Perception of Congruent Facial and Haptic Expressions of Emotions

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1 Introduction

Haptic expression of emotions has received less attention than other modalities. Bonnet et al. [2011] combine visio-haptic modalities to improve the recognition and discrimination of some emotions. However, few works investigated how these modalities complement each other. For instance, Bickmore et al. [2010] highlight some non-significant tendencies of complementarity between the visual and haptic modalities.

This study aims to identify the most relevant modality to convey each dimension of the PAD space (pleasure, arousal, dominance) [1977] for an efficient recognition of emotions by users. It explores how facial and haptic expressions of emotions are perceived by participants when those expressions are presented separately or simultaneously. Results should provide some cues for the choice of the suitable modality to convey each emotional dimension and emotion.

2 Experimental settings

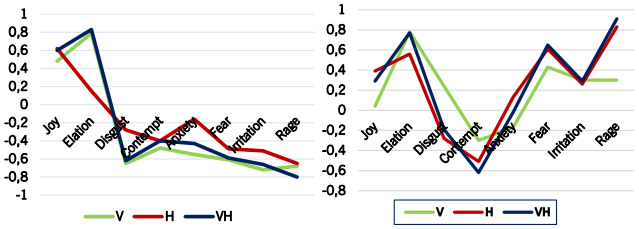
Our experimental platform features a Geomagic Touch X device for playing 3D haptic expressions, in correspondence with previously recorded expressions. A desktop screen displays the facial expressions created using a virtual avatar [2008].

Forty-one people (10 women and 31 men), between 20 and 62 years old (28 years old on average, SD = 9), participated in the experiment. For eight studied emotions, participants went through three conditions presented in random order: visual (V), haptic (H) and visio-haptic (VH) expression of emotion. For each expression, participants reported their feeling in the PAD scale using a five point Likert scale for each dimension, and the emotion category they perceived from a list of eight possible categories.

3 Results

We observed that the majority of the values reported by participants on the PAD scale for the VH condition fall into the values of the V and H conditions. V and H perception results present distances between them greater than for V and VH ($p = 0.05$), as those for H and HV ($p = 0.05$). However, the distance between V/VH and H/VH were similar ($p = 0.72$), which statistically support the previous observation.

Concerning the ratings of each dimension of given emotions, the evaluation of pleasure for V expressions was similar to the reported pleasure for VH expressions of the corresponding emotion. We also found than the evaluation of arousal for H expressions was similar to the reported arousal for VH expressions. This means that subjects relied more on the visual(resp. haptic) modality to evaluate the pleasure (resp. arousal) in the VH expressions (see Fig. 1).



(a) *Pleasure* **(b)** *Arousal*

Figure 1: *Average perception of pleasure and arousal according to the modality of expression. For pleasure, the perception in VH is close to V. For arousal, the perception in VH is close to H.*

Concerning the relation between the modality of expression and recognition rates, a Spearman's test highlighted a better recognition rate of emotions conveyed with visual (resp. haptic) expressions and presenting an important magnitudes for the pleasure ($p = 0.046, \rho = 0.74$, resp. arousal, $p = 0.062, \rho = 0.68$) dimension. No correlation was found for the dominance dimension.

4 Conclusion

Visual and haptic modalities seems not be equal in their ability to convey the different emotions. This result is in line with previous work [Bickmore et al. 2010] and suggests that modalities are interpreted in complementary and not redundantly.

Our results show that subjects tend to merge facial and haptic cues to rate emotions. However, the perception of each dimension of the PAD scale depends on the modality of expression. Moreover, if an emotion presents an important arousal, the addition of a suitable haptic expression to a facial expression should improve the recognition rates. Future researches will explore how to exploit these results to improve the recognition of close emotions in the pleasure dimension and presenting similar visual expressions using haptic expressions.

References

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