3rd HUMAINE EU Summer School Casa Paganini-InfoMus Lab, DIST, University of Genova, Italy
(September 22nd to 28th 2006)

Generation of Facial Emotional Expressions Based on Psychological Theory

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1 Scherer's theory on iCat robot

Facial expressions are an important aspect in affective social computing. They express internal states of robots during social interactions. Scherer's psychological theory has the advantage of linking cognitive and emotional processes. We have implemented a part of this theory on a robot: iCat.

We are interesting in 'The Component Process Model of Emotion" defined by Scherer [1]. This dynamic process allows to recognize and to generate emotional expressions. In this paper, we will only focus on the generation of emotional facial responses in terms of Action Units on iCat robot.

Fig. 1. iCat robot

Fig. 2. iCat facial expressions

iCat is a robotic research platform developed by Philips. It is focused on human-robot interaction with speech and facial emotional feedback [2]. We will interest in iCat's social aspect and its abilities to express basic emotions such as sadness, anger, happiness or fear (figure 1 and 2). To implement Scherer's theory, we had to adapt AUs in terms of iCat possibilities: some AU remain unchanged (AU2: outer brow raise), others are extrapolated (AU4: brow lowered is expressed as AU2) or even ignored (AU17: chin raising), as shown in Table 1.

2 Believability, Exaggeration, and Recognition User Studies

We have implemented a first time the theory on iCat and results obtained by comparing the believablity of our expression with Philips expressions were not

Action Units	FACS Name	Neutral Example	Medium Example	Very High Example
POSSIBLE ACTION UNITS				
AU2	Outer Brow raise			
AU12	Lip Corner Puller			
AU15	Lip Corner Depressor			
EXTRAPOLATED ACTION UNITS				
AU4	Brow Lowered			
AU26	Jaw Drop			
AU41	Lid Droop			

Table 1. Possible and Extrapolated Action Units

satisfying. We have decided to adapt this theory with cartoon animations and results are better: believability and exaggeration of our new expressions have increased (figure 3 and 4). We have also evaluate the recognition rate (table 2).

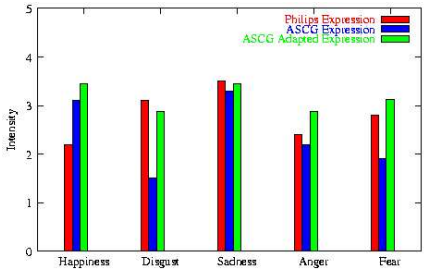

Fig. 3. Emotions believability

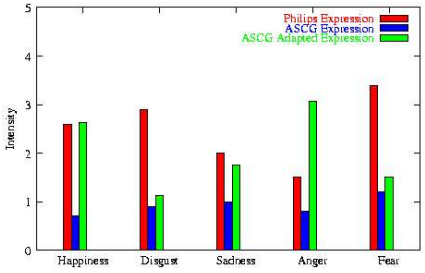

Fig. 4. Emotions exaggeration

Showed \ Recognized	Happ.	Disg.	Cont.	Sadn.	Prid.	Fear	Ange.	Indi.	Sham.	None
Happiness	**75%**	13%	0%	0%	0%	0%	0%	0%	6%	6%
Disgust	0%	**25%**	56%	0%	6%	0%	0%	6%	0%	6%
Contempt	6%	0%	**19%**	0%	63%	6%	0%	0%	0%	6%
Sadness	0%	19%	0%	**56%**	0%	0%	0%	0%	25%	0%
Pride	13%	0%	0%	0%	**38%**	31%	0%	6%	0%	13%
Fear	0%	0%	0%	0%	0%	**69%**	0%	6%	13%	13%
Anger	0%	0%	6%	0%	0%	0%	**88%**	0%	0%	6%
Indifference	0%	0%	0%	6%	19%	0%	0%	**63%**	13%	0%
Shame	0%	0%	0%	31%	0%	0%	6%	19%	**31%**	13%

Table 2. Emotional recognition rate for iCat

The results showed that our representation is believable but we have open research questions regarding the adaptation of Scherer's emotion theory for computational modeling.

References

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