Corpus-based Validation of a Dialogue Model for Social Support

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Abstract

Recent developments in affective computing show that Embodied Conversational Agents (ECAs) are increasingly capable of complex social and emotional dialogues. Our research concerns the design and evaluation of an ECA that provides social support to children that are being bullied though the Internet. Recently, we proposed a domain-independent dialogue model for verbal social support. In this paper, the model is compared to actual comforting chat conversations about bullying. Analysis of the most important and complex conversation phases shows that conversation topics predicted by the model are mostly discussed in the expected phases and that conversation patterns used to discuss topics and give (verbal) social support also correspond to the model.

1 Introduction

Today, children and adolescents spend a lot of time on the Internet. One of the risks they run online is to become a victim of cyberbullying. Cyberbullying is bullying through electronic communication devices. It is a complex problem that has a high impact on victims [14]. To help victims deal with their negative emotions, specialized helplines, such as Cybermentors[1] and Pestweb[2] enable them to talk to online counselors and/or peers trained to give social support. Social support or comforting refers to communicative attempts, both verbal and nonverbal, to alleviate the emotional distress of another person [5].

Early work in the field of affective computing demonstrated that virtual agents are able to reduce negative emotions in users by addressing them [10]. More recent developments show that empathic agents are increasingly capable of complex social and emotional dialogues (see for example [11, 12]). However, these dialogues are predominantly task oriented, i.e. to help users perform concrete tasks, such as finding information and learning. Generally, giving social support is unrelated to this type of tasks.

We are interested in investigating how and to what extent conversational agents can provide social support. Our research concerns the design and evaluation of an Embodied Conversational Agent (ECA) that supports cyberbullying victims. Recently, we proposed a domain-independent dialogue model for social support [19, 18]. Since it is based on psychological literature and common sense, it is unclear how well actual comforting dialogues are represented by the model. The goal of this paper is to present validation of the model in a qualitative study with real world data, i.e. actual comforting dialogues with bullying victims.

This paper is organized as follows. In section 2, we discuss related work on conversational agents that provide (social) support. In section 3, we present the domain-independent dialogue model for social support. In section 4, we specify the methodology used for the qualitative analysis and section 5 describes the results. Finally, in section 6, we present our conclusions.

2 Related work

Many virtual agents aimed at supporting users have been developed over the past few decades. These systems are predominantly task oriented. Another popular application of task oriented virtual agents is

[1] www.cybermentors.org.uk

[2] www.pestweb.nl

supporting users in e-learning and tutoring systems [8, 12, 17]. Such pedagogical agents use different strategies, such as displaying active listening behavior, encouragement and praise, to motivate users and to make learning more engaging.

The 'How was your day' (HWYD) system developed by Cavazza et al. is an example of a non-task oriented ECA [6, 16]. The ECA allows users to talk about their day at the office and responds by asking questions to gather information or by generating appropriate affective responses to the information gathered. In addition to short sympathetic responses to the user's input, the system may start a longer utterance that provides advice and support in a more structured fashion. These longer utterances are called comforting tirades. Comforting tirades are aimed at encouraging, comforting or warning the user.

Adam et al.'s toy that engages children with personalized dialogue is another non-task oriented dialogue system [1]. The toy's personalization behaviors are based on the analysis of two corpora of children-adult dialogues and include strategies such as asking personal questions, recalling shared activities and taking the child's preferences into account. Additionally, the toy employs emotional strategies including expressing empathy, encouraging the child to take active steps to remove a stressor, and providing mental disengagement [2]. These emotional strategies are based on a classification of coping strategies.

Supportive strategies of virtual agents are often based on psychological literature (e.g., [15, 13]) or expert opinions (e.g., [3]). To the best of our knowledge, these strategies have not been validated, even though some systems employing these strategies have been subjected to user experiments. We believe it is important to validate the dialogue strategies used by an ECA, especially when dealing with sensitive application domains (e.g., cyberbullying) and/or vulnerable target audiences (e.g., children). The contribution of this paper is the specification and application of a method to validate dialogue strategies with real world data.

3 Dialogue Model for Social Support

In this section, we present our dialogue model for comforting conversations. The model consists of multiple components, each of which is discussed in this section. The conversation is structured according to the 5-phase model, a methodology to structure counseling conversations [4]. In every conversation phase, one or more topics are discussed. Some topics have been derived from the 5-phase model while others are based on the topics that can be addressed in the course of a supportive conversation as suggested by Burleson and Goldsmith [5]. A topic is discussed in one or more dialogue sequences, where a dialogue sequence refers to a set of utterances or conversation turns in which a request for information or the pro-active sharing of a piece of information is completed by the dialogue partners. Verbal statements to communicate social support are part of these sequences. We will now discuss the different components of the model in more detail.

According to the 5-phase model, the five phases of a conversation are [4]:

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

During the conversation, different topics are discussed. In phase 1 the agent welcomes the user (topic hello). The topics in phase 2 (Gather information) are based on the topics that can be addressed in the course of a supportive conversation suggested by Burleson and Goldsmith [5]; these topics are: the upsetting event(s), the user's emotional state, the personal goal that is being threatened by the upsetting event(s), and the user's current coping strategies. In phase 3 (Determine conversation objective), the topic is the conversation objective. Even though multiple conversation objectives are possible, the model assumes the user wants to get advice on how to deal with cyberbullying. Phase 4 (Work out objective) consists again of topics suggested by Burleson and Goldsmith: future coping strategies and advice. Future coping strategies are actions the user intends to perform to cope with the problem, while advice is an action suggested by the agent for the user to perform to cope with the problem. Finally, in phase 5 (Round off) the agent says goodbye to the user (topic bye).

Support type	Description	Example
Sympathy	Express feelings of compassion or concern	How awful that you are being bullied!
Encouragement	Provide recipient with hope and confidence	I know you can do it!
Compliment	Positive assessments of the recipient and his or her abilities	Good of you to have told your parents!
Advice	Suggestions for coping with a problem	Perhaps you should tell your parents.
Teaching	Factual or technical information	You can block a contact by clicking the 'block' button

Table 1: The types of social support incorporated in the dialogue model.

Topics are discussed in one or more dialogue sequences. These sequences consist of verbal utterances expressed by either the agent or the user. During a dialogue sequence, the agent can utter speech acts to communicate social support. Phase 2 and 4, the phases in which the topics suggested by Burleson and Goldsmith are discussed, are the most appropriate to give support. Five types of social support that frequently occur in counseling conversations by chat [9] were incorporated in the model: sympathy, compliment, encouragement, advice and teaching. Table 1 lists descriptions and examples of these support types.

The model also specifies how social support is communicated in dialogue sequences for phases 2 and 4. To report sequence patterns, we use the following notation. Speech acts are denoted by $\{Q_i, A_i, Ac_i, Sym_i, Enc_i, Com_i, Adv_i, Conf_i, Reject_i, Teach(request), Teach(step\ x)_i, SA_i\}$ which refer to question, answer, acknowledgment, sympathy, encouragement, compliment, advice, confirmation, rejection, request teaching, teach step x, and speech act (not otherwise specified) respectively; $i \in \{c, u\}$ indicates a speech act is expressed by the counselor (c) or the user (u). Choices are indicated with $|$, ? means a speech act is uttered 0 or one times, and $*$ indicates a speech act is repeated 0 or more times. The sequence for phase 2 and topic coping future in phase 4 is $Q_c\ A_u\ (Ac_c|Sym_c)?\ (Enc_c|Com_c)^*$. The sequence for advice is: $Adv_c\ Conf_u$. Optionally, a piece of advice is followed by a list of instructions or steps (teaching). The sequence pattern for teaching is: $Adv_c\ Teach(request)_c\ (Conf_u\ Teach(step\ 1)_c\ Conf_u \cdots Teach(step\ n)_c\ Conf_u| Reject_u)$. More details regarding the sequence patterns in phase 2 and 4 can be found in [18].

4 Methodology

To validate the dialogue model we proposed, we performed a qualitative analysis of chat conversations about bullying. These chat conversations are considered to be a 'gold standard' for our model.

4.1 Description of the Data

Pestweb 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 the chat conversations is similar to what we have in mind for the comforting dialogue agent. Three counselors gave consent to use their conversations. A total of 66 conversations were gathered over the course of one month. To protect the privacy of the children and adolescents contacting the helpline, only the counselor's side of the conversation was made available. However, the data did contain the positions of the user's utterances, so we know *when* they said something, but not *what* they said. Additionally, all utterances were anonymized; all identifying information, including the counselor's name, was replaced by generic labels. For example, proper names were replaced by <name>.

Not all 66 conversations were usable for the analysis: 17 conversations appeared to be non-serious (e.g., people trying out the helpline); 19 conversations were off-topic (e.g., conversations just before closing time, and conversations where one of the partners is experiencing technical difficulties while using the chatroom); 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).

4.2 Data Analysis

The data was coded by a single coder according to the method proposed by Chi [7]. The coder started by dividing the conversations into the phases of the 5-phase model. The second step consisted of dividing all phases into sequences of utterances. A sequence is a set of utterances or conversation turns in which a request for information or the pro-active sharing of a piece of information is completed by the dialogue partners. 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.

A codes was added for 'comforting tirades' (cf. [6, 16]) which are longer utterances to provide support that 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, new 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. These sequences have been coded as off-topic.

Step 4 of the coding process consisted of marking social support types in the sequences of phase 2 and 4. 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. The proposed patterns were changed to better fit the data; in the QA-pattern Ac_c was made optional, because in the data, the counselor does not always respond to an answer provided by the user. Additionally, the user does not always respond to a piece of advice, so the user confirmation in the advice sequence was made optional as well. Also, codes for new patterns were added. In order to describe newly found utterances, we introduced $\{Adv(introduction)_i$, $Adv(options)_i\}$ to define parts of a new type of advice. More details about the sequence patterns in the data can be found in section 5.2.

While coding, we made some assumptions about the data. Because the data consists of utterances and the proposed sequence patterns consist of speech acts, we assume an utterance consists of one or more speech acts and a speech act can consist of one or more utterances. The utterances of the user are unavailable in the data, but the user turns are available. We assume a user turn can consist of multiple utterances and/or multiple speech acts. The contents of a user turn are determined based on the response of the counselor. We assume that a user utterance is relevant only if the counselor explicitly responds to it. While a few sequences were difficult to understand based on the counselor utterances alone, in general, the conversations were easy to follow, because the counselors frequently request feedback from their conversation partners and summarize their input.

5 Results

In this section we describe the results of the data analysis and assess the match between the data and the model.

5.1 Phases and Topics

In total 637 sequences were found in the data; 534 of these (83.8%) was coded with one of the topics from the model. Table 2 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

	H	E	ES	PG	CC	CO	CF	A	B	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 2: Occurrence of topics in the different phases. Grey cells indicate that, according to the model, the topic occurs in this phase. (H: hello, E: event, ES: emotional state, PG: personal goal, CC: coping current, CO: conversation objective, CF: coping future, A: advice, B: bye, Total: Total number of conversations containing this phase (at least partial))

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 bye (B) is discussed in all conversations that include a phase 5.

5.2 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 dialogue patterns for sequences in phase 2 and 4. In this section we explore to what extent these patterns can be found in the data. A complicating factor is that the sequence patterns were specified in speech acts and the data consists of utterances. We assume a speech act consists of one or more utterances and an utterance consists of one or more speech acts. Additionally, we only include user utterances in the patterns if the counselor explicitly responds to a user utterance (we assume that the counselor explicitly responds to user utterances that contain relevant information).

Table 3 contains all sequence patterns we found in phase 2 and 4. Included in the analysis are all sequences with topics event, emotional state, personal goal, coping current, coping future, advice, and social support other. The sequence patterns are specified in the second column of table 3. The third column contains examples from the data. To indicate the user utterances are missing from the data, they have been replaced by black squares; the position of the user utterances does come from the corpus.

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 2). Table 4 shows the frequency of each of these patterns 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.

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 5 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.

5.3 Match between the Data and the Model

In general, the model predicts the occurrence of the topics in the phases very well. Only in phase 4 some topics not expected in this phase are discussed. Additionally, the topic Personal goal seems to be irrelevant as it only occurs once in the 23 conversations analyzed. Over 80% of the sequences in the data could be assigned one of the topics from the model. Sequences that could not be assigned a topic from the model are conversation or chat management techniques (6.8%), off-topic (5.5%) or a new kind of supportive utterance that can be characterized as a 'comforting tirade' (3.9%).

Additionally, we analyzed the patterns in conversation sequences for phases 2 and 4. After relaxing two of the three patterns specified by the model, we found that a majority of the sequences followed the (relaxed) patterns (94.2% for phase 2 and over 66% for phase 4). In total, 7 additional sequence patterns were found.

Pattern	Sequence	Example
QA 1	$Q_c\ A_u\ (Ac_c)$ $(Sym_c\|Enc_c\|Com_c)^*$	C: *What names are they calling you?* (C3) U: ■■■■■■■■■■■■■■■■ C: *Oh, they say nasty things!*
Advice 1	$Adv_c\ RF_c\ A_u$ $(Sym_c\|Enc_c\|Com_c)^*$	C: *You can go talk to a teacher* (C46) C: *How about that?* U: ■■■■■■■■■■■■■■■■ C: *It is difficult, I know*
RtU 1	SA_u $(Sym_c\|Enc_c\|Com_c)^*$ Adv_c	U: ■■■■■■■■■■■■■■■■ (C43) C: *Yes, that's a good idea!* C: *You can also try to ignore the bullies*
Other 1	$(Sym_c\|Enc_c\|Com_c)\ SA_u$ $(Sym_c\|Enc_c\|Com_c)^*$	C: *You shouldn't keep it to yourself for too long* (C61)
Advice 2	$Adv(introduction)_c$ $(RF_c\ Conf_u)?$ $Adv(options)_c$ $(RF_c\ Conf_u)?$	C: *There are four things you can do* (C1) 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*
RtU 2	$SA_u\ Q_c\ A_u\ Sym_c$	U: ■■■■■■■■■■■■■■■■ (C33) C: *And how did that go?* U: ■■■■■■■■■■■■■■■■ C: *Parents often find it hard to believe their child is a bully*
QA 2	$(Sym_c\|Enc_c\|Com_c)?$ $Q_c\ SA_u\ (Ac_c)?$ $(Sym_c\|Enc_c\|Com_c)?$	C: *I'm sorry you are being bullied that bad!* (C56) C: *Can you tell me something about it?* U: ■■■■■■■■■■■■■■■■ C: *Gosh, that's annoying!*
Teaching	$Adv_c\ RT_c\ (Conf_u$ $Teach(step\,1)_c\ Conf_u \cdots$ $Teach(step\,n)_c\ Conf_u$ $\|Reject_u)$	C: *You could try to ignore the bullies* (C61) C: *do you know how to ignore people?* U: ■■■■■■■■■■■■■■■■ C: *Exactly!*
RtU 3	$Q_u\ A_c\ SA_u$	U: ■■■■■■■■■■■■■■■■ (C39) C: *Yes, you can tell me* U: ■■■■■■■■■■■■■■■■
Other 2	$Q_c\ SA_c$	C: *Is that it? Or is it even worse?* (C46) C: *You can safely tell me how you feel*

Table 3: Sequence patterns found in phase 2 and 4. Grey rows indicate patterns specified in the dialogue model. Utterances between [] have been added by the authors for clarity of reading.

	QA 1	RtU 1	RtU 2	QA 2	RtU 3	Other 1	Other 2
Occurrences	230	6	3	2	1	1	1
Conversations	23	3	3	2	1	1	1

Table 4: 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
Occurrences	47	21	13	11	5	1
Conversations	13	9	3	4	5	1

Table 5: Occurrence of the sequence patterns in phase 4. Grey columns indicate patterns expected in phase 4.

So, the conversations show a lot of regularity and again we can conclude there is a good match between the data and the model. However, the analysis shows that the dialogue model misses a pattern to respond to user input without asking a question first. While only 5.56% of the sequences in phase 2 and 4 was assigned pattern RtU 1, we believe it is important the comforting ECA is able to respond to information the user introduces pro-actively. Therefore, this pattern will be added to the model.

6 Conclusion

In this paper, we compared a dialogue model for social support based on psychological literature and common sense to the counselor side of 23 real comforting chat conversations. The results show great similarities between the data and the model 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.

To further confirm the validity of the dialogue model, more research is needed. First of all, to improve the validity of the analysis, more coders should be involved in analyzing the data. Second, while 23 conversations is a substantial amount, the generalizability of the results could be increased by analyzing more conversations. And finally, to investigate the extend to which the conversation model is domain independent, social support conversations from other domains should be included in the analysis as well.

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