure that its advice will not make the user's situation worse? We believe that considerations regarding the conversational setting, such as the previous example have magnified the resistance triggered by the idea of a virtual buddy against cyberbullying.

Our choice to develop a virtual dialogue partner in a socially relevant and sensitive application domain has had major consequences for the way in which the research was conducted, in particular the evaluation of the virtual buddy's supportive behavior. For the evaluation of the virtual buddy's supportive behavior, we switched from a quantitative to a qualitative approach, partly because we suspected that participants' evaluations of the virtual buddy's supportive behavior had been affected by their opinions on the desirability or undesirability of a virtual buddy that provides emotional support and practical advice to cyberbullying victims. Section 9.3.2 further elaborates on the probable effects of convictions regarding the domain on evaluations of the virtual buddy's supportive behavior.

9.3.2 Users' Preconceptions May Have Affected Evaluations of the Virtual Buddy's Behavior

As mentioned in the introduction, at the start of the project, we assumed that the target audience (i.e., cyberbullying victims between the ages of 10 and 14) would accept the virtual buddy as a provider of support, because they have something to gain from interacting with it, and that the acceptance of other stakeholders was beyond the scope of our research. The interviews with the target age group confirm that they are willing to use the virtual buddy and generally accept it as a provider of support (see Chapter 8). Indeed, the resistance against a virtual buddy for cyberbullying victims mainly came from adults. This resistance indicates that the acceptance of the virtual buddy among adults is low.

We suspect that opinions about the desirability and usefulness of a virtual

buddy as a tool to support cyberbullying victims affected the subjective experience of social support. As mentioned in Section 6.2.3, cluster analysis of the perceptions of support ratings gathered during the quantitative emotional expressiveness study (see Section 6.2.2) revealed three clusters of participants; 1) participants that assigned low scores to the agent's emotional skills, 2) neutral participants, and 3) participants that were very positive about the virtual buddy's social support skills. The existence of these clusters are consistent with our assumption that the perceptions of support ratings have been affected by convictions concerning the desirability and acceptance of a virtual buddy against cyberbullying.

If users' preconceptions do in fact have an effect on evaluations of an ECA's behavior, it is important to take this influence into account when designing ECAs and/or setting up experiments to evaluate this behavior. As more and more companion and coaching ECAs are being developed, and ECAs are increasingly designed to fulfil roles in sensitive application domains, such as (mental) health care, it is imperative to understand how users' attitudes towards specific applications and domains can affect users' subjective experiences when interacting with these types of ECAs. In addition to awareness of the effects of preconceived ideas, it is also important to explore ways to reduce and/or avoid these effects.

The expert evaluation (see Chapter 7) was set up in such a way as to minimize the effects of preconceived ideas on evaluations of the virtual buddy's behavior. To this end, the first topic that was discussed in the focus group was 'associations triggered by the idea of a virtual buddy'. Participants were asked to make all ideas and assumptions explicit before interacting with the virtual buddy. We believe that discussing these associations facilitated an open-minded evaluation of the virtual buddy's behavior. The focus group discussion yielded constructive feedback, without participants feeling the need to dwell on the desirability and/or acceptance of a virtual buddy against cyberbullying.

9.3.3 Qualitative Research Methods Allow for a Fine-Grained Analysis of an ECA's Behavior

The evaluation of the virtual buddy's behavior was in large part conducted through qualitative studies (see Chapter 7 and 8). Although literature on the evaluation of affective interfaces and ECAs refer to qualitative research methods (see [52, 93, 95]), quantitative methods dominate in ECA research. Dehn and Van Mulken [63], and Beale and Creed [19] proclaim a fine-grained analysis is required to gain more insight into how and why behavior of ECAs has certain effects on user perception, attitudes, and behavior. We argue that qualitative studies can be part of this fine-grained analysis, precisely because they provide detailed insight into how ECAs' interaction strategies affect users' subjective experiences, and why these effects occur.

As shown in Chapter 7 and 8, qualitative studies into the supportive behavior of the virtual buddy resulted in insight into aspects of interaction with the virtual buddy prototype that were perceived as being supportive, aspects that disrupted

the perception of support, and how the overall experience of social support can be improved. In particular, we found that participants of the focus group mainly contributed feeling supported to the combination of the virtual buddy's verbal and nonverbal behavior, and that the children participating in the interviews tended to focus on informational support. Based on our experience with qualitative research, we contend that qualitative studies are especially valuable for conducting preliminary evaluations early in the ECA design cycle, to gather detailed feedback on behaviors that were designed to elicit specific effects in users.

An advantage of small-scale qualitative studies of interaction strategies over quantitative research is that in small-scale studies it is easier to contextualize the application and to address convictions about specific applications and domains, as we have done in the focus group (Chapter 7) and interviews with the target age group (Chapter 8). This is especially important for applications developed for sensitive domains, such as the virtual buddy against cyberbullying. In other words, using qualitative research methods might be an effective way to increase the acceptance of applications, because qualitative methods allow taking into account and dealing with objections and concerns raised by participants. In quantitative studies, there is less room to deal with these issues. This way, qualitative studies might help to reduce the effect of preconceived convictions on evaluations of ECA behavior.

9.3.4 Prototypes Increase Acceptance

In order to gain insight into how ECAs can provide social support, we developed a prototype that simulates a number of essential aspects concerning the provision of support, including the expression of emotions, and giving advice (see Chapter 5). In Chapter 6, 7 and 8, we show that a relatively simple prototype suffices to elicit social responses in users, in our case the experience of social support. Thus, we demonstrated the suitability of prototypes to evaluate aspects of ECAs, such as the effects of certain behavior.

However, it is important to emphasize that prototypes have important limitations when compared to more complex applications. For example, in usage scenarios that involve repeated interaction with an ECA, more complex systems are required. A good example demonstrating this requisite is FitTrack coach Laura that was developed to build a relationship with users over multiple interactions [25]. Even though Laura was equipped with a substantive collection of behaviors and verbal messages, many subjects that participated in the evaluation of this ECA thought conversations with Laura became predictable and repetitive after some time.

A prototype can be put together relatively fast and easy. This allows researchers and developers to gather feedback from potential users and other stakeholders in the early stages of ECA development. In the case of applications that are met with resistance by potential users and other stakeholders, quickly having prototypes available has additional benefits. In our experience, the virtual buddy prototype

facilitated understanding of the virtual buddy, helped clarify implicit assumptions, and may have reduced uncertainties concerning the virtual buddy's intended use and abilities. Interacting with the virtual buddy prototype might increase acceptance of the virtual buddy, and reduce the potential effects of convictions regarding the domain on evaluations of the virtual buddy's behavior.

9.4 Future Work

There are many directions in which the work presented in this thesis could be advanced. In this section, we discuss possibilities for future research regarding the effects of preconceived ideas on the design and evaluation of ECAs for vulnerable target audiences and in sensitive domains, extensions and improvements of the virtual buddy application, and the virtual buddy as an intervention against cyberbullying.

9.4.1 Effects of Preconceptions on Evaluating ECAs

During our research on social support by ECAs, we encountered resistance against the idea of a virtual buddy that provides emotional support and practical advice to victims of cyberbullying. In Section 9.3.2, we discussed a number of possible causes for this resistance, and hypothesized this resistance affected users' ability to evaluate the virtual buddy's behavior open-mindedly, which may have distorted the results of the quantitative evaluation of the virtual buddy's behavior (see Chapter 6). Generalizing this hypothesis, we propose to investigate how preconceived ideas about applications and domains affect users' perceptions, attitudes, and behavior when interacting with ECAs developed for sensitive domains and/or vulnerable target audiences. A question related to this issue is how preconceived ideas can be uncovered in different domains and applications.

If further evidence for the effects of preconceived ideas on users' attitudes towards ECAs, and subjective experiences of the behaviors exhibited by ECAs can be found, we need to investigate how these effects can be reduced or reversed. We are particularly interested in ways to use them to the system's advantage. For example, if it is known that skeptical users do not like to interact with, or more importantly, do not benefit from interacting with an emotionally expressive ECA in a certain application, these users should be allowed to interact with non-emotional instances of this ECA. This requires further research on what are indicators for certain underlying attitudes, how to (unobtrusively) discover the attitudes of a user, and how applications should be adapted in order to provide the best user experience for every (type of) user.

9.4.2 Improvements and Extensions of the Virtual Buddy Application

As stated in the introduction, the virtual buddy prototype was primarily developed as a tool to explore how ECAs can provide social support. We have shown that different groups of users feel supported when interacting with the virtual buddy prototype. We believe that improving the tool can boost the experience of being supported. The virtual buddy can be improved in various ways.

A first category of improvements for the virtual buddy prototype concerns its input and output modalities. Firstly, the virtual buddy's embodiment can be improved. We propose to replace the static images of emotional expressions by animated nonverbal behavior. Additionally, adding vocal output with appropriate intonation might also increase the experience of social support. Although most of the participants in our evaluation studies did not mind using predefined response options, allowing users to type free text, or use spoken language makes interaction with the virtual buddy more natural; in turn, this might improve the experience of social support. Using animated non-verbal behavior also makes interacting with the virtual buddy more natural. In order to determine to what extent the experience of social support is improved by a more natural conversational setting, more research is required.

Second, the virtual buddy can be improved by adding other types of support. During the evaluations of the virtual buddy's supportive behavior, many participants suggested other types of support the virtual buddy might use, including providing explanations about bullying (e.g., explaining why bullies bully, that bullies sometimes randomly select a victim, that the victim is a good person despite what other people say, that bullying happens a lot of people, that bullying can be resolved), and using more and other emotional expressions to complement verbal messages. Additionally, other support types from Braithwaite's taxonomy of social support can be incorporated in the conversation.

One of the design decisions made for the virtual buddy prototype, was to assume that the user has a single conversation with the virtual buddy (see also Section 5.2). Another improvement to the virtual buddy is to allow users to have multiple conversations with the virtual buddy. For example, if the virtual buddy's advice did not help to resolve the bullying, the user can ask for additional advice in a follow-up conversation. This means that information gathered during conversations needs to be preserved, and included in the current conversation. Modeling these knowledge updates, taking into account their effects on the conversation structure, and evaluating the effects of multiple conversations on users' perceptions of support are interesting lines for future work.

A related way in which the experience of social support might be improved is making conversations more flexible, and tailoring them to individual users. This can be accomplished by designing and implementing an affective user model (cf. Martinho et al. [144]). Such a user model can be used by the virtual buddy to customize the course of conversations to individual users, for example based on the

user's current emotional state, the reasons for this emotional state, and (counterproductive) thought processes. Such a model allows the virtual buddy to intervene in these thought processes as well as to engage users. We hypothesize that flexible, personalized conversations lead to an increased experience of support.

A different line of further work on the virtual buddy as a tool to investigate social support by ECAs concerns applying it in other domains. As mentioned in the introduction, there are many domains and applications where social support by ECAs is relevant, including companion and coaching ECAs, programs for behavioral change, training applications, and (mental) health care via Internet. The conversation model was designed to be domain-independent; however, it has not yet been tested in other domains. Because applicability in other domains increases the value of the work presented in this thesis, we propose to investigate whether the conversation model and the virtual buddy also have the desired effect in other domains.

9.4.3 The Virtual Buddy as a Cyberbullying Intervention

Throughout this thesis, we have used cyberbullying as application domain to investigate how ECA can provide social support. However, the cyberbullying domain was not a random choice; in Section 1.2.2, we motivated why cyberbullying victims in particular might benefit from interacting with a socially supportive ECA. To date, no validated interventions exist, even though there is a need for them. Therefore, we propose to investigate the effectiveness of the virtual buddy as intervention against cyberbullying. This line of future work requires expertise on (developmental) psychology, and should therefore be conducted by psychologists, rather than computer scientists.

The next step in our evaluation of the virtual buddy is evaluation of its supportive behavior by cyberbullying victims. We propose to start with the scenario-based evaluation, as used in the previous studies (see Chapter 6, 7, and 8). If this evaluation shows cyberbullying victims feel supported by the virtual buddy, the next step is to evaluate its behavior using actual cyberbullying experiences. To ensure the safety and well-being of participants, these evaluations have to be conducted in close cooperation with and under supervision of pedagogical experts (e.g., online counselors and/or psychologists).

Before the virtual buddy's supportive behavior can be evaluated based on actual experiences, it is necessary to expand its domain knowledge (i.e., what cyberbullying situations might occur, what the virtual buddy needs to know about each of these situations, and what advice to give in each of these situations). Again, this requires collaboration with domain experts. Additionally, it is worthwhile to further improve the virtual buddy. In principle, all refinements proposed for the virtual buddy to improve the experience of social support (see Section 9.4.2) might also help to improve the virtual buddy as intervention against cyberbullying.

If we can establish that cyberbullying victims feel supported when discussing their negative online experiences with the virtual buddy, it is interesting to inves-

tigate whether the virtual buddy is effective as intervention against cyberbullying. Important questions that need to be answered to determine the virtual buddy's effectiveness against cyberbullying include do cyberbullying victims that interact with the virtual buddy use more effective coping strategies, and what are the effects of the use of these coping strategies (e.g., are cyberbullying situations resolved more quickly, and do they lead to less cyberbullying incidents)?

The directions for further research mentioned in this section all can be pursued using prototypes of increasing complexity. We would like to remark that a lot more than satisfactory performance in laboratory experiments is needed before an application such as the virtual buddy can be introduced into real world settings. Many additional criteria play a part in the feasibility and acceptability of software applications, such as the protection of privacy, prevention of adverse consequences due to misunderstanding the virtual buddy's advice, dealing with extreme cases (e.g., severe bullying, and suicidal victims), and other ethical and legal issues. At the very least, the virtual buddy should be able to detect and deal with cases it can not handle, either by referring the user to a specialized helpline, or call in a human counselor that takes over the conversation.

Appendix A

Example Conversation from the Pestweb Data

The conversation was translated from Dutch to English by the author.

Conversation 46

COUNSELOR	Hi NAME
NAME	…
COUNSELOR	Good of you to come to the Pestweb's chatroom
COUNSELOR	Did you ever talk to us before?
NAME	…
COUNSELOR	Okay, then I'll just give you a brief explanation
COUNSELOR	We have 20 minutes to chat (the chat room closes at 5 p.m.)
COUNSELOR	I'm going to ask you a lot of questions to try and understand you
COUNSELOR	And then we'll try to come up with a plan together.
COUNSELOR	Alright? Do you have questions so far?
NAME	…
COUNSELOR	Okay, you can start telling me, how can I help you?
NAME	…
COUNSELOR	I'm sorry for you
COUNSELOR	For how long?
NAME	…
NAME	…
COUNSELOR	That is very long, yes!
COUNSELOR	op wat voor manier word je gepest?
NAME	…
COUNSELOR	Gosh, that's harsh
COUNSELOR	Is it always the same people that do it?
NAME	…

COUNSELOR There are a lot of people that bully you…
NAME …
COUNSELOR How do you cope with that?
NAME …
COUNSELOR That is a beautiful way
COUNSELOR How does it help you?
NAME …
COUNSELOR Does it help you to get rid of the bad feelings?
NAME …
COUNSELOR Where are you being bullied?
COUNSELOR At school?
NAME …
COUNSELOR How does being bullied make you feel?
NAME …
COUNSELOR Is that it? Or is it much worse?
COUNSELOR It is safe to tell me
COUNSELOR How you feel, I mean
COUNSELOR Have you tried to do something about the bullying before?
NAME …
COUNSELOR Oh, good of you
COUNSELOR Can you tell me something about that?
NAME …
COUNSELOR What kind of people?
NAME …
COUNSELOR O, okay
COUNSELOR And what can I do for you?
COUNSELOR Or do you want to tell your story
COUNSELOR That's possible as well
NAME …
COUNSELOR Oh, good
COUNSELOR What exactly do you want tips about?
NAME …
COUNSELOR There are a lot of ways you can do something about it. Let's try to find something that suits you
COUNSELOR You can ignore it
COUNSELOR You can say something back or do something
COUNSELOR You can also ask for help
COUNSELOR How do you usually respond?
NAME …
COUNSELOR Okay
COUNSELOR What happens when you ignore them?
NAME …
COUNSELOR It gets worse?
NAME …

COUNSELOR	Would you prefer to get help from someone at school?
NAME	…
NAME	…
COUNSELOR	OK, let's think about that
COUNSELOR	Perhaps you could talk to your mentor or another teacher
COUNSELOR	Or a school counselor
COUNSELOR	What do you think?
NAME	…
NAME	…
NAME	…
COUNSELOR	It can be hard, yes
COUNSELOR	You are afraid they'll think you exaggerate
COUNSELOR	I don't think you exaggerate
COUNSELOR	Being bullied is awful, especially when it it has been going on for so long
COUNSELOR	With whom would you feel most at ease, which teacher, or counselor or mentor?
NAME	…
COUNSELOR	ok
NAME	…
COUNSELOR	I'm thinking for a moment
COUNSELOR	oh, ok
COUNSELOR	Sometimes it helps if you just tell the other person
COUNSELOR	that you are nervous and that you are afraid that that person thinks you exaggerate
COUNSELOR	Do you have friends at school?
NAME	…
COUNSELOR	That's too bad
COUNSELOR	I wanted to suggest taking a friend when you make an appointment with your mentor
COUNSELOR	Do you have your mentor's e-mail address? Because writing seems easy for you
NAME	…
COUNSELOR	Perhaps you could send him an e-mail?
NAME	…
COUNSELOR	You should try that! I also think you have the courage to do it. And that you will be able to do it!
NAME	…
COUNSELOR	I'm sorry, we have to end this chat, because we are closed…
NAME	…
COUNSELOR	Good luck

COUNSELOR	If you want, you can send the e-mail to me first: info@pestweb.nl. Just mention 'to COUNSELOR', and then I'll have a look at the e-mail and give you some tips. And you can send it to your mentor afterwards
NAME	…
COUNSELOR	Goodbye, have a nice weekend!

Appendix B

Evaluation Scenario

Je krijgt nu een verhaal te lezen over een 14 jarige jongen die gepest wordt via internet en vervelende smsjes ontvangt op zijn telefoon. Lees dit stuk aandachtig door en probeer je zo goed mogelijk in de situatie in te leven. Hierna krijg je een aantal vragen over wat er gebeurd is. Beantwoord deze vragen alsof jij de persoon in het verhaal bent.

René is een jongen van 14 jaar en hij zit op het VMBO. Vandaag is René naar school geweest. Gelukkig vielen Nederlands en Wiskunde uit, dus kon hij tijdens de tussenuren even met een vriend naar buiten. René komt na schooltijd thuis. 'Fijn even msn-en'. Hij doet zijn computer aan en ziet dat er iemand is die hem wil toevoegen, genaamd 'Pietje the best', zonder na te denken accepteert hij de uitnodiging en begint een gesprek. Al snel verloopt het gesprek totaal anders dan dat René had verwacht en verandert de naam in: 'Je ergste nachtmerrie'. Het gesprek gaat als volgt:



René wordt hier erg verdrietig van. 'Niet nu ook al via msn!', denkt hij. Het is namelijk niet de eerste keer dat René dit soort berichtjes krijgt. René heeft al vervelende berichtjes gekregen via sms, Hyves en Facebook. Bij zijn foto's staan nu teksten als: 'Wat ben jij lelijk' en 'Iedereen haat je'. Er is zelfs een keer een foto van hem bewerkt met scheldwoorden erbij en via e-mail verzonden naar iedereen! René is ten einde raad!

Na deze gebeurtenis is hij het zat en gaat op zoek naar een manier om dit te stoppen. Omdat René niet weet wat hij moet doen gaat hij op internet zoeken, tot hij bij 'Robin' uitkomt, een computerprogramma dat hulp biedt aan kinderen die online gepest worden.

Appendix C

Questionnaires Pilot Experiment

The questionnaire below was given to participants that interacted with the virtual buddy. For participants in the control group, the wording of questions was changed to refer to the informative text instead of the virtual buddy.

Leeftijd: ..... jaar

Geslacht □ Jongen
□ Meisje

Hebben jullie thuis een computer met internet?
□ Ja
□ Wel een computer, geen internet
□ Geen computer en geen internet

Heb je een mobiele telefoon met internet?
□ Ja
□ Wel een mobiele telefoon, geen internet
□ Geen mobiele telefoon en geen internet

Hoeveel uur per week zit je op internet?
□ Minder dan 2 uur per week
□ 2 tot 8 uur per week
□ 8 tot 16 uur per week
□ Meer dan 16 uur per week

Je hebt net gechat met Robin, een computerprogramma dat kinderen leert hoe ze het beste om kunnen gaan met pesten via internet. De volgende vragen gaan over Robin. Er zijn geen goede of foute antwoorden, we willen graag weten wat jij van het computerprogramma vond.

1. Geef voor iedere stelling aan in hoeverre je het eens bent met de stelling.

	Helemaal mee eens		Niet mee eens/niet mee oneens		Helemaal mee oneens
De informatie die Robin geeft is belangrijk voor kinderen die digitaal gepest worden	☐	☐	☐	☐	☐
De informatie die Robin geeft is betrouwbaar	☐	☐	☐	☐	☐
De informatie die Robin geeft is gemakkelijk te begrijpen	☐	☐	☐	☐	☐
Als ik René was dan zou ik de adviezen van Robin opvolgen	☐	☐	☐	☐	☐
Wat Robin zei tijdens het gesprek was precies toegespitst op de situatie van René	☐	☐	☐	☐	☐
Robin hield rekening met de gevoelens van René	☐	☐	☐	☐	☐
Ik denk dat René zich gesteund zou voelen door te chatten met Robin	☐	☐	☐	☐	☐

2. Wat voor cijfer (1-10) geef je Robin als hulp tegen digitaal pesten?
   (1 staat voor heel slecht, 10 staat voor perfect)? Leg uit waarom je dit cijfer gegeven hebt.

Cijfer:

3. Denk je dat kinderen die digitaal gepest worden iets zouden kunnen hebben aan een chat met Robin? Waarom wel/niet?

4. Robin is een hulpmiddel om kinderen die digitaal gepest worden beter te leren omgaan met pesten. Hoe zou dit hulpmiddel verbeterd kunnen worden?

Appendix D

Questionnaire Emotional Expressiveness Study

Bij TU Delft hebben we een computerprogramma ontwikkeld dat steun geeft aan kinderen (van 10 tot 14 jaar) die digitaal gepest worden. Digitaal pesten is pesten via internet. Het computerprogramma steunt slachtoffers door met ze te praten over het pesten. Omdat pesten een gevoelig onderwerp is, willen we meningen van een minder kwetsbare doelgroep verzamelen, voordat we gaan testen met kinderen. Door mee te doen aan dit onderzoek help je het programma voor te bereiden voor de uiteindelijke evaluatie met kinderen. Dat is een belangrijke stap! Bovendien krijg je 10 Euro beloning.

Zo meteen krijg je een scenario te lezen. Dit scenario gaat over iemand die digitaal gepest wordt. Probeer je zo goed mogelijk in te leven in de hoofdpersoon. Vervolgens krijg je uitleg over het computerprogramma en mag je het computerprogramma proberen. Daarna volgen een aantal vragen. Vragen gemarkeerd met * zijn verplicht.

Het computerprogramma maakt gebruik van Java. Het laden van het programma kan even duren, wees dus geduldig. Hier kun je testen of je de Java plugin hebt (opent in een nieuw venster). Op deze website kun je ook informatie vinden over het installeren van de Java plugin.

Het proberen van het computerprogramma en het invullen van de vragenlijst duurt in totaal ongeveer 30 minuten. Deelname aan de enquete is anoniem. Aan het eind van de vragenlijst kun je je e-mailadres invullen. Dit adres gebruiken we alleen om contact op te nemen voor de 10 Euro beloning.

Omdat we de resultaten gaan gebruiken als voorbereiding op tests met kinderen is erg belangrijk dat je de vragenlijst serieus invult. Doe dus alleen mee als je van

plan bent om de vragenlijst serieus in te vullen.

Vragen en/of opmerkingen kun je kwijt bij Janneke van der Zwaan (j.m.vanderzwaan@tudelft.nl).

Let op: Het kan dat je straks een of meerdere keren een veiligheidswaarschuwing te zien krijgt.



Klik altijd op 'Yes' om het programma te kunnen gebruiken.

Er zijn 20 vragen in deze enquête.

Scenario Tom
Lees het verhaal hieronder en leef je in in de hoofdpersoon Tom.
Je krijgt zometeen een aantal vragen over dit verhaal. Beantwoord deze vragen alsof jij Tom bent.

Tom is een jongen van 12 jaar en hij zit een half jaar op de middelbare school. Vandaag is Tom naar school geweest. Gelukkig vielen Nederlands en Wiskunde uit, dus kon hij tijdens de tussenuren even met een vriend naar buiten. Tom komt na schooltijd thuis. 'Fijn even msn-en'. Hij doet zijn computer aan en ziet dat er iemand is die hem wil toevoegen, genaamd 'Pietje the best', zonder na te denken accepteert hij de uitnodiging en begint een gesprek. Al snel verloopt het gesprek totaal anders dan dat Tom had verwacht en verandert de naam in: 'Je ergste nachtmerrie'. Het gesprek gaat als volgt:



Tom wordt hier erg verdrietig van. 'Niet nu ook al via msn!', denkt hij. Het is namelijk niet de eerste keer dat Tom dit soort berichtjes krijgt. Tom heeft al vervelende berichtjes gekregen via sms, Hyves en Facebook. Bij zijn foto's staan nu teksten als: 'Wat ben jij lelijk' en 'Iedereen haat je'. Er is zelfs een keer een foto van hem bewerkt met scheld-woorden erbij en via e-mail verzonden naar iedereen! Tom is ten einde raad!

Na deze gebeurtenis is hij het zat en gaat op zoek naar een manier om dit te stoppen. Omdat Tom niet weet wat hij moet doen gaat hij op internet zoeken, tot hij bij 'Robin' uitkomt, een computerprogramma dat hulp biedt aan kinderen die digitaal gepest worden.

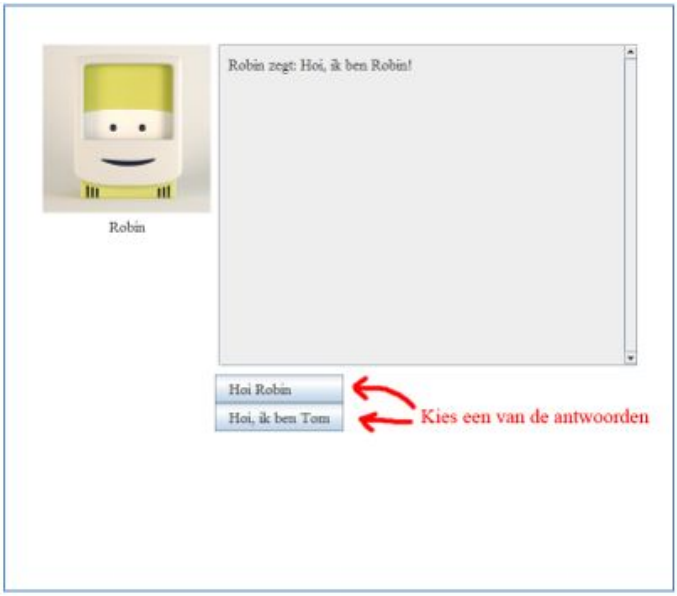
* Hoe denk je dat Tom zich voelt?
Een laag cijfer betekent dat je denkt dat Tom zich niet prettig voelt; een hoog cijfer betekent je denkt dat Tom zich prettig voelt.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

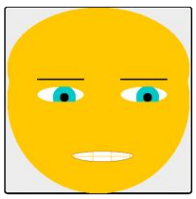
* Hoe ernstig denk je dat Tom het probleem van het pesten vindt?
Een laag cijfer betekent dat je denkt dat hij het probleem niet ernstig vindt; een hoog cijfer betekent dat je denkt dat hij het probleem ernstig vindt.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

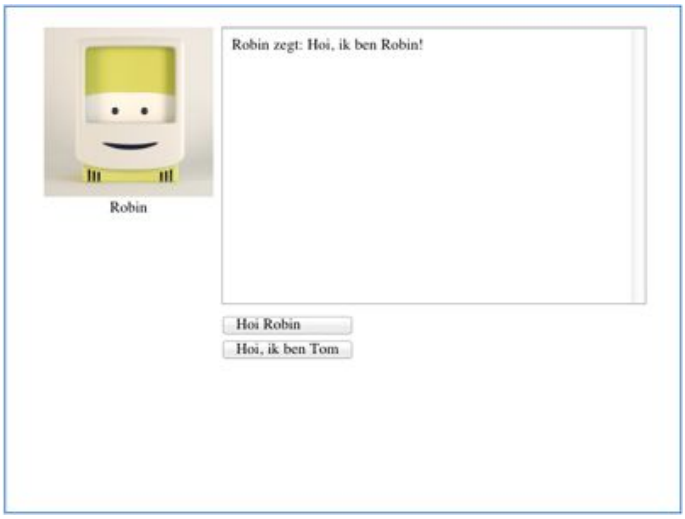
Uitleg computerprogramma Robin
Je gaat zometeen het computerprogramma gebruiken dat Tom op internet gevonden heeft. Het programma werkt als volgt. Als Robin een vraag stelt, kun je antwoord geven door op een van de knoppen onder het chat venster te klikken.



Bij sommige vragen zul je een knop met een gezicht zien als antwoordmoge-lijkheid. Beweeg met je muis over het gezicht en klik als je de juiste gezichts-uitdrukking hebt gevonden. Je kunt de knop hieronder proberen (maar er gebeurt verder niks als je op de knop klikt):



Computerprogramma Robin
Chat met Robin alsof je Tom bent. Reageer zoals je denkt dat Tom zou reageren. Als je niet meer weet hoe het verhaal precies ging, mag je zelf verzinnen hoe het verder gaat. Het gesprek is afgelopen als staat dat Robin de chat verlaten heeft.



* Heb je het gesprek met Robin af kunnen maken?
○ Ja ○ Nee

Hoe voelt Tom zich?

* Hoe denk je dat Tom zich voelt?
Een laag cijfer betekent dat je denkt dat Tom zich niet prettig voelt; een hoog cijfer betekent je denkt dat Tom zich prettig voelt.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

* Hoe ernstig denk je dat Tom het probleem van het pesten vindt?
Een laag cijfer betekent dat je denkt dat hij het probleem niet ernstig vindt; een hoog cijfer betekent dat je denkt dat hij het probleem ernstig vindt.

1	2	3	4	5	6	7	8	9
○	○	○	○	○	○	○	○	○

---

* De volgende stellingen gaan over het gesprek dat jij, in de rol van Tom, net hebt gevoerd met Robin. Geef voor iedere stelling aan in hoeverre je het ermee eens bent.

	Helemaal mee oneens			Niet mee eens/niet mee oneens			Helemaal mee eens
Robin probeerde ervoor te zorgen dat Tom zich beter zou voelen	○	○	○	○	○	○	○
Tijdens het gesprek voelde Tom zich gesteund door Robin	○	○	○	○	○	○	○
Robin begreep het probleem van Tom	○	○	○	○	○	○	○
Robin begreep hoe Tom zich voelde	○	○	○	○	○	○	○
Robin leefde mee met Tom	○	○	○	○	○	○	○
De adviezen van Robin zijn toepasbaar	○	○	○	○	○	○	○
De adviezen van Robin kloppen met de situatie van Tom	○	○	○	○	○	○	○
Als ik Tom was dan zou ik de adviezen opvolgen	○	○	○	○	○	○	○

Evaluatie Robin - Woordparen 1 van 3
Nu volgen een aantal woordparen om het programma te evalueren. Elk paar bestaat uit twee contrasterende woorden. Met de antwoordmogelijkheden tussen de extremen kun je aangeven in welke mate je een bepaalde beschrijving van toepassing vindt. Een voorbeeld:



Dit antwoord betekent dat je het programma over het algemeen sympathiek vindt, maar dat er ruimte is voor verbetering.

Probeer niet te veel na te denken over de woordparen. Geef een spontane reactie. Kies altijd een antwoord, ook als je het gevoel hebt dat de woorden niet van toepassing zijn op het programma. Er zijn geen goede of foute antwoorden. Het gaat om je mening!

* Kies voor ieder woordpaar het antwoord dat het best bij het programma past.

Menselijk	○	○	○	○	○	○	○	Technisch
Isolerend	○	○	○	○	○	○	○	Verbindend
Aangenaam	○	○	○	○	○	○	○	Onaangenaam
Inventief	○	○	○	○	○	○	○	Conventioneel
Eenvoudig	○	○	○	○	○	○	○	Gecompliceerd
Professioneel	○	○	○	○	○	○	○	Onprofessioneel
Lelijk	○	○	○	○	○	○	○	Aantrekkelijk
Praktisch	○	○	○	○	○	○	○	Onpraktisch
Sympathiek	○	○	○	○	○	○	○	Onsympathiek
Omslachtig	○	○	○	○	○	○	○	Eenvoudig

Evaluatie Robin - Woordparen 2 van 3

* Kies voor ieder woordpaar het antwoord dat het best bij het programma past.

Stijlvol	○	○	○	○	○	○	○	Smakeloos
Voorspelbaar	○	○	○	○	○	○	○	Onvoorspelbaar
Goedkoop	○	○	○	○	○	○	○	Van hoge waarde
Vervreemdend	○	○	○	○	○	○	○	Bij elkaar brengend
Brengt me dichter bij mensen	○	○	○	○	○	○	○	Verwijdert me van mensen
Ontoonbaar	○	○	○	○	○	○	○	Toonbaar
Afwijzend	○	○	○	○	○	○	○	Uitnodigend
Fantasieloos	○	○	○	○	○	○	○	Creatief
Goed	○	○	○	○	○	○	○	Slecht

Evaluatie Robin - Woordparen 3 van 3

* Kies voor ieder woordpaar het antwoord dat het best bij het programma past.

Verwarrend	○	○	○	○	○	○	○	Duidelijk gestructureerd
Wekt afkeer op	○	○	○	○	○	○	○	Aansprekend
Gedurfd	○	○	○	○	○	○	○	Voorzichtig
Innovatief	○	○	○	○	○	○	○	Conservatief
Saai	○	○	○	○	○	○	○	Fascinerend
Niet veeleisend	○	○	○	○	○	○	○	Uitdagend
Motiverend	○	○	○	○	○	○	○	Ontmoedigend
Baanbrekend	○	○	○	○	○	○	○	Gewoon
Onhandelbaar	○	○	○	○	○	○	○	Beheersbaar

Evaluatie Robin - Verbeteringen

Hoe zou Robin beter emotionele steun kunnen geven?

Heb je nog andere ideeën om Robin te verbeteren?

Demografische gegevens

* Geslacht
○ Vrouwelijk ○ Mannelijk

* Leeftijd

* Bij welke universiteit of hogeschool sta je ingeschreven?

* Welke opleiding volg je?

* In welk jaar van je studie zit je?

Wat is je e-mailadres? (Je e-mailadres wordt alleen gebruikt om contact op te nemen over de beloning.)

Heb je nog opmerkingen naar aanleiding van dit onderzoek?

Hartelijk bedankt voor het invullen van de vragenlijst! Als je je e-mailadres hebt ingevuld, nemen we binnenkort contact met je op over de 10 Euro beloning. Vragen

en/of opmerkingen kun je kwijt bij Janneke van der Zwaan
(j.m.vanderzwaan@tudelft.nl).

Appendix E

Topic List Focus Group

Topiclijst Focus Group "Virtuele buddy bij cyberpesten"

Inleiding focus group (13.00u; Margot)

- Welkom & dank
  - Uitgenodigd door Janneke van der Zwaan
  - Jullie zijn uitgenodigd als experts om bij te dragen aan haar promotie-project
- Inhoud: virtuele buddy en hoe deze steun kan bieden bij cyberpesten
- Opbouw van de bijeenkomst:
  - Beginnen met voorstelrondje, waarin Janneke heel kort het project toe zal lichten
  - Drie grote onderwerpen en een afsluitend onderwerp
  - Na elke groot onderwerp even pauze, d.w.z. drie keer pauze
  - Een onderdeel is dat jullie de virtuele buddy gaan uitproberen
  - Jullie zullen je reacties opschrijven en daarover zullen we met elkaar praten
  - Tijd: tot 16 uur (e-mail 16.30u)
  - Telefoons graag uitzetten
- Werkwijze:
  - Ik zal het gesprek leiden, aangeven waar ik het graag over wil hebben-zowel schrijven als praten. Voel je vooral vrij om te praten.
  - Als er om de een of andere reden onduidelijkheden zijn, gewoon zeggen
  - Ik stel voor dat we tutoyeren
  - We zullen geluidsopname maken zodat Janneke het gesprek na kan luisteren
  - Janneke en ik zullen beiden ook aantekeningen maken, om tijdens het gesprek bij te houden waar op doorgevraagd dient te worden

Kennismaking (13.05u; Margot eerst, Janneke laatst)

- Naam, organisatie, functie (op bordje)
- Vanuit welke expertise je naar de virtuele buddy kijkt (bijv. cyberpesten; social media; leeftijdsgroep)
- Vragen voordat we aan het gesprek beginnen

Introductie virtuele buddy (13.10u; Janneke – Powerpoint, 2 slides)

- Virtuele buddy; wat is het?
- Doel vandaag: reacties van experts op de virtuele buddy (later evaluatie-onderzoek)

TOPIC 1: Associaties bij het concept 'virtuele buddy' (13.15 – 13.45u)
Doel topic: De resultaten van een eerder experiment leken beïnvloed door vooroordelen/automatische aannames/associaties die mensen van tevoren hadden.
Doel van dit topic is om grip te krijgen op automatische aannames en associaties die mensen hebben als ze horen over het idee van de buddy.

Introductie topic:

- Het eerste grote onderwerp.
- We gaan het vandaag hebben over een virtuele buddy- zoals zojuist door Janneke uitgelegd. Waarschijnlijk roept het allerlei reacties bij jullie op- nog voordat jullie specifiek aan de slag gaan met Robin. Vanuit jullie expertise. Bijv. ervaring mee, kennis van, oordeel over, mening over. Dit speelt een rol bij de reacties die jullie straks zullen hebben op Robin, zoals door Janneke ontwikkeld.
- Daarom willen we eerst graag een overzicht van "alle" reacties op het concept van een virtuele buddy bij cyberpesten (ongeacht van hoe Robin zich specifiek gedraagt)
- (Vanuit jouw rol als expert. Je hoeft niet per se te gaan bedenken wat een 10-14-jarige zou vinden.)
- Werkwijze:
  - Schrijf al je associaties op die je hebt bij het gebruik van een virtuele buddy bij cyberpesten. Mogen steekwoorden zijn of verhaaltjes. De tijd voor nemen
  - Totdat iedereen klaar is met schrijven.
  - We zouden graag achteraf de antwoordformulieren meenemen.
  - Daarna in de groep reacties uitwisselen

Bespreken associaties:

- Rondje maken [eventueel op flip-over schrijven]
- Op elkaar reageren met toevoegingen
- Afronding: Mijn doel is om zoveel mogelijk associaties op tafel te krijgen. Nog meer?

- Dus we hebben hiermee een goed beeld van welke denkbeelden er allemaal spelen m.b.t. een virtuele buddy?

Afronding topic:

- Belangrijk voor Janneke's project om overzicht te hebben van "alle" reacties. Dat is bij deze gelukt.
- Inhoudelijk: enkele punten zullen expliciet terugkomen wanneer we het specifiek over Robin hebben
- Inhoudelijk: ook enkele discussiepunten die niet terug zullen komen
  - Een aantal grote discussies hoeven we vandaag gelukkig niet op te lossen
  - Discussiepunten: kan een virtuele buddy een mens vervangen?
  - In dit project: het vervangt geen mens/menselijke steun; het is geen therapie; het vervangt geen organisaties zoals Pestweb en kindertelefoon. Het is naast mens en therapie. Extra kanaal voor steun, laagdrempelig.
- Zometeen gaan we aan de slag met Robin. Je kunt deze dus zien als extra laagdrempelige toevoeging naast therapie, niet als vervanging van een mens.

@ Pauze- overlopend in opstarten van programma Robin op laptops (13.45u-14.00u)
Introductie:

- Nu pauze (even bijkomen en wat drinken) en dan aan de slag met Robin.
- Jullie krijgen hiervoor een USB stick, met daarop het programma met Robin
- Pak wat drinken, strek je benen, toilet. Daarna op laptop Robin openen.
- Janneke helpt indien nodig

- Ik zal toelichting geven als jullie allemaal laptop met Robin voor je hebben (om 14 uur)

@ Programma Robin uitproberen- in het licht van topic 2 en 3 (14.00u-14.30u)
Introductie:

- Nu laptop met Robin voor je.
- Je gaat het programma doorlopen. Lees eerst scenario. Daarin staan 2 opties die je het programma laat doen:
  1. Je laat Tom (de gepeste jongen om wie het gaat) zijn verhaal vertellen
  2. Je laat Tom vragen om tips om het pesten te stoppen
- Terwijl je doorloopt, antwoord geven op 2 topics, d.w.z. 2 antwoordformulieren:
  - Alle reacties die je hebt- mag heel specifiek, op alle aspecten van Robin
  - Reacties die je hebt m.b.t. sociale steun = praktisch advies en emotionele steun
- Werkwijze:

- Doorloop programma, schrijf continu je reacties op, mag van alles zijn
- Als je een reactie hebt die gaat over de sociale steun, schrijf die op het aparte formulier.
- Schrijf het in steekwoorden op, op een manier dat Janneke het achteraf kan begrijpen (want het lukt niet om in het groepsgesprek letterlijk elke reactie te bespreken)
- Vraag Janneke als je niet weet hoe je iets moet doen
- Ik loop rond en inventariseer alvast reacties
- Daarna gaan we bespreken: topic 2) al jullie reacties, en topic 3) over sociale steun

[Eventueel korte pauze na uitproberen, voordat we met nabespreken beginnen]

TOPIC 2: Reacties op programma Robin (14.30u-15.00u)
Het doel is om "alle" reacties op het programma vast te leggen.

Introductie topic: zoals uitgelegd- eerst "alle" reacties op Robin. Daarna rond ik dat af en gaan we specifiek naar sociale steun.

Bespreking reacties:

- Rondje maken van de reacties
- Op elkaar reageren met toevoegingen

- Mogelijke werkwijze: rondje van reacties, categorieën maken en die bespreken (eventueel op flip-over)
- Mogelijke werkwijze: steeds 1 reactie nemen. Categorie van maken. Andere deelnemers op die "categorie" laten reageren

- Checken of aan de orde zijn gekomen/toevoegingen zijn m.b.t.:
  - Inhoud: Mening over WAT Robin zegt
  - Inhoud: Mening over kwaliteit van het advies (namelijk: Pestweb, met iemand gaan praten, uitprinten pestberichten, blokkeren van pesters)
  - Structuur van het gesprek (namelijk: 5-fasenmodel)
  - Gebruik antwoordopties i.p.v. vrije invoer
  - Uiterlijk Robin
  - Domeinkennis, d.w.z. dat reacties van Robin meestal ongeveer hetzelfde zijn
  - Sterke punten van het programma
  - Zwakke punten van het programma

Afronding topic:
Mijn doel is om zoveel mogelijk reacties op tafel te krijgen. Nog meer? Dus we hebben hiermee een goed beeld van alle reacties op Robin? (sociale steun bespreken we apart en we zullen antwoordformulieren bekijken)

Pauze: 15.00-15.10u

TOPIC 3: Reactie op Robin's strategieën om sociale steun te bieden (15.10u-15.40u)
Doel van topic: gedetailleerde informatie verkrijgen over wat aan het gedrag van de buddy als steunend ervaren wordt en wat niet.

Introductie topic: Robin is vooral bedoeld om sociale steun (praktisch advies en emotionele steun) te bieden. Ik wil graag met jullie inventariseren op welke manieren Robin er volgens jullie in slaagt om sociale steun te bieden aan kinderen van 10-14 jaar.

Bespreking reacties:

1. Reacties m.b.t. sociale steun door Robin.
   Checken of aan de orde zijn gekomen:
   - Praktisch advies
   - Emotionele steun
2. Reacties op de strategieën die Robin 'gebruikt' om sociale steun te geven.
   Checken of aan de orde zijn gekomen:
   - Informatieve steun: advies/ de ander iets leren
   - Aanmoedigen
   - Sympathie/empathie
   - Compliment

[Eventueel 5 minuten pauze; in dat geval topic 4 voor pauze alvast aankondigen]

TOPIC 4: Tips voor de toekomst van de virtuele buddy (15.45u-15.55u)
Doel: inzichten die de experts hebben m.b.t. mogelijkheden van virtuele buddy (die nog niet aan de orde gekomen zijn) naar voren brengen

Introductie: tot slot een afrondende vraag. We waren vandaag bijeen om bij te dragen aan een virtuele buddy die daadwerkelijk steun kan bieden aan kinderen te maken hebben met cyberpesten. Jullie hebben enorm veel input geleverd, m.n. specifiek over Robin. Wellicht zijn er punten waarvan jullie tot slot zeggen: dat moet een toekomstige effectieve virtuele buddy zeker wel/ niet hebben. Uitgaande van Robin: wat moet zeker blijven (sterk punt)/ wat zou zeker nog toegevoegd moet worden.

Zouden jullie 1 of 2 tips op kunnen schrijven.

Inhoudelijk nog iets toevoegen m.b.t. gebruik van virtuele buddy mag ook. Zodat we het gevoel hebben dat alles wat we vandaag konden zeggen over deze virtuele

buddy gezegd is.

Bespreking:

- Iedereen 1 tip laten noemen (positief afsluiten: iedereen in rol van expert)

Afronding (15.55u-16.00u)

- Dan denk ik bij deze dat we kunnen concluderen dat jullie alles ingebracht hebben wat er over Robin en een virtuele buddy bij cyberpesten gezegd kan worden
- Bedanken. Zeer veel input voor het onderzoek van Janneke
- Resultaten. Inschrijflijst voor resultaten focus groep en proefschrift (over ongeveer een jaar)
- Praktisch: Formulier reiskostenvergoeding komt via de mail
- Nog vragen?
- Tot ziens

Appendix F

Interview Checklist

CHECKLIST SINGLE INTERVIEWS

Voor:	Janneke van der Zwaan (TU Delft)
Van:	Joris Schuurman en Nicolien Scheerman (YoungWorks)
Betreft:	Checklist single interviews 'anti-cyberpesten avatar'
Projectcode:	CYB-100
Datum:	Week 14/15/16 - 2013

INTRODUCTIE 5″

Doel: verwachtingen van jongere managen, jongere op zijn/haar gemak stellen. Uitleg werking interview.
Kort voorstellen:

- Wie ben je?
- Hoe oud ben je?
- Wat doe je het liefst na school?
- OF: Wat ga je doen met Koninginnedag? Heb je al plannen?

ALGEMEEN BEELD CYBERPESTEN 10″

Doel: inzicht krijgen in het algemene beeld van pesten en online hulp. Persoonlijke relevantie achterhalen.

- Weet je wat cyberpesten is? (Uitleg: pesten op het internet)
- Heb je online pesten wel eens meegemaakt? Ken je iemand die op internet is gepest?
- Heb je wel eens voor een probleem online hulp gezocht? En zo ja, hoe?
- Hoe ga je met online problemen om?
- Praat je er wel eens over met anderen? Met wie praat je hierover?

- Wat zou er volgens jou gedaan kunnen worden om gepeste kinderen te helpen?

INTRODUCTIE COMPUTERPROGRAMMA **15″**

Doel: spontaan het programma doorlopen om de eerste reacties te peilen.

Het is belangrijk om te benadrukken dat Robin een computerprogramma is en geen persoon!

Voorafgaand aan het invullen van het computerprogramma wordt aan de jongere een scenario over een gepeste leeftijdsgenoot voorgelegd, zodat de res-pondent zich kan inleven in de situatie en het gevoel van 'gepest worden'.

"Ik ga je nu een verhaaltje voorlezen over een leeftijdsgenoot die online iets vervelends heeft meegemaakt."

Scenario

"Tom is een jongen van 14 jaar. Hij is vandaag naar school geweest. Tom komt na schooltijd thuis en gaat even kijken op Facebook. Hij doet zijn computer aan en ziet dat er iemand is die hem wil toevoegen. Zonder na te denken accepteert hij de uitnodiging en begint een gesprek. Al snel verloopt het gesprek totaal anders dan dat Tom had verwacht. Iemand stuurt hem onaardige berichtjes."



"Tom wordt hier erg verdrietig van. 'Niet nu ook al via Facebook', denkt hij. Het is namelijk niet de eerste keer dat Tom dit soort berichtjes krijgt. Tom heeft al vervelende berichtjes gekregen via sms en Hyves. Bij zijn foto's staan nu teksten als: 'Wat ben jij lelijk' en 'Iedereen haat je'. Er is zelfs een keer een foto van hem met scheldwoorden erbij verstuurd via e-mail naar al zijn klasgenoten! Tom weet niet wat hij moet doen."

"Na deze gebeurtenis is hij het zat en gaat op zoek naar een manier om dit te stoppen. Omdat Tom niet weet wat hij moet doen gaat hij op internet zoeken. Hij komt op een website bij een computerporgramma uit. Hier chat hij met 'Robin'. Dit programma helpt kinderen die online gepest worden."

(Check: begrip verhaal)

Onderzoeker: *"We gaan nu het computerprogramma gebruiken. Jij mag de knoppen bedienen en met Robin chatten. Tijdens het chatten mag je alles zeggen wat je opvalt. Ik heb het zelf niet bedacht, dus je mag dus alles eerlijk zeggen wat je vindt of als je iets niet zo goed vindt of niet snapt."*

- Voordat we gaan beginnen: wat verwacht je van het computerprogramma? (Check op doel, invulling, ideeën, functies).

We laten de jongere eerst zelf 10 minuten het programma doorlopen. Daarbij vragen we hen de teksten van Robin en zichzelf hardop voor te lezen.

- Wat valt je op?
  - Wat vind je goed / niet goed? (Check: Logisch/niet logisch)
  - Hoe denk je dat Tom zich nu voelt? Leg uit.
  - Denk je dat Tom iets aan de chatsessie met Robin heeft gehad? Leg uit.
  - Wat zou Tom nu doen?

VERDIEPING VAN DE REACTIES OP HET COMPUTERPROGRAMMA — 15″

Doel: achterhalen van de beleving.

De onderzoeker loopt samen met het kind stap voor stap het programma door. Hierin gaan we dieper op onderdelen in en stellen gericht vragen. De nadruk ligt op de beleving van emotionele steun en de vormgeving van de avatar. De gebruiksvriendelijkheid komt aan bod, maar dit is niet de centrale vraag in dit onderzoek.

- Wat vind je van Robin? (Check: aantrekkelijkheid)
- Wat vond je een goed antwoord? Wat vond je een minder goed antwoord dat Robin gaf? Waarom? (Check: geloofwaardigheid)
- Wat vind je van de taal die Robin gebruikt? Snap je wat hij zegt?
- Denk je dat Tom zich minder verdrietig voelt door de antwoorden van Robin? (Check: steun die ervaren wordt)
- Wat vind je van de tips die Robin geeft? Zou je die gebruiken? Waarom wel of niet?
- Wat vind je ervan dat het gezicht van Robin verandert?
- Hoe vind je dat het eruit ziet? Zijn er dingen die je zou willen veranderen?
- Voor wie is dit programma bedoeld? Is dit ook voor jou gemaakt denk je?

- Zou je het gebruiken als je gepest zou worden? Zo ja, hoe en wanneer? Zo nee, waarom niet?
- Zou je dit aanraden aan een vriend als hij/zij gepest wordt?

- Wat vind je van de naam 'Robin'?

- Was het programma zoals je vooraf had verwacht? Heb je nieuwe dingen geleerd?

- Als je het programma een cijfer zou mogen geven (1 -10), wat zou het zijn? Waarom?

BRAINSTORM OPTIMALISATIE 5″

Doel: een creatieve oefening om de vormgeving van de avatar te optimaliseren.

De onderzoeker geeft de jongere een A4-vel waar Robin en een onderdeel uit de chatsessie staat afgebeeld. De respondent mag op dit papier zijn of haar plus- en minpunten van het chatscherm erbij schrijven of tekenen.

Onderzoeker: *"Hier krijg je de afbeelding van het scherm en Robin. Mijn vraag is: 'Hoe zouden we dit nog beter kunnen maken?' Alles wat jij anders zou doen (of zo zou laten) mag je erbij tekenen of schrijven. Ga je gang!"*

AFRONDING - VRAGEN VAN KLANT / TOOL BOUWER 5″

Check bij klant of er nog specifieke vragen zijn voor de deelnemer?

- Heb je nog vragen?

- *Indien voldoende tijd:* Is het meteen duidelijk hoe je het moet gebruiken?
- Waar zou een online plek zijn waar je dit programma tegen kunnen komen? Op welke website?

Vergoedingsformulieren invullen
Bedankt!

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Summary

The work presented in this thesis concerns endowing Embodied Conversational Agents (ECAs) with the skill of providing social support. ECAs are virtual characters that interact with users based on principles of human face-to-face conversation. Social support refers to comforting the user, and includes providing emotional and information support (advice). In order to be able to provide social support, a context of emotional distress is required. In our research, this context of emotional distress is cyberbullying, that is, bullying through electronic communication devices. The research aim that guided our work was:

> *To understand how ECAs can provide social support to users by designing, implementing, and evaluating a prototype of an empathic virtual buddy that provides social support to cyberbullying victims aged 10 to 14 years old.*

Most existing ECAs are task-oriented systems, i.e., systems that help users perform certain concrete tasks. In conversations with task-oriented ECAs, these tasks provide the foundation of interactions between users and ECAs. An ECA that provides social support to cyberbullying victims is not a task-oriented system. Therefore it is unclear what the virtual buddy and the user should talk about.

In order to determine what should be discussed during a social support conversation, we studied literature on social support. Based on the insights gathered, we constructed a conceptual model for social support conversations that can be used by non task-oriented ECAs to guide conversations with users. The conversation model specifies the contents and structure of social support conversations, and incorporates different types of social support, including sympathy (emotional support), compliment (esteem support), encouragement (emotional support), advice (information support) and teaching (information support). The conversation model also specifies the sequences (i.e., conversation patterns such as question–answer) that make up these conversations.

The conversation model was validated by comparing the model to a corpus of real-world comforting chat conversations about bullying. The results show that there are great similarities between the model and the data on conversation structure, the topics discussed, and the sequence patterns used to discuss topics and for verbal expressions of support. The analysis confirms the proposed model for social support is a valid specification of comforting conversations in the domain of (cyber)bullying.

The conversation model for social support conversations was implemented in a prototype of the virtual buddy. Because we were interested in understanding the principles that enable ECAs to provide social support, the design and implementation of the virtual buddy prototype was focused on these principles; other aspects of the prototype were kept simple. As our literature study of social support showed that the expression of emotions by support providers is essential for the experience of social support by support receivers, the prototype was equipped with an emotion model that generates the virtual buddy's emotions. Emotions are generated in response to user input, and the virtual buddy is capable of expressing generated emotions both verbally and nonverbally.

The virtual buddy prototype was evaluated by different groups of participants. The participants of subsequent studies were increasingly closer to the actual target audience of the virtual buddy, i.e., cyberbullying victims between the ages of 10 and 14. We used the same prototype in all studies, except for the WoZ pilot study, during which an earlier version of the prototype was used. For ethical reasons, we did not recruit (cyber)bullying victims to evaluate the virtual buddy's supportive behavior. Because being bullied was not a criterion to participate, interactions with the virtual buddy were based on a fictitious cyberbullying scenario. Participants were asked to play the role of the main character from the scenario when interacting with the virtual buddy. We used the same scenario for all of the studies.

The WoZ pilot study was conducted to validate the idea of the virtual buddy and the underlying principles of its behavior. During this experiment, interacting with the virtual buddy was compared to reading an informative text with the same information content as the conversation with the buddy. Thirty children between the ages of 14 and 16 participated in the experiment ($\mathrm{N_{Text}} = 14, \mathrm{N_{Buddy}} = 16$). The results suggest that the virtual buddy is at least as good at providing support as the text, and significantly better when it comes to taking into account the user's feelings. We conclude that children between the ages of 14 and 16 generally have a positive attitude towards the idea of a virtual empathic buddy against cyberbullying. Additionally, results show that the emotional cues emitted by the buddy are recognized and accepted, thus validating our approach.

The next study was designed to quantitatively assess the effect of variations in the virtual buddy's emotional expressiveness on user experience, the effectiveness of support, and perceptions of social support. There were four conditions in the experiment: no emotion, verbal emotion only, nonverbal emotion only, or verbal & nonverbal emotion. In total, 100 bachelor students from different universities in the Netherlands participated in study. Participants were randomly assigned to one of the conditions; there were 25 participants in each condition.

The results show that the user experience of the virtual buddy prototype is acceptable, and does not impede the virtual buddy's potential for providing social support. The results also show the virtual buddy is effective at providing support support; all participants reported a significant increase in well-being and a significant decrease of perceived burden of the problem. In addition, perception of support ratings were generally high (> 4.24 on a 7-point scale). There were no

statistically significant differences between conditions for user experience, effectiveness of support and perceptions of social support. The large number of participants suggesting to increase the virtual buddy's emotional expressiveness in order to improve its emotional support skills (e.g., by expressing emotions more often than the virtual buddy currently does), confirm that expressing emotions is an important factor in the perception of support.

In order to gain more insight into how the virtual buddy's behavior was experienced, and why users feel supported or not, two qualitative studies were conducted. The first qualitative study was a focus group discussion among pedagogical and bullying experts. Six experts were invited to try the virtual buddy prototype, and assess what aspects of the interaction were perceived as being supportive, what aspects disrupt the perception of support, and how the overall experience of social support can be improved. The results demonstrate that the experts recognized the different social support strategies employed by the virtual buddy, including the supportive statements (sympathy, compliments, and encouragement), different facial expressions, and advice and teaching. The experience of being supported was contributed to the virtual buddy's supportive verbal utterances, the different facial expressions, and the combination of verbal utterances and facial expressions. The embodiment clearly has added value for the application.

The second qualitative study was conducted among children between the ages of 10 and 14, the virtual buddy's target age group. Feedback on the virtual buddy's supportive behavior was gathered in 12 one-on-one interviews. Participants generally enjoyed interacting with the virtual buddy, although some of them were quite critical. Participants justified liking the virtual buddy by referring to its advice giving skills (information support). When prompted, participants also admitted to experiencing emotional support. The experience of emotional support was attributed to the virtual buddy's supportive messages and the accompanying facial expressions. We conclude that the virtual buddy is able to convey support to the target age group. When comparing the results from the interviews to the results from the focus group, we found a large overlap. This suggests that when assessing aspects of an ECA's behavior evaluations by pedagogical and domain experts can be used to approximate children's opinions, thereby reducing the burden of performing evaluations in sensitive domains on vulnerable target audiences (e.g., children).

Samenvatting

Het onderwerp van dit proefschrift is sociale steun door *Embodied Conversational Agents* (ECAs). ECAs zijn virtuele karakters die principes van een-op-een-communicatie tussen mensen toepassen bij interacties met gebruikers. Sociale steun verwijst naar het troosten van gebruikers, en bestaat onder andere uit emotionele en informatieve steun (advies). Er kan alleen sociale steun gegeven worden in een context waarin de gebruiker emotionele pijn ervaart. De context van emotionele pijn die in dit onderzoek gehanteerd wordt is cyberpesten, pesten via elektronische communicatieapparatuur (zoals computers of mobiele telefoons). Aan dit onderzoek ligt het volgende onderzoeksdoel ten grondslag:

> *Begrijpen hoe ECAs sociale steun kunnen geven aan gebruikers door het ontwerpen, implementeren, en evalueren van een prototype van een empathische virtuele buddy die sociale steun geeft aan kinderen tussen de 10 en 14 jaar die via internet gepest worden.*

De meeste bestaande ECAs zijn taakgeoriënteerde systemen, oftewel systemen die gebruikers helpen bij het uitvoeren van concrete taken. In gesprekken met taakgeoriënteerde ECAs functioneren deze taken als basis voor het gesprek. Een ECA die sociale steun geeft aan slachtoffers van cyberpesten is geen taakgeoriënteerd system. Daarom is het niet duidelijk waar de virtuele buddy en de gebruiker het samen over moeten hebben.

Om te bepalen wat er besproken moet worden tijdens een gesprek waarin sociale steun gegeven wordt, hebben we literatuur over sociale steun bestudeerd. Op basis van de bevindingen hebben we een conceptueel model opgesteld van dergelijke gesprekken. Het gespreksmodel specificeert de inhoud en structuur van gesprekken waarin sociale steun gegeven wordt, en bevat verschillende typen sociale steun, waaronder sympathie (emotionele steun), complimenten (waardering (*esteem support*)), aanmoediging (emotionele steun), advies (informatieve steun), en technische uitleg (informatieve steun). Het gespreksmodel specificeert ook de sequenties (dat wil zeggen, gesprekspatronen zoals vraag–antwoord) waar het gesprek uit is opgebouwd.

Het gespreksmodel is gevalideerd door het te vergelijken met een corpus van echte chatgesprekken over pesten waarin sociale steun gegeven wordt. Uit de resultaten blijkt dat er grote overeenkomsten zijn tussen het model en de data met betrekking tot de inhoud het structuur van het gesprek en de sequenties die gebruikt

worden om verschillende onderwerpen te bespreken en voor verbale uitingen van steun. Onze analyse bevestigt dat het voorgestelde gespreksmodel geldig is voor gesprekken over pesten waarin sociale steun geboden wordt.

Het gespreksmodel voor sociale steun is vervolgens geïmplementeerd in een prototype van de virtuele buddy. Omdat we vooral geïnteresseerd waren in het begrijpen van de principes die ECAs in staat stellen om sociale steun te geven, hebben we het ontwerp en de implementatie van het prototype toegespitst op deze principes; alle andere aspecten zijn zo simpel mogelijk gehouden. Omdat uit onze literatuurstudie over sociale steun bleek dat het uitdrukken van emoties door steungevers essentieel is voor het ervaren van steun door ontvanger, is het prototype uitgerust met een emotioneel model dat de emoties van de virtuele buddy genereert. Emoties worden gegenereerd als reactie op invoer van de gebruiker. De virtuele buddy is in staat om deze emoties verbaal en non-verbaal uit te drukken.

Het prototype van de virtuele buddy is geëvalueerd door verschillende groepen participanten. Participanten van de opeenvolgende studies lagen steeds dichter bij de doelgroep van de virtuele buddy, namelijk kinderen tussen de 10 en 14 jaar die online gepest worden. Tijdens de studies hebben we telkens hetzelfde prototype geëvalueerd, behalve bij de WoZ pilot studie. Bij deze studie hebben we een ouder prototype gebruikt. Uit ethische overwegingen hebben we proefpersonen niet geselecteerd op basis van dat ze zelf pesten meegemaakt moesten hebben. Omdat gepest zijn geen criterium was om deel te nemen aan de studies, kregen de participanten een fictief scenario waar ze hun gesprek met de virtuele buddy op konden baseren. Bij alle studies is hetzelfde scenario gebruikt.

De WoZ pilotstudie werd uitgevoerd om het idee achter de virtuele buddy en de onderliggende principes van zijn gedrag te valideren. In dit experiment werd interactie met de buddy vergeleken met het lezen van een informatieve tekst. De tekst bevatte dezelfde informatie als het gesprek met de virtuele buddy. Aan het experiment deden dertig kinderen tussen de 14 en 16 jaar oud mee ($N_{\text{Tekst}} = 14$, $N_{\text{Buddy}} = 16$). De resultaten duiden erop dat de virtuele buddy minstens evenveel steun overbrengt als de tekst en dat de virtuele buddy significant beter rekening houdt met de gevoelens van de gebruiker. We concluderen dat kinderen tussen de 14 en 16 over het algemeen positief oordelen over het idee achter een virtuele buddy voor kinderen die via internet gepest worden. Daarnaast laten de resultaten zien dat de participanten de emotionele cues van de virtuele buddy herkennen en accepteren. Dit betekent dat onze aanpak werkt.

De volgende studie was opgezet om het effect te meten van variaties in emotionele expressiviteit op de gebruikerservaring, de effectiviteit van de gegeven steun, en waargenomen sociale steun. In het experiment werden vier condities vergeleken: 1. de virtuele buddy uitte geen emoties, 2. de virtuele buddy uitte emoties alleen verbaal, 3. de virtuele buddy uitte emoties alleen non-verbaal, en 4. de virtuele buddy uitte emoties verbaal en non-verbaal. Aan de studie deden in totaal 100 bachelorstudenten van verschillende Nederlandse universiteiten mee. Participanten werden willekeurig ingedeeld bij één van de vier condities; in elke conditie deden 25 participanten mee.

De resultaten laten zien dat de gebruikerservaring van het prototype van de virtuele buddy acceptabel is, en het ervaren van steun niet in de weg staat. Uit de resultaten bleek ook dat de steun die de virtuele buddy geeft effectief is; bij alle participanten was welzijn significant gestegen en de ernst van het probleem significant gedaald. Daarnaast waren de scores voor waargenomen sociale steun over het algemeen hoog (> 4.24 op een 7-punts schaal). Er waren geen statistisch significante verschillen tussen de condities voor gebruikerservaring, effectiviteit van de steun, of waargenomen sociale steun. Er was een groot aantal participanten dat voorstelde om de emotionele steun van de virtuele buddy te verbeteren door zijn emotionele expressiviteit te vergroten (bijvoorbeeld door vaker emoties te uiten tijdens het gesprek). Dit resultaat bevestigt dat het uitdrukken van emoties een belangrijke factor is bij het ervaren van sociale steun.

Om meer inzicht te krijgen in hoe het gedrag van de virtuele buddy wordt ervaren en waarom gebruikers zich wel of niet gesteund voelen, zijn er twee kwalitatieve studies uitgevoerd. De eerste kwalitatieve studie was een focusgroepdiscussie tussen pedagogische experts en experts op het gebied van pesten. Zes experts hebben het prototype van de virtuele buddy uitgeprobeerd en beoordeeld welke aspecten van de interactie als steunend ervaren worden, welke aspecten de perceptie van steun verstoren, en hoe de steunbeleving in het algemeen verbeterd kan worden. De resultaten laten zien dat de experts de verschillende strategieën voor sociale steun herkennen, inclusief de steunende uitspraken (sympathie, complimenten, en aanmoediging), de verschillende gezichtsuitdrukkingen, en het advies en de technische uitleg. Het gevoel van steun werd toegeschreven aan de verbale uitingen waarin steun uitgedrukt werd, de verschillende gezichtsuitdrukkingen, en de combinatie van verbale uitingen en de gezichtsuitdrukkingen. De aanwezigheid van het virtuele karakter (*embodiment*) heeft duidelijk toegevoegde waarde voor de applicatie.

De tweede kwalitatieve studie is uitgevoerd onder de eigenlijke doelgroep van de virtuele buddy, kinderen van tussen de 10 en 14 jaar oud. Voor deze studie is feedback op het steunende gedrag van de virtuele buddy verzameld tijdens 12 individuele interviews. Ondanks een aantal kritische reacties, vonden de deelnemers het over het algemeen leuk om de virtuele buddy te gebruiken. De deelnemers verwezen exclusief naar de tips (informatieve steun) als ze gevraagd werd uit te leggen wat ze goed vonden aan de virtuele buddy. Als er specifiek naar gevraagd werd, gaven de deelnemers ook aan emotionele steun te ervaren. De ervaring van emotionele steun werd toegewezen aan de steunende verbale uitspraken van de virtuele buddy en de bijbehorende gezichtsuitdrukkingen. Hieruit concluderen we dat de virtuele buddy in staat is om een gevoel van steun over te brengen aan kinderen in de geselecteerde leeftijdsgroep. De resultaten van de interviews komen in hoge mate overeen met de resultaten van de focusgroep. Deze overlap geeft een indicatie dat evaluaties van aspecten van het gedrag van ECAs door pedagogische en domeinexperts gebruikt kunnen worden als benadering van de mening van kinderen, waardoor de last op kinderen bij het uitvoeren van evaluaties in gevoelige domeinen verminderd kan worden.

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Doing the user studies was the part of the work I liked most. All participants, thank you for your contribution! Special thanks is due to the experts that provided valuable feedback during the focus group discussion. Your positive remarks convinced me it would be possible and worthwhile to evaluate the virtual buddy with children. I would also like to thank Margot van der Goot, who did an excellent job of moderating the focus group. The interviews with the children were conducted by Youngworks; thank you, Nicolien, Joris, and everybody else, it was a pleasure to work with you!

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least, I would like to thank Martijn. Thank you for putting up with me and helping me wherever you could. I look forward to returning the favor!

Curriculum Vitæ

Janneke van der Zwaan was born in Gouda on October 22, 1981. Upon completing her high school education in 1999, she started studying Dutch Language and Literature at the University of Amsterdam. One year later, after following an introductory course in computer programming, she changed majors to Artificial Intelligence. During her studies, Janneke displayed a clear preference for socially relevant and real-world applications of artificial intelligence. She obtained her bachelor's degree in 2004, and continued with a master's degree focusing on Intelligent Systems. In 2006, she graduated cum laude, after which she took on an additional master's program in Science Communication at VU University. There she became interested in multidisciplinary research.

In November 2009, Janneke started her PhD research at the ICT section of the Faculty of Technology, Policy and Management at Delft University of Technology. She explored how conversational agents can provide social support to users. During her work, Janneke focused on endowing agents with the emotional skills required to comfort users. As part of the multidisciplinary cyberbullying project, she developed and evaluated a prototype of an empathic virtual buddy that provides emotional support and practical advice to victims of cyberbullying.

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