

INVESTIGATION OF THE PERCEPTION OF POLITENESS IN SMALL GROUP FORMATIONS

GROUP NUMBER 15

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Abstract

Studying crowds have come to be a complex matter and many factors need to be taken in consideration. Earlier research have shown that some affective expressions are as efficient as facial expressions, if not better (Kleinsmith, A & Bianchi-Berthouze, N, 2013). In this psychophysical study we evaluated the perception of a small crowd of 3 individuals in F-formation. More specifically the perceiving of politeness/impoliteness in a person's body orientation in relation to other members of a group and from that determine the rotation threshold of perceptual politeness. The study used yellow stick figures as virtual characters, not specified by gender, age, cultural background, height or relation between them. Subjects were separately presented with a stimuli in which he/she was a part of a group formation where one virtual character was rotated. Different stimulus were presented in a randomized order where each stimuli had a different rotation angle. The subject was then given the task to rate the perceived politeness of each stimuli. Our results suggests that rotation of a character in a group did have an impact on the perceived politeness.

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1. Introduction

1.1 Background

Factors such as appearance, shape and environment are all affecting the way we as humans perceive things or different events. Kleinsmith & Bianchi-Berthouze (2013) especially emphasize the importance of body expressions and behaviour when conveying emotions, rather than only focusing on facial expressions as has been done a lot more in earlier research. As for our social behaviour, the body motion is seen to be an important cue when perceiving emotions in crowds or groups as well as our understanding the social information that is conveyed with (McHugh, J. E. et al. 2010). When it comes to studying crowds, these factors almost becomes more apparent and needs to be taken into consideration to get an actual understanding of the formations that occur.

In the book *Conducting Interaction: Patterns of Behaviour in Focused Encounters*, the author Adam Kendon investigates the relation F-formation - a spatial-orientational pattern that occurs whenever two or more people sustain the relationship within the pattern. The space between them (o-space) is one to which they have equal, direct and exclusive access (Kendon, A. 1990). We wanted to extend this study by investigating the relation between the orientation of the body within a group of three people in F-formation and the perception of impoliteness. Combining the book with our research we believe that it will make way for more research to be done in the area, so that developers working with animation and virtual reality can use this previous research as a guide.

In *Challenges in crowd simulation* by Daniel Thalmann and others, the authors identify what problems need to be solved in order to simulate real-time crowds in a virtual environment. The goal was to create crowd behaviour in specific situations, reacting to events, having a goal. They go in on the various factors that need to be considered such as appearance, shape, animation etc.

What we will consider is the perception of a crowd in F-formation, more specifically the perceiving of a person's body orientation in relation to the other members of the crowd. Since animation and virtual reality is a big part of the future and development of technology, it is our belief that it is important that the development considers all the sociological factors of the human species.

1.2 Goal

In this perceptual study, our aim was to investigate when an individual's body orientation, in a group formation of 3 individuals, is perceived as impolite. Is there a threshold degree where politeness/impoliteness is perceived? Or does it even have an impact concerning politeness/impoliteness? Moreover this study expect to determine the rotation threshold level.

The study's null-hypothesis is that the rotation angle of the body does not have an impact concerning politeness/impoliteness.

2. METHODOLOGY

We created a psychophysical user study to be able to determine if the rotation has an impact on politeness. This was a relational investigation between the independent variable “rotation of the body” against the dependent variable “politeness” (Lazar et al., 2010).

2.1 Modeling the stimulus

To be able to conduct an experiment for a user study, we created a scene in Unity3D where we placed two virtual characters in a group formation with a camera. The camera was used to take screenshots of the scene to be viewed as stimulus for a human test subject. As the camera was placed where the third person would have been placed in the group, it can be used to simulate being a part of the group. The camera was placed at the same height as the characters (which also both were the same height) to not place any value in height differences. To achieve good immersion, the horizontal field of view of the camera was calculated to 82° with a 100” screen. This was calculated at the distance of 127 cm to the screen. It was later revealed that the screen we got to use was much bigger which made the calculated field of view incorrect. We adjusted this by raising the distance to the screen to 2 meters in which the subject was to stand. This was done arbitrarily and might have resulted in a systematic bias. Calculations after the test showed that the error we had in relation to the field of view was around -0,2 meters.

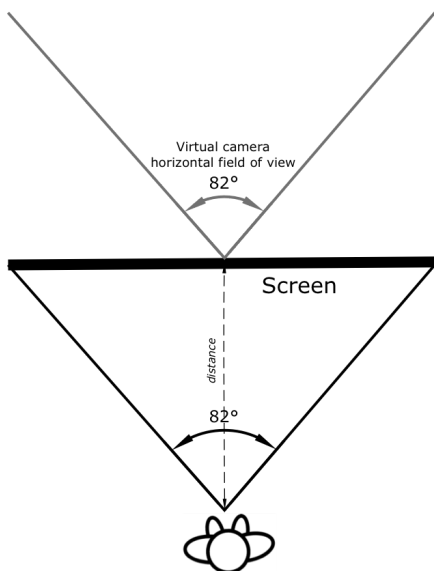


Figure 1: Schematic to calculate distance for subject or field of view for the camera

$$hFOV = 2 \arctan\left(\frac{\frac{\text{screenwidth}}{2}}{\text{distance to screen}}\right)$$

Equation 1: How to calculate the horizontal field of view (used for the virtual camera)

In the **starting** formation the group was placed in a triangle in the p-space of an F-formation all facing in the center of the o-space with equal distance between them (see Figure 2).

For the virtual characters we used (two) yellow stick figures, not specified by gender, age, cultural background or height. Nor is the relation between these specified. Since different color of the figures may influence emotion perception differently and yellow has shown to have a low emotional perception (Feng et al., 2010), the characters implemented as yellow. Instead the figures only acted as neutral characters standing in an F-formation system. The variation in the formation only depended on the body orientation of the figures. For the subject to perceive the characters as neutral as possible, neither eyes or finger motions have been defined, in case the subject would interpret feelings or current state of mood that is not relevant for the study and would influence the results.

The group were placed in a surrounding where visual clutter was reduced and the symmetry lines were straight as to not create any optical illusions (see Figure 3). The stimuli salience was low, except for the visual characters, to not create any attention capture besides the characters (Goldstein, 2016).

Other important factors are lightness and chroma which can influence emotional perception. (Ramos-Carretero, 2014; Carretero et al., 2014) The study has therefore tried to keep the lighting as neutral as possible, concerning both the figures, the background and shadows. Some shadow was necessary to be able to identify which direction the virtual character was looking (nose etc.), but too much could influence the affections of the test subject.

A script in Unity was created that rotated one of the virtual characters 18° relative to the current rotation and took a screenshot. The character's rotation at the start of the script was -90° from the center of the o-space. 10 screenshots was taken¹, which means the angles presented in the screenshots were -90° to 90° in 18° degrees increments.

¹ <https://www.dropbox.com/sh/xlku63e54fqyckl/AABUC9xX2x7DRpY932PSXfHEa?dl=0>

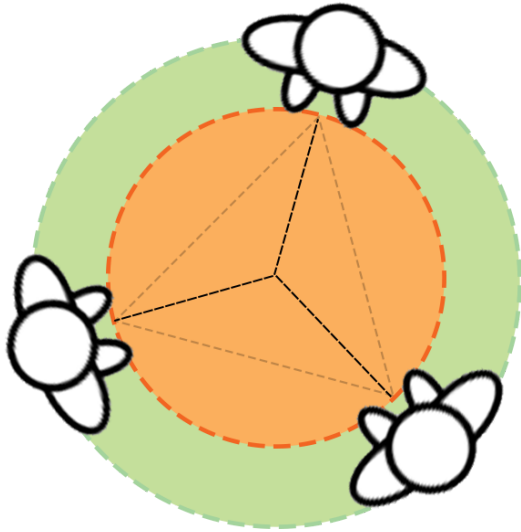


Figure 2: The “neutral” group formation. In our experiment two are virtual characters and one is a human subject (simulated by a camera).



Figure 3: The “neutral” group formation. In our experiment two are virtual characters and one is a human subject (simulated by a camera).

2.2 User Study

The screenshots (henceforth referenced as stimuli) were “randomized” to prevent systematic bias (Lazar et al., 2010) and compiled in a PowerPoint-presentation to be presented to a test subject. Testing was a simple within-group (Lazar et al. 2010) test where every subject was presented to all the stimulus. The randomization was done manually to not place close angles next to each other to not confuse the subject (close angles could have been mistaken as the same angle which could have influenced their answer). Some stimulus appeared more than once as we deemed them more interesting than the extremities and the starting rotation which meant we collected more data for some angles. This can be noticed on the confidence interval in the results.

We conducted the experiments on two occasions and the ordering was changed between the occasions to account for some possible ordering, learning and fatigue effects (Cunningham & Wallraven, 2011). Other methods can be used in further studies to better account for ordering effects such as blocking (divide stimulus and/or subjects into similar groups) or latin square to separate different factors.

When presenting the stimulus, the subjects were given the task to rate on a Likert scale from 1 to 5 (see Fig. 4) if they strongly agreed/disagreed with the statement that the (rotated) character is perceived as impolite in a group setting (rating 1=strongly disagree to 5=strongly agree) (Cunningham, 2011).

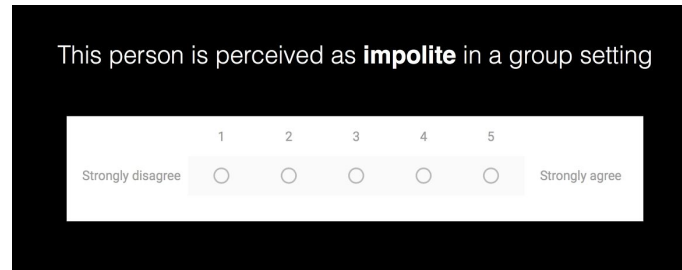


Figure 4: The statement presented to the subject. This was shown after each stimuli in the study.

Before the test started every subject was told instructions and presented with the scenario. Same instructions were told to all the subjects; they were told not to put any value in emotions and body-language. The participants were told that they were acquainted with the characters and that the group were having a easy conversation. But the main focus was to concentrate on the rotation of the character. They were also explicitly told it was not a test on them personally and to try to answer with his/hers first impression. All participants stood 2 meters from the screen.

Every slide/stimuli was shown for around 4-5 seconds to not make them overthink the situation.

All trials for the study took place in the VIC-studio (Visual Interaction Collaboration) located at KTH, CSC-building. The stimuli was presented through their rear projected 180” 4K-screen, with two JVC D-ILA 4K projectors projecting onto a glass screen, with the subject standing at a fixed distance from the screen (Fig. 5).

A small pilot study was done before conducting the actual study which gave us valuable feedback especially on the scenario, setting and instructions for the test subject.

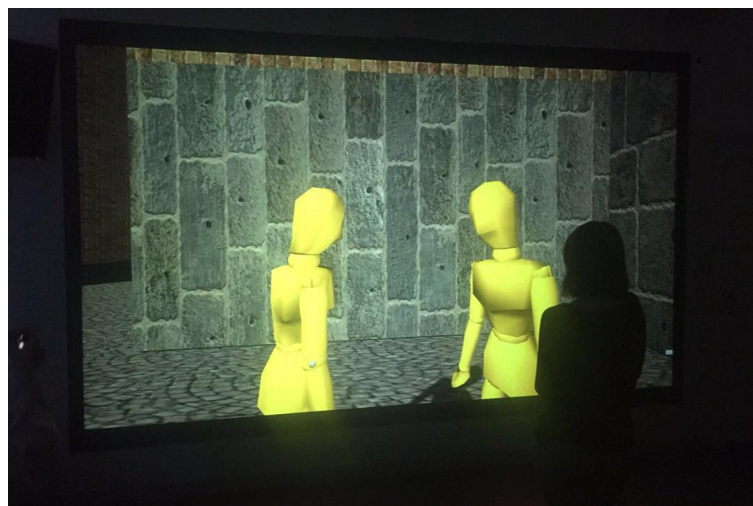


Figure 5: A test subject in front of the screen

2.3 Participants

A total of 21 test subject participated in the study split between two sessions. Most of them were students at Royal Institute of Technology and 57% of which were females. The mean age was 26.

3. RESULTS

Figure 6 shows the outcome of how much or if each rotation angle was perceived as polite/impolite. The mean value for each angle/stimuli were calculated with a 95% confidence interval and are also shown in the figure. Standard deviations was in the range of 0,6 - 1,2. The deviations and sample sizes were used to calculate the confidence intervals. 95 % confidence interval implies that the values within the interval we found in the study's selection is with 95% confidence also found in a larger population.

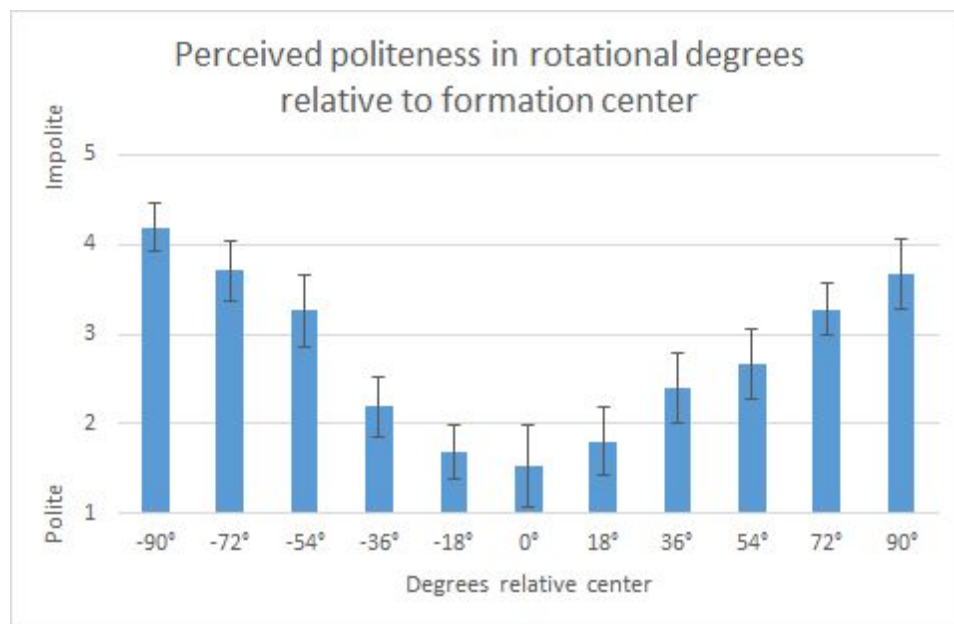


Figure 6: Results with 95% confidence intervals included

ANOVA (Analysis of Variance) can be used to analyze the statistical significance. One null-hypothesis we had was “Rotation does not have an impact on politeness” which we can test with a single factor ANOVA. Using the variance and means of our discrete categories we can test if our means are statistically significantly different (one or more means differs from the rest). We used the analytical toolpak in Excel to find a p-value of $1,30362097543633 \cdot 10^{-30}$ which is well under the alpha of 0,05 (we can say that we are 95% certain that one or more means are different). Thus we can reject our null-hypothesis.

4. DISCUSSION

4.1 Conclusions

It was found that the body orientation of an individual in a group formation does have an impact on the perception of impoliteness. The result shows that only rotating the body affected how our subjects perceived the figures. A 3-rating on our scale was “neutral politeness”, which can be translated to that angles over a 3-rating is impolite. Rotation within the range -36° to $+36^{\circ}$ relative to the center is perceived as polite in a group formation of three individuals. Rotation in the positive direction equals rotation towards the test subject, which can explain the upper limit being close to $+54^{\circ}$. Nevertheless $+54^{\circ}$ can't be included, as the confidence interval is above the neutral rating. Therefore $\pm 36^{\circ}$ is the only significant rotation angle threshold found.

It can therefore be concluded that the body orientation is an important factor when designing and simulating virtual crowds or characters. Certain results from this study can be applied when creating media with virtual characters. Our study gives some guidelines when creating group formations that want to be perceived as polite. Our study implies that when creating a group formation of three virtual characters, the angle of one of these characters can rotate up to 36 degrees without the formation to be perceived as impolite.

4.2 Weaknesses and strengths

Since we were able to use the 4K screen in the VIC-studio, we were able to simulate an environment for the subjects and further eliminate possible errors that could occur with not being able to experience a real environment. Research on the development of the virtual characters were done to make them as neutral as possible so that the subjects would not be affected by prejudices. Inevitably there are some other factors that we can not exclude entirely, it is possible that the body position affected the perception of impoliteness, for example. The study had some comments from subjects saying that the position of the body made it look like it was sad, which shows that it is hard to eliminate all other factors that have an impact on the perception. The participants were told that they were acquainted with the characters and that the group were having an easy conversation. Acquaintance and easy conversation could be interpreted differently by the participants. One can argue that the perception of a virtual character is biased by the viewer, in other words, can a study about perception entirely be bias free? The possibility that the participants will experience the virtual characters differently due to different backgrounds, childhood, life experience, etc. will most likely be a factor in perceptual studies.

There was a matter of logistics that made it hard to get other subjects than students that physically circulate in the near area of the university. All of our subjects were therefore between the age of 17-32 which is not a realistic representation, so the result is to be considered as a representation of students in the above mentioned age-group.

4.3 Reflection

We were able to successfully determine the range in which a person in a group formation is perceived as impolite. This is a project which can be used as a base for further research, and further development. The length and complexity of the study is limited and therefore can not be seen as a definitive result. We want this study to be considered as a discussion and a pre-study to more elaborated similar research. With more time we would have considered more influencing factors to the study in order to make the study more applicable. We would have made in-depth questions regarding the perception of the group formation to get a better understanding of what was influencing the answers we received. Relevant and qualitative questions could have been for example: “What about this person's body language makes you perceive it as impolite?”. This would have given a more in-depth understanding of what was actually perceived as impolite, where as in our case we assume that it is because of the body orientation because they were instructed to only consider the orientation. The amount of participants in the study should have been above 50 subjects so that the study could have been statistically reliable whereas in this study this is a hint more so than a definitive answer/conclusion. Also gender would have been taken into consideration to measure the difference in result to determine if there is a significant difference in perception between male and female perception (this could have been done in the results analysis, as we recorded gender on test subjects, but was left out due to time constraints).

This study covers the f-formation where three people form a triangular arrangement thus no conclusion can be drawn regarding the other f-formation variants; the vis-a-vis arrangement, L-arrangement, the side to side arrangement or other applicable formations. The possibility of the same conclusion being applicable to all these f-formations is not confirmed or denied but further research would need to be done to be able to draw a conclusion.

4.5 Future work

Our study in combination with other relevant factors such as body position and facial expressions can be used in variant algorithms for creating virtual group-formations. Since we were able to determine that body orientation is a relevant factor in perceived politeness in a group formation it is important to include this in future related studies. Due to the time limit on this project we chose one relevant variable to be able to successfully execute the project. While we did not have the time to further investigate all the relevant factors, we believe it to be important to consider this subject as the result may seem intuitive it is something that need to be researched in order to develop virtual characters and animation so that the intuitive factors can be explained and also explained to computers. It is important to comprehend the human behaviour in a mathematical way so that the gap between the behaviour of virtual characters/animations and the human behaviour is reduced.

If this study was to be developed further, one interesting aspect would be to investigate rotation of the body but keeping the face focused on the subject. Why not make a deeper study in group

formation by enlarging this study and analyze both rotation of the body with fixed face and rotation of the body with face focused on the subject. Furthermore analyze and compare the outcomes of these to scenarios.

Another possible future study would be investigating the body rotation in a group formation, as this study did, but instead of virtual characters use real persons. Would that study result in similar conclusions? Moreover this study can be considered as a pre-study to continue on whereas opportunities for further development, such as those above mentioned, are very much feasible .

To summarize the reflections and weaknesses of the study, to design a hypothetical study we can conclude that it will need much more participants that can range more in different ages. When it comes to the experiment itself, it will naturally be optimal if participants could experience real-life scenarios and then advance the questions so that you get an understanding of how much the body-orientation actually matters. This study will lead the way for many similar studies and ideally, enough data will be collected to be able to develop algorithms that generate animated human-like characters.

References

- Kleinsmith, A and Bianchi-Berthouze, N. (2013) *Effective Body Perception and Recognition: A Survey*, pp 2
- Ramos-Carretero, M (2014) *Expression of Emotion in Virtual Crowds: Investigating Emotion Contagion and Perception of Emotional Behaviour in Crowd Simulation*
- Carretero, M. R., Qureshi, A., & Peters, C. (2014, August). *Evaluating the perception of group emotion from full body movements in the context of virtual crowds*. In Proceedings of the ACM Symposium on Applied Perception. ACM
- McHugh, J. E., McDonnell, R., O'Sullivan, C., & Newell, F. N. (2010). *Perceiving emotion in crowds: the role of dynamic body postures on the perception of emotion in crowded scenes*. Experimental brain research, 204(3)
- Kendon A. (1990) *Conducting Interaction: Patterns of behaviour in focused encounters*, p 209
- Goldstein, E. B., & Brockmole, J. (2016). *Sensation and perception*. Cengage Learning.
- Lazar, J., Feng, J. H., & Hochheiser, H. (2010). *Research methods in human-computer interaction*. John Wiley & Sons.
- Cunningham, D. W., & Wallraven, C. (2011). *Experimental design: From user studies to psychophysics*. CRC Press.
- Thallman, D. & Grillon, H. (2009) *Challenges in crowd simulation*. International conference on Cyberworlds
- Feng, Haifeng, Marie-Jeanne Lesot, and Marcin Detyniecki (2010). *Using association rules to discover color-emotion relationships based on social tagging*. Intelligent Information and Engineering Systems. Springer Berlin Heidelberg
- Stimulus used in study
<https://www.dropbox.com/sh/xlku63e54fqyckl/AABUC9xX2x7DRpY932PSXfHEa?dl=0>