Social eMotions

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SUMMARY

In this project we combined artistic and scientific research methods to investigate the bodily expression and communication of emotions.

In the artistic research, two choreographer-dancers explored the bodily correlates of social emotions, and then prepared a short, "neutral" choreography that could be performed in a number of different emotional contexts. These performances were motion-captured and analysed to establish a mapping between emotions and movement features. Stick-figure animations of the mocap data were used as stimuli in a perceptual study that looked at how the audience perceives the performers' expressive movement.

In addition to the scientific output, the project also resulted in a dance performance that brings together different strands of the project.

ARTISTIC RESEARCH

Two dancer-choreographers (JL & JN) used Stanislavski's methods to map the physical correlates of various social emotions, e.g. pride, shame, love, and loathing. They investigated how they influence movement and interactions between dancers, and experimented with different targets and sources for these emotions (self/other/shared). Later in the project, the musical correlates of these emotions were explored with two professional cellists, and finally a media artist (RP) created dynamic visualisations of these emotions for the performance (Fig 1). This produced a matrix of emotions and their performative characteristics (Table 1).

Based on the artistic research, we decided to focus on "loving" and "loathing" in the kinematic and perceptual studies that followed. A dance work (main image) further explored the issues of emotional communcation and dynamics.

Figure 1. Example of the projection used in the performance. Edges of the dancers' bodies are captured with Kinect, and the shapes are processed to express love (left) and hate (right). The live, dynamic visualisation also draws lines between the dancers, indicating how their emotions shape their interaction.

KINEMATIC STUDY

Different versions of a short (20–30 s) "neutral" choreography were motion-captured using a 20-camera optical mocap. Each performance contained 7 repetitions of the choreography. Performers had the same or different emotion (loving, neutral, loathing), they either maintained the starting emotion or let it change to another over the 7 loops. A total of 22 combinations were recorded plus 2 performances of pride and shame (Fig 2).

372 kinematic features were extracted from the data. A principal component analysis (PCA) was conducted to reduce the dimensionality of the feature space, and to link kinematic features with expression of different emotions (Fig 3). The PC's were also correlated with the perceptual data.

Two PC's were needed to map the movement features to the intentional variations in the performances. PC1 (51.6% of variance), loaded the velocity features, and mapped onto the overall amount of loving or loathing in the performance, while PC2 (24.9%) represented the contrast in performer's dances.

PERCEPTUAL STUDY

Viewers were asked to rate one of the two stick-figures (the blue one) on three different seven-step scales: feeling of blue dancer towards the green one, how energetic the dancer appears, and whether the blue dancer is leading or following the dance (valence, arousal, dominance).

Stimulus videos were created from single loops of performances with static emotional content. Here we report results from a set of more controlled pairs of videos: the rated character was kept identical, but the partner was either the original one or one copy-pasted from a performance depicting an opposite emotion.

The questionnaire was run on a crowdsourcing platform CrowdFlower, where 275 people participated, each rating up to 20 videos. Eventually, every video was rated 30 times.

Ratings were affected by the partner figure's expression (Fig 4). While even the video where both express *loathing* (HH) was judged *neutral*, swapping the partner to *loving* (HL) shifted the rating towards negative, by establishing a contrast.
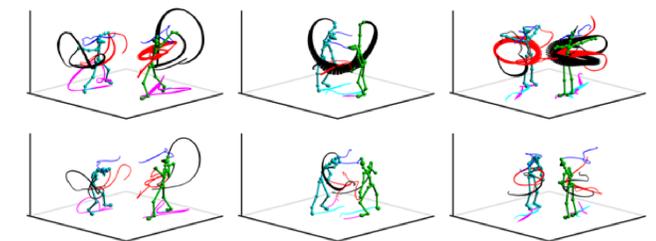
Figure 2. Examples of motion-captured movement. Loving (top row) and loathing (bottom). The width of the trajectories indicates the speed of the movement. The characters are similar to those used in the perceptual study.
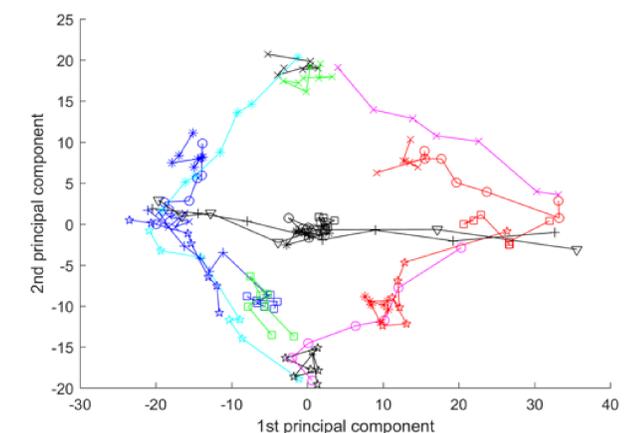
Figure 3. PC's 1 and 2. Each marker represents one cycle of the choreography. Performances that start by expressing love are in red colors, those that start indicating loathing in blue, neutral in black. The 1st PC loads features related to velocity and acceleration, 2nd PC to how different or similar the two characters are.
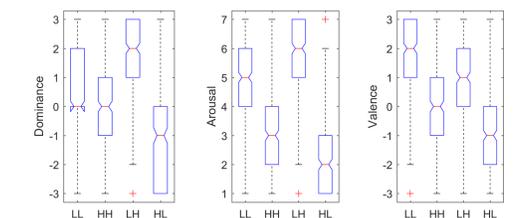
Figure 4. Perceptual study results indicate that swapping the partner changes how a character is rated along all three scales. LL (loving - loving) and HH (loathing - loathing) are the originals, and in LH and HL the rated character is the same, but the partner is swapped from another recording.

CONCLUSIONS

Our research studied the correlates between bodily sensations, expressions, and perceptions of emotions. Results help performers understand emotional interactions between themselves, and with audience. Movement velocity and similarity are key factors in distinguishing loving and loathing, and contrasts between animated characters influence how they are perceived.

Combining artistic and scientific methods allowed us to study emotional communication and to challenge the concept of emotional "states"; emotions were in constant flux.
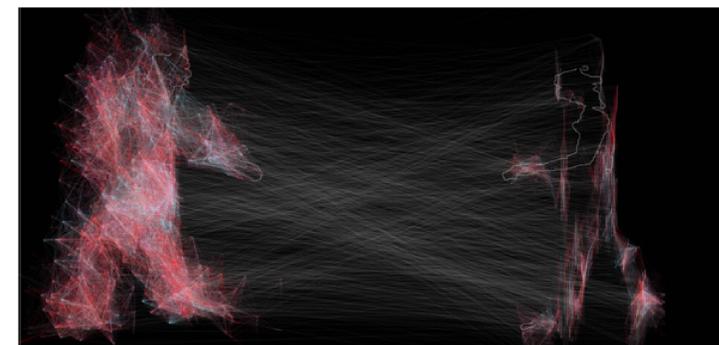
	MOVEMENT				MUSIC				PROJECTIONS		
	RELATIONSHIP	DISTANCE	FACING	PHYSICALITY	PHRASING	PHRASE VARIATION	TIMBRE	SYNCHRONY	SPEED	MORPHOLOGY OF THE BODY	LENGTH OF LINES
LOVE	Partner as target	Aims to be close by	Feels the other regardless	Heart bursting. Warmth spreads from heart to whole body	Long lines	Looking for long lines, picks notes.	Strong, warm, and free	In harmony with the other.	Fast accelerations, fluidity	Expands freely	Connects to the other
LOATHING	Partner as target	Tries to get away	45 degrees away	Low centre of gravity. Nausea. Pushing away.	Shivering swells and glissandi	Dissonant intervals	Suffocated	Aims to break synchrony	Occasional jittery movement	Energy departs, body's structure changes	A slow wave of lines towards the other body
INTEREST	Partner as target	Seeks to be closer	Towards the other	Positive, very focused	Playful	Rhythmicity (picks notes)	Playful and free	Listening to the other	Playful, with moderate accelerations	Energy departs, curious, excited about other's presence	Connecting lines come as waves
SUSPICION	Partner as reason / target	1–5 m (on a 6x6 m stage)	45–75 degrees away	Watching	Reserved and expecting	Doesn't need to occur	Relatively stiff and superficial	Within an arms length	Swift, bursts of acceleration	Close to the body	Swift lines connecting to the other

Table 1. Characteristics of movement, music and projections for four emotions. Each medium has its own "dimensions" of description.

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