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Kantharaju, Reshmashree B.; Pease, Alison; Reidsma, Dennis; Pelachaud, Catherine; Snaith, Mark; Bruijnes, Merijn; Klaassen, Randy; Beinema, Tessa; Huizing, Gerwin; Simonetti, Donatella; Heylen, Dirk; Den Akker, Harm Op

Published in:
IVA 2019 - Proceedings of the 19th ACM International Conference on Intelligent Virtual Agents

DOI:
10.1145/3308532.3329450

Publication date:
2019

Document Version
Publisher's PDF, also known as Version of record

Integrating Argumentation with Social Conversation between Multiple Virtual Coaches

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ABSTRACT

This paper presents progress and challenges in developing a platform for multi-character, argumentation based, interaction with a group of virtual coaches for healthcare advice and promotion of healthy behaviours. Several challenges arise in the development of such a platform, e. g., choosing the most effective way of utilising argumentation between the coaches with multiple perspectives, handling the presentation of these perspectives and finally, the personalisation and adaptation of the platform to the user types. In this paper, we present the three main challenges recognized, and show how we aim to address these.

CCS CONCEPTS

• **Human-centered computing → Interaction paradigms**.

KEYWORDS

Argumentation, Social Conversation, e-Coaching

ACM Reference Format:
Reshmashree B Kantharaju, Alison Pease, Dennis Reidsma, Catherine Pelachaud, Mark Snaith, Merijn Bruijnes, Randy Klaassen, Tessa Beinema, Gerwin Huizing, Donatella Simonetti, Dirk Heylen, and Harm op den Akker. 2019. Integrating Argumentation with Social Conversation between Multiple Virtual Coaches. In *ACM International Conference on Intelligent Virtual Agents (IVA '19), July 2–5, 2019, PARIS, France.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3308532.3329450

IVA '19, July 2–5, 2019, PARIS, France

ACM ISBN 978-1-4503-6672-4/19/07.
https://doi.org/10.1145/3308532.3329450

1 INTRODUCTION

The development of e-coaching tools to support behaviour change towards a healthy lifestyle is a domain that is attracting increasing attention, mostly due to the rise in healthcare cost and proliferation of chronic disease in the Western World. One of the major challenges in e-coaching is a lack of engagement and trust, especially in the long-term; an issue that severely hampers the ability of e-coaches to deliver the necessary health coaching over long periods of time. A common strategy to bring about behaviour change is goal-setting, where healthcare professionals motivate a patient into making changes by collaboratively setting manageable goals [11, 13]. A key feature here is commitment: goals must be understood and agreed upon if they are to be effective [11]. This goal-setting process, however, can be extremely difficult due to a range of complex and often conflicting healthcare information currently available.

These points raise the following issue: *"How can we present holistic, complex and conflicting health information to a user in an engaging, trustworthy way?"* In order to tackle this issue, we present here a new approach for social argumentation conversations in an e-coaching context to increase user engagement in the context of the Council of Coaches project. Our approach relies on using a group of virtual coaches and encompasses argumentation and social conversation. Regarding the latter, in traditional one-on-one human-agent conversations it is extremely challenging to keep a user engaged when he/she is not willing to partake in conversation (a dialogue takes two). By creating a multi-agent system of coaches, dialogues can be automatically advanced between two or more virtual agents, without being dependent on user input. The hypothesis is that a user can still learn by observing dialogues between virtual agents, and eventually will be tempted to actively participate. Regarding the former point, each agent will provide its own argumentation based on its expertise. Thus, the metaphor of multi-agents enables us to present a variety of views, including conflicting information, to the user, while each agent maintains

internal consistency. Additionally, by portraying each agent as a different specialist in a user's overall health we can enable holistic decision making.

The work presented in this paper describes three main challenges that arise in developing a group of virtual coaches. As motivated, the first challenge is to integrate argumentation system and social agent system. The second challenge is to adapt the presentation of an argument to the user by selecting an approach that fits that type of user. The third challenge is to manage turn-taking including multiple (possibly conflicting) perspectives to increase trust in the advice given. In the paper, we first present related work followed by the challenges and our approach to address these challenges.

2 RELATED WORK

Social agents for health coaching: Several virtual agents have already been developed in the healthcare domain to aid patients in understanding health information and making healthcare decisions [6]. In [22], Kristina, an ECA is developed to provide healthcare advice, assistance and act as social companions for the elderly. A virtual agent that assists patients with chronic pain and depression was developed in [17] and patients reported significant improvements in depressive symptoms, social support, and stress. An agent that was designed to provide social support for older adults showed high levels of acceptance and satisfaction in [20]. Researchers have also developed virtual agents focusing on specific domains like a meditation coach [16] to help users to relax through meditation; a diabetes coach to manage prescribed exercise, nutrition, monitoring blood glucose levels and medication adherence [14]; and an exercise advisor [4].

Persuasive social agents: Social conversational agents can be effective tools to persuade people to change their behaviour. Previous research has explored underlying factors, such as the effect that agent appearance [2], gender [3] and visual realism [23]. An early evaluation study [9] was conducted to observe the influence of *gender*, *status* (authoritative and peer), and *focus* employed by the agent i. e., *(i) user-directed:* persuading by addressing the user directly, and *(ii) vicarious:* persuading the user indirectly by engaging another agent in the discussion. Results showed that in general multiple agents were more persuasive than single agents, particularly when they employed the vicarious persuasive method. In addition to this, authoritative agents were shown to be more persuasive than peer agents in the study.

3 C1: INTEGRATING ARGUMENTATION SYSTEMS AND SOCIAL AGENT SYSTEMS

Challenges: The e-coaching that is to be provided by our platform will be based on formal models of reasoning and argumentation. Argumentation is a broad field spanning philosophy, linguistics and artificial intelligence [19]. The main challenge with using such models in an e-coaching context is that arguments need to be expressed in a natural, conversational style while also retaining the underlying formal logical model to allow for machine-based reasoning and evaluation.

Argumentation schemes [21] provide general patterns of reasoning for the construction and evaluation of types of everyday conversational arguments. A classic example, of particular relevance to health coaching, is Walton's *Argument from Expert Opinion* (AEO) scheme [21]. The general structure of AEO is: *Source E is an expert in subject field F containing proposition A*; and *E asserts that proposition A is true (false)*; therefore *A is true (false).* A series of *critical questions* allow applications of the scheme to be evaluated; AEO has six such questions, including *How credible is E as an expert source?* and *Is E an expert in the field F that A is in?*[1]. While the descriptions of argument schemes, and their associated critical questions, might seem quite formal, they in fact lend themselves well to a conversational style of reasoning that remains underpinned by sound logical models; for example, the statement *"Dr Jones suggests you should eat 2,500 calories per day"* encapsulates the essence of AEO: Dr Jones (the expert) is suggesting a course of action (an assertion in her field of expertise).

Our approach: Models of dialogue, in which two or more participants interact in a structured way, have formed a cornerstone of argument-based agent interaction [12]. The Dialogue Game Execution Platform (DGEP) and Dialogue Game Description Language (DGDL) allow users - human or virtual [18] - to engage in structured dialogues that follow a prescribed protocol [10]. Encoded within these protocols is the ability to use argumentation schemes in both a conversational and formal style: the former being presented to human users, the latter in generating the logical argumentative structure of the dialogue. From this structure, dialogue outcomes, such as who "won" an argument (in an adversarial dialogue) or which course of action should be taken can be determined using argument evaluation techniques [7].

4 C2: ADAPTING DELIVERY STYLES TO REASONING

Challenges: Once we have integrated the argumentation and social capabilities into the virtual coach, we have to take into account the differences between users. Hence, the second challenge is to adapt the presentation of an argument to the user by selecting an approach that is suitable for that type of user. That is, the argument needs to be presented in such a manner that the user is inclined to perform the desired behaviour. From behaviour change literature we know that users can be in different stages of change and that different approaches are effective for different stages [1, 15]. For example, users that are only contemplating to change their behaviour would require arguments that construct their belief that the behaviour is indeed healthy, while users in an *action* stage have moved beyond this, and would benefit more from concrete advice or suggestions. Even for the decision to present a trigger, the inclusion of a motivational component or a facilitating component could mean a difference in effect, depending on the user's level of motivation or ability [8].

Our approach: Our argumentative dialogue approach takes into account different *coaching strategies*. The selection of the coaching strategy that will be followed will depend on characteristics of the user, information about a user's health and activities derived from sensors, and a previous history of coaching interactions, stored in a knowledge base. This data may be used to trigger the argumentation module to pursue certain argument styles (e.g. peer pressure,

[1]The full set of critical questions for Argument from Expert Opinion can be found in [21]

motivational support, or expert authority), to make the arguments more specific (e.g. by mentioning explicitly how much the user moved last week), and so on. We also intend to utilize vicarious persuasion techniques in our approach, i.e., to let one agent present the information or arguments to another agent in the group with the aim of indirectly persuading the user. This technique was shown to be more persuasive among users when employed by a virtual agent over user-directed persuasion [9]. Adjusting the approach to the user also means that the delivery style and the nonverbal behaviour of the coaches need to be adjusted.

5 C3: MANAGING MULTIPLE PERSPECTIVES

Challenges: As we aim to leverage the opportunities inherent in a *group of multiple coaches* that work together, each with their own expertise, it is important to handle the interaction among the group of coaches and the user. Among these is the possibility of presenting the user with multiple, not necessarily convergent perspectives on the same problem. There are potential advantages to exposing, a conflict between different coaching perspectives. We believe that this may raise the user's awareness of their relations and (ir)reconcilability, and may deepen the user's understanding of the varied coaching advice that they receive. While argumentation provides techniques for managing and resolving conflict, applying them in a multi-party coaching context is not without challenges. Firstly, the question of exposing the user to conflict depends on how it affects the perceived level of trust in the group of virtual coaches by the user and their ability to persuade the user. Secondly, we need to decide what would be the most effective way to show and resolve conflicting information to help change the user's behaviour.

Our approach: One of the approaches for effectively presenting multiple perspectives, that can be conflicting, is development of a group conversation model that takes the level of group cohesion into consideration. Group cohesion describes the tendency of group members to share a bond, the attraction to stay together and the willingness to work together [5]. It is prominent when the main goal of the group is decision making or problem solving. We consider the task and social dimensions of group cohesion to model the shared commitment to group tasks and positive relationship with members respectively. This will help us to develop agents that will be able to present multiple perspectives, handle the differences in individual goals and perspectives, and work toward achieving the group goal.

6 CONCLUSIONS

We believe that showing complexities and conflicts of a health issue to users of an e-coaching tool can: help them to understand a complex issue and come to an informed decision or goal, and increase trust in a system by exposing complexities and making conflicts transparent to avoid oversimplification. We have discussed challenges and our proposed solution to develop a platform for multi-character, argumentation based, social conversational interaction with a group of virtual coaches that provide advice on health related issues. We plan to pursue the challenges mentioned via an open platform, and to make the resulting systems available to the community for further development.

ACKNOWLEDGMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant Agreement Number 769553. This result only reflects the authors' views and the EU is not responsible for any use that may be made of the information it contains.

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