

Business-Driven Negotiation Strategies for Proactive Embodied Conversational Agents in E-Commerce

Sameh Abdel-Naby Maxime Morge Bruno Beaufiles
sameh.abdel-naby@lifl.fr maxime.morge@lifl.fr bruno.beaufils@lifl.fr

Laboratoire d'Informatique Fondamentale de Lille
Université des Sciences et Technologies de Lille
59655 Villeneuve d'ascq cédex – France

Abstract

A considerable number of the research conducted in the area of Software Agents focus on the enhancement and the proper provision of online Embodied Conversational Agents (ECAs). However, the ability of these agents to transform an ordinary visitor of an e-commerce who needs assistance to an actual buyer is yet of no notable weight. In this paper, we adopt a sell-based approach for online customer service, so that the conversational agent is proactive since he initiates an offer without waiting for assistance requests. We introduce new negotiation strategies for embodied conversational agents which reflect real-life sales approaches, such as bundling two or more items into one deal, or providing a promotion on a certain item for a certain time, or the commonly used value-added sales.

Keywords: Embodied Conversational Agents, Negotiation, E-Commerce.

1 Introduction

Within the last twelve years e-commerce has succeeded to pursue a massive number of shoppers to change their idea of buying [5]. Several existing businesses have taken an advantage of this boom by adding a virtual presence to their physical one by means of an e-commerce website, moreover, new companies that exist only through the web have also appeared, *bricks and clicks* businesses, (e.g., Amazon). Although the online presence of companies is cost-efficient, yet the lack of a persuading salesman affects the transformation ratio (sales vs. visits). Then, several companies have started to embody a virtual assistant to aid potential online shoppers.

In Computer Science, several research efforts were made to study, analyze, and better shape the processes of assisting customers while being present in an e-commerce space [8]. In Artificial Intelligence, a considerable amount of the research conducted in the area of Software Agents [14] focus on the enhancement and the proper provision of online Embodied Conversational Agents (ECAs) [3].

Whether these agents sell, assist, or just recommend, it is now clear that such autonomous

agents are capable of engaging in verbal and non-verbal dialogues with e-commerce's customers. However, the ability of these agents to transform an ordinary visitor of an e-commerce who needs assistance to an actual buyer is yet of no notable weight.

In the context of ECA, we adopt a sell-based approach for online customer service, so that the conversational agent is proactive since he initiates an offer without waiting for assistance requests. Among several other advantages, making an agent proactive is necessary when it is important for the concerned online seller to maximize their benefits by driving specific conversations to certain goals. For example, turning a normal assistance dialogue to a sale or a proper product recommendation.

However, since most of the currently available ECAs are designed to ask questions and wait for answers, one of the major challenges we are facing these days is about the reversibility of the current options. Meaning, to reach a proper ECA proactivity / sales attitude, the questions an agent should ask to collect sales data should be placed in nowadays agents' answers, and the vice-versa. Consequently, for the ECAs of existing literature; the current design approach of agents' answers generation mechanism must be adjusted for a conversational agent who is in the process of asking questions too (proactive) and not just giving answers.

In addition, since the existing negotiation strategies for software agents are not adapted, we get inspiration from marketing literature in order to provide selling strategies for an ECA to convince a (human) buyer to buy a product or bundled products in one conversation.

This paper is structured as follows. Section 2 gives a formal description of the context we expect our negotiation strategies to be employed within. In section 3 we introduce the business-driven negotiation strategies. Section 4 gives an overview of the related research efforts. We then

conclude this paper and provide a summary of our future work in section 5.

2 The Online Negotiation Context

We assume in this paper that an e-commerce website is representing a specific company or a group of united companies. For each company, or a union of companies, there is a set of **Products** wherein each of its elements represents one sellable item; **Products** = $\{p_1, \dots, p_n\}$. We also refer to all of the companies represented online by means of an e-commerce websites as a set **Companies** = $\{c_1, \dots, c_k\}$. The total number of potential buyers that each may acquire an item $p \in \mathbf{Products}$ can also be referred to as the set **Surfers**.

Since an online buyer's visit to a specific website refers to his willingness to eventually acquire an item, then the interaction involving this buyer, the provisioning company, and the list of available products is a negotiation session. In the context of our research, we formally represent an **Online Negotiation Session (ONS)** as a tuple,

$$\langle T, s, Products, Companies \rangle$$

where

- T is the specific time a buyer started to browse the concerned website;
- s is the potential buyer, $s \in \mathbf{Surfers}$;
- $Products$ is the set of items a buyer is showing interest in.
- $Companies$ is the set of product provisioning entities, (e.g., the product manufacturer and its delivery partner).

Figure 1 shows a possible online negotiation session that is traditionally found in e-commerce websites that has no embodied conversational agents assisting or selling to potential buyers - *surfers*. From the set **Companies** we show a possible union between two companies, (e.g., a retailer and a delivery service company), which is likely to happen online. In the situation depicted in the same figure, we show that the entire negotiation is linked to a single product $p \in Products$, but in real-life situation, the shopping-cart may include multiple products, which is the dotted line linking two Ps. However, the potential buyer is commonly one.

However, the recent involvement of ECAs in most of the current online interactions between

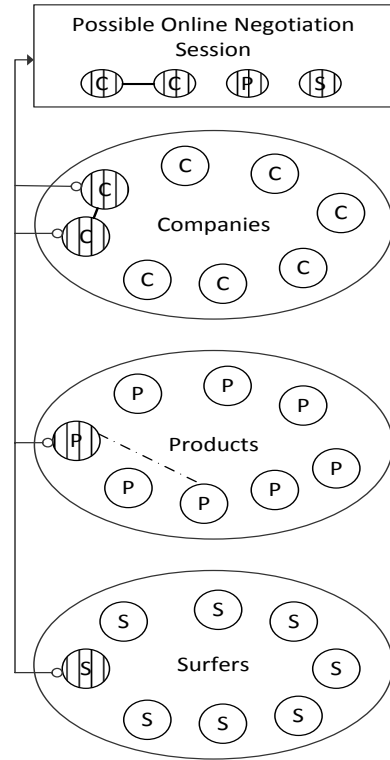


Figure 1: Possible Online Negotiation Session Involving Two United Companies

potential online buyers and companies' websites has made it clear that a mediator could exist. The existence of this mediator will lead us to widening the dimensions of the Online Negotiation Process (ONP) to also include this mediating agent.

Assuming that all mediating agents belong to the set **Agents**, we then formally represent the Mediated Online Negotiation Session (MONS) as a tuple

$$\langle T, a, s, Products, Companies \rangle$$

where,

- $\langle T, s, Products, Companies \rangle$ is an ONS as defined previously;
- a is the agent, $a \in \mathbf{Agents}$, mediating between $s \in \mathbf{Surfers}$ and one or more of **Companies**.

In figure 2, we show a possible online negotiation session while an ECA is mediating in-between the sellers and the buyers. Different from figure 1, in this figure we assume that one company of the set **Companies** is attempting to sell $\{p_1, p_2, p_3\} \in \mathbf{Products}$, therefore,

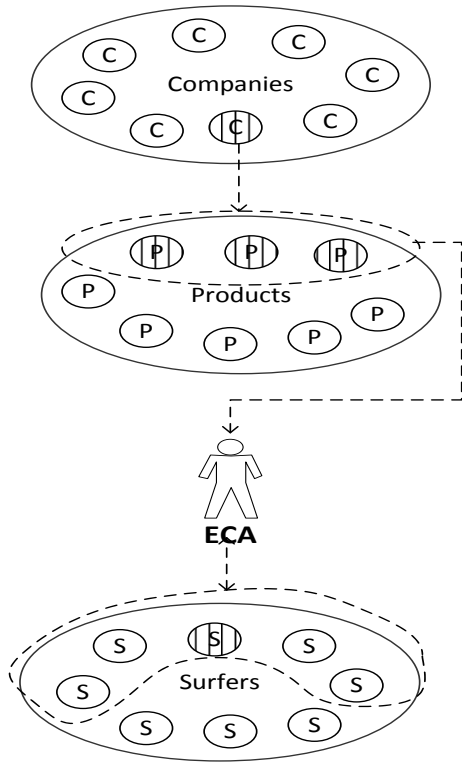


Figure 2: ECA Mediating in Possible Online Negotiation Session

$c \in \mathbf{Companies}$ is also delivering what it offers to online surfers.

Following the depictions of figure 2, the ECA is delegated by the company to sell or assist on a specific set of products online surfers are expected to show interest in. Therefore, the involvement of an ECA in any online negotiation session is always optional, depending on surfer's willingness to rely on a virtual assistant or seller, and whether the e-business imposes certain regulations to push online sales.

3 Negotiation Strategies

In this section, we introduce three different business-driven strategies for an ECA to convince a potential online buyer - *surfer* - to take a certain action, (e.g., buy). We start by the Bundling Strategy, and then the Promotion Strategy, and at the end we introduce the Value-Added Strategy.

3.1 The Bundling Strategy

Finding the best strategy to bundle a product is an attractive research issue that is being tack-

led by many scholars from different fields. For example, from economics we see some studies linking Product Bundling to market monopoly and other challenges in [1]. From computer Science, we see scholars relating the diversity of online shopping behaviors to the available bundling strategies in [15].

In the context of our research, we consider bundling as the action taken by a mediating entity to combine a set of products in order to facilitate reaching an agreement between two conflicting parties.

For example, considering a commonly encountered *ONS* that includes an e-commerce company called Taxilux, which is using DKL, as sub-company for delivering its products to the online shoppers. And, a surfer John that is showing an interest in a Leather Shoe. Therefore, this *ONS* will look similar to,

$$\langle T, John, LeatherShoe, \{Taxilux, DKL\} \rangle$$

In the above example, the involvement of a mediating entity - *ECA* - between the website's surfer John and Taxilux may make it possible to convert John's interest in the Leather Shoe to an actual buying desire. Assuming that *ECA*'s approach here to finalizing this trade will be *Bundling*, then this *MONS - Mediated Online Negotiation Session* - will have {Leather Shoe, Green Socks, Delivery} in its *Products* set. Assuming that the Delivery Service have an actual cost, the *ECA* here have combined three different products into one bundle.

In our research, we consider it possible for an *ECA* to apply a bundling approach in a specific situation under two conditions. These conditions are:

- If bundling a product p_1 with p_2 of *Products* will make it possible to acquire any $p \in \mathbf{Products}$ for no cost.

For example, assuming that it is a company's business rule to grant their online shoppers a free delivery if their total amount exceeds 10€, and the *ECA* is designed to handle such rule, in figure 3, *relation C* reflects this condition. Here, the *ECA* is combining the Shoe and the Socks so that John can qualify for a free delivery.

- If combining two or more products of the set *Products* will decrease the cost of buying at least one of them separately.

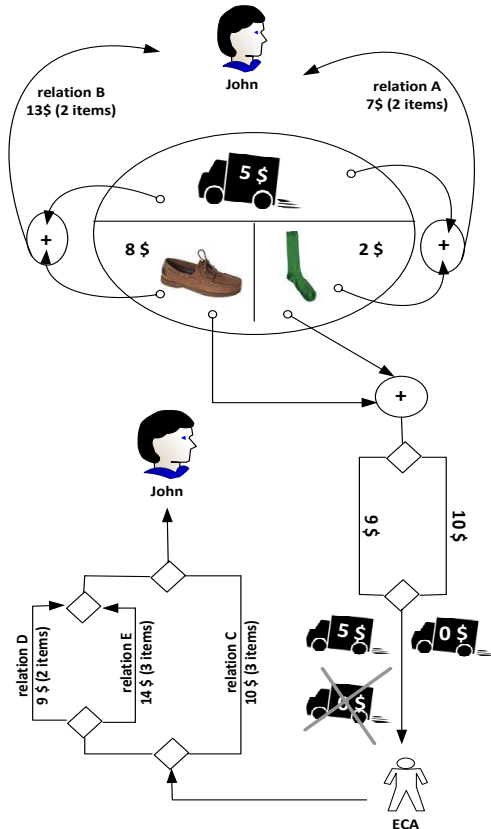


Figure 3: ECA and the use of bundling to generate new business offers

For example, in *relation D* of figure 3 the shoe can cost less than 8€ if it gets bundled with the socks. The reason some of the companies are relying on this approach goes back to the fact that the total net profit of the bundled items can be higher than selling each separately, even after applying a slight discount on one of them.

From figure 3 we can observe that the bundling option for the Embodied Conversational Agent (ECA) of this example have made it possible to generate three different offers for John, which may also lead to three different negotiation session and increase the sales potentiality. Although some of the generated bundling offers are not mutually beneficial, (i.e., *relation E*), yet an ECA can be designed to take advantage of such situations to generate as much profit as possible for the e-business and its partners only.

3.2 The Promotion Strategy

In real-life trading situations, it is quite common to walk into a store and find plenty of promotions on a range of products or services, (e.g., 5-

Year warranty on all TVs). Promoting a specific product takes place according to several business circumstances, which some of them can be:

1. the unexpected delay in selling a particular set of products with respect to the cost of their storage;
2. the sudden change of agreements made with business partners, (e.g., courier or maintenance companies), which will be allowing possible business extensions that did not exist earlier;
3. the necessity to increase the cash flow of the offering company in particular timeframe.

In our research, we look at product promotion as the action taken by a mediating entity to discount a certain product with respect to predefined condition in order to persuade a buyer's decision to conclude a specific deal.

For example, assuming that **KEX** is an electrodomestics retailer that is having a deal with **Philcos - TV manufacturer** - to receive 100 sets every month for 10% discount per set. Since the TV market was not that alive in this specific month, **KEX** have decided to give a 5% discount on **Philcos** TVs for buyers of this month. In such situation, all involved parties are benefiting from the promotion since the buyer is taking 5% off, **KEX** is making 5% less of their profit but still there is a profit, and **Philcos** keep on manufacturing its TVs.

Online, an example like the above will be happening on the e-commerce website of **KEX** through banners that advertise such promotion, or newsletters, and then it is up to surfers of this website to chose whether to click on the banner or no. Therefore, an Online Negotiation Session (ONS) for such commonly encountered situation will look similar to,

$$\langle T, Bill, TV, \{KEX, Philcos, DKL\} \rangle$$

However, involving an ECA into the above **ONS** will make the **Products** set increase according to the value previously defined by **KEX** to push this certain product into the market. Therefore, the newly emerged **MONS** will have {TV, -5%} in its set of **Products**.

In order for us to introduce the condition under which an ECA would apply the promotion negotiation strategy, we will first give a brief explanation on how a product price is calculated. Considering the fact that for each item of the set

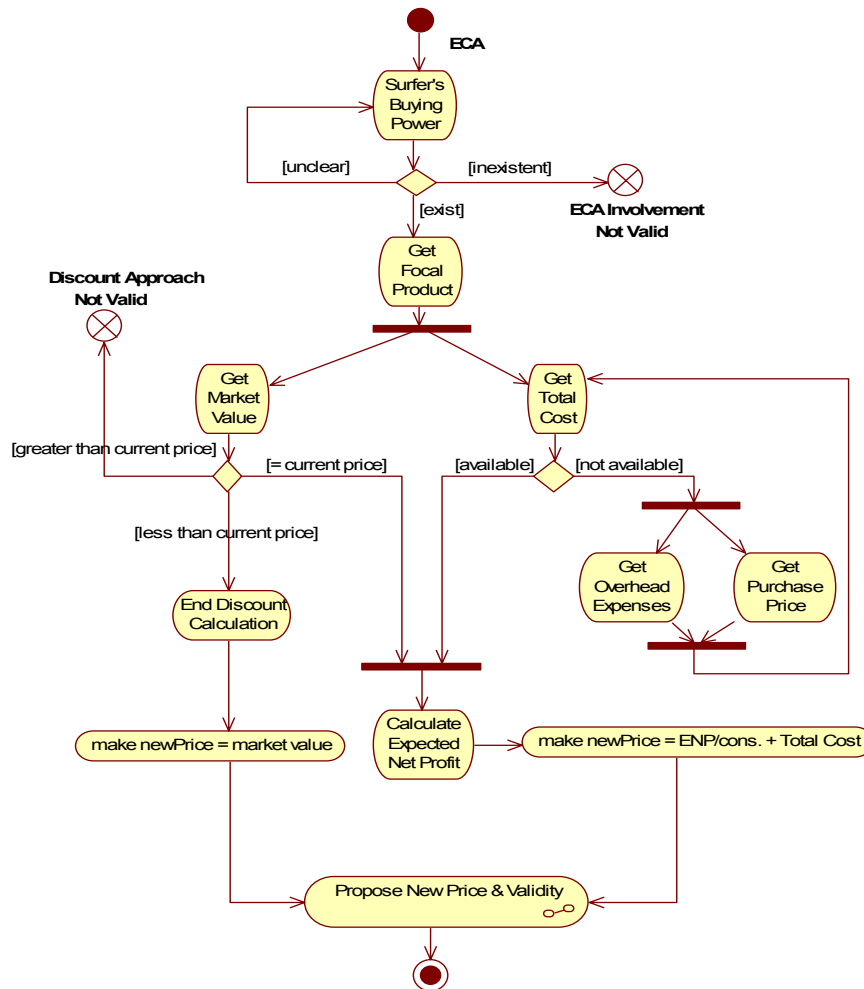


Figure 4: ECA's activities to obtain a new promotional price for a potential buyer

Products of any company there must be a *Market Value* and an *Estimated Overhead Expenses*.

In our research, we look at *market value* as the maximum price given by a company to a product without exceeding the price of buying the same product or similar from competitors. And, in our research, we look at a product's *estimated overhead expenses* as the average cost of all hidden services that are made by the seller in order to prepare an offer to a potential buyer.

For example, the market value of a used BMW X5 cannot exceed or equal the price of buying a new one and, the price of a new BMW X5 cannot also be very much far from the price of similar cars offered by competitors.

We then consider that a *Product Price* is defined by summing the actual purchase price, estimated overhead expenses per unit, and the desired net profit. Therefore, a product discount is valid if the discounted price is less than the *mar-*

ket value and greater than or equal to the total sum of the *actual purchase price* and *estimated overhead expenses*.

In figure 4, using a UML activity diagram we summarize the steps we expect an ECA to take in order to examine the possibility to obtain a product promotion, (i.e., a discount), for a potential buyer. Assuming that an external function exists, (e.g., a triggering engine), that is responsible of calculating the buying power - *potentiality to purchase* - of a surfer according to his/her behavior through a specific e-business. Once a sufficient buying power regarding a specific product is observed by this triggering engine, it is now the ECA turn to approach the potential buyer.

As long as the buying power of a certain product is *inexistent* or *unclear*, (i.e., less than a predefined rate), there will be no need for the ECA to approach the surfer. Eventually, the ECA will start calculating the new promo-

tional price by retrieving the *Market Value* and the *Total Cost* of the focal product. For example, the market value of $p_1 \in Products$ equals to 20€ since it is the maximum price a buyer can find for it in the market. And 10€ is the actual total cost of p_1 after summing its purchasing cost to its estimated overhead expenses, (i.e., delivery, storage, ... etc).

During the ECA's retrieval process of the market value a brief sub-operation is expected to occur in order to position the Current Price of p_1 with respect to competitors. If the current price is greater than market value, we then assume that it will be feasible for the ECA to make the new price of p_1 equal to the current market value. And, if the current price of p_1 is less than its market value the overall Promotion Strategy will not be of great use since higher prices elsewhere will auto-promote it.

However, if the market value of the concerned product is equal to its current price, then it is still valid for an ECA to apply this strategy. Following to that, a step wherein the **Expected Net Profit (ENP)** is calculated by retrieving the difference between p_1 's market value - *also current price in this case* - and its actual total cost.

Here, the `newPrice` will then be the ENP divided by a **constant** value - *defined by each company separately* - and then added to the total cost. For example, assuming that p_1 's market value is equal to its current price that is 20€, and its actual total cost is equal to 10€, then p_1 's ENP is equal to 10€.

Further on, assuming that KEX has its own business rule which says that ECAs can deduct 50% of a product's profit to generate its promotional price, then the constant will be equal to 2. Therefore, as an example, the equation allowing the ECA here to generate a `newPrice` for p_1 will be: $10/2 + 10$, that is 15 €.

3.3 The Value-added Strategy

In [11], Reilly presents the value-added sales as an approach a seller may employ to be proactive while negotiating a deal. Reilly also confirms the confusion found in literature when it comes to defining value-added sales in general. However, it is commonly found that buyers perceive value-added items as those acquired for free on top of their purchases. On the other hand, sellers whether they are service providers or retailers, a value-added item for them must have low

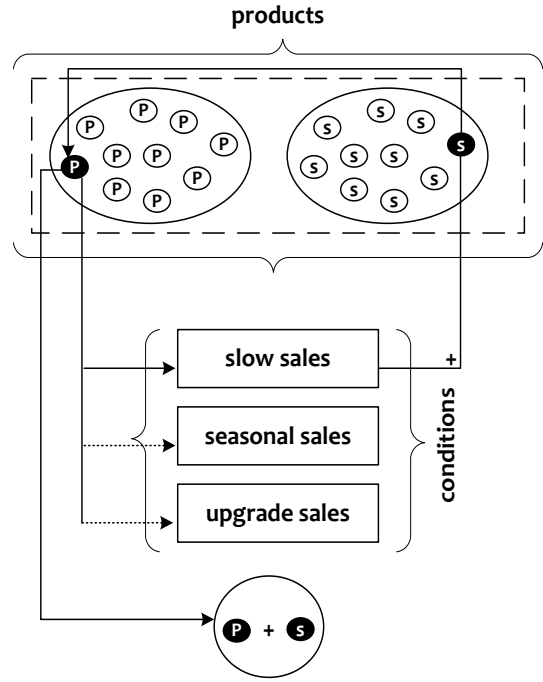


Figure 5: A value-added sale: products, conditions and services.

cost and low profit, and once attached to another item with greater profit both are then better sold to customers or pushed to market.

For example, a free memory card on top of any purchased digital camera is a value-added item. However, when the cost of this card is covered by the profit generated from selling the camera itself it is then looked at as a marketing strategy. Discounting the price of the camera itself is another marketing strategy that does not involve any value-added services but lead to the same goal.

In our research, an agent's decision whether to make use of the value-added sales approach or not is linked to the validity of at least one of the following conditions:

- **slow sales**: if the last time of selling an item that is similar to the negotiated one has reached a certain undesirable period. For example, if an online shopper is showing an interest in a TV that a similar one was last sold three months back, which is undesirable non-selling period for the seller. Then the seller agent may then be instructed to make use of the value-added approach.
- **seasonal sales**: if the product is designed to fulfill the needs of a specific season that is approaching an end within a period that is predefined by the selling entity. For example, if

the negotiated product is an air-condition and, as predefined by the seller, summer sales end in two weeks.

- **upgrade sales:** if the negotiated product is about to be replaced with an alternative one that is of the same money value but yet with higher functionality. For example, expanding a car’s warranty to four or five years few months before introducing a new shape of the same model.

As it was previously assumed that each $c \in Companies$ is linked to a set of *products* that are all offered to online companies. In this section, we assume that two different types of products exists - *Products Subsets*. A subset represents the core products - *Products* - of a company and, the other subset - *Services* - represents the secondary ones. As described in figure 5, a value-added sale for us will have to combine an item or more of the *Products* set with an item or more from the *Services* set; while keeping the total cost of the sale equal to sum of prices from the *products* set only.

For example, assuming that a potential online buyer is showing an interest in a digital camera that costs 200€ and a TV that costs 300€. Assuming that both items are under one or two of the conditions we mentioned above. In such scenario, a seller agent will then pick one or two items of the *Services* set, for instance; 2 years warranty & free delivery, add them to the camera and TV, then offer them all for 500€.

4 Related Work

Rahwan et al. [10] propose an analysis grid of strategies for agents engaged in negotiations. According to this grid, the factors which influence our strategy are: the goals (an optimal profit here), the domain (the products), the negotiation protocol (a one-shot conversation), the abilities of agents (sell services here), the values (cooperativeness of the agent).

Few concrete strategies of agents engaged in negotiations have been proposed. Jeffrey S. Rosenschein and Gilad Zlotkin have proposed a monotonic concession strategy for bilateral negotiations in [12]. In this protocol, each agent starts from the deal that is best for him and either concedes or stand stills in each round. A (monotonic) concession means that an agent proposes a new deal that is better for the other agent. Sierra et al. [13] propose different strategies based on arguments such as threats, rewards

or appeals (e.g. to authority). It is clear that these strategies are adapted for automated (bargaining) negotiation amongst software agents in the context of business-to-business. By contrast, we have proposed selling strategies for an ECA to convince a (human) buyer to buy a (bundle of) product(s) in a one shot conversation.

Rahwan et al. distinguish in [9] different approaches for automated negotiation, including game-theoretic approaches [12] (which usually assume complete information and unlimited computation capabilities), heuristic-based approaches [4] (which try to cope with these limitations) and argumentation-based approaches [2] (which allow for more sophisticated forms of interaction). By adopting a game-theoretic approach, our negotiation model is simple. It should be interesting to adopt an argumentation-based approach. In this way, agents may deal naturally with new information in order to mutually influence their behaviors. By arguing (even if it is internally), parties can take into account the information given by the buyer, and then let the agents make some points to convince the buyer.

Authors of [6] and [7] highlights the significant role Embodied Conversational Agents (ECA) play in nowadays e-commerce websites, and how large is the potential for these ECAs to replace real-life human interactions, which also include business-related ones. However, in [6] the main focus was on introducing and using the Virtual Reality Modeling Language (VRML), which is one of the available tools used to manage 3D environments while considering players of this environment as ECAs.

5 Conclusions & Future Work

In this paper, we introduced the idea of applying business inspired selling approaches to the negotiation strategies Embodied Conversational Agents (ECAs) can employ to achieve specific deals online. In order for us to present this notion, we briefly presented a formalization for the context we imagine these kind of negotiations to take place. We looked at ECAs as the mediating entities between the selling players, (i.e., companies), and the potential buyers, (i.e., certain websites’ surfers). We then presented our business-driven negotiation strategies that reflect real-life product bundling, promotions, and value-added sales.

As an extension to our work, we aim for build-

ing a simulation environment that reflects the correct behavior of websites' surfers, and also reflects the needs of e-commerce websites. With that simulation in hands, we will look for evaluating these negotiation strategies in more practical way, and tuning them up and down until a proper design schema is reached.

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