

# QUANTIFYING FACIAL MIMICKING USING 3D MOTION CAPTURE

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## INTRODUCTION

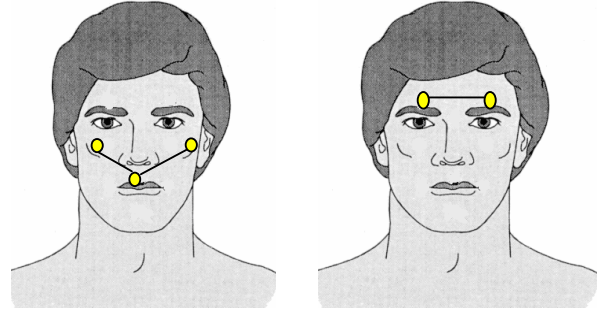
Facial motion capture is a useful tool that has been applied in the animation industry to reproduce the facial expressions of graphically rendered characters [1]. Similar data acquisition methods can be used to assess imitation of facial expressions. Mimicry plays a key role in social communication, understanding and rapport. It is altered in clinical conditions such as Down syndrome and Parkinson's disease. In this study, a methodology has been developed to quantify patterns of facial movement whilst participants voluntarily mimic facial expressions of emotions to examine the role of cognitive resources in mimicry.

## METHODS

Five healthy subjects (age  $23 \pm 1$  year, M:F, 2:3) were included in the study. Retro-reflective markers were attached to the face and the dominant upper limb. Three Qualisys Pro-Reflex MCU1000 cameras were used to collect 3D data of markers placed on the face. A 15.4 inch screen was placed 1.2 m away from the seated participant, displaying a sequence of static facial expressions posed by five females. "happy", "neutral", and "sad" expressions were presented in that order for a period of 100 seconds. Subjects were instructed to mimic the facial expressions displayed on the slide show. In addition, each participant completed the Berkeley Expressivity Questionnaire (BEQ) [2].

## RESULTS AND DISCUSSION

Positive facial expressions were quantified with the Normalised smile angle (NSA) between the mouth maker and the two cheek makers (Figure 1(a)) The negative expressions were consequently quantified with the Normalised frown distance (NFD) (Figure 1(b)) between the two eyebrow makers. NSA and NFD were compared with the BEQ positive (B+ve) and negative (B-ve) expressivity indices as shown in Table 1 for the 5 participants. No strong correlation was found between B+ve and the NSA, however NFD and B-ve showed a greater extent of correlation compared to the former (0.047 for the +ve and 0.66 for the -ve), thus an indication that participants have a greater self-perception of their expression of negative emotions as compared to positive.



**Figure 1:** Maker position used for data analysis a) Normalised Smile Angle and b) Normalised Frown Distance

## CONCLUSION

Comparison of motion analysis data and BEQ Index indicates that quantitative analysis of mimicked facial expressions provides an objective measure of the extent of facial movement for 2 different expressions. A combination of facial movement variables will provide a more powerful classification of positive and negative emotions. This may be a useful tool for comparison with patients who demonstrate poor mimicking performance, such as those with Huntington's disease. A more meaningful outcome will be explored for a larger cohort and ethical approval is being sought to apply the current protocols to clinical populations and neuron-imaging.

## ACKNOWLEDGEMENTS

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## REFERENCES

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**Table 1:** Positive (+) and Negative (-) BEQ Index and the Normalised Smile Angle (NSA) and Normalised Frown Distance (NFD) for 5 subjects for mimicking

Subject	BEQ Index		Motion capture	
	Positive	Negative	NSA	NFD
1	0.9	0.6	1.03±0.02	0.93±0.01
2	0.8	0.5	1.08±0.0	0.87±0.02
3	0.8	0.5	1.05±0.01	0.85±0.01
4	1.0	0.5	1.05±0.01	0.80±0.02
5	0.6	0.5	1.03±0.01	0.84±0.05