VISUALISING EMOTIONS AND AUTISM

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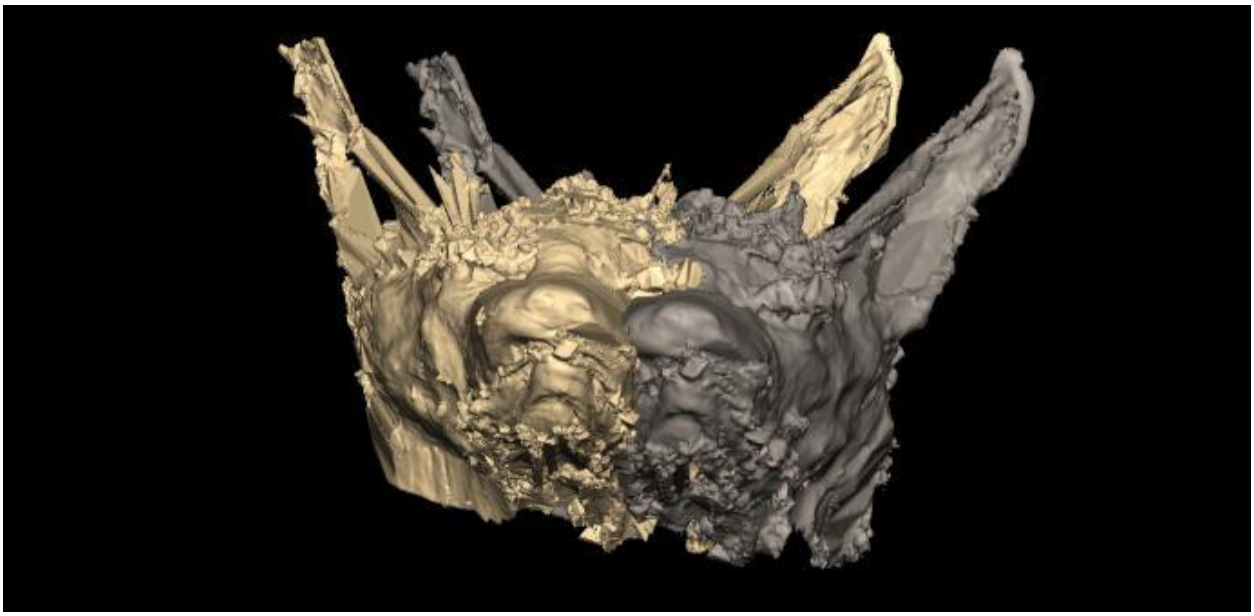
The e_Motion research proposal integrates 3D visualization, haptic technology and rapid prototyping as a window into the Autism Spectrum Disorders (ASD) mind. It represents an exciting evolution of past work done on emotion and digital media. Through the research of Simon Baron-Cohen and others we have learned that ASD falls along a broad spectrum.



Preface

It is now well known that many ASD people are visual thinkers and learners, and this paper proposes new research to utilize state-of-the-art but 'APPROACHABLE' digital technologies that will allow the autistic person to speak with distinct and enhanced visual voices. This differs from art therapy in that it will lead to a better understanding of how ASD individuals think and feel, through visualization. That the products of creativity might allow psychologists and neuroscientists to better place individuals along the ASD spectrum is especially critical.

This research paper outlines a unique contribution emphasizing emotion and visualization through digital 3D production and haptic technologies. The project is still in its early stages of production, however it has initiated the outlines and hypothesis of a promising cross-disciplinary study that also introduces a PLAY method for emotion rehearsals.

Introduction: Engaging Autism at e_Motion Lab

The discussion of affective computing that Rosalind Picard introduced in the mid-1990s is rather interesting to me when it comes to machines learning about affect and emotions. If we claim that we are ready to produce synthetic emotions to build affect in robots, we seem to know a great deal about them. Here, I am concerned with finding out what happens if emotions go wrong. At 'e_Motion Research Lab' we work together and investigate with the autistic person, or more correctly the person on the Autism spectrum disorders (ASD) who serves as a case study for a malfunctioning of emotion handling. The autistic person's main goal is twofold: it is to learn to read and respond emotionally to signs of emotions and of equal importance to experience emotions in their full meaning. It has been questioned whether the autistic child can actually learn to experience true emotions. I am investigating in the floortime approach introduced in 'Engaging Autism', a book by Stan Greenspan, in which he delivers thorough research that helps autistic children to relate, communicate and think in a meaningful way. The work suggests that the psychology therapist has to examine the developmental stages of the very young child and go through the learning processes with the child (and parent) step by step. They initiate creative situations by employing a Play methodology. What I bring to this approach is the use of haptic and

tactile interfaces to generate and also measure emotional feedback and affective creation. I suggest that the haptic technological interface research might enhance emotional and affective experiences through the hands-on creation process.

Intersubjective Approaches to Influence Emotional Communication

How do we learn a language and/or social skills? We seem to build on personal experiences; we create a model of the world that is being constantly updated. However emotions are very subtle and the autistic person seems to be less tolerant of emotional responses that differ from the model they had just adopted. By this I mean to introduce the subtleties of facial or bodily gestures that communicate all shades of emotional correspondence.

The problem with emotions is that we need emotions to make creative choices but also emotions and feelings are necessary in order to make rational choices. Affective computing talks about this problem of affect and emotion not being the same: affect is central to our understanding of culture, in particular to the postmodern debate; the body and its capacity for sensation is informing cultural theory - its discussion about how society and humanity are far more complex, and cannot be reduced to a diagram. Picard (1996:1) defines affective computing as "computing that relates to, arises from, or influences emotions." (She coined the term in the mid-1990s.)

My earlier attempts to visualize emotions came into being when I worked on a study about facial expressions. I employed Paul Ekman's understanding of universal emotions, expressions of the face that can be understood across cultures. His classification of basic emotions into a list of six distinct emotions (anger, disgust, fear, happiness, sadness, and surprise) was later extended to include guilt, contempt, shame and others. I initially used a list of seven emotions by adding contempt to the original six basic expressions. This allowed me to select distinct facial expressions in the human face that are identified with being happy, sad, disgusted, afraid etc.

Through a previous collaboration with the University College London I had access to a large 3D database of the human face, where I suggested adding new scans, namely scans of a smiling, frowning, surprised or disgusted face of a man. Furthermore I was interested in discussing the evolutionary aspect of emotions, not unlike Darwin's interrogation of expressions of emotions in animal and man. I therefore included a fox's neural expression in the very same large database. This allowed me to morph not only from a happy to a sad person, but I could now also animate the face to become more fox-like, with a happy or sad expression on its face. This model will be used in a study to test facial expressions and mimicry in the autistic person.

Several research creations were produced using this large database. Works include 'emotional degrees' (animation), 'interFaced' (sculptures), and 'friends' (hybrid digital representations of merged faces). I will include images of these works. Copyright Barbara Rauch.

In his book 'Emotions Revealed: Recognizing Faces and Feelings to Improve Communication and Emotional Life' Ekman (2003) describes the importance of the face in human communication. We all recognize a smile, we mimic it and so does the infant child.

The autistic child however might not return a smile, and it has been discussed whether this is due to the child not being able to read the emotion of the mother more generally, or if this is due to a frustration

caused by the child not being able to clearly identify or classify slightly different emotional expressions on the face.

The study of emotions in autistic people has been addressed by numerous researchers, and one particular theory is of importance to my research and this will be elaborated here. When discussing the issues of emotions in humans we relate concepts of consciousness, mind, empathy, and evolutionary biology, animal study and social neuroscience; all of the named concepts address the debate of an emotion theory and the theory of mind (ToM).

If a subject has an understanding of self and other, place and time, the person will be able to simulate a situation or even imagine someone's thoughts and intentions. And this is what seems to go wrong in the autistic child's mind. Theory of mind impairment sometimes referred to as mind-blindness discusses the inability of the autistic person to understand that another person has her own thoughts, this of course also includes feelings or emotions in response to particular incidents that the other person might experience.

Imitation, mentalizing and empathizing are skills that the young child acquires by mimicking and learning, however it seems that the autistic child might not have a very robust theory of mind (Baron-Cohen 1985). 'Theory of Mind' is what Baron-Cohen refers to as 'social reciprocity'. It is important as a social skill to pay not only attention to others, but also to others' intentions. The learning of other and self is usually mastered by a young child of 2 years of age. (See chapter 2, PhD thesis, Rauch 2006.)

The ability to imitate, mimic, mentalize etc., allows social-cognitive achievements, perspective taking, empathy: all these are the base for a theory of mind. The ASD child does not mimic the mother's gaze or smile, because it seems she cannot read exactly, as the face might vary too much for the ASD's liking of systematic answers and clarity in the expression. There is fascinating research on the interaction of the autistic child with robot toys that confirm this bold statement (Kaspar the friendly robot or soccer-playing humanoid robot Nao have both been developed for use treating autistic children).

Stanley I. Greenspan in 'Engaging Autism' (2006) points out how important early signs of autism in infancy are and in describing and advocating the floortime approach and the DIR program parents and therapists can intervene and help the autistic child to learn how to develop social skills. Greenspan reiterates how important it is to learn each step in the development. One has to be able to engage in basic attention, to be able to share a world to be able to develop higher levels of abstract thinking. And since this is one of the main problems that have been identified in autism, 'e_Motion Lab' research takes the specific object and then generalizes it to create a prototype image or memory of it. The digital data can then be treated like clay or other materials to manipulate, pull and push the data to play with iterations of the very same prototype.

Temple Grandin's work in 'Thinking in Pictures' encourages visual thinking over verbal expression. She talks about the frustration that the child will experience by not being able to label and express a particular emotion, resulting in the child's turning away from emotional data and instead concentrate on objects, toys or systems that are more reliable. By introducing models that the ASD person can identify with this will be a huge opportunity to create specific and recognizable representations of emotions almost on demand. The lab is linked with an adjacent rapid prototyping set-up where we hope to introduce 3D printers that range from handling material output that is soft resin, hard and porous plastic/ceramic shell and paper modeling using lasers, additive and substructive sintering machinery.

Temple Grandin elaborates on her particular interests in systemizing designs. She explains that the ASD has developed a hypersensitivity to detail and individual blocks of information. ASDs often are talented in the breaking down of complex models or designs into small parts.

Grandin is a high-functioning autistic person, and in the near future we will be working with ASD adults and ASD artists and designers who would be encouraged to work with complex data sets; they would be touching the data using haptic and other sensory tools. We speculate that their particular sensitivity with touch and feedback will produce a unique body of designerly and artistic work. The fluid data set would offer a rehearsal situation for their emotional frustration, they will be altering faces or change objects to their liking. And I hypothesize that this body of work will be revealing insights into the unique haptic and sensory skills of the emotionally challenged ASD. (REB approval in process.)

As mentioned above e_Motion Lab works not only with autistic people. We collaborate with artists and designers on creating through haptic devices and visualization tools and techniques. We recently received funding to stage a PlayShop workshop series employing a Play Methodology. My particular workshop hopes to deliver insights into emotions and feelings and the use of technological tools and to apply these findings to enhance the potential expression of emotions for the ASD person.

Emotions and feelings are probably the most confusing phenomena for psychologists, biologists, and those working in general in the sciences and humanities alike. Artists and designers have over the centuries devoted themselves to work on questions of and around consciousness and emotions. This is not just because emotions and their expressions often withdraw themselves from verbal reports but they are expressed equally both internally as feelings and sensations and externally as bodily gestures or facial expressions.

Being such a complex issue many influential researchers have engaged in emotion studies; Charles Darwin was as an early figure of evolutionary biology and William James (1890) an early key proponent of the psychology of consciousness; Dennett as a contemporary philosopher within cognitive studies, and his method of heterophenomenology, when it comes to the study of one's own mind. But if it is for Dennett we are all just conscious robots. On the other hand Joseph E. LeDoux and Antonio Damasio confront us with their neurological views. In Descartes' Error (1994), Damasio outlines how important emotions are for rational decision-making. He explains that reason and emotion are not separate; instead, mind and body need to be examined and explained in tandem. Damasio also explains the difference between emotions and feelings, as emotions happening in and with the body, while feelings are reflective and conscious experiences in the mind.

For facial expressions, emotions and bodily emotional gestures I want to highlight here again the work that Paul Ekman has done over many decades. Ekman's examples of how to read emotions on faces will be explored. Ekman created hundreds of photos; some are collaged works since they are difficult to make on demand. One approach in the workshop will be to improve our ability to read the face of the other. We will mimic and play with toys, so as to create a basic means of communications between ourselves.

We will study Robert Plutchik's psychoevolutionary theory of emotion in more depth to employ his wheel of emotions in our Play workshop session. If we consider his elaboration on emotion and cognition, emotions are really developed to help predict future events. Emotions are there for survival of the species and they serve as cognitive information about our environment. In that sense they are not linear events but feedback processes, they are in loop to restore a state of equilibrium in the body. This is true

for internal as well as external stimulation i.e. dreams trigger much of our emotion processing in the amygdala of the brain, where emotional data is mainly being processed.

As for the planned three-dimensional colour wheel for emotion concepts, Plutchick has developed a 'circumplex' model that not only represents emotions and their intensity but also explains how emotions can be combined. In addition the wheel has been used as a tool for personality labeling. I would hope that by playing with the model we will also examine how we relate to each other's emotional states.

The e_Motion Research Project (e_MRP) looks into Autism Spectrum Disorders as a model for understanding the mind of the other. With facial expression and reading emotions through an intersubjective approach, we explore both the relations with oneself and an object and the manifold relationships between subjects and externalized others.

Through these imaginative play or pretend play situations we create scenarios in which one engages in make-believe situations. Imagination and pretending helps children and adults to rehearse actions and sequences of actions; they can play out their ideas so as to rehearse for later in real life situations.

The Play Methods Workshop will be considered such a rehearsal situation. We aim to visualize the information we have gathered and hope to come up with some infograph/ sketches for the sessions. It is hoped that the visualization employs Csikszentmihalyi's theory of flow, the 'optimal state of experience' and deep immersion in the experience of one's self.

References and Notes:

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