Generating Politeness in Task Based Interaction: An Evaluation of the Effect of Linguistic Form and Culture

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Abstract

Politeness is an integral part of human language variation, e.g. consider the difference in the pragmatic effect of realizing the same communicative goal with either "Get me a glass of water mate!" or "I wonder if I could possibly have some water please?" This paper presents POLLy (Politeness for Language Learning), a system which combines a natural language generator with an AI Planner to model Brown and Levinson's theory of politeness (B&L) in collaborative task-oriented dialogue, with the ultimate goal of providing a fun and stimulating environment for learning English as a second language. An evaluation of politeness perceptions of POLLy's output shows that: (1) perceptions are generally consistent with B&L's predictions for choice of form and for discourse situation, i.e. utterances to strangers need to be much more polite than those to friends; (2) our indirect strategies which should be the politest forms, are seen as the rudest; and (3) English and Indian native speakers of English have different perceptions of politeness.

Introduction

Politeness is an integral part of human language variation in conversation, e.g. consider the difference in the pragmatic effect of realizing the same communicative goal with either "Get me a glass of water mate!" or "I wonder if I could possibly have some water please?", with choices of these different forms driven by sociological norms among human speakers (Brown & Levinson, 1987). Recent work on conversational agents suggests that such norms are an important aspect of language generation for human-computer conversation as well (Walker et al., 1997; André et al., 2000; Reeves & Nass, 1996; Cassell & Bickmore, 2003; Porayska-Pomsta, 2003; Johnson et al., 2004). (Walker et al., 1997) were the first to propose and implement Brown & Levinson's (1987) theory of politeness, henceforth B&L, in conversational agents. Their goal was to provide interesting variations of character and personality in an interactive narrative application. Subsequent work has shown the value of politeness strategies based on B&L in many conversational applications, e.g. tutorial dialogue (Porayska-Pomsta, 2003; Johnson et al., 2004), animated presentation teams (André et al.,2000; Rehm and Andre, 2007), real estate sales (Cassell & Bickmore, 2003), and has also shown that the cross-cultural claims of B&L hold up in these contexts (Johnson et al., 2005).

This paper presents POLLy (Politeness for Language Learning), a system which combines a natural language generator with an AI Planner to model B&L's theory of politeness in task-oriented dialogue. Our hypothesis is that politeness forms are difficult for non-native speakers to learn, and that a virtual environment where learners can interact with virtual agents embodying different politeness strategies in different discourse contexts, will provide a fun and stimulating environment for learning English as a second language (ESL). As a first step, we evaluate the use of different politeness strategies in task-oriented dialogues in a collaborative task domain of cooking, where

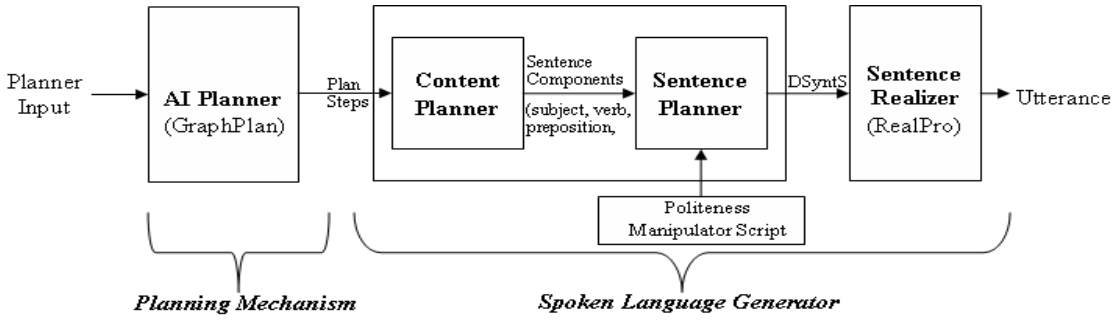

Figure 1: Complete System Architecture

subjects are asked to collaborate with another person to make a recipe. We show that: (1) politeness perceptions of POLLy's output are generally consistent with B&L's predictions for choice of form and for discourse situation, i.e. utterances to strangers need to be more polite than those to friends; (2) our indirect strategies which should be the politest forms, are seen as the rudest; and (3) English and Indian speakers of English have different perceptions of politeness. Section 1 describes POLLy's architecture and functionality. Section 2 describes an experiment to evaluate user's perceptions of automatically generated task-oriented polite language and Section 3 presents the experimental results. Section 4 sums up and compares our results with previous work.

1 POLLy's architecture and theoretical basis

POLLy consists of two parts: an AI Planner based on GraphPlan (Blum & Furst, 1997) and a spoken language generator (SLG), as illustrated in Figure 1. GraphPlan is a class STRIPS-style planner which, given a goal, e.g. cook pasta, produces a plan of the steps involved in doing so. POLLy then allocates the plan steps to two agents as a shared collaborative plan to achieve the cooking task, with goals to communicate about the plan via speech acts (SAs) needed to accomplish the plan collaboratively, such as Requests, Offers, Informs, Acceptances and Rejections (Grosz & Sidner, 1990; Sidner 1994). The SLG then generates variations of the dialogue based on B&L's theory of politeness that realizes this collaborative plan, as in (Walker et al, 1997; Andre et al, 2000). This is explained in more detail below and an example dialogue is shown in Figure 4. When this dialogue is embedded in our virtual reality environment (Romano, 2005), the human English language learner should be able to play the part of one of the agents in order to practice politeness in a real-time immersive environment.

1.1 Brown and Levinson's theory

B&L's theory states that speakers in conversation attempt to realize their speech acts (SAs) to avoid threats to one another's **face**, which consists of two components. **Positive face** is the desire that at least some of the speaker's and hearer's goals and desires are shared by other speakers. **Negative face** is the want of a person that his action be unimpeded by others. Utterances that threaten the conversants' face are called Face Threatening Acts (FTAs). B&L predict a universal of language usage that the choice of linguistic form can be determined by the predicted Threat Θ as a sum of 3 variables:

1. P: power that the hearer has over the speaker;
2. D: social distance between speaker & hearer;
3. R: a ranking of imposition of the speech act.

Linguistic strategy choice is made according to the value of the Threat Θ. We follow (Walker et al, 1997)'s four part classification of strategy choice. The **Direct strategy** is used when Θ is low and executes the SA in the most direct, clear and unambiguous way. It is usually carried out either in urgent situations like "Please Help!", or where the face threat is small as in informing the hearer "I have chopped the vegetables" or if the speaker has power over the hearer, "Did you finish your homework today?". The **Approval strategy** (Positive Politeness) is used for the next level of threat Θ - this strategy is oriented towards the need for the hearer to maintain a positive self-image. Positive politeness is primarily based on how the speaker approaches

B&L	Request Forms	Strategy Names	Inform Forms	Strategy Names
Direct	Do X.	RD1Imperative	X	ID1DirectAssert
	Do X please.	RD2ImperativePlz	-	-
	You must do X.	RD3ImperativeInsist	-	-
	You could do X.	RD4AsModAbility	-	-
Approval	Could you please do X mate?	RAp1QModAbility	Do you know that X?	IAp1QKnowledge
	If you don't mind you can do X.	RAp2AsModAbility	Do you know that X mate?	IAp2QueryKNowledgeAddress
	Would it be possible for you to do X?	RAp3AsPossible	-	-
	I'm sure you won't mind doing X.	RAp4AsOptimism	-	-
Autonomy	Could you possibly do X for me?	RAu1QModAbility	It seems that X.	IAu2AsAppear
	I know I'm asking you for a big favour but could you please do X?	RAu2ApologizeQModAbility	I am wondering if you know that X.	IAu1AsConfuse
	I'm wondering whether it would be possible for you to do X.	RAu3AsConfusePossibility	-	-
	Would you not like to do X?	RAu1QOptimism	-	-
Indirect	X is not done yet.	RI1AsNegation	-	-
	X should have been done.	RI2AsModRight	-	-
	Someone should have done X.	RI3AsModRightAbSub	-	-
	Someone has not done X yet.	RI4AsNegationAbsSub	-	-
	Where X is a task request. For example 'You could chop the onions,' or 'Would it be possible for you to clean the spill on the floor?'	*These strategies are applied to the various tasks requests X.*	*Where X is an inform event, like 'Do you know that the milk is spoilt mate?' or 'I'm wondering if you know that you have burnt the pasta.'*	*These strategies are applied to the various inform events X.*

Figure 2: The individual B&L strategies used for Request and Inform speech acts

the hearer, by treating him as a friend, a person whose wants and personality traits are liked, and by using friendly markers "Friend, would you please close the door?" or exaggerating "Amazing, you are the best cook in the world!" The **Autonomy Strategy** (Negative Politeness) is used for great face threats, when the speaker may be imposing on the hearer, intruding on their space or violating their freedom of action. These face threats can be mitigated by using hedges, "I wonder if you would mind closing the door for me," or by minimizing imposition, "I just want to ask you if you could close the door." The **Indirect Strategy** (Off Record) is the politest strategy and is therefore used when Θ is greatest. It depends on speaking in an indirect way, with more than one attributable intention so that the speaker removes himself from any imposition. For ex., using metaphor and irony, rhetorical questions, understatement, hints etc. "Its cold in here," which implies a request to close the door, or being vague like "Perhaps someone should clean the table."

1.2 SLG (Spoken Language Generation)

The SLG is based on a standard architecture (Dale & Reiter, 1995) with three components: Content planning, sentence planning and surface realization. See Figure 1. The politeness strategies are implemented through a combination of content selection and sentence planning. The linguistic realizer RealPro is used for realization of the resulting sentence plan (Lavoie & Rambow, 1997), and the content planning and sentence planning components produce outputs that can be transformed into RealPro input, which we discuss first.

The **Surface Realizer** RealPro takes a dependency structure called the Deep-Syntactic Structure (DSyntS) as input and realizes it as a sentence string. DSyntS are unordered *trees* with labelled nodes and arcs where the nodes are

lexicalized. Only meaning bearing lexemes are represented and not function words. An example of a DSyntS for the sentence "I have chopped the vegetables." is given below. The attributes to all the nodes are explicitly specified, tense, article, etc. The two nodes are specified with relations I and II, where I is the subject and II is the object.

```
"chop" [ lexeme: "chop" class: "verb" taxis: "perf" tense: "pres" ]
(
  I  "<PRONOUN>" [ lexeme:"<PRONOUN>" number: "sg"
     person:"1st" rel: "I" ]
  II  "vegetable" [ lexeme: "vegetable" article: "def" class: "com
      mon_noun" number: "pl" rel: "II"]
)
```

The **Content Planner** interfaces to the AI Planner, selecting content from the preconditions, steps and effects of the plan. According to B&L, direct strategies are selected from the steps of the plan, while realizations of preconditions and negating the effects of actions are techniques for implementing indirect strategies. For instance, in case of the first direct request strategy RD1Imperative (stands for Request SA, Imperative direct strategy) shown in Figure 2, which is realised as 'Do X', task X is selected from the steps of the plan and since it is a request SA and imperative strategy, it is realized simply as 'Do X'. Similarly, in case of the first indirect strategy RI1AsNegation (Request SA, Assert Negation Indirect strategy) which is realized as 'X is not done yet', the content is selected by the negation of effects of the action of doing X. The content planner extracts the components of the sentences to be created, from the plan and assigns them their respective categories, for example, lexeme get/add under category verb, knife/oil under direct object etc and sends them as input to the Sentence Planner.

The **Sentence Planner** then converts the sentence components to the lexemes of DSyntS nodes to create basic DsyntS for simple sentences (Berk, 1999), which are then transformed to create variations as per B&L's politeness strategies. The SAs for which the Sentence Planner creates sentences can be divided into two kinds: Initiating SAs like request, inform, suggest, offer etc and Response SAs like inform SA and acceptance and rejection of various SAs. In the conversation, first the initiating SAs are created followed by response SAs. The subject is implicitly assumed to be first person singular (I) in case of offer, inform, accept and reject, second person singular (you) in request_act and request_inform and first person plural (we) in case of suggest and accept_suggest. Each SA has multiple variants for realizing its politeness strategies as shown in Figure 2.

For realizing these B&L strategies, transformations to add lexical items such as 'please', 'if you don't mind', and 'mate' were added to the DSyntS to make a sentence less or more polite. These politeness formulas are divided into four categories: **Address** form which means a friendly manner of addressing someone like 'mate'. **Abstracting the subject** by saying 'someone should have washed the dishes' instead of addressing the hearer directly. **Softeners** like 'if you don't mind,' 'if you know,' 'please' and 'possibly'. **Additives** consisted of *Apologizing* like admitting impingement as in "I know I'm asking you for a big favour", using *must* "You must take out the trash" and explicitly stating that you are asking a favour as in "Could you chop the onions for me?" For example if we want variations for a Request_act SA in which one agent requests the other to cook vegetables, the Content Planner sends the verb (cook) and the direct object (vegetable) to the Sentence Planner which then creates a base DsyntS. Figure 3 shows the RAu9QOptimism transformation for the CookVeg task (which stands for Request act speech act, Query optimism autonomy strategy for the task cook vegetables).

```
"cook" [lexeme: "cook" class: "verb" tense: "pres" mood:"imp"]
(
  II "vegetable" [lexeme: "vegetable" article: "def" class: "com
     mon_noun" number: "pl" rel: "II" ]
)
```

This would be realized simply as *"Cook the vegetables."* It is transformed to create utterances which vary in politeness according to B&L.

Base DSyntS

```
"cook" [lexeme:"cook" class:"verb" mood:"cond" question:"+" ]
(
  I  "<PRONOUN>" [lexeme:"<PRONOUN>" number:"sg"
     person:"2nd" rel:"I" ]
  II "vegetable" [lexeme:"vegetable" article:"def" class:"com
     mon_noun" number:"pl" rel:"II" ]
  ATTR "like_to" [lexeme:"like_to" class:"adverb" rel:"ATTR"]
  ATTR "mate" [lexeme:"buddy" rel:"ATTR" ]
)
```

Realized as "Would you like to cook the vegetables mate?"

Base DSyntS manipulated to create polite DSyntS

Figure 3: Transformation from base DSyntS to the RAu9QOptimism strategy for CookVeg task

Agent	Utterance	SA and Politeness Strategy
Agent1	*Could you tell me if you have placed the pan on the burner?*	Approval: REQUEST_INFORM
Agent2	*Oh yes, I have placed the pan on the burner.*	Direct: ACCEPT_REQUEST_INFO
Agent1	*Have you turned-on the burner mate?*	Approval: REQUEST_INFORM
Agent2	*I am not sure.*	Direct: REJECT_REQUEST_INFO
Agent2	*Could I boil the pasta in the pan for you?*	Autonomy: OFFER
Agent1	*Alright if it is not a problem.*	Autonomy: ACCEPT_OFFER
Agent2	*Do you know that I have chopped the vegetables with the knife?*	Approval: INFORM
Agent1	*Ok.*	Direct: ACCEPT_INFORM
Agent2	*Do you know that I have added the oil to the pan my friend?*	Approval: INFORM
Agent1	*Yeah.*	Direct: ACCEPT_INFORM
Agent1	*I have added the vegetables to the pan.*	Direct: INFORM
Agent2	*Alright.*	Direct: ACCEPT_INFORM
Agent1	*Could I add the other-ingredients to the vegetables?*	Approval: OFFER
Agent2	*That is nice of you but no please do not bother yourself.*	Approval: REJECT_OFFER
Agent2	*I am wondering whether you would like to cook the vegetables in the pan.*	Autonomy: REQUEST_ACT
Agent1	*Please do not mind but I can not do that.*	Autonomy:REJECT_REQUEST_ACT

Figure 4: An example run of the system for two agents cooking pasta with vegetables

In addition, in the second row of Figure 2, the sentence planner transforms the selected content by adding 'please' for the second direct request strategy RD2ImperativePlz, and in the third row, it adds 'must' to the RD3ImperativeInsist. Under indirect strategy in Figure 2, the strategy of abstracting the subject by saying 'someone' instead of addressing the hearer directly is shown as RI4AsNegationAbsSub. An example run of a dialogue generated by the system for two agents cooking pasta is given in Figure 4.

2 Experimental Method

We conducted an experiment to study the perception of politeness by subjects in different discourse contexts, with subjects from two different cultural backgrounds: 11 were British and 15 Indians. Subjects were presented with a series of tasks implemented as a web-based questionnaire, and asked to rate various utterances said to them by their partner in the collaborative task in terms of how polite they perceived them to be on a five point Likert-like scale, as Excessively Overpolite, Very Polite, Just Right, Mildly Rude to Excessively Rude. All of the tasks were selected to have relatively high R (ranking of imposition) as per B&L's theory. Requests were to 'chop the onions', 'wash the dishes', 'take out the rubbish' and 'clean the spill on the floor.' The events for the propositional content of the Inform SAs were "You have burnt the pasta" and "The milk is spoilt", "You have broken the dish" and "The oven is not working". Subjects rated a total of 84 sentences spread over these 8 different tasks. There was also a text box for subjects to write optional comments.

There were five experimental variables: (1) Speech act type (request vs. inform); (2) B&L politeness strategy (direct, approval, autonomy, indirect); (3) discourse context (friend vs. stranger); (4) linguistic form of the realization of the B&L strategy; (5) cultural background (Indian vs. British). The politeness strategies were selected from strategies given by B&L for each level of politeness, and are shown in Figure 2. We did not manipulate the power variable of B&L.

For each task, subjects were told that the discourse situation was either they were working on the cooking task with a **Friend**, or with a **Stranger**. This was in order to implement B&L's D variable representing social distance. A friend has a much lower social distance than a stranger, thus Θ should be much greater for strangers than friends.

We tested two speech acts: **Request** and **Inform**. The ranking of imposition R for speech acts has Requests with higher R than Inform, so Θ should be greater for requests, implying the use of a more polite B&L strategy. For the

Request speech act, subjects judged 32 example sentences, 16 for each situation, Friend vs. Stranger. There were 4 examples of each B&L strategy, direct, approval, autonomy, indirect. The B&L strategies for requests are given in Figure 2. For the Inform speech act, subjects judged 10 example utterances for each situation, friend and stranger, with 5 B&L strategies, used to inform the hearer of some potentially face-threatening event. Of the five, there was one direct, two approval and two autonomy utterances. No Indirect strategies were used for Inform SAs because those given by B&L of hints, being vague, jokes, tautologies are not implemented in our system. The B&L strategies for Informs are also in Figure 2.

3 Results and Observations

We calculated ANOVAs with B&L category, situation (friend/stranger), speech act, syntactic form, politeness formula and the nationality of subjects as the independent variables and the ratings of the perception of politeness by the subjects as the dependent variable. Results are in Tables 1, 2, and 3 and are discussed below.

B&L strategies Effect: The four B&L strategies (Direct, Approval, Autonomy and Indirect) had a significant effect on the interpretation of politeness (df=3, F=407.4, p<0.001). See Table 1. The overall politeness rakings from least polite to most were Indirect, Direct, Approval and then Autonomy strategy as shown in the graph in Figure 5.

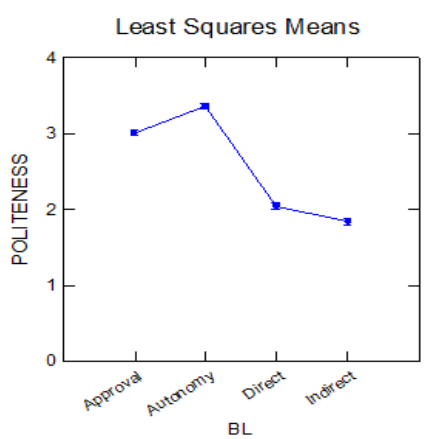

Figure 5: The B&L Strategies effect

It must be noted that as opposed to our findings, B&L regarded the indirect strategy as the most polite of all. This may be so because the indirect realizations that our generator produces from the AI planner are the *effect not achieved* forms like the indirect request strategies (RI1AsNegation, RI2AsModRight, RI3AsModRightAbSub and RI4AsNegationAbsSub) as shown in Figure 2 which sound like a complaint or sarcasm. Other Indirect strategies given by B&L like giving hints, being vague, sarcasm or jokes are situation dependent and require general language knowledge and are not implemented.

Situation Effect (Friend/Stranger): Table 1 also shows that sentences spoken by the Friend were rated to be overall more polite than those spoken by the Stranger (df=1, F=123.6, p<0.001). This shows B&L's social distance variable that when the distance is large, more polite sentence is appropriate but if we use a sentence with too much politeness in case of lesser social distance, the sentence would be regarded as over polite.

SA Effect (Request/ Inform): Inform SA was rated as more polite than Request SA (df=1, F=61.4, p<0.001). Requests have more face threat than Informs as they impede upon hearer's freedom of action and need to be more polite.

Sentence Form Effect: We divided the sentences into four categories, used for B&L strategy realizations, as per their syntactic forms. *Queries* interrogate the listener, like strategy RAp1QModAbility, "Could you please wash the dishes mate?" *Assertions* in case of request SA refer to sentences that make a request by asserting something like by asserting that the precondition holds or asserting the ability of the hearer like strategy RAp2AsModAbility, "If you don't mind you can chop the onions." In case of inform SA, they refer to polite declaratives that use some politeness formulas or additives with autonomy and approval strategies. *Direct Assertions* refer to sentences that directly assert something without much politeness tactic and are used to realize the direct form of the Inform SA, like ID1DirectAssert strategy, "You have burnt the pasta." Lastly, *Imperatives* are those sentences that directly command the user to perform some action, like the RD3ImperativeInsist strategy, "You must clean the spill on the floor" In case of requests, Imperatives were rated as least polite followed by Assertions and then Queries with (df=2, F=279.4, p<0.001). In case of Inform SA,

		Direct	Approval	Autonomy	Indirect	Overall
Speech Act	Request	2.0	3.0	3.4	1.8	2.6
	Inform	2.4	3.0	3.2	NA	3.0
Situation	Friend	2.3	3.3	3.6	2.0	3.0
	Stranger	1.8	2.8	3.1	1.7	2.4

Table 1: Mean values of the politeness ratings of SAs and situations for B&L's strategies and their overall mean score

Assertions are considered to be most polite, followed by Queries and then Direct Assertions with (df=2, F=36.0, p<0.001).

Politeness Formula Effect: We observed that sentences with address form 'mate' were rated more polite than those without it (df=1, F= 49.8, p<0.001). Abstracting the subject (used in indirect strategy) made the sentence less polite (df=1, F=125.0, p<0.001) and adding Softeners notably increased politeness (df=4, F=104.0, p<0.001). In case of additives, apologies were rated to be most polite, followed by those that asked for favour and sentences that used an insisting adverb such as must were least polite of all (df=3, F=185.6, p<0.001).

Nationality Effect: We found that the politeness interpretation of Indian and British subjects was significantly different. Indians rated the sentences as overall much more polite than British. This was most evident in case of a Friend saying something, (df=1, F=6.0, p<0.01) and in case of Requests (df=1, F=6.37, p<0.01) whereas in case of a stranger their measures were almost equal. This shows the culture effect that Indians are more informal in their communication, especially when they are talking to a friend, and opposes the universality assumption of B&L.

		Overall Score
Sentence Form	Imperative	1.8
	Assertion	2.5
	Queries	3.2
	Direct Assertions	2.4
Politeness Formula	AddressForm	3.1
	AbstractSubject	2.0
	Softeners	3.3
	Additives	3.0

Table 2: Overall mean values of the sentence forms and politeness formulas

		Request	Inform
Situation	Friend	2.8	3.2
	Stranger	2.3	2.8
Sentence Form	Imperative	1.9	NA
	Assertion	2.4	3.2
	Queries	3.3	3.0
	Direct Assertions	NA	2.4

Table 3: Mean values of situation and sentence forms in relation to the speech acts

Conclusion

We presented an implementation of a system, called POLLy, that combines a general AI planner with a spoken language generator behaviour, for generating polite language as per the theory of Brown and Levinson, and demonstrated how to extract language from a plan to generate conversations that are oriented towards performing an action (Sidner, 1994). (Walker et al., 1997) were the first to propose an application of B&L to conversational agents, but while they used a planner representation, they did not integrate a planner and their approach was not evaluated. Here, we have presented an experiment which shows that the B&L strategies have a significant effect on humans' perception of politeness. The utterances evaluated by our subjects were produced by POLLy and there was no human moderator unlike the evaluation experiment of (Cassell & Bickmore, 2002) which was wizard-of-oz. Where cultural differences are concerned, our experiment showed strong differences in the perception of politeness by Indian and British native speakers of English in case of SAs with B&L's high ranking of imposition like requests and where B&L's social distance variable was less when the discourse situation was specified as that of talking to a friend, whereas in their experiment, (Johnson et al., 2005) showed that the perceptions of politeness of American and German speakers in the domain of tutorial

dialogues was identical. (André et al., 2000) proposed the idea of animated presentation teams for presenting information to the user but they investigated only personality and not politeness and their NLG was template based. Our generator is to be applied in the domain of teaching ESL. Previously, (Porayska-Pomsta, 2003) applied B&L's theory in the tutorial domain for modelling teacher's corrective responses, with a generator was based on case based reasoning, selecting utterances from human-human dialogues rather than building a generator based on B&L. (Johnson et al., 2004) also had a similar approach for generating socially appropriate tutorial dialogue, with a template based NLG component, for a language training system that provides training in a foreign language and culture through AI enhanced story driven gaming, task-oriented spoken language instruction and intelligent tutoring. Their language courses have a strong task-based focus, on skills needed to cope with specific situations; they give people enough knowledge of language and culture to enable them to carry out particular tasks in a foreign country, like introducing yourself, obtaining directions and arranging meetings. Rehm and Andre have shown that the interpretation of politeness strategies is affected by the gestures used in an embodied conversational agent (Rehm and Andre, 1997). In future work, we aim to modify the language generator to make it more robust and integrate POLLy into a virtual reality environment for learning politeness when learning English as a second language.

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