Negotiation Skills Training Intervention Based on Automated Recognition of Human Emotion and Non-Verbal Behaviour

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This research explores the effect of 'social signals' feedback intervention based on automated recognition of affect and non-verbal behaviours within the context of negotiation skills training. The work uses several off-the-shelf technologies; Sociometric badges, iMotions Biometric Research Platform and Nemesysco Layered Voice Analysis, to recognise and analyse emotional expressions, vocal emotions and body movement. A controlled experiment compared standard negotiation skills feedback to feedback augmented with emotion and sensor-based social skills evaluation to explore whether negotiation performance and use of social signals vary depending on feedback condition. The study focusses on paired-negotiation tasks with three conditions: control (standard feedback) vs. two experimental conditions; one where both negotiators in the pair received the augmented feedback; one where only one of the pair received the augmented feedback. We collect objective and subjective measures of negotiation performance, and emotion and social signals data in order to test the following hypotheses: H1: measurable changes in social signals will be evident following training in negotiation skills; changes will be greater in those who receive social signals feedback & H2: training using social signals feedback will result in differences in negotiation outcomes (measured objectively and subjectively).

Human computer interaction. Affective computing. Social signal processing. Emotion. Negotiation. Non-verbal communication. Controlled experiment. Training.

1. INTRODUCTION

This study focusses on the potential of using automated affect recognition technologies within the context of training for negotiation skills. It is motivated in part by academic literature on emotion recognition and the research in the emerging, cutting-edge field of social signals processing, exemplified by the work of Pentland (2008), which illustrates that combinations of social signals (such as tone of voice, posture, etc.), which can be detected by non-obtrusive, non-contact technologies, are predictive of outcomes in face-to-face tasks such as negotiation. The reciprocal social/emotional behaviour of two or more interlocutors is thought to be an important predictor of outcome (Chartrand & Bargh, 1999; Pentland, 2008). This research strand emphasises the functional benefits of the use of emotional and social signals which have the potential to be applied to practical situations, independent of ongoing debate about the nature of felt emotion.

1.1 Emotion

Research into how we react to and interact with the world and those around us remains one of the most considerable scientific challenges. Human communication of emotion is a vast research field, with person-to-person interaction being considered by many as the most fundamental part of understanding human emotion. There are multiple definitions of emotions. However, most point to three distinct features of emotion: subjective experience, physiological reactions and action tendencies (Lazarus, 1991). Emotions are viewed as continually evolving through adaptation to ever changing life-tasks (Paul Ekman, 1992), with research existing in multiple domains and resulting in numerous models and theories. Cornelius (2000) outlines four main theoretical approaches to understanding human emotions: the Darwinian perspective, the Jamesian perspective (James, 1884), Cognitive perspective and the Social Constructivist Perspective (Averill, 1980). These four approaches have different theoretical origins, definitions of emotions and research methodologies. However, in recent years all four have shown concepts that are coinciding and within these

overlapping theoretical perspectives new descriptive models of emotional states have been developed: the Basic Emotions Model (Paul Ekman, 1992), Paul Ekman (2003) defines five universal 'basic emotions' as enjoyment, sadness, anger, fear and disgust), Cognitive Models (Ortony, Clore, & Collins, 1990), Dimensional Models (Posner, Russell, & Peterson, 2005) and Interactional Models (Boehner, DePaula, Dourish, & Sengers, 2007). In the current research we take a functional perspective looking at the behavioural and social outcomes of detectable signals, independent of more philosophical concerns about the nature of experienced emotion.

Humans display emotional signals through various channels which can be recognized by others in the environment (Argyle, 2013). Therefore, a useful perspective to consider is the communication of emotion between people. Argyle (2013) identified three major reasons for why humans send emotional signals: spontaneous expression of emotions, direct physiological reaction and deliberate emotional expression. Such non-verbal communication - the eye movements, facial expressions, tone of voice, postures and gestures that we all use more or less consciously and more or less effectively - can enhance or diminish every form of social interaction (Lu & Argyle, 1993), therefore it is important to look at how such social signals affect us in our day to day person-to-person communication and whether it is possible to predict and control such human behaviours.

1.2 Social Signals Processing

The largest part of the human expressive behaviour is unconscious and therefore most of the time happens unintentionally (Ambady & Rosenthal, 1992). Research highlights the unconscious nature of social signals, meaning that people may naturally detect a range of social signals and spontaneously act upon them. MIT academic Alex Pentland (2008) advocates that such 'secondary channels' of communication as non-verbal behaviours are rooted deep in our brain structure (evolutionary derived) which makes these signals extremely reliable for prediction of human behavioural tendencies. Unconsciously processed social signals are uncontrollable and unplanned, consequently they are relatively difficult to fake. Accordingly, they are regarded as 'honest signals' (Buchanan, 2009). The 'honest' nature of non-verbal signals is supported by Ekman's (2003) leakage hypothesis, which suggests that humans do not worry about censoring their body movements. Most people do not get feedback about how their body moves or what the movements reveal, therefore, we do not feel the need to learn how to monitor our non-verbal signals.

Social Signals Processing (SSP) is a relatively new research domain aimed at understanding and modelling social interactions and equipping computers with similar social intelligence abilities in human-computer interaction scenarios. SSP is a term formulated by Pentland (2007) who used SSP to describe the process of ascertaining socially relevant information from non-verbal behaviour cues. Social signals are the key concept in the framework of SSP (Pantic et al., 2011; Poggi, D'Errico, & Vinciarelli, 2012). The emerging field of SSP illustrates that combinations of social signals (tone of voice, body posture, facial expressions etc.) can be detected by non-contact technologies and can be predictive of outcomes in face-to-face tasks such as negotiations, mediation and interviewing (Pentland, 2008; Vinciarelli, Salamin, & Pantic, 2009). A body of literature on social signals within a communication setting presents evidence for the 'thin slices' of expressive behaviour as predictors of outcomes in social situations. Meta-analysis of multiple domains by Ambady and Rosenthal (1992) shows how accurate predictions of behaviour can require as little as 5 minutes of observation regardless of the behaviour channel or environmental manipulation of a given behaviour.

Looking at the evidence above a question is proposed of whether it is possible to use automated recognition of emotional and social signals to train and improve emotion detection and control in person-to-person interactions.

1.3 Negotiation

Negotiations take place around the world daily and can range from small-scale to multinational, formal to informal settings, minor to life-threatening context. The negotiation process can be described as an act of bargaining between two or more parties. Each party usually has their own viewpoints, needs and aims. Through the negotiation process each party seeks to find a common ground and reach an agreement on issues. Negotiation can be seen as one of the most common and constructive ways of dealing with social conflict. Models behind the negotiation process are based on multiple theoretical and practical ideas of strategies, skills required, and behaviours observed, which if understood and implemented correctly increase the changes of a successful outcome (Raiffa, 1982).

Cialdini's (1984) theory of influence is a widely-used model in numerous fields. He summarizes social psychology research on the topic using six key principles, which are based on social constructs that ease human decision making in uncertain situations. The principles are: reciprocity, consistency and commitment, social proof, liking, authority and scarcity. Cialdini's principles have widely been used in negotiation practices, as they play a powerful role in the persuasion process (Guthrie, 2004).

Non-verbal cues used by negotiators can enhance or diminish the negotiation process if used together with Cialdini's principles. For example, mimicking your opponents' body language can increase liking (Gueguen, Jacob, & Martin, 2009; Stel et al., 2010).

Goldstein, Martin and Cialdini (2008) argue that when a verbal influence strategy is embedded in a nonverbal style that fits its orientation it boosts the strategy's effectiveness, whereas a misfit reduces the force of its impact. On the other hand, coming across as powerful and cold can make people resent or envy you. And if you don't have any warmth or real authority to back up that appearance of power it can lead to you being exploited or harassed (Goman, 2011).

Emotions are seen as innate in the negotiation process and social conflict (Davidson & Greenhalgh, 1999) and are viewed as critical to understanding of how people behave in such situations (Barry, 1999). Surprisingly little attention has been given to the role of emotions in negotiation and to how negotiators respond to each other's emotional signals. Prior research has mainly focused on how negotiators' emotional state affects their own behaviour (intrapersonal effect of affect on the negotiation). For example, positive affect has been shown to increase joint gain (Allred, Mallozzi, Matsui, & Raia, 1997), increase cooperation (Baron, Fortin, Frei, Hauver, & Shack, 1990) and an increase in the use of cooperative negotiation strategies (Forgas, 1998). On the other hand, negative affect has been shown to increase the use of competitive strategies (Forgas, 1998), promote the rejection of ultimatum offers (Pillutla & Murnighan, 1996) and decrease the desire to work together in the future (Allred et al., 1997). Although this research has demonstrated well how negotiators own affect impacts the negotiation process, what it fails to take into consideration is the process of negotiation as a social phenomenon. Several researchers have emphasized the importance of interpersonal effect of emotions in the negotiation process, especially the importance emotions have on social functions and consequences (Ekman, 2003; Kopelman, Rosette, & Thompson, 2006; Van Kleef, De Dreu, & Manstead, 2004). For example, in a computer-mediated negotiation task with a simulated opponent, Van Kleef and colleagues (2004) provided participants with information about the opponent's emotional state as being angry, happy or having no emotion at three-time points during the negotiation. They found that participants with an angry opponent placed lower demands and made larger compromises than participants with a non-emotional opponent, whereas participants with a happy opponent placed higher demands and made smaller compromises. In a face-to-face dispute simulation, participants who displayed positive emotion, in to contrast those who displayed negative or neutral emotions, were more likely to incorporate a future business relationship in the negotiated contract. Additionally, those who were strategically displaying positive emotion were more likely to close a deal and displaying positive emotions was a more effective strategy for gaining compromises from the other negotiator (Kopelman et al., 2006; Van Kleef et al., 2004).

Recent research demonstrates that social signals detection and feedback in social interactions can be a good predictor of negotiation outcomes and have the potential to bring about enhanced group collaboration (Kim, Chang, Holland, Pentland, & Sandy, 2016). Curhan and Pentland (2007) present a study in which participants took part in a simulated employment salary negotiation where they were randomly assigned a role of either middle manager or vice-president. The middle manager was seeking the best deal for themselves, while the vice-president was seeking the best deal for the company. The conversation dynamics measures were picked from the social science literature and deemed as an equivalent to Pentland's 'honest social signals' (2008). The features were vocal mirroring, activity level, conversational engagement and prosodic emphasis. In was found that quantitative measurements of these four features within the first five minutes of the interaction could predict 30% of the variance in individual outcomes, supporting the theory that social signals are important in person-to-person interactions. However, participants in this study were not given any feedback on their use of social signals, so it is not clear whether this might have led to different outcomes. This raises a question of whether people can be trained to use social signals better within negotiation skills training.

The negotiation process is a complex and cognitively challenging task. Negotiators must keep in mind their own preferences and limits as well as monitor their opponent's behaviour, locating their limits, and combining all the information to come up with a strategy. The question that arises is whether social signals and emotions feedback about negotiators' behaviour during the process can benefit and ultimately improve the process itself as well as its outcomes.

While the review of the literature suggests potential value of providing social signals and emotional feedback to support training for negotiation tasks, it remains unclear (a) whether people can effectively act on such feedback in this context to change their use of non-verbal cues within negotiation and (b) whether this leads to any improvements in performance. To explore this, an experiment will be designed to compare negotiation skills training with and without a social / emotional signals feedback element, testing the following hypotheses:

H1: measurable changes in social signals will be evident following training in negotiation skills; changes will be greater in those who receive social signals feedback

H2: training using social signals feedback will result in differences in negotiation outcomes (measured objectively and subjectively

2. STUDY DESIGN, METHODOLOGY

To inform the design of the experiment, we conducted several observations of negotiation training classes

delivered in a leadership training context. These illustrated a typical training design structure where trainees first receive a lecture-style introduction to negotiation skills, and then engage in a number of practice negotiation tasks, after each of which they discuss their performance with the trainer and receive subjective feedback. These insights were used to design a training context in which an intervention using the results of automatic detection of emotional and social signals could be tested.

An experiment has been designed to test the impact of 'social signals' feedback (providing social and emotional signals feedback) within the context of negotiation skills training. All participants will receive a training lecture on theory of negotiation (pre-recorded), followed by a first negotiation exercise (baseline), a feedback step, and then a further (scored) negotiation exercise. During the feedback step conditions will vary according to whether participants receive 'social signals' feedback or not.

2.1 Participants

Participants will be volunteers from amongst the students and early career staff at Brunel University London. With off-the-self technology being used in an exploratory context we will be restricting the sample, however the long-term goal is to have no constraints on participation. Exclusion criteria will include participants with self-declared neuro-psychological disabilities affecting the ability to hold a spoken conversation, participants with physical or motor disabilities impairing non-verbal communication. The sample will not include those aged under 18 and those who are not fluent in English.

The sample size is chosen based on a priori sample size calculation (Erdfelder, Faul, & Buchner, 1996) for MANOVA and ANOVA and taking into consideration the practical constraints on intervention group size that can be achieved given the duration of the experiment. A priori sample size calculation will ensure that the study is appropriately powered and can achieve a true statistical significance. By using an a priori analysis, we can compute that the sample size required to achieve a power of $1 - \beta = 0.95$ with a medium effect size ($d=0.5$) and a significance level of $\alpha = 0.05$ is N=45 (N=15 per group).

Participants will be allocated to conditions at random. Participants will be allocated to experimental pairs based on their availability.

Within the mixed feedback pairs (experimental group one) one member of each pair will be allocated to receive 'social signals' feedback or standard feedback at random (by the toss of a coin). This procedure is aimed at reduction of variability between conditions which could be attributable to extraneous variables.

2.2 Experimental Design

H1: measurable changes in social signals will be evident following training in negotiation skills; changes will be greater in those who receive social signals feedback

To explore this hypothesis, a 2x2 mixed factorial experimental design will be used. The between-participants independent variables will be training type with two levels: 'social signals' feedback and standard feedback. The within-participants independent variable will be time with two levels: baseline and post-test. The dependent variables will be measures of emotional and social signals provided by the suite of technology described in section '3. Measures'.

H2: training using social signals feedback will result in differences in negotiation outcomes (measured objectively and subjectively)

To explore this hypothesis three condition between-participants experimental design will be used. The independent variable is type of feedback with three conditions: Control condition: no 'social signals' feedback (standard feedback); Experimental condition 1: one member of the pair receives 'social signals' feedback and one member receives standard feedback; Experimental condition 2: both members of the pair receive 'social signals' feedback. The dependent variables will be objective performance (paired performance and individual) and subjective performance (perception scores based on views of the other member of the pair) (see section '3. Measures' for more details).

2.3 Procedure

The experiment will consist of a lecture style online introduction to negotiation skills (which will take place in set participant pairs) based on several observations of negotiation training examples (Cialdini, 1984; Fisher & Shapiro, 2005; Fisher, Ury, & Patton, 1991). After the introduction participants will be fitted with sociometric badges, followed by a short (baseline) practice negotiation scenario based on the role simulation materials provided by George Mason University Institute for Conflict Analysis and Resolution. All participants will work through the same practice negotiation task. Upon completion of the practice negotiation task, participants will be asked to complete a Process Evaluation Score sheet to determine each participant's perception of the negotiation process, Rapport Score sheet (Drolet & Morris, 2000), Future Collaboration Score sheet (Moore, Kurtzberg, Thompson, & Morris, 1999) and Trust Score sheet (Cummings & Bromiley, 2008).

Procedure for the feedback stage will vary according to condition as follows (see Figure 1):

- Control condition: The experimenter (as trainer) will facilitate individual discussions about what they felt went well or badly in the negotiation task;

no feedback on emotional signals data will be provided to either participant in the pair.

- Experimental condition 1: One participant in the pair will be chosen at random to receive 'social signals' feedback; the other participant will experience the same procedure as the control condition, with an individual refection session in which they will discuss what they thought went well/not so well in the practice negotiation.

- Experimental condition 2: Both participants will receive 'social signals' feedback. This will be delivered individually to each participant.

'Social signals' feedback will be generated using social signals, emotions data and voice data collected during the practice negotiation scenario (The Ugli Orange Negotiation). Individual 'social-signals' feedback will include a graphical summary based on the recorded social signals, facial emotions and voice data alongside the use of the iMotions playback tool. The individual 'social signals' feedback will be delivered as follows:

(i) Sociometric badges will provide data for the feedback on participant's movement rate, movement mirroring, participant's posture, posture mirroring, participant's vocal volume, vocal volume mirroring and speed of turn taking.

(ii) Video Recordings will provide facial emotions data for feedback on participant's seven basic emotions: joy, anger, surprise, fear, contempt, sadness and disgust, as well as their engagement, smile, smirk and brow furrow.

(iii) Voice recordings will provide vocal emotions data for feedback on participant's vocal content, upset, hesitation and extreme emotion (i.e. passion, anger etc.).

After the feedback sessions, all participant pairs will be given an additional negotiation scenario (Big Pipeline in the Isle of Grain) based on the role simulation materials provided by the Program of Negotiation at Harvard Law School, to work through (the same scenario for all participants). Social signals data, objective and subjective measures will be collected from all the participants during both the baseline and post-feedback negotiation tasks.

Figure 1 shows experiment flow chart which highlights the differences between the three experimental conditions.
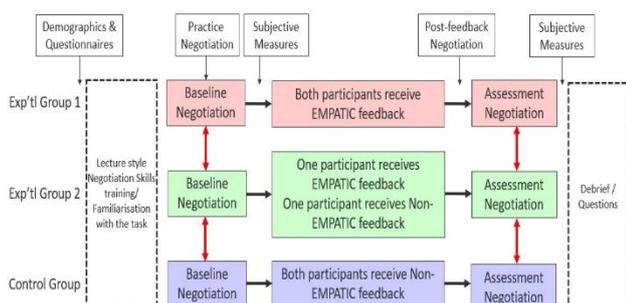

Figure 1: *Experiment structure for control and experimental conditions*

This study has been reviewed and given favourable opinion by the Brunel University Research Ethics Committee (ref: 11518-LR-May/2018- 12643-1).

3. MEASURES

3.1 Data Collection

3.1.1. Social Signals.
The following section describes social signals, emotion and voice measures (dependent variables) that will be collected during the experiment and equipment to be used for their collection:

(i) Facial expression recognition: Video images of participants will be captured by either a standard video recorder or a webcam and analysed using the iMotions Biometric Research Platform: Affectiva's AFFDEX.

(ii) Emotion recognition from voice: Audio recordings collected using a zoom recorder will be processed using the Nemesysco Layered Voice Analysis software, as it can extract complex emotional data out of life and pre-recorded voice materials.

(iii) Sociometer data analysis: the signals captured by the Sociometric badges 03-02 will be analysed to produce estimates of face-to-face interaction, conversational time, physical proximity to other people, and physical activity levels using social signals derived from vocal features, body motion, and relative location.

3.1.2. Measures of Negotiation Performance.
The following choice of measures of negotiation performance draws upon guidance provided by Tripp and Sondak (1992):

(i) Negotiation score outcomes (Big Pipeline only) – paired and individual outcomes.

(ii) The two roles in Big Pipeline have a different range of score that they can achieve in mutually acceptable agreements. The Briggs role can score in the range 30-55, while the Marchaud role can score in the range 45-94. There are fifteen outcome combinations which are acceptable to both parties (based on the instructions provided to negotiators):

3.1.3. Measures of Negotiation Performance.
The following subjective measures will be adopted for this study:

(i) Process evaluation scores (Sabin, 2007). Each participant will rate their negotiation partner on five process attributes: trust; respect; equitability; regard for the other's interests; and interest in future collaboration. These attributes will serve as proxies for assessing the future of the business relationship based on their experiences during the negotiation.

(ii) Rapport as measured by the five-item scale (Drolet & Morris, 2000) (reported alpha = 0.83). This questionnaire asks about the quality of the relationship that developed between the parties during the negotiation. When negotiators effectively show rapport during negotiation, this rapport is likely to motivate others to build trust and create a desire to continue working together in the future.

(iii) Trust will be measured using twelve-item scale Organizational Trust Inventory (OTI) scale (Cummings & Bromiley, 2008). (reported alpha = 0.70). The questionnaire asked participants how honest and reliable their partner was during the negotiation.

(iv) Desire to work in the future will be measured using a two-item scale (Moore et al., 1999) (reported alpha = 0.91). It asks participants whether they would have worked with their opponent again if they had a chance in the future.

3.1.4. Control measures and Demographics.

The following control measures will be adopted, and demographics will be collected for this study:

(i) Emotional Intelligence, as measured by the Schutte Self Report Emotional Intelligence Test (SSEIT) (Schutte et al., 1998) (reported alpha = 0.87).

(ii) Individual differences, as measured by the Big Five Inventory (BFI) (John & Srivastava, 1999).

(iii) Basic demographic measures will be collected: job role; gender; age; ethnic background; place of birth; nationality; first language; social/physical and communication impairment; and prior experience of negotiation.

3.2 Data Analysis

3.2.1 Data screening

Prior to analysis, the data obtained will be screened for normality and outliers. For subjective measures, internal consistency will be assessed through Cronbach's Alpha.

3.2.2 Factor analysis

Factor analysis will be used to look for patterns and associations within the emotional and social signals data. Where appropriate, factor scores will subsequently be used as dependent variables within inferential tests.

3.2.3 Inferential statistics

Mixed factorial ANOVAs will be used to examine changes as a result of training (from baseline to assessment negotiation, across the different training types). This approach applies to the social signals data (which will be collected as both stages) and to the subjective performance measures (e.g. process evaluation, trust, etc). Differences between training condition negotiation outcomes will be examined by one-way ANOVA (for negotiation score in the assessment task) and by Chi Squared (for impasse rates in the assessment task).

4. RESEARCH CONTRIBUTIONS

The present study is deliberately exploratory in nature as a necessary first step to validate the extent to which theories of emotion and social signals can be incorporated into practical reality and to explore the potential effects of social signal, voice and facial expressions features on negotiation practice and outcomes. Our aim is to see 'social signals' feedback result in negotiation outcomes that are more mutually beneficial for both negotiating parties as measured objectively. Practical implications of such joint gain results will have benefits within negotiation skills teaching and learning environments. Negotiation is one of the most common and constructive ways of dealing with social conflict and has wide application appeal and practical value. We hope that by adding 'social signals' feedback to training we are increasing the power of negotiation practice and performance by aiding individuals in creating a much better fit between their own personal characteristics and skills and practical negotiation techniques. Ultimately, increasing the chances of mutually beneficial negotiation outcomes.

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