Detecting politeness and efficiency in a cooperative social interaction

Paul M. Brunet [1], *Marcela Charfuelan* [2], *Roderick Cowie* [1], *Marc Schroeder* [2], *Hastings Donnan* [3], *Ellen Douglas-Cowie* [4]

[1] School of Psychology, Queen's University Belfast, United Kingdom
[2] Deutsche Forschungszentrum für Künstliche Intelligenz, Germany
[3] School of History and Anthropology, Queen's University Belfast, United Kingdom
[4] School of English, Queen's University Belfast, United Kingdom

p.brunet@qub.ac.uk, Marcela.charfuelan@dfki.de, r.cowie@qub.ac.uk, marc.schroeder@dfki.de, h.donnan@qub.ac.uk, e.douglas-cowie@qub.ac.uk

Abstract

We developed a cooperative time-sensitive task to study vocal expression of politeness and efficiency. Sixteen dyads completed 20 trials of the 'Maze Task', where one participant (the 'navigator') gave oral instructions (mainly 'up', 'down', left', 'right') for the other (the 'pilot') to follow. For half of the trials, navigators were instructed to be polite, and for the other half to be efficient. The simplicity of the task left few ways to express politeness. Nevertheless it significantly affected task accuracy, and pilots' subjective ratings indicate that it was perceived. Efficiency was not as clearly perceived. Preliminary acoustic analysis suggests relevant dimensions.

Index Terms: Politeness, efficiency, social signal, detection

1. Introduction

Social signal processing (SSP) has emerged as a multi-disciplinary domain of research. It draws on the rich literatures of human sciences and pairs it with the breakthroughs of technological research. Simplistically, SSP consists of understanding how an individual's internal states are signalled or transmitted to other people via indicators [1]. However, other factors, such as culture and context, also contribute to the social signal process, and consequently need to be considered in SSP research [2].

Emotions are arguably the most researched of the possible states, yet there is a wide range of states (or categories of states) that can be signalled during a social interaction. One such category is the communicative states, which could be defined as intentions to communicate in a specific style. Politeness is a communicative state that has been primarily claimed by linguists following Brown & Levinson's seminal work on the topic [3,4]. Their theory of politeness is focused on the protection of 'face', which encompasses our public self-image (i.e. positive face) and our desire to act freely (i.e. negative face). Consequently, Brown and Levinson define politeness as minimizing the threats we make against another person's 'face' during social interactions. To achieve politeness, they describe a variety of linguistic strategies that we may employ.

However, Brown and Levinson's theory of politeness has received much criticism. Despite claiming to be universal, others have argued that the theory cannot properly be applied to some cultures and languages, notably Japanese [5]. We would like to argue that Brown and Levinson's theory also does not adequately account for short utterances and limited word choice. Not all situations allow for time for the appropriate use of Brown and Levinson's strategies, which highlights the importance of context when considering social interactions. In time-sensitive situations, politeness might need to be signalled more succinctly than the Brown & Levinson strategies permit. Fortunately, in the linguistic literature there are alternative explanations of politeness that can be more useful. For example, Arndt & Janney [6] distinguished two kinds of politeness; 1) conventional politeness, which focuses on following the proper etiquette and rules as dictated by society, and 2) interpersonal politeness, where the focus is on consideration for the feelings of other people. Neither of these necessarily requires time-consuming strategies. We suspect that politeness can still be signalled in time-sensitive situations via more restricted, yet still informative, vocal behaviour (e.g. fewer words, shorter utterances) than Brown & Levinson's analysis might suggest.

To explore this theory, we adapted an experimental paradigm designed by Park [7], in which groups of 3 or 4 people performed a cooperative task (i.e. assembling a radio) for 20 minutes. Park instructed the groups to communicate politely (which was defined as being supportive and being concerned not to offend others) or efficiently (defined as not wasting time and providing clear opinion) while completing the task. By providing these instructions, Park was in essence assigning a communicative state to the members of the group. Park's choice of efficiency as an alternative to politeness was well founded as to be efficient would suggest being focused on a task instead of being focused on the other people's feelings or proper etiquette. We modified the paradigm by choosing a cooperative task with a more restricted time limit (i.e. multiple trials at less than a minute per trial) assigned to a dyad. Additionally, given the nature of the task (i.e. navigating through a maze), participants only needed to use a minimal vocabulary of 5 words (up, down, left, right, and stop) to successfully complete the task, but were given no instructions to limit their vocabulary.

From this experiment design, two preliminary research questions could be assessed:

1) Do the communicative states of politeness versus efficiency during a time-sensitive task affect the outcome of the social interaction (i.e. task accuracy) differently? We predict in such a limited time frame that any attempt to be polite will ultimately decrease task accuracy compared to being efficient.

2) Do the communicative states of politeness and efficiency during a time-sensitive task affect the evaluation of interactant and self during a social interaction? Despite not having the time to use Brown & Levinson's strategies, we expect that participants will still be able to use their vocal behaviour to properly signal the assigned states. Consequently, we predict that the participants will rate their partners as more polite and less efficient in the polite condition, and more efficient and less polite in the efficient condition.

2. Methods

2.1. Participants

Participants (N=23), ranging in age from 18 to 36 (mean =22.6 years, SD = 4.4), were recruited from Queen's University Belfast. Fourteen participants were paired together; 4 dyads consisted of pairs of friends, 3 dyads were pairs of strangers. The other 9 participants were paired with a confederate (i.e. a member of the experimental team posing as participant); 5 were paired with a confederate of a higher academic status, and 4 were paired with a confederate of equal status).

2.2. Cooperative Task

A maze-like computer task was developed by updating a previously designed maze programme. The cursor must be moved from one corner of the screen to another corner. A certain percentage of the screen is filled with white squares and the rest with black squares. The cursor can move through the white spaces but not the black spaces. To successfully complete the task, the cursor must be moved through the white spaces to the end point in the designated amount of time.

The task was made into a cooperative task by running the visual of the task to a computer monitor in one testing room, and the control of the task to a keyboard in a second testing room. Via microphones and headphones, the person who could see the maze (i.e. the 'navigator') could direct the person who could control the cursor (i.e. the 'pilot') through the maze, but could not see it.

2.3. Procedure

After completing the consent forms, participants from the participant-participant dyads were randomly assigned to the role of pilot or navigator. The 9 participants paired with a confederate were always assigned to the role of navigator, and the confederate served as the pilot. Participants were seated in front of their respective computers in separate testing rooms. The pilot could see the navigator on the monitor, and could control the cursor in the maze using the arrows on the keyboard. The navigator could see the maze on the monitor in front of them, and could see the pilot on a second monitor located to the right side. The experimental sessions were recorded (audio and visual) with the consent of the participants.

Participants were first given a practice trial to familiarize themselves with the task. The experimental trials were broken into 4 blocks of 5 trials. In each block, the trials became increasingly more difficult by increasing the black squares by 5% (i.e. first trial had 10% black squares; second trial 15%; third trial 20%; fourth 25%; and fifth 30%). For all four blocks, participants were told to successfully complete as many of the trials as they could. However, for the first two blocks, participants were either instructed to be polite or to be efficient as their main priority, and for the last two blocks they received the opposite instruction. The order of polite and efficient was randomized. For the second and fourth blocks (i.e. the last block of each of the polite and efficient conditions), the vertical and horizontal cursor controls were flipped (i.e. left arrow moved the cursor right, right arrow moved left, up moved down, and down moved up). Participants were informed of this change.

After each condition (i.e. polite and efficient), participants completed a questionnaire asking them to rate themselves and their partners on a 7-point Likert scale regarding their efficiency, politeness, consideration of partner, and consideration of social etiquette. At the end of the experiment, participants also completed the Big-Five Inventory [8] and the Cheek and Buss Shyness and Sociability Scale [9].

3. Results

3.1. Accuracy

Accuracy was measured in distance from the position of the cursor at the end of trial compared to the position of the end point. The score is the sum of the horizontal and of the vertical vectors (measured in number of squares) between the cursor and the endpoint. If the trial was successfully completed, a score of zero was achieved. Low numbers represent greater accuracy, and high numbers signify poorer accuracy. An average accuracy score was calculated for each of the four blocks. There were no significant differences in accuracy between the participant-participant dyads and the participant-confederate dyads. Therefore, for the accuracy analysis, we collapsed the two groups.

A 2X2 repeated-measures ANOVA (polite condition versus efficient condition; original arrow controls versus flipped controls) was run with the average accuracy as the dependent measure. The analysis revealed a statistically significant condition effect, $F(1,15) = 8.24$, $p = .01$. As predicted, when instructed to be efficient, dyads were more accurate ($M = 16.76$, $SE = 2.1$) compared to when they were instructed to be polite ($M = 24.14$, SE 3.3). The direction of the cursor keys did not statistically significantly influence accuracy ($p = .17$), nor was there an interaction between the condition and the direction of the keys ($p = .42$).

3.2. Ratings

3.2.1. Participant-participant dyads

We conducted a series of planned 2X2 mixed ANOVAs (friends versus strangers as the between subjects variable; and polite condition versus efficient condition as the within subjects variable) using the ratings from the questionnaires, examining how the pilot rated the navigator on efficiency, politeness, consideration of partner, and consideration of social etiquette, and how the navigator rated themselves on these same measures.

The analysis revealed a statistically significant main effect of condition on pilot's ratings of navigator's politeness, $F(1,5) = 6.43$, $p = .05$. Pilots rated navigators higher in politeness during the polite condition ($M = 4.75$, $SE = .51$) than during the efficient condition ($M = 4.00$, $SE = .59$). Likewise, a statistically significant main effect of condition on pilot's ratings of navigator's consideration of the pilot was found, $F(1,5) = 7.00$, $p = .046$. Pilots rated navigators higher in consideration during the polite condition ($M = 4.96$, $SE = .47$) compared to the efficient condition ($M = 4.38$, $SE = .51$). No main effects of condition were found for pilot's ratings of navigator's efficiency or of their consideration of social etiquette. Additionally, no main effects of familiarity were found, nor any condition by familiarity interactions.

Surprisingly, the analyses of the navigator's self-ratings did not reveal any statistically significant main effects of condition. Furthermore, no main effect of familiarity, or any familiarity by condition interaction were found.

3.2.2. Participant-confederate dyads

Similarly to the participant-participant dyads, we conducted a series of planned 2X2 mixed ANOVAs using the ratings from the questionnaires in the participant-confederate dyads. We consider here the participant's self ratings on efficiency, politeness, consideration of partner, and consideration of social etiquette. There were no main effects of condition, nor any status by condition interaction. However, there was a significant main effect of status on the participant's self-rating of consideration of social etiquette, $F(1.6) = 6.52$, $p =.043$. Participants paired with the confederate of higher status rated themselves higher on consideration of social etiquette ($M = 4.13$, $SE = .35$) than participants paired with a confederate of equal status ($M = 5.38$, $SE = .35$).

3.2.3. Preliminary acoustic analysis

The paradigm induces speech types that are perceived differently, and have different effects The simplicity of the language limits the range of ways that the difference might be signalled. We have started to examine correlates of politeness in prosody and voice quality. The procedure is the following: (i) measures extraction: compute frame based and utterance based raw prosodic and spectral measures and derived measures of voice quality; (ii) clustering: use Principal Component Analysis (PCA) to search for patterns, reduce redundancy among the measures and identify most relevant acoustic predictors; (iii) Perceptual interpretation of acoustic measures: based on perceptual correlates reported in the literature. More details on this procedure can be found in [10].

Our objective is to analyse variation or patterns on the measures due to politeness and efficiency. The measures are affected though, by other sources of uncontrolled variability (e.g. individual speaking style, overlapping speech, outbursts such as laughter, the intrinsic contextual variability). There are ways of tackling this problem based on averaging and control of phonetic content [10]. Of these, averaging per user and session trial does not show strong effects, and reducing contextual variability depends on transcriptions that are not yet available. However, we have analysed the polite and efficiency patterns at level of acoustic measures for each individual session. The blocks and trials of every session have been manually segmented and the "words" in each trial automatically segmented by energy level; the acoustic measures then correspond to frame averages on these small segments. Figure 1 shows the PCA results for one session in which there was no difference in accuracy between the two conditions (difference score = 0.5). Figure 2 shows the PCA results for session in which the dyad was much more accurate in the efficient condition (difference score = 18.1). In Figure 2, a difference in acoustic pattern can be observed.

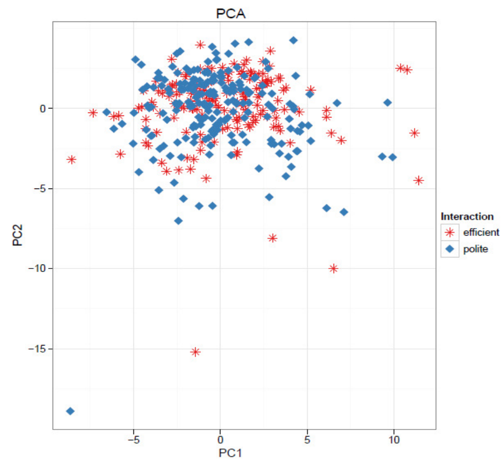

Figure 1 *Politeness and efficiency patterns: first two principal components, no accuracy difference*

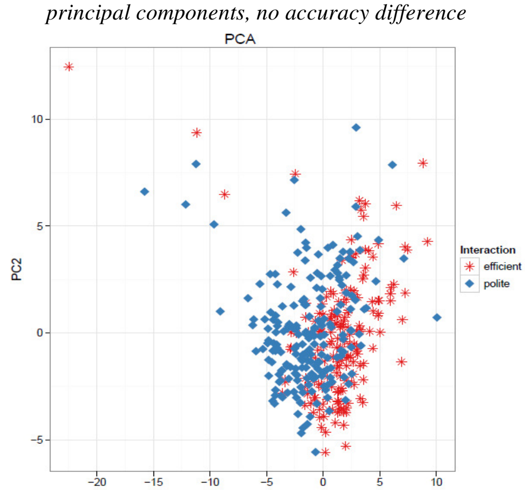

Figure 2 *Politeness and efficiency patterns: first two principal components, large accuracy difference.*

In Fig. 2, it can be seen that PC1 distinguishes relatively clearly the polite from the efficient set of utterances. The acoustic measures that load most strongly on PC1 are glottal opening gradient (GOG, -0.212) and rate of closure gradient (RCG, -0.233). To the extent that higher GOG corresponds to breathier voice and higher RCG to softer phonation [10], this suggests that the speaker has produced the polite utterances with a somewhat softer voice than the efficient utterances.

The contrast between the figures shows a general tendency observed in speakers with large accuracy difference. Most of them present significant differences in other measures like pitch, energy, voicing rate, etc., in polite and efficient utterances. This indicates that there exist a consistent acoustic separation when polite and efficient scores are very different. This will be further studied in a more detailed acoustic analysis.

4. Discussion

We have studied politeness in a situation where participants could not rely on Brown & Levinson's linguistic strategies to signal politeness without sacrificing the goal of the task. Hence, they needed to signal politeness (or efficiency) mainly via vocal behaviour.

We formulated two preliminary research questions. The first asked if the instructions to be polite or efficient would produce practically different types of communication (i.e. they would affect task accuracy). Given the nature of the task, we predicted that task accuracy would be higher in the efficient condition compared to the polite condition. The prediction was confirmed. In this case, there appears to be an accuracy-politeness trade-off. We stress that the same will not necessarily happen in other tasks.

The second question was whether the instructions would affect the evaluations of the social interaction. It was tested using participant ratings of themselves and their partners on efficiency, politeness, consideration of others, and consideration of social etiquette. We expected pilots to rate navigators as more polite and less efficient in the polite condition than in the efficient condition. The findings only supported half of that prediction. Pilots did rate navigators higher in politeness during the polite condition. The ratings of efficiency did not differ between the two conditions. It would suggest that pilots could detect the signalled politeness, but did not recognize when the navigator was specifically aiming to be efficient. That is surprising given that the dyads were objectively more accurate in the efficient condition.

The natural conclusion is that pilots focused on vocal behaviour, and it provides clearer cues to some conditions than others. Politeness appears to be a state that can be relatively well signalled even with the severely limited type of speech involved in this paradigm. Again, we stress that the same contrast will not necessarily appear in other tasks.

Interestingly, navigators did not report statistically significant differences in their self-ratings of politeness and efficiency across the polite and efficient conditions. This finding on its own would have suggested that the participants failed to adopt the assigned communicative states. However, since we found differences in accuracy and in pilots' ratings of navigators' politeness, we know that differences in behaviour and social signals did occur. Most likely, navigators were preoccupied with the task, and that reduced their ability to monitor their own behaviour.

Finally, in addition to efficiency and politeness, participants were asked to rate their partner and themselves on consideration of their partner and of social etiquette. These two ratings map onto interpersonal politeness (e.g. consideration of partner) and conventional politeness (e.g. consideration of social etiquette) [6]. For consideration of the partner, we found the same effect that we found for ratings of politeness. Pilots rated navigators as showing more consideration of them in the polite condition compared to the efficient condition. No such effect was found for the consideration of social etiquette. These findings would suggest that navigators have a personal definition of politeness more akin to the interpersonal politeness than to conventional politeness, and consequently signalled their consideration of others during the interaction. Likewise, pilots would also appear to favour the interpersonal definition as they reported similar differences in politeness and consideration of others, but not of social etiquette.

5. Conclusions

We have described a paradigm where it can be shown that communicative states related to politeness are both perceived, and affect the outcome of the interaction (i.e. the accuracy of the task). Despite the short duration of the trial, and the limited range of linguistic resources, navigators still managed to modify their behaviour to signal politeness-related states, and their partners detected the signals. The findings of the preliminary analysis provide a useful starting point in exploring the vocal behaviour associated with the communicative states. Although it has not been analysed here, the data also show the facial behaviour of both parties.

From these findings, we can now more thoroughly analyze the vocal (both verbal and non verbal) and facial behaviour to isolate the specific indicators that are associated with greater politeness in the polite condition and lesser politeness in the efficient condition. Furthermore, other factors can be manipulated in similar experimental designs such culture (e.g. native English speakers versus non-native English speakers) to determine if these findings of time-sensitive situations is specific to members of the same cultural background or generalises to other cultures.

6. Acknowledgements

This study was supported by FP7 IST project SSPnet.

7. References

[1] Vinciarelli, A., Pantic, M., and Boulard, H., "Social signal processing: Survey of an emerging domain", Image Vision Comp, 27:1743-1759, 2009.

[2] Brunet, P.M., McKeown, G., Cowie, R., Donnan, H., and Douglas-Cowie, E., "Social signal processing: What are the relevant variables? And in what ways do they relate". Affective Computing & Intelligent Interaction Proc., Vol II, 77-82, 2009.

[3] Brown, P., and Levinson, S.C., "Universals in language use" in Goody (ed.) "Questions and politeness". Cambridge University Press, Cambridge, 1978.

[4] Brown, P., and Levinson, S.C., "Politeness: Some universals in language use". Cambridge University Press, Cambridge, 1987.

[5] Longcope, P, "The universality of Brown and Levinson's politeness theory: A Japanese perspective". Working Papers in Educational Linguistics, 11:69-79, 1995.

[6] Ardnt, H., & Janney, R.W., "Politeness revisited: Cross-modal supportive strategies". Int Rev of Applied Ling in Language Teaching, 23:281-300, 1985.

[7] Park, H.S. "The effects of shared cognition on group satisfaction and performance: Politeness and efficiency in group interaction". Commun Res, 35:88-108, 2008.

[8] John, O. P., Naumann, L. P., and Soto, C.J., "Paradigm shift to the integrative Big-Five Trait taxonomy: History, measurement, and conceptual issues. In O. P. John, R. W. Robins, & L. A. Pervin (Eds.), Handbook of personality: Theory and research (pp. 114-158). Guilford Press, NY, 2008.

[9] Cheek, J.M., and Buss, A.H. "Shyness and sociability". J Pers Soc Psychol, 41: 330-339, 1981.

[10] Charfuelan, M., and Schöder, M., and Steiner, I. "Prosody and voice quality of vocal social signals: the case of dominance in

scenario meetings". Submitted to Interspeech 2010 Special session on Social Signals in Speech, 2010.