Are you for real? A Negotiation Bot for Electronic Negotiations

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Are you for real?
A Negotiation Bot for Electronic Negotiations

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Abstract

Bots are autonomous software agents able to imitate human behaviour which makes them interesting for interactive processes such as electronic negotiations. In electronic negotiation training, humans often negotiate with negotiation software agents which respond quickly to the offers of the human participants. Currently, these agents are limited in their communication behaviour and thus restrain the effectiveness of electronic negotiation training. For an effective training, coherent and transparent communication processes are desirable, in which the agent takes up the human's arguments and provides their own reasonable arguments. Following the design science research methodology, we derive requirements and a meta-design for a negotiation bot to improve communication quality, and finally present our newly developed negotiation bot. The evaluation comparing the bot with an existing agent shows that although the bot sometimes provides unsuitable arguments, the bot imitates human behaviour well and ensures coherent communication processes. The bot can thus improve communication training for electronic negotiations.

Keywords: social bot, chatbot, communication quality, negotiation software agent, negotiation training, e-negotiations, design science research

1.0 Introduction

Negotiations are nowadays to a large extent electronic negotiations (e-negotiations) (Schoop et al., 2008). In times of the COVID-19 pandemic their importance increased. Individuals at the workplace are expected to gain the relevant skills for successful e-negotiations; to do so they need dedicated e-negotiation training. Such training often uses negotiation support systems (NSSs), which provide support for the inherent communication and decision-making tasks of negotiations (Melzer et al., 2012; Schmid et al., 2020). In e-negotiations, social cues such as gestures and mimics cannot be observed. Consequently, participants have to learn to read between the lines, to avoid misunderstandings and to build up a positive digital relationship with their partner (Köszegi and Kersten, 2003).
Negotiation software agents (NSAs) are frequently used as negotiation partners in e-negotiation trainings (Melzer et al., 2012; Schmid et al., 2020). Existing agents for human-agent negotiations follow a predefined negotiation strategy and underpin their offers with text messages, which are generated from a priori defined sentence templates that fit the current situation (Melzer et al., 2012; Vahidov et al., 2017). Whilst participants like the immediate feedback of such an NSA in contrast to a more time-consuming training with another human negotiation partner, the agent is also criticised for lacking real human communication behaviour (Schmid et al., 2020).

In the last years, individuals, business, and research have developed various types of bots for different purposes, e.g. chatbots for customer support, social bots to spread social media content, or conversational agents to support collaborative work (Bittner et al., 2019; Gorwa and Guilbeault, 2020). Bots often employ human-like behaviour (Varol et al., 2017). While early chatbots were developed for specific purposes, recent research has drawn attention towards creating more personalised messages (Thomaz et al., 2020; Bowden et al., 2019) and towards establishing social relationships between bots and humans (Przegalinska et al., 2019). Therefore, bots can provide opportunities for more realistic communication behaviour in e-negotiations.

Recent research in human-agent negotiations has focussed on the agent’s strategies in B2C settings (Vahidov et al., 2017; Vahidov et al., 2012) or on providing a motivating training experience for the human participants that enables the participants to experiment with different negotiation strategies and facilitates their skill acquisition (Schmid et al., 2020; Schmid, 2021). Less emphasis has been put on the communication behaviour of the agent. Therefore, this study focusses on improving negotiation software agent’s communicative abilities. Following the design science research methodology (Hevner et al., 2004), our research goal is to create a new software artefact that improves communication quality of NSAs and imitates human behaviour by using bot technology. This paper reports on the first design and a first evaluation of such a negotiation bot.

The remainder of the paper is structured as follows: In chapter two, we summarise a literature review on e-negotiations, communication quality and bots, providing the basis for the bot’s meta-requirements and meta-design in chapter three. Chapter four explains the artefact in detail and is followed by the results of the evaluation using interviews and surveys. Finally, we provide an overall discussion and a conclusion with areas for future research.
2.0 Theoretical Background

The following sections present the results of the literature review, providing the theoretical foundations for the artefact design.

2.1 Electronic Negotiations

In a negotiation at least two parties deal with interdependent tasks and continually engage in decision-making and communication tasks with the aim to settle a compromise (Bichler et al., 2003). Such negotiations are nowadays often conducted electronically via email (Schoop et al., 2008) or use dedicated NSSs providing the human negotiators with support for decision making, communication and conflict management (Schoop, 2010, 2020). NSSs were developed to find agreements of higher quality, to find agreements in faster time and to save transaction costs (Bichler et al., 2003).

A negotiation includes three important phases: the preparation phase, in which the parties define their goals and alternatives, a phase of intensive information and argument exchange to resolve problems and find possible solutions, and a final phase of settling on an agreement and implementing the deal (Lewicki et al., 2010). When multiple attributes are about to be negotiated, NSSs help the parties to assess their preferences in the preparation phase, i.e. the attributes importance and which values they prefer. Based on this information, decision support during the information exchange with the negotiation partner is provided by a utility value (typically ranging between 0 and 100%) that evaluates each offer (Schoop, 2010). This value also helps negotiators to assess their concessions while creating a new counteroffer.

Negotiations are a cognitive challenging and non-routine activity. Settling a good agreement requires negotiation skills for the decision making tasks such as preparedness, effectiveness, rationality, strategic behaviour (Lewicki et al., 2010). At the same time, skills for the communication tasks are required to implement negotiation strategies, resolve conflicts, and develop a mutual understanding. These communication tasks are reflected in the decisions that the negotiator undertakes (Schoop et al., 2014). E-negotiations impose additional burdens on the communication process, as gestures and mimics cannot be observed (Köszegi and Kersten, 2003), which can be a source of misunderstanding and ineffective communication.
2.2 Communication Quality in Negotiations

Communicative acts are analysed on three semiotic layers, i.e. syntactic, semantic, and pragmatic layer (Morris, 1938). The syntactical layer refers to the correct transmission of messages and is a necessary prerequisite for successful communication; the semantic layer refers to the joint interpretation of the message by sender and recipient; the pragmatic layer refers to the intention the sender has when making an utterance. Understanding an utterance means understanding all three layers (Schoop et al., 2010; Schoop, 2020).

Communication acts in negotiations can range from very simple statements to extensive multi-attribute offers about complex products or services (Schoop et al., 2010). Communication processes in negotiations can be considered as good when messages are associated with high levels of coherence and transparency, both parties evaluate the interaction positively and there are mutual efforts to resolve conflicts on all three semiotic levels (Schoop et al., 2010).

Communication quality therefore encompasses the three quality dimensions effectiveness, efficiency, and relationship. Effectiveness describes whether negotiators have reached a shared understanding of the task and situation, whether they have explored different alternatives, and whether the outcome of the negotiation is reasonable. Shared understanding requires the absence of misunderstanding on all three semiotic layers. Efficiency relates to the effort to achieve the shared understanding, i.e. mutual clarification efforts and conflict management. Efficiency can be improved by coherent utterances which refer to the negotiation partner’s previously stated utterances. Finally, the relationship dimension describes the negotiators’ ability to build and maintain trust and shared identities (Schoop et al., 2010). Relational aspects also manifest in the depth of the communication (Emmers-Sommer, 2004). This dimension is especially important for long-lasting business relationships. Schoop et al. (2010) provide an overview of possible methods and relevant constructs for assessing communication quality in negotiations.

2.3 Bots and Software Agents

Bots or software agents have been developed in various application domains and, therefore, a variety of terms emerged (Gorwa and Guilbeault, 2020). The distinction between bots and agents is not clear-cut and many definitions exist (Lebeuf et al., 2019). The term bot is an abbreviation for robot. Lebeuf et al. (2019) view bots as an
interface that connects users with a software service. In this sense, a social bot interacts with users on social media and produces or shares content in an autonomous manner (Ferrara et al., 2016). Chatbots are programs that sustain a conversation with a user by processing the user’s input and formulating a response, e.g. to provide customer support (Gorwa and Guilbeault, 2020). A broader term for chatbots are conversational agents (Bittner et al., 2019). An agent is defined as a computer system performing autonomous actions to meet its design objectives in its situated environment (Wooldridge, 1999). Therefore, bots can be viewed as agents, as they act autonomously to achieve an objective and are situated in a certain environment such as social media or other platforms.

In e-negotiation research, several attempts have been made to automate negotiation and auction processes (Braun et al., 2006). One such option are negotiation software agents: “A negotiation software agent (NSA) is software that is actively involved in a significant part of negotiations and makes decisions on behalf of its human or artificial principal” (Kersten and Lai, 2007, p. 557). An NSA may conduct the complete negotiation or selected negotiation activities (Jennings et al., 2001). As an example, the human principal may define the preferences and goals in the preparation phase, but the actual message exchange with the negotiation partner is performed by the NSA. Only a few NSAs support the generation of text messages (Vahidov et al., 2017; Melzer et al., 2012), while others primarily exchange offers without textual feedback (Braun et al., 2006).

Text messages of NSAs are generated using sentence templates (Vahidov et al., 2017; Melzer et al., 2012). However, NSAs employing such templates lack real human communication behaviour, e.g. they do not care about humans politeness and are not considered to be human-like (Schmid et al., 2020). In particular, they fail to take up the partner’s argument and instead argue for their position only. Similarly, the application domain of a chatbot is often task-specific, also uses templates (e.g. for answering questions, booking a flight), and allows for little “chit-chat” or human-friendly conversations (Bowden et al., 2019). More human-like communication behaviour can be achieved by using sophisticated techniques such as sentiment analysis, topic analysis, or summarization (Bowden et al., 2019). Recently developed and sophisticated bots imitating human behaviour provide a new opportunity to improve NSAs communication behaviour.
3.0 Explanatory Design Theory

Apart from specific artefact instantiations solving problems in an innovative way, design science research seeks to contribute to research by theorising about the design. The explanatory design theory (Baskerville and Pries-Heje, 2010) explains the internal structure of the artefact. It includes general requirements (i.e., meta-requirements) and their relationship to the corresponding components (i.e., the meta-design). Both provide generalised design knowledge for the class of negotiation bots and an abstraction from the concrete artefact instantiation. In this chapter, we derive the general requirements for a negotiation bot from the literature followed by the corresponding components to realise the requirements, before our concrete implementation is presented in chapter four.

Similar to existing NSAs, the bot should conduct activities in negotiations with multiple attributes on behalf of a human or artificial principal (Kersten and Lai, 2007). In particular, the bot should autonomously exchange offers with the negotiation partner and be able to settle on an agreement or leave the negotiation without a deal (requirement 1). To evaluate offers and conclude the negotiation, goals, aspiration levels, and reservation levels must be defined. Therefore, the bot must employ traditional decision support based on a utility function (Schoop, 2010), which is based on preferences and goals defined by the principal (requirement 2). For our negotiation bot, this is the only phase that is not yet performed autonomously and is beyond the scope of this project.

Resolving the negotiation conflict requires the choice of a strategy, which in general is either to maximize the negotiator’s own profit following a distributive strategy or to maximize the joint profit of all negotiators following an integrative strategy (Lewicki et al., 2010). The choice depends on the negotiation context; therefore, the bot should support different strategies (requirement 3). Given a certain negotiation context and the preferences for each negotiation attribute, the bot should be able to provide reasonable arguments for each attribute in an autonomous manner (requirement 4).

The bot must also ensure high communication quality (requirement 5). This requires establishing a communication process with the absence of misunderstanding on all three semiotic layers. Furthermore, the communication must be transparent, coherent, and facilitate the development of a relationship (Schoop et al., 2010). It also requires the prevention of identical arguments or phrases to be used repeatedly.
Communication behaviour is reflected by the decisions of a negotiator (Schoop et al., 2014). Furthermore, communication behaviour is closely linked to emotions (Filzmoser et al., 2016). Positive emotions in negotiation messages indicate a successful negotiation (Hine et al., 2009). They are further related to integrative behaviour, while negative emotions are related to distributive behaviour (Filzmoser et al., 2016). Therefore, the bot should also express emotions to emphasise its behaviour and strategy (requirement 6).

3.2 Components
In this section we will describe each component (C) implementing each of the previously presented requirements (R). The central component of a chatbot is often a dialogue manager, which handles the result of the natural language understanding process and coordinates all sub-tasks for natural language generation (Galitsky, 2019). In our setting, this dialogue manager (C1) ensures the autonomous exchange with the negotiation partner (R1) and the support of different negotiation strategies (R3). In addition, a decision support component (C2) is required to evaluate offers (R2) and generate new offers following the defined strategy (R3). Strategies can, for example, be time-dependent or behaviour-dependent reflecting the partner’s concessions (Faratin et al., 1998). Based on the bot’s configured strategy, the dialogue manager calls the decision support component, which generates a new proposal in terms of the selected values for each negotiation attribute.

The generated proposal then requires a textual message. To generate the arguments for the negotiation attribute(s) in question (R4), we need a web-based knowledge base (C3) (Galitsky, 2019). Our dialogue manager requests arguments from this knowledge base. In addition, arguments must fit to the negotiation topic (R4) and should ensure coherence (R5). Therefore, the retrieved arguments from the knowledge base must be checked by a quality and coherence evaluation component (C4).

Chatbots are often based on an event or rule-based component, which creates particular responses when such an event is triggered (Galitsky, 2019). An event component (C5) is also need in our context to generate additional text snippets as a reaction to the last offer of the negotiation partner. This event component supports different strategies (R3), ensures communication quality (R5), and represents emotions (R6). It ensures that negotiation to be terminated (with or without an agreement). Furthermore, for an integrative strategy it can provide an open and trustful information exchange about
one’s preferences, insert text snippets when an agreement for one attribute has been found, or provide utterances and emotions that help to establish a good relationship.

4.0  Artefact Design

We designed a new simplified and standalone NSS providing decision support and a structured message exchange with a negotiation bot to implement the requirements and components presented before. Users can simply register in the NSS and start a predefined negotiation or set up a new negotiation with the bot.

An example negotiation message received from the bot in our system can be seen in figure 1. The user received a counteroffer. The generated text message of the counteroffer is displayed on the left, the user’s utility value of the offer and the selected values for the negotiation attributes are displayed on the right. We will now describe the generation of such a negotiation message.

![Screenshot of a Received Message.](image)
The overall workflow for the negotiation message creation is shown in figure 2. The central component is the dialogue manager called BotMsgBuilder in the middle. Based on the strategy and preferences defined by the principal, the offer received from the partner is evaluated and a new proposal (i.e., selected values for the negotiation attributes) is generated.

In a second step, arguments against the partner’s offer and for the new counteroffer in the bot’s proposal are needed. No argument for a value is needed when the partners have already agreed on it. For each of the values arguments are retrieved via a Rest API from the argument search engines args.me and ArgumenText. While args.me developed by Wachsmuth et al. (2017) uses arguments from debate portals, ArgumenText by Stab et al. (2018) retrieves its arguments from various web documents. Therefore, our knowledge base is internet-based and can support arbitrary negotiation topics. Both APIs deliver a set of arguments and provide an evaluation score for each argument.

![Workflow for the Creation of a Negotiation Message](image)

**Figure 2.**  **Workflow for the Creation of a Negotiation Message.**

In the next step, these arguments are evaluated by our argument evaluation component. First, a context evaluation is performed based on the negotiation context, i.e., the negotiation description and the negotiation attributes and values. Using the Levenshtein algorithm implemented in Apache Lucene, summarisation is performed and a score is computed that indicates the extent to which an argument conforms with the negotiation context. Second, a machine learning (ML) evaluation is performed to evaluate the
argument’s syntax and typical structure. We implemented the ML evaluation using the Weka library (University of Waikato, 2020) and a Naive Bayes classifier. ML training data included negotiation descriptions, attributes and values, and arguments. The arguments in the training data were evaluated as good or bad arguments by the researchers. Last, a coherence evaluation is performed to ensure the argument references the user’s last message. Keywords from the last user message and from the arguments are extracted using Apache Lucene. Therefore, the coherence evaluation computes a score indicating the similarity between each argument and the last user message is computed. Finally, a score for each argument is generated based on the three modules of our evaluation component and the quality score by the argument APIs. The coherence evaluation has a weighting of 0.35, while the sum of the other argument evaluations contributes by 0.65 to the final score. The sum of the other argument evaluations includes the score of the API multiplied by 0.3, the ML score multiplied by 0.7, and the criteria evaluation multiplied by 0.1. The resulting two best and two worst evaluated arguments of the overall evaluation are added as new machine learning training data.

In parallel to the argument generation, the event component is called by the BotMsgBuilder. Different events can be triggered depending on the bot’s strategy, the last text message of the user, the concessions made by the user, and the overall negotiation progress. As an example, the NegotiationStartEvent is triggered when the bot writes its first message and generates text phrases to welcome the negotiation partner. The IntegrativeNegotiationStartEvent is additionally triggered when the bot follows an integrative strategy, resulting in an open and trustful exchange of important negotiation attributes. The RudeWordEvent analyses the user’s text message and searches for rude words. If such words are found, the bot behaves reservedly and insists on its last offer. The NoConcessionEvent is triggered when at least two user messages have been received and the user did not concede. Therefore, the bot warns the user and can abort the negotiation if the user’s concession behaviour does not change. Several other events are available too and more events and triggers can be added. Finally, the BotMsgBuilder receives a list of evaluated arguments as well as different text phrases and reactions by the event component. The BotMsgBuilder either chooses the generated proposal or – when certain events were triggered – insists on its last offer or aborts the negotiation. If the proposal is chosen, the BotMsgBuilder ensures that the arguments have not been used before and choses the best evaluated arguments.
Additionally, the different text phrases from the event component are included in the text message.

5.0 Evaluation

To evaluate our bot, we conducted a negotiation experiment in September 2020 and compared it with an existing NSA. The Tactical Negotiation Trainer (TNT) by Melzer et al. (2012) is an NSA currently used in e-negotiation training (Schmid et al., 2020) and, therefore, utilised for comparison with the bot. The TNT is part of the Negoisst system, which is the most sophisticated NSS integrating communication support, decision support, and contract management (Schoop, 2010, 2020).

Due to the pandemic and expected difficulties in finding sufficient participants for a between-subjects evaluation design, we opted for a within-subject design. Each participant negotiated twice about the same negotiation case, once with our bot and once with the TNT. First, participants were shortly introduced to the system before they started negotiating. We applied counterbalancing for the sequence of treatments (Greenwald, 1976) to avoid potential biases when every participant would start with the bot first. Therefore, half of them started negotiating with the bot, while the others started with the TNT first (see figure 3). All negotiations were conducted via Negoisst to rule out any bias regarding the user interface. Therefore, messages in the bot negotiations were manually copy-pasted from our new system in Negoisst. The TNT and the bot required about three minutes to send a reply. Both followed the tit-for-tat strategy, which mirrors the concessions of the human negotiation partner (Faratin et al., 1998).

After each negotiation, the participant had to fill in a survey assessing the communication quality and we conducted a short interview. 14 students participated in the evaluation.

Figure 3. Evaluation Procedure.
5.1 Survey Results

The survey assessed different suggested constructs of the effectiveness, efficiency, and relationship dimensions for communication quality (Schoop et al., 2010). All items can be found in the appendix and were assessed using a 5-point Likert scale from “Strongly disagree (1)” to “Strongly agree (5)”. The data was analysed using IBM SPSS Statistics 27. We used the Wilcoxon signed-rank test to compare the scores from the two related samples (Field, 2018). The medians, means, standard deviations (SDs) and the test statistics for each construct are displayed in table 1.

Regarding the effectiveness dimension, the participants observed fewer syntactical errors in the messages of the TNT than the ones by the bot, resulting in a significant difference (p = .039) and a medium effect (r = -.39). However, shared understanding was on average rated a little higher in negotiations with the bot. The efficiency dimension was operationalised by coherence, transparency, conflict management, and participants’ general feeling about the process. All variables are almost equally rated for the TNT and the bot. Only conflict management is on average rated a little better for the bot than for the TNT, but still insignificant. The relationship dimension was operationalised by the depth of communication and the feelings about the relationship. The latter variable was rated almost similar, whereas depth of communication evaluation shows slightly better but insignificant results for the bot.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Bot</th>
<th>TNT</th>
<th>Test statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Median</td>
<td>Mean</td>
<td>Median</td>
</tr>
<tr>
<td></td>
<td>(SD)</td>
<td>(SD)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Syntax</td>
<td>4.00</td>
<td>3.86</td>
<td>5.00</td>
</tr>
<tr>
<td>Shared Understanding</td>
<td>3.67</td>
<td>3.71</td>
<td>3.67</td>
</tr>
<tr>
<td>Coherence</td>
<td>3.33</td>
<td>3.45</td>
<td>3.33</td>
</tr>
<tr>
<td>Transparency</td>
<td>3.75</td>
<td>3.82</td>
<td>3.75</td>
</tr>
<tr>
<td>Conflict management</td>
<td>3.50</td>
<td>3.52</td>
<td>3.25</td>
</tr>
<tr>
<td>Feelings about the process</td>
<td>3.50</td>
<td>3.64</td>
<td>3.75</td>
</tr>
<tr>
<td>Depth of communication</td>
<td>3.50</td>
<td>3.32</td>
<td>3.00</td>
</tr>
<tr>
<td>Feelings about the relation</td>
<td>3.50</td>
<td>3.52</td>
<td>3.38</td>
</tr>
</tbody>
</table>

Table 1. Survey Results for the Communication Quality.
### 5.2 Interview Results

In each interview the participants were asked about the atmosphere, the shared understanding, reactions of their partner and what they liked or disliked in general during the negotiation about their partner. Finally, they were asked whether their partner was a human negotiator.

Overall, participants in both negotiations rated the atmosphere as relaxed. Two participants considered the TNT to behave impersonal. The majority did not face any misunderstanding with their partner. The others criticised both agents’ strategies and two considered the communication behaviour of the TNT to be unsuitable for the offers sent. On the one hand, a few criticised that both agents’ messages did not pick up their arguments and positions. On the other hand, more participants liked the bot referring to their previously sent messages.

Regarding mutual clarification efforts, four criticised the TNT for missing arguments. Three participants criticised the bot for unsuitable arguments, while another three participants explicitly liked the bot’s argumentation behaviour. As a result of the arguments exchanged and the clarification efforts, seven participants were satisfied with their negotiation outcome with the bot, while only four were satisfied with their outcome with the TNT. Finally, seven of the participants (six of whom started with the TNT first) thought they negotiated with a human when they were in fact negotiating with the bot, while only two thought the TNT was a human.

### 6.0 Discussion

Our research goal is to design a bot to improve the communication quality compared to current NSAs and to imitate human communication behaviour. The bot’s text messages are created using two web-based argument search APIs, evaluating these retrieved arguments regarding negotiation context and their reference to the last user message, and an additional event system that triggers events depending on the bot’s strategy, the negotiation process, the user’s text message and/or the user’s concessions.

The evaluation using surveys and comparing the bot with the TNT (Melzer et al., 2012) reveals that the bot has still some problems regarding correct spelling and grammar. This might be a result of the arguments retrieved from the web. Regarding the efficiency dimension of communication quality, the results show slightly better conflict
management of the bot than for the TNT. The depth of communication for the relationship dimension is also slightly better evaluated for the bot.

The following more in-depth interviews show additional weaknesses and strengths: Overall, more participants were satisfied with the bot’s reference to their last message, but some also criticised missing references. Our coherence evaluation is quite similar to the one of existing debate bots (Rakshit et al., 2019), but ensuring coherent communication remains a challenging task and more sophisticated summarisation or topic analysis algorithms might be evaluated (Bowden et al., 2019). Several participants liked the bot’s argumentation behaviour, while a few criticised unsuitable arguments. Unrelated or wrong arguments impede good communication quality at all three dimensions (Schoop et al., 2010) and might explain the mixed picture of the survey results. Interestingly, although the participants observed more grammar and spelling mistakes for the bot, it is perceived as a human negotiator by more participants compared to the TNT. This perception might be caused by the bot’s argumentation behaviour and by relying less on sentence templates than the TNT.

In addition to the artefact itself, our contribution includes the meta-requirements for a negotiation bot derived from the literature and the corresponding meta-design presented in chapter three. From this perspective, the bot’s greatest advantage compared to existing NSAs (Melzer et al., 2012; Vahidov et al., 2017) is that it does not require large amounts of sentence templates. In fact, only a few sentence templates for the different events are needed, while the bot is able to provide reasonable arguments for different negotiation topics and attributes using the two web-based argument search APIs (Stab et al., 2018; Wachsmuth et al., 2017). Furthermore, the bot can pursue different negotiation strategies and further events can be added to respond adequately to a user’s message.

Based on our findings, we conclude that we have successfully shown the potential of a negotiation bot to improve communication behaviour and to imitate human behaviour. The interview results are encouraging and show that the bot improves coherence and provides arguments supporting its offer and counterarguments for the human’s last offer. However, this study presents only a first design and evaluation of such a bot, revealing that improvements are still possible and further refinements in the design are necessary. Similar to other NSAs, it provides almost synchronous responses. However, such NSAs were recently criticised regarding their communication behaviour (Schmid et al., 2020). The bot’s improved communication behaviour paves the way for a holistic
e-negotiation training to facilitate the development of communication and decision-making skills. Adequate responses and personalisation of bot messages are also one of the major challenges in domains such as marketing (Thomaz et al., 2020) and technological advancements in these areas may further help to improve our negotiation bots. In the long term, such a bot may be used in standardised or recurring B2C negotiations (Vahidov et al., 2012), but may require a different knowledge base for argument retrieval.

Our study and the artefact have some limitations: First, the bot relies on the argument APIs which of course only include real-world arguments. Fictional negotiation cases such as the ones in Kaya et al. (2017) and many other negotiation studies cannot be supported. The bot’s argumentation is limited to negotiation issues with concrete values (such as the programming language in figure 1). Additional sentence templates and other argument retrieval methods are necessary to argue for other issues such as a price or a salary within a continual range. Furthermore, like other agents the bot cannot be convinced by better arguments to revise its position or adapt to new information exchanged (Braun et al., 2006). Last, the quantitative and qualitative evaluation is based on a within-subject study. More participants in a randomised between-subject study might improve and further validate the findings.

7.0 Conclusion & Outlook

Bots are a promising but also potentially damaging technology that imitate human behaviour. As current negotiation software agents are limited in their ability to imitate human communication behaviour (Schmid et al., 2020), we have designed a new bot for multi-attribute negotiations. Especially, we focused on providing reasonable arguments and ensuring a coherent communication process. Our survey evaluation shows that the bot can still be improved, e.g. making fewer (or ideally none at all) syntactical mistakes. The interview results partly support that a coherent communication process with reasonable arguments was achieved. Furthermore, more participants considered the bot to be a human negotiator compared to the existing agent. The bot could, therefore, be used in e-negotiation training to improve the communication skills of human participants. Such a bot may also be suitable for standardised B2C negotiations (Vahidov et al., 2012).
The current research project calls for future research directions. Other algorithms or ML approaches should be tested to provide suitable and good arguments. Based on sentiment analysis (Körner, 2019), further event triggers can be added to respond adequately to a user’s utterances. Different strategies of the bot as investigated e.g. in Vahidov et al. (2017) can be further aligned through the events with the utterances of the bot. Consequently, a large experiment with different bot implementations may be conducted, which also includes transcript or content analysis of the messages (Schoop et al., 2010). An additional comparison with all human negotiations will further reveal the differences between the behaviour of the bot and of the humans.

References


**Appendix**

<table>
<thead>
<tr>
<th>Variable</th>
<th>#</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syntax</td>
<td>1</td>
<td>The messages of my negotiation partner included several spelling and grammar mistakes. (R)</td>
</tr>
<tr>
<td>Shared Understanding (derived from Schoop et al. (2010))</td>
<td>1</td>
<td>The final negotiation outcome is reasonable to me.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The fundamental conflict became apparent to me during the communication with my negotiation partner.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>During the negotiation, many different alternatives have been discussed.</td>
</tr>
<tr>
<td>Coherence (adapted from Duckek (2010))</td>
<td>1</td>
<td>My negotiation partner referred to my arguments.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The messages exchanged between me and my negotiation partner did not follow a coherent communication process. (R)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>My negotiation partner’s textual reply to my prior message was plausible.</td>
</tr>
<tr>
<td>Transparency (derived from Garcia (2002))</td>
<td>1</td>
<td>The views and positions of my negotiation partner became clear to me.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The most important goals of my negotiation partner became clear to me.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>My negotiation partner’s argumentation was comprehensible.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>My negotiation partner’s utterances helped me to understand my partner’s goals.</td>
</tr>
<tr>
<td>Conflict Management (derived from Schoop et al. (2010))</td>
<td>1</td>
<td>My negotiation partner actively contributed to the conflict resolution.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Me and my negotiation partner were both actively engaged to resolve conflicts.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Conflicts between me and my negotiation partner were resolved.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>The communication with my negotiation partner helped to resolve our conflicts.</td>
</tr>
<tr>
<td>Feelings about the process (adapted from Curhan et al. (2006))</td>
<td>1</td>
<td>My negotiation partner listened to my concerns.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The negotiation process was fair.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>The effort to settle on an agreement was satisfying.</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>My negotiation partner considered my wishes.</td>
</tr>
<tr>
<td>Depth of communication (adapted from Emmers-Sommer (2004))</td>
<td>1</td>
<td>Me and my negotiation partner had an in-depth communication.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>The communication with my negotiation partner was superficial. (R)</td>
</tr>
<tr>
<td>Feelings about the relationship (adapted from Curhan et al. (2006))</td>
<td>1</td>
<td>My negotiation partner made a positive impression on me.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>I am satisfied with the relationship with my negotiation partner that results from this negotiation.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>The negotiation did not build a good foundation for a future relationship with my negotiation partner. (R)</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>My negotiation partner trusted me.</td>
</tr>
</tbody>
</table>

Table 2. Survey Items.

*Notes: All items were presented in a different language to the participants and were carefully translated into English for this paper. Items with (R) are reversed items.*