TALKING FACE

Elena Georgiana
Daniela Decheva

Delft, Netherlands
June 2004

I. *Acknowledgments*

We would like to thank here especially to Dr. Drs. L. J. M. Rothkrantz for his guidance and support. We also want to give thanks to Ania Wojdel who assists us to work on this project. The thank belongs also to chief assistant S. Smrikarova from the University of Rousse, who helped us to come in Delft for development ours bachelors' diploma projects in Delft University of Technology.

II. *Table of contents*

III. *Introduction*

At the start of the new millennium, telecommunication is slated to fully embrace "data" over Internet protocol (IP) networks in the form of multiple media such as voice, video, documents, database accesses, etc. More and more devices, from telephones to Personal digital assistants (PDAs) and PCs, will enable communications over IP networks in multiple modalities, including "video" in addition to the traditional "voice" communication. Increasingly, human-to-human communication will be amended by communication between humans and machines for such applications as e-commerce, customer care, and information delivery in services.

Today, human–machine communication is dominated by the input of typed text plus mouse clicks, while the machine produces text and graphics output. With recent advances in speech recognition, natural language interpretation and speech synthesis, however, conversational interfaces are finding wider acceptance. The next step in giving human–machine interfaces the look and feel of human–human interaction is the addition of visual elements. Image analysis enables the recognition of faces, or of other objects for a visual input, while animation techniques can synthesize human faces providing spoken output by a machine. [6]

At Delft University of Technology, there is a project running on talking faces. The goal is to develop an automated newsreader. Given some text, this text will be read aloud by a 3D synthetic face, which show also appropriate facial expression. The first step is to develop a newsreader in a "neutral " environment. The next step will by to develop a newsreader "in action", that is to say the newsreader is on the spot where the action is. In that case the newsreader has to by context sensitive. The project is composed of several subprojects, which will be described text.

Animated faces have many potential applications, for example, in e-learning, customer relations' management, as virtual secretary, or as your representative in virtual meeting rooms. Many of these applications promise to be more effective if the talking heads are video-realistic, looking like real humans. When buying something on a Web site, a user might not want to be addressed by a cartoon character. However, streaming or live video of a real person is in most cases not feasible because the production and delivery costs are far too high. Similar arguments apply to e-learning applications. Several researchers have found that a face added to a learning task can increase the attention span of the students. Yet producing videos is prohibitively expensive for most e-learning tasks. If an application is accessed over the Internet, there is the additional difficulty of a limited bandwidth that often prevents streaming or lives videos. With synthetic faces, it is possible to achieve a far higher compression than usual with compressed videos; hence, they can be presented over narrow band modem connections. One important application of animated characters has been to make the interface more compelling and easier to use. For example, animated characters have been used in presentation systems to help attract the user's focus of attention, to guide the user through steps of a presentation, as well as to add expressive power by presenting nonverbal conversational and emotional signals. Animated guides or assistants have also been used with some success

in user help systems, and for user assistance in Web navigation. Personal character animations have also been inserted into documents to provide additional information to readers. [6]

IV. *Literature survey*

1. Multiple Messages in Nonverbal Communication

Corresponding to the several sources of expressive information in the face are the many nonverbal communication messages that the face can provide. A further difficulty for interpreting the face is that the appearances produced by one source of facial information can interact with another, producing a mixture, as mentioned above, that can hide, mask, or interfere with the messages conveyed by each source. The structure of facial nonverbal communication is complex. The interpretations of these facial expressions should provide an idea of the variety of information that can be derived from nonverbal communication by the face and the sources of this information.

2. Facial expression

The face is a visible signal of others' social intentions and motivations, and facial expression continues to be a critical variable in social interaction. The human face is the most complex and versatile of all species. For humans, the face is a rich and versatile instrument serving many different functions. It serves as a window to display one's own motivational state. This makes one's behavior more predictable and understandable to others and improves communication. The face can be used to supplement verbal communication and to complement verbal communication, such as lifting of the eyebrows to lend additional emphasis to a stressed word. The term "expression" implies the existence of something that is expressed. Facial expressions have primarily a communicative function. Regardless of approach, certain facial expressions are associated with particular human emotions. Research shows that people categorize emotion faces in a similar way across cultures that similar facial expressions tend to occur in response to particular emotion eliciting events, and that people produce simulations of emotion faces that are characteristic of each specific emotion.
Human universal facial expressions1 of emotion are perhaps the most familiar examples of facial expression, at least among anthropologists. Six basic expression categories have been shown to be recognizable across cultures. The six basic emotional expressions, or facial configurations associated with particular emotional situations, have been shown to be universal in their performance and in their perception (Ekman and Keltner, 1997), although there is some objection to the idea that these expressions signal similar emotions in people of different cultures In addition to the six basic facial expressions, there are also coordinated, stereotyped nonverbal displays that include stereotyped facial expression components. These include the eyebrow flash, yawning, startle, the coy display, and embarrassment and shame displays. In addition, the perception of facial expression, important for understanding communicative adaptations, is also a source of individual variation.

In our daily life, we show a lot of facial expressions interacting with other people. Facial expressions reveal our emotions. Our interpersonal interaction is also regulated by facial expressions. By showing interest we stimulate a conversational partner to speak. Facial expressions play an important role in

nonverbal communication. Some facial expressions display more then thousand of words. Some facial expressions can't be labeled by word. Other facial expressions are used to put accent on some of our words.

Face-to-face interaction has interesting features that set it apart from other interaction methods, the most important one being the number of modes that a person can employ to convey a single thought: facial expressions, various types of gestures, intonation and words, body language, etc. [1]

Facial expressions evolved in humans as signals to others about how they feel and forecast people's future actions. Expressions occur when people prepare to take some kind of action whether there are others present or not. Facial expressions tell others something about the overall character of a person's mood, whether it's positive or negative, and context then provides details about specific emotions. There is a link between facial expression and emotion, but it's not a one-to-one kind of relationship as many once thought. There are many situations where emotion is experienced, yet no prototypic facial expression is displayed. And there are times when a facial expression appears with no corresponding emotion. Facial expression is unambiguously social, in that the expressions are produced with greater frequency and intensity in social situations and can be directly linked to interactive consequences. Variation in the signal itself, the visible changes in the face, is important to addressing hypotheses of the signaling value of facial expressions.

The expression of a given face at a specific time is conveyed by a composite of signals from several sources of facial appearance. These sources include the general shape, orientation (pose), and position of the head, the shapes and positions of facial features (e.g., eyes, mouth), coloration and condition of the skin, shapes of wrinkles, folds, and lines, and so forth. Some of these sources are relatively fixed, others, more changeable. The most important source of change in facial expression is the set of muscular movements produced by facial muscles, which provide the most substantial changes in facial appearance over short time durations and contribute most to nonverbal communication by the face. These latter sources include the sizes, positions, and shapes of fleshy tissues, hair, teeth, cartilage, and bones.

3. Basic facial expressions

To develop ontology of facial expressions we chose a corpus-based approach. We record the facial expressions of people in their daily life. One way to realize that is to attach a camera to helmet in front of the face. As stated already most of the recordings show a neutral expression of the face. We can observe when a facial expressions start to change from the neutral default and when it returns to the default state again. Between onset and offset-tags one or more facial expressions can be shown. Let us assume that we express every facial expression by its level of activation of the AUs. Our assumption is that the space of all facial expressions is composed of clusters of expressions and transitions between the clusters. The next step is to interpret these clusters, i.e. to label it. The process of labeling is subjective. According to P. Ekman some expressions are universal. So we expect that every person space of facial expressions have clusters corresponding to the six basic emotions happiness,

sadness, disgust, anger, fear and surprise (See Fig.1). These are said to be universal in the sense that they are associated consistently with the same facial expressions across different cultures. The human face is also able to show a combination of emotions at the same time. These are called blends. Ekman and Friesen describe which blends of the basic emotions occur and what these blends look like universally.
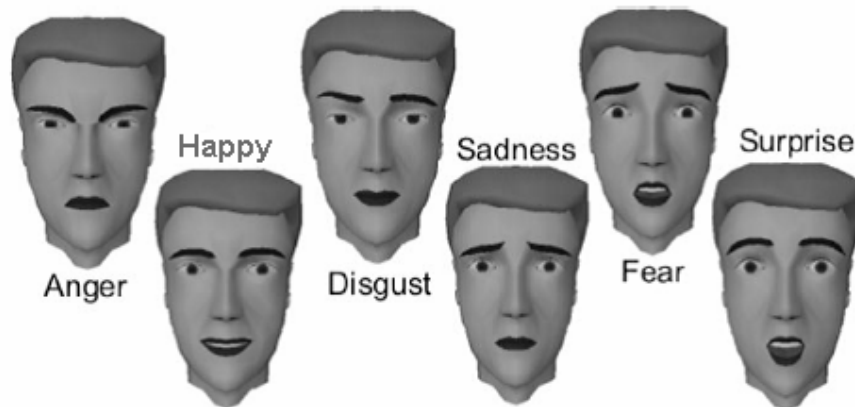
Figure 1: Six basic facial expressions

Usually we start from the neutral cluster and return to it after some time. But in between we can switch from several clusters. A recording of facial expressions can be considered as a track in the space of all facial expressions. This is what is called visual non-verbal communication. This is the basic for non-verbal annotation of a corpus of facial expressions. Given some text we are aimed at annotating this text so that "talking face" can be generated.

4. Relation between facial expression and emotion

To match a facial expression with an emotion implies knowledge of the categories of human emotions into which expressions can be assigned.
The recent development of scientific tools for facial analysis, such as the Facial Action Coding System, has facilitated resolving category issues. The most robust categories are discussed in the following paragraphs.

4.1. Happy
Happy expressions are universally and easily recognized, and are interpreted as conveying messages related to enjoyment, pleasure, a positive disposition, and friendliness.

4.2. Sad
Sad expressions are often conceived as opposite to happy ones, but this view is too simple, although the action of the mouth corners is opposite. Sad expressions convey messages related to loss, bereavement, discomfort, pain, helplessness, etc. Although weeping and tears are a common concomitant of sad expressions, tears are not indicative of any particular emotion, as in tears of joy.

4.3. Anger

Anger is a primary concomitant of interpersonal aggression, and its expression conveys messages about hostility, opposition, and potential attack. Anger is a common response to anger expressions, thus creating a positive feedback loop and increasing the likelihood of dangerous conflict. Although frequently associated with violence and destruction, anger is probably the most socially constructive emotion as it often underlies the efforts of individuals to shape societies into better, more just environments, and to resist the imposition of injustice and tyranny.

4.4. Fear

Fear expressions are not often seen in societies where good personal security is typical, because the imminent possibility of personal destruction, from interpersonal violence or impersonal dangers, is the primary elicitor of fear. Fear expressions convey information about imminent danger, a nearby threat, a disposition to flee, or likelihood of bodily harm.

4.5. Disgust

Disgust expressions are often part of the body's responses to objects that are revolting and nauseating, such as rotting flesh, fecal matter and insects in food, or other offensive materials that are rejected as suitable to eat. Obnoxious smells are effective in eliciting disgust reactions. Disgust expressions are often displayed as a commentary on many other events and people that generate adverse reactions, but have nothing to do with the primal origin of disgust as a rejection of possible foodstuffs.

4.6. Surprise

Surprise expressions are fleeting, and difficult to detect or record in real time. They almost always occur in response to events that are unanticipated, and they convey messages about something being unexpected, sudden, novel, or amazing. The brief surprise expression is often followed by other expressions that reveal emotion in response to the surprise feeling or to the object of surprise, emotions such as happiness or fear. Surprise is to be distinguished from startle, and their expressions are quite different.

5. Facial Action Coding System (FACS) – method in facial expression research

The development and use of the Facial Action Coding System (FACS), an anatomically based coding system for recording appearance changes caused by the action of individual muscles, was the first to make possible the collection of a large body of reliable empirical data on these expressions These methods rely mainly on overall change in images of the face or entire body over the course of nonverbal expression.

Facial expressions are generated by contraction and dilatation of 43 facial muscles. Body tissue and the skin cover the facial muscles. Human observers can observe the muscles movements only in a non-direct way, i.e. by changing contours of the mouth, eyes and eyebrows. P. Ekman developed a system FACS, to describe all facial expressions. The system is based on minimal basic facial movement, called AUs. Every facial expression can be described in term of AUs.

The FACS system is developed for classification of facial expressions by human observers. Facial Action Coding System (FACS) is the most widely used and versatile method for measuring and describing facial behaviors. Paul Ekman and W.V. Friesen developed the original FACS in the 1970s by determining how the contraction of each facial muscle (singly and in combination with other muscles) changes the appearance of the face. They associated the appearance changes with the action of muscles that produced them by studying anatomy, reproducing the appearances, and palpating their faces.

With FACS, Ekman and Friesen detailed which muscles move during which facial expressions. For example, during a spontaneous smile, the corners of the mouth lift up through movement of a muscle and the eyes crinkle, causing "crow's feet. [2]

Their goal was to create a reliable means for skilled human scorers to determine the category or categories in which to fit each facial behavior.

FACS measurement units are Action Units (AUs). Action units (AUs) are the smallest visibly discriminable change in facial movement. Using combinations of action units, all possible facial expressions can be described. Asymmetries in facial movement, such as occur when one but not the other brow is raised, may be described as well.

FACS assigns each muscle movement an "action unit" number, so a smile is described as AU12--representing an uplifted mouth--plus AU6--representing crinkled eyes. In all, Ekman and Friesan identified 46 distinct action units. [2]

A FACS coder "dissects" an observed expression, decomposing it into the specific AUs that produced the movement. The scores for a facial expression consist of the list of AUs that produced it. Duration, intensity, and asymmetry can also be recorded.

V. *Design and description of suggest decision*

Various types of facial cues are present on different levels of the communication process. Firstly, facial expressions are perhaps the most important way of signaling emotion. We can immediately tell if a person is happy, sad, scared, angry etc. by simply looking at his/her face. Secondly, in verbal communication situations, the face express information related to discourse, phrasing, emphasis and dialogue turn-taking. In this sense facial expressions are intimately related, and often complementary, to prosodic features of the voice. Thirdly, the face reveals some visible aspects of the speech production and thus also carries much information about the phonetic content of a spoken utterance.

1. Analyses of the video records

Facial expressions are not displayed as isolated pictures but as a video stream. From a video stream we can extract and process isolated pictures. But we can also extract sequence of picture and consider the transition between pictures or movement aspects. Not every random movement of facial muscles can be considered as a meaningful facial expression. Swallowing or blinking of the eyes can be used on purpose or as an automated, involuntary movement. Some facial expressions can be shown with different intensity.

Our task was to recognize the most expressive facial expressions and the time (frames) where they came into being. We used the MGI VIDEO WAVE III for observing the facial expressions. With this tool, we recorded the exact time, when the facial expressions appeared (it's start, middle and end time). (See Appendix 1 and Appendix 2)

During our daily life we show most of the time a neutral face. In our interaction we show 20-40 different facial expressions. People are able to show more that 5000 different expressions but most of them will not be used.

Observation of facial expressions is subjective. In consciousness observation of facial expressions we try to interpret those facial expressions. Facial expressions, which we can't interpret will not be observed or neglected.

Original data was collected from a sample of video records of Ania and Jacek. The videos are dialog records between both of them. During the conversation Ania and Jacek express different kind of emotions, in respect to the theme of the dialog. For example in one moment they are happy, in other they are surprised, angry, sad (See Pictures below).
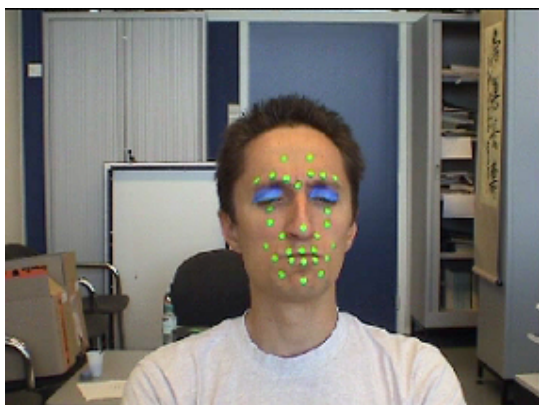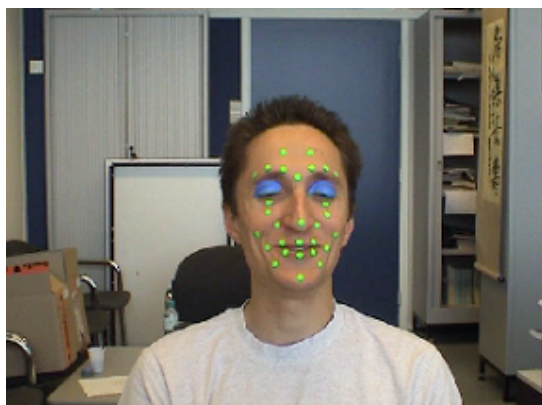
Disgust

Happy

Sad

Anger
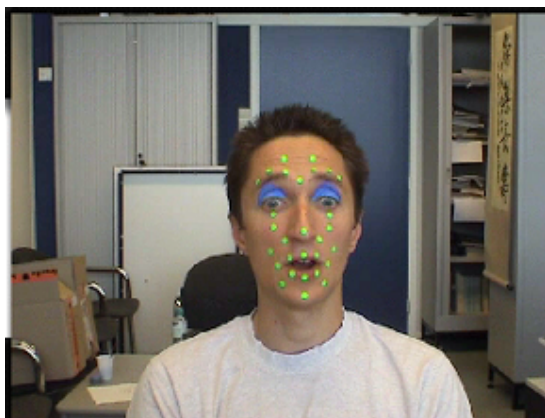
Surprise

Fear

Anger
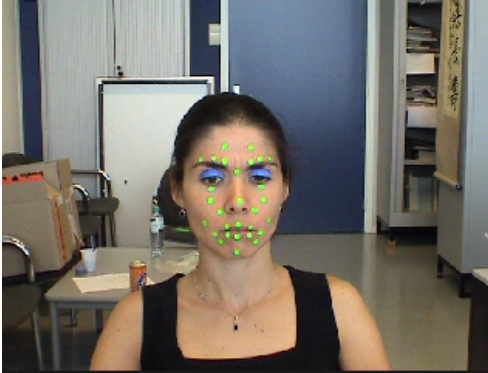
Joy
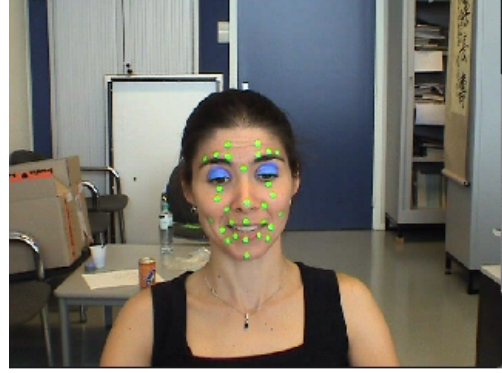
Surprise
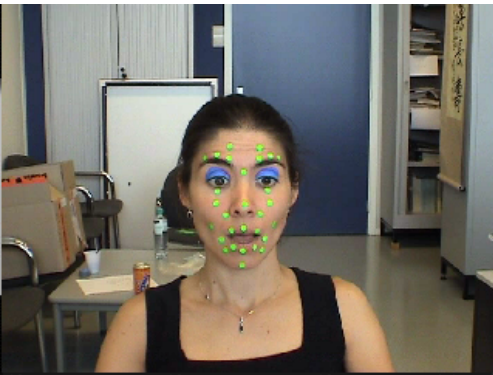
Disgust
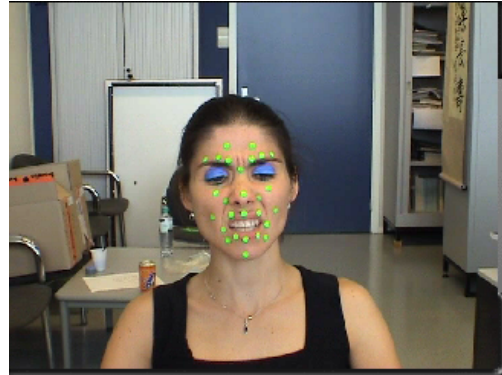
Sadness
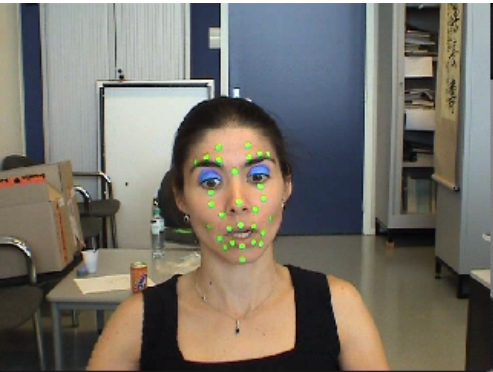
Fear
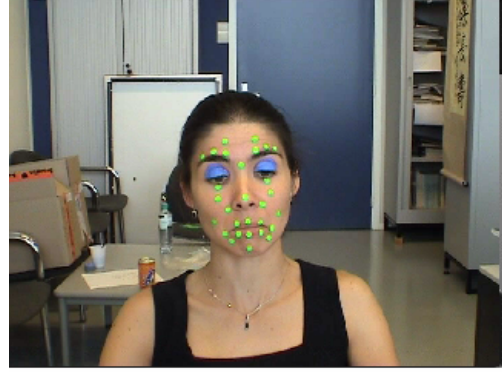
To research recordings of facial expressions we can use two approaches. In the top-down approach we assume that we have set of facial expressions and use this set as a benchmark. Given some recording we check which facial expressions are included. In the bottom-up approach we chose a data-mining approach. We start from a dataset and use statistical clusters techniques to assess meaningful clusters. Because the neutral face is very dominant in recording of facial expressions, there is a risk that meaningful facial expressions will be considered as noise and only the dominant neutral facial expressions will be found. So as a preprocessing step we have to delete the neutral expressions.

2. Relation text - trigger - facial expressions

People do not think what they will express with their face in the nonverbal communication. The expressions appear suddenly during the conversation. For example somebody hear the word "mother" his/her facial expression ought to be nice, sweet and tender. But when he/she hears "death" or "shark" the facial expression become scared or disgusted.

Based on findings that people label photos of prototypical facial expressions with words that represent the same basic emotions: a smile represents joy, a scowl represents anger, Ekman pioneered the idea that by carefully measuring facial expression, he could evaluate people's true emotions.

During our research we come to conclusion that facial expressions are dependent not only on the words but also on the context of the conversation. So one word can mean different things according to the context of the dialogue.

We have the text of the whole dialogue. We extract only the triggers for the facial expressions that are more express and that we have already download during. Using the dialog text and the middle time, we defined the triggers. (See Appendix 1 and Appendix 2)

Facial expression during social interaction is possibly an honest signal of affiliation, or willingness to reciprocate. Ekman (1979) detailed the multiple patterns of association of brow movements with speech: as "batons" stressing a particular word, as question marks, or as "under liners" emphasizing a sequence of words, among others. If nonverbal signals, including facial expressions, are coordinated with speech, they might also assist in the grooming function of speech.

People as an individual have different way to express their feelings and emotions. For example some of them are more expressive. Their facial expressions are stronger and clear expressed then the facial expressions of the other people.

We compared the expressions that had the same triggers. Thus we draw the table. Here is a table with facial expressions that have the same trigger. These pictures are downloading during a dialogue between two persons: a man and a woman. Facial expressions are not identical because everybody reacts in different way in the similar situation. In our case the triggers are the same but the expressions are different. (See Appendix 3)

In the records (10 per each of them) the Ania and Jacek's faces were marked with points. These points correspond to so-called facial characteristic points (FCP's). Each of them has their own coordinates.

3. Model for Coordinates

To classify facial expressions in a semi-automated way we have to choose a model. In recent year many models have been developed. Most of them are based on the changing contours of the mouth, eyes and eyebrows

We used two models to define the coordinates. Kobayashi and O'Hara design one of them. In this model the position of 30 points are located around the contours of the mouth, eyes, and eyebrow (See Fig. 2). The other one shows the

positions of the 31 points, which are on Ania and Jacek's face during records (See Fig. 3).

The figures show that the eyes and mouth are the most critical areas of the face for determining facial expressions.
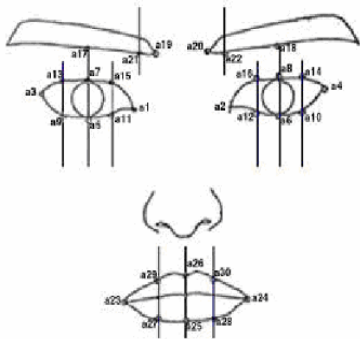
Figure 2:Kobayashi coordinates
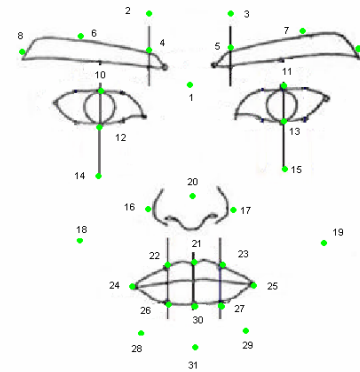
Figure 3:Green points coordinates

There is a program, FED10 (See Fig.4), developed by one of the assistants of TU Delft. We use this program to obtain the Kobayashi coordinates from images with green points. First we load the image, and then we make a contour around the head and zoom out this area. Next step is to put all of the 30 points in their position according Kobayashi model. When everything is complete the program automatically generate coordinates. Then we save them in a text file.On the basis of these coordinates is going to be made a statistical analysis.
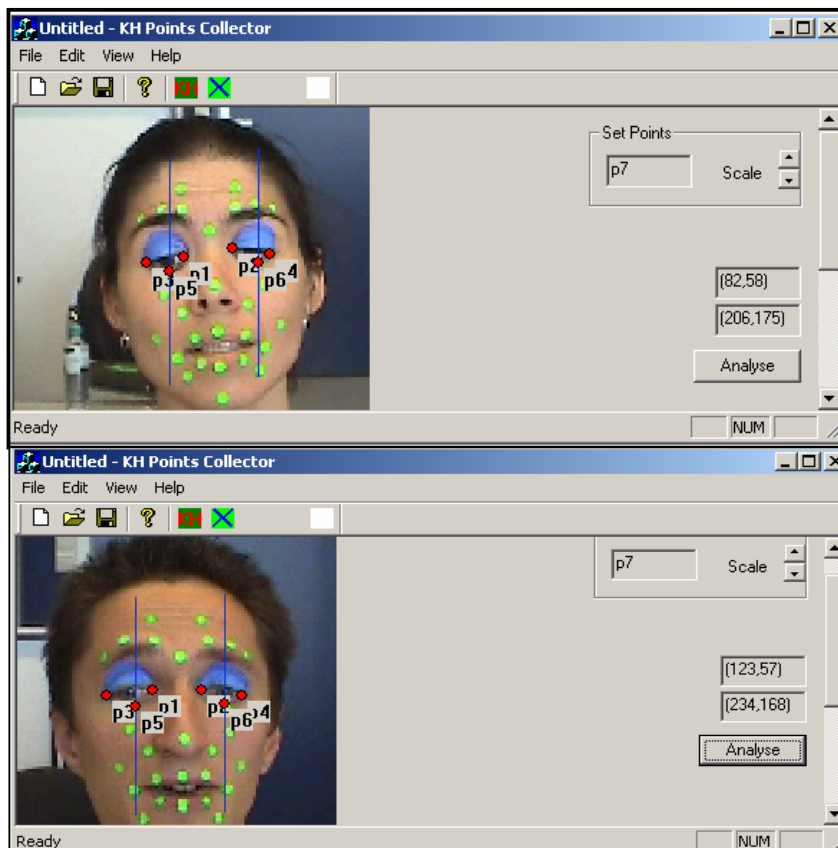
Figure 4: Fed10

For example here is a table for comparing the coordinates of the two models for two different images. One of them is with neutral facial expression and the other one show some kind of expression.

TALKING FACE

Image 1(Neutral)
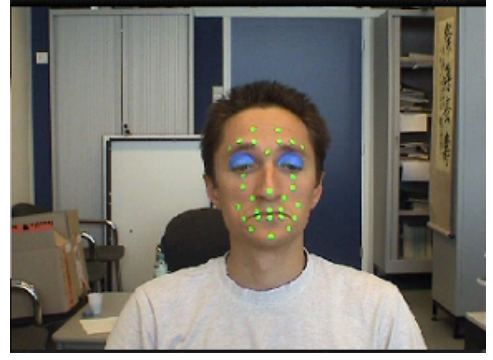
Image 2 (Sad)

Number point	Green points' coordinates				Kobayashi coordinates			
	Image 1		Image 2		Image 1		Image 2	
	X	Y	X	Y	X	Y	X	Y
P1	404.399994,240.399994		389.100006,244.199997		169,115		165,114	
P2	382.600006,209.100006		367.700012,207.000000		186,115		182,114	
P3	421.200012,212.100006		405.500000,208.000000		155,116		152,117	
P4	386.600006,226.699997		369.399994,226.399994		200,116		195,116	
P5	424.600006,229.000000		406.799988,225.500000		162,118		159,118	
P6	363.799988,226.199997		347.500000,225.199997		194,119		188,117	
P7	440.799988,232.199997		427.000000,227.100006		162,112		159,115	
P8	347.100006,238.199997		331.500000,238.500000		194,113		188,114	
P9	454.000000,238.500000		441.299988,235.300003		158,117		155,118	
P10	363.799988,267.000000		350.700012,265.000000		197,118		191,117	
P11	438.100006,272.000000		424.899994,268.000000		166,117		162,117	
P12	365.799988,287.100006		352.299988,284.200012		190,117		185,116	
P13	442.200012,291.299988		427.700012,287.000000		158,113		155,115	
P14	365.100006,305.000000		351.600006,303.000000		197,114		191,114	
P15	441.700012,309.000000		427.000000,304.600006		166,113		162,113	
P16	380.299988,324.700012		365.799988,322.299988		190,113		185,113	
P17	427.899994,325.200012		414.299988,321.100006		162,100		159,106	
P18	358.899994,338.700012		344.899994,336.600006		194,101		188,104	
P19	448.500000,339.100006		435.700012,334.399994		172,99		169,105	
P20	408.500000,316.200012		392.399994,310.299988		184,100		180,104	
P21	406.500000,347.799988		392.299988,341.600006		170,100		166,104	
P22	387.299988,350.299988		372.600006,344.100006		186,101		182,103	
P23	423.399994,348.100006		410.000000,340.899994		166,151		161,148	
P24	368.500000,357.700012		353.299988,356.299988		190,151		190,148	
P25	441.000000,358.299988		429.799988,355.600006		179,156		176,144	
P26	391.000000,368.500000		375.899994,354.200012		179,148		176,141	
P27	424.899994,368.500000		410.399994,353.500000		173,155		169,145	
P28	376.299988,381.700012		364.000000,374.100006		186,155		184,144	
P29	434.299988,381.799988		420.899994,372.799988		173,149		169,143	
P30	408.100006,372.799988		393.299988,354.700012		186,149		184,143	
P31	406.799988,399.899994		394.700012,385.799988					
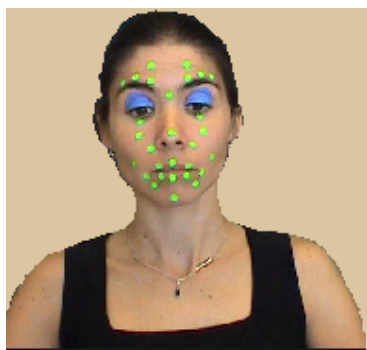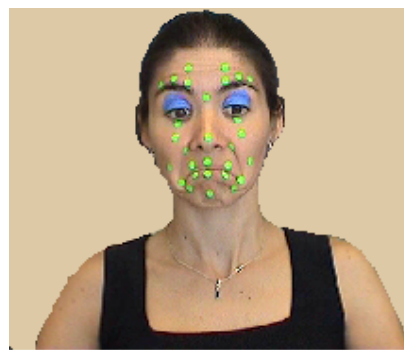
Image 1(Neutral)

Image 2 (Sad)

Number point	Green points' coordinates				Kobayashi coordinates			
	Image 1		Image 2		Image 1		Image 2	
	X	Y	X	Y	X	Y	X	Y
P1	339.200012	256.299988	341.500000	256.399994	143,113		143,114	
P2	317.500000	219.000000	319.500000	218.800003	161,112		158,112	
P3	360.799988	217.800003	362.799988	217.100006	129,114		173,113	
P4	317.500000	236.199997	320.299988	237.300003	174,112		127,116	
P5	361.000000	233.199997	363.399994	233.500000	136,118		136,119	
P6	299.600006	231.199997	302.000000	232.899994	168,115		167,117	
P7	377.899994	228.699997	379.100006	228.899994	136,111		136,113	
P8	284.500000	238.800003	286.200012	240.000000	168,109		167,111	
P9	391.200012	232.199997	392.200012	232.199997	132,116		131,118	
P10	302.000000	271.000000	304.000000	272.000000	171,113		171,115	
P11	377.500000	265.000000	378.700012	266.000000	140,116		140,116	
P12	304.799988	289.600006	307.100006	289.700012	164,114		162,116	
P13	376.500000	284.600006	378.500000	283.500000	132,112		131,114	
P14	302.100006	307.100006	305.500000	308.100006	171,110		171,111	
P15	380.899994	302.600006	382.600006	301.299988	140,111		140,113	
P16	313.600006	322.399994	319.799988	324.100006	164,109		162,111	
P17	369.200012	318.299988	369.500000	319.399994	136,100		136,101	
P18	295.000000	343.500000	299.000000	341.799988	168,99		167,99	
P19	391.700012	336.700012	392.899994	334.200012	143,105		143,104	
P20	340.899994	306.899994	345.000000	305.399994	157,103		156,103	
P21	340.200012	336.799988	345.799988	340.899994	140,101		139,102	
P22	322.200012	341.000000	329.399994	344.500000	164,99		161,100	
P23	364.799988	341.500000	365.399994	344.100006	140,149		141,147	
P24	308.399994	364.200012	314.500000	358.500000	165,147		165,145	
P25	380.600006	360.399994	380.500000	354.299988	152,144		152,150	
P26	324.899994	353.399994	332.500000	358.299988	152,139		152,143	
P27	361.700012	354.299988	362.299988	357.299988	146,146		146,149	
P28	319.100006	370.600006	324.100006	369.899994	160,146		159,149	
P29	371.299988	373.200012	373.600006	368.000000	146,143		146,145	
P30	340.399994	351.799988	345.700012	359.899994	160,143		159,145	
P31	342.700012	376.700012	347.700012	385.899994				

The hardest and most time-consuming part of all this work is collecting a database of facial images during our research. Using this enormous database (423 facial images) we define the frequency of the facial expressions (See Fig.5, Fig.6 and Fig.7).
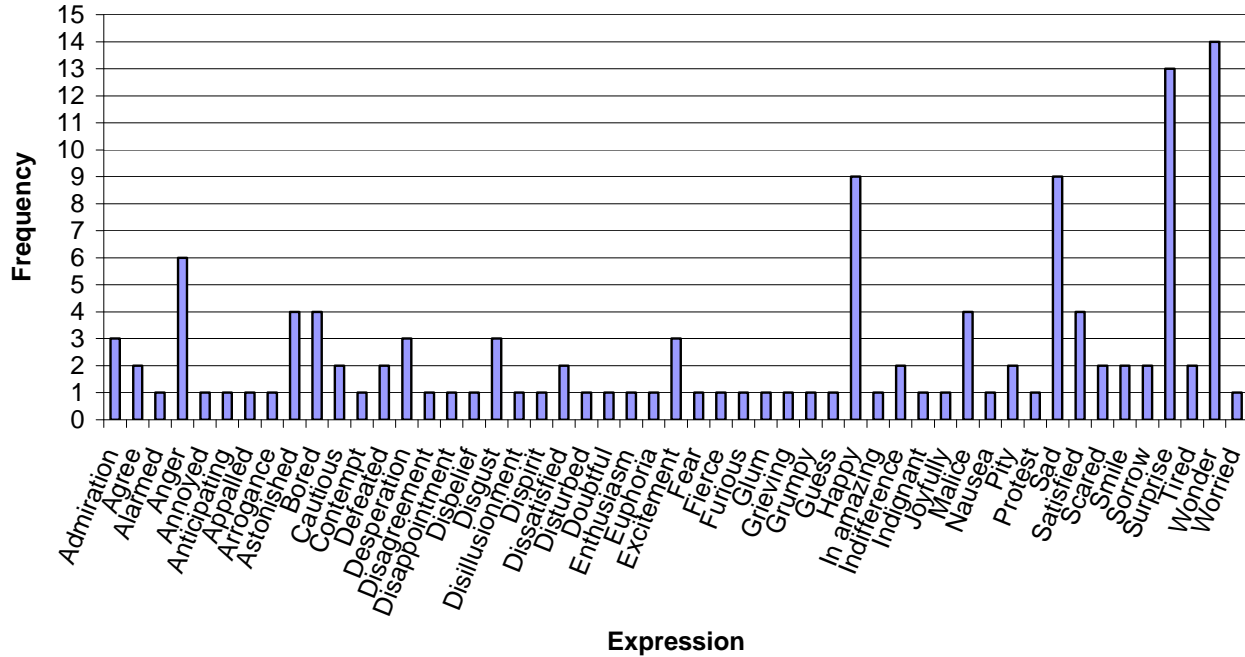
Figure 5: Jacek's frequency of Facial Expressions

Ania's facial expressions
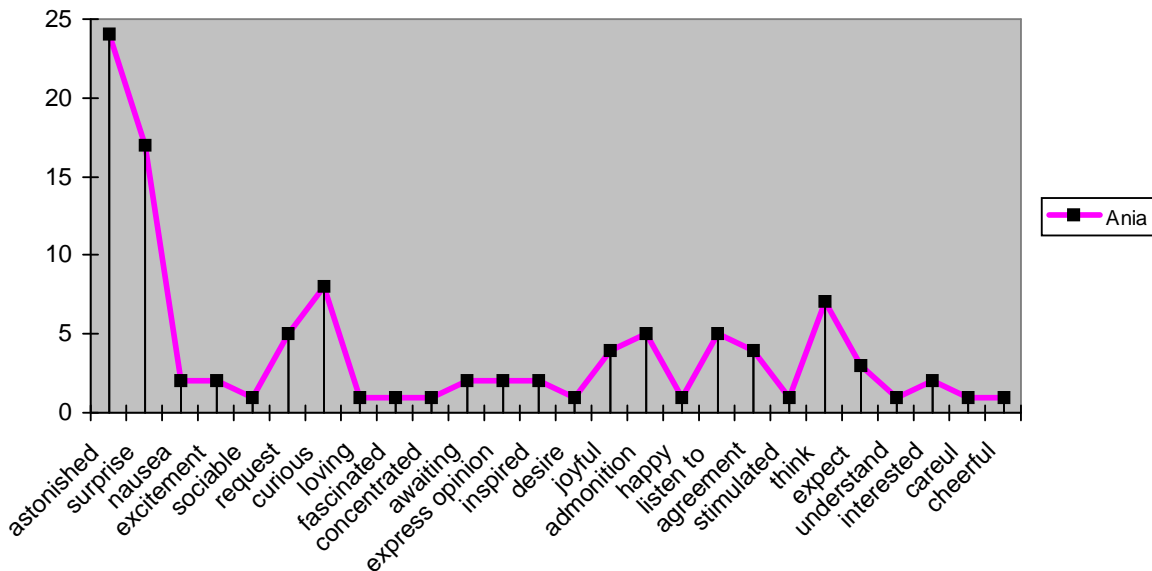
Figure 6: Ania's frequency of Positive Facial Expressions
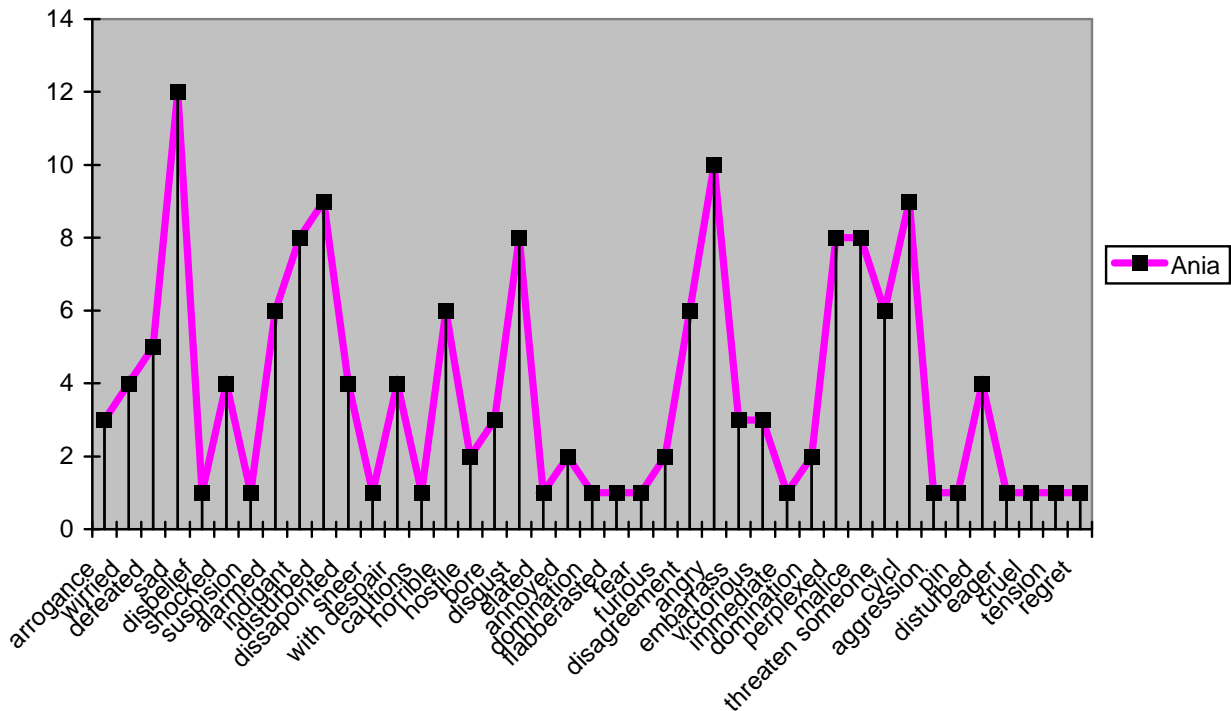
Figure 7: Ania's frequency of Negative Facial Expressions

4. <u>Statistical analyses (PCA)</u>

One of the latest steps was to analyze the data set of characteristic facial points. As explained before we have 30 FCP's. This means that every facial expression is represented as a vector in a 60-dimensional space. To explore this space in a visual way we have to reduce this vector space to a 2-dimensional space. Principal Component Analysis realized this.

PCA can be used as a data reduction technique. All the points of the 60 dimensional space are plotted on 2-dimensional space of the first two principal components in such a way that as much of the variation of the points is preserved. But of course during the reduction process data will be loosed. But we hope that clusters of points will be mapped to clusters of points in the 2-dimensional space.

In figure 8 we showed a 2-dimensional plot where the axes are the first two principal components (F1 and F2). To see the difference in the plot in figure 9 we show the first and the third principal components (F1 and F3), in figure 10 – second and third (F2 and F3). There are no clear clusters in the plot. The first two components explain only 54.73% of the variance. In a second analysis we try to interpret the two axes. In Appendix 4 we can see the loading of every variable on the axes. By considering the different variables we can conclude that along the first axes the vertical stretch of the mouth and open of the eyes has the greatest variation and along the second axis the open of the eyes. So the first two components are dominated by the variation of some FCP's along the mouth and eye contour. In fact the set of FCP's can be split up in three sets, the points along the contour of the mouth, eye and eyebrows. But the variation of the points in this set is dependent from each other. During a smile the corners of the mouth are

turned upwards and the eyes are closed or remain unchanged. So not every random movement of FC's take result in a facial expression.

Figure 8: Biplot (axes F1 and F2: 54.73 %)

Figure 9: Biplot (axes F1 and F3: 47.39 %)

Biplot (axes F2 and F3: 30.52 %)
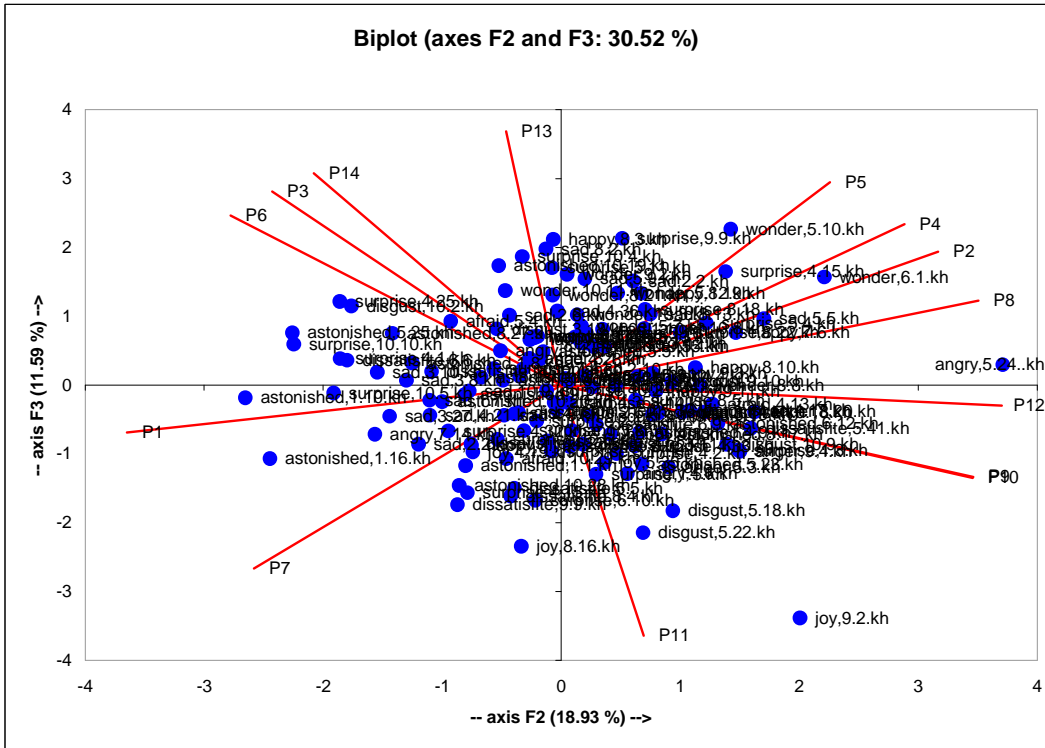
Figure 10: Biplot (axes F2 and F3: 30.52 %)

In this figures vector P_i is a function of a_i, where a_i is a point of the model of Kobayashi:

P1: $\square$ a1, a4, a20   :AU1

P2: $\square$ a4, a2, a8   : AU4, AU7

P3: $\square$ a4, a6, a2   : AU7

P4: $\overline{a_2 a_{20}}$: AU1, AU2, AU4, AU5, AU9

P5: $dy\left(\overline{a_6 a_{18}}\right)$: AU1, AU2, AU4

P6: $dy\left(\overline{a_6 a_8}\right)$: AU5

P7: $\overline{a_{19} a_{20}}$: AU5

P8: $dy(\overline{a_6 a_{26}})$: AU10

P9: $\left|\overline{a_2 a_{24}} - \overline{a_1 a_{23}}\right|$: AU 10

P10: $\overline{a_{25} a_{26}}$: AU10, AU16, AU23, AU24, AU25, AU26, AU27

P11: $\overline{a_{23} a_{24}}$: AU10, AU12, AU15, AU20, AU23, AU24, AU25, AU26, AU27

P12: $\overline{a_2 a_{24}}$: AU12, AU15, AU20

P13: $\overline{a_1 a_{23}}$: AU12, AU15, AU20

P14: $\overline{a_6 a_8}$: AU12

VI. *Demo (CSLU)*

The use of speech technology in information systems will continue to increase. Most currently installed information systems that work with speech, are telephone-based systems where callers can get information by speaking aloud some short commands. Also real dialogue systems wherein people can say normal phrases become more and more common, but one of the problems in this kind of systems is the limitation of the context. [5]

Recently there has been an increased interest in computer interfaces that combine multiple input and output modalities to increase the communication bandwidth with computers. One important application of animated characters has been to make the interface more compelling and easier to use. For example, animated characters have been used in presentation systems to help attract the user's focus of attention, to guide the user through steps of a presentation, as well as to add expressive power by presenting nonverbal conversational and emotional signals. [1]

Sometimes when you talk with somebody, but he/she always has a neutral facial expression, it is difficult to understand what he/she exactly means.

Generating lifelike animated faces remains a challenging task despite decades of research in computer animation. To be considered natural, a face has to be not just photo-realistic in appearance, but must also exhibit proper postures of the lips, synchronized perfectly with the speech. Moreover, realistic head movements and emotional expressions must accompany the speech. We are trained since birth to recognize faces, and to scrutinize facial expressions. [6]

Therefore, many researchers investigate how to animate a talking face from a natural voice. One of the different approaches is "Phonemes from Audio". Speech recognition techniques are able to recognize the words in recorded speech. The text can then be used to align the phonemes of text and the audio signal. In such a way, we are able to hand text as well as phone message with their durations to the face animation system. If real-time performance is not required, the recorded speech can be transcribed manually, thus avoiding recognition mistakes. Then the text is aligned with the audio. In the case of high-quality recordings, the automatic alignment procedures work very well, resulting in high-quality mouth animations comparable to those achieved using a TTS engine. Sample-based face animation with recorded audio can look so natural that it is indistinguishable from recorded video for most viewers.

The speech is usually rendered by a TTS system. TTS systems synthesize text based on the phonemes that correspond to the words in the text. Therefore, any TTS can be used to drive a face animation system, provided the phoneme timing information is accessible. The TTS system analyzes the text and computes the correct list of phonemes, their duration, appropriate stress levels, and other parameters. Finally, the TTS engine computes the audio signal. [6]

These are the main reasons according to which we decide to use Rapid Application Developer (RAD) of Center of Spoken Language Understanding (CSLU) Toolkit, because there is an option to give the face different expressions.

1. Toolkit Overview

The toolkit provides a modular, open architecture supporting distributed, cross-platform, client/server-based networking. It includes interfaces for standard

21

telephony and audio devices, and software interfaces for speech recognition, text-to-speech synthesis, speech reading (video) and animation components. This flexible environment makes it possible to easily integrate new components and to develop scalable, portable speech-related applications. The major toolkit components are outlined below:

1.1. Speech recognition

The toolkit supports several approaches to speech recognition including artificial neural network (ANN) classifiers, hidden Markov models (HMM) and segmental systems. It comes complete with a vocabulary-independent speech recognition engine, plus several vocabulary-specific recognizers (e.g., alpha-digits). In addition, it includes all the necessary tutorials and tools for training new ANN and HMM recognizers.

1.2. Speech synthesis:

The toolkit integrates the Festival text-to-speech synthesis system, developed at the University of Edinburgh (Black & Taylor, 1997). CSLU has developed a waveform-synthesis "plug-in" component (Macon et al., 1997) and six voices, including male and female versions of American English and Mexican Spanish. Festival provides a complete environment for learning, researching and developing synthetic speech, including modules for normalizing text (e.g., dealing with abbreviations), transforming text into a sequence of phonetic segments with appropriate durations, assigning prosodic contours (e.g., pitch, amplitude) to utterances, and generating speech using either diphone or unit-selection concatenative synthesis.

1.3. Facial animation:

The toolkit features Baldi, an animated 3D talking head developed at the University of California, Santa Cruz. Baldi, driven by the speech recognition and synthesis components, is capable of automatically synchronizing natural or synthetic speech with realistic lip, tongue, mouth and facial movements. Baldi's capabilities have recently been extended to provide powerful tools for language training. The face can be made transparent revealing the movements of the teeth and tongue while producing speech. The orientation of the face can be changed so it can be viewed from different perspectives while speaking. Also, the basic emotions of surprise, happiness, anger, sadness, disgust, and fear can be communicated through facial expressions.

1.4. Authoring tools

The toolkit includes the Rapid Application Developer (RAD), which makes it possible to quickly design a speech application using a simple drag-and-drop interface. RAD seamlessly integrates the core technologies with other useful features such as word-spotting, barge-in, dialogue repair, telephone and microphone interfaces, and open-microphone capability. This software makes it

possible for people with little or no knowledge of speech technology to develop speech interfaces and applications in a matter of minutes.

1.5. Waveform analysis tools:

The toolkit provides a complete set of tools for recording, representing, displaying and manipulating speech. Signal representations such as spectrograms, pitch contours and formant tracks can be displayed and manipulated in separate windows. The display tools allow recognition results, such as phonetic or word decoding, to be displayed and time-aligned with recognized utterances. Three-dimensional arrays can also be aligned to utterances, showing, for example, the output categories of a neural network phonetic classifier.

1.6. Programming environment:

The toolkit comes with complete programming environments for both C and Tcl, which incorporate a collection of software libraries and a set of API's (Schalkwyk et al., 1997). These libraries serve as basic building blocks for toolkit programming. They are portable across platforms and provide the speech, language, networking, input, output, and data transport capabilities of the toolkit. Natural language processing modules, developed in Prolog, interface with the toolkit through sockets.[7]

VII. *Future projects*

1. Facial Expressions dictionary

The goal of this project is to design and implement a nonverbal dictionary. Similar to a common verbal dictionary we want to develop a nonverbal dictionary, which enables users to look up the meaning of facial expressions. The "words" are the "facial expressions". All facial expressions are defined by the action or deactivation of facial muscles. Researcher P. Ekman developed a system called FACS, which can be used to classify all facial expressions. That system is based on (observable) moving parts of the face (Action Units). So every facial expression can be defined in terms of Action Units, which are the characters to compose the nonverbal words.

To fill the database, we recorded discussions between people and localize facial expressions. After processing these pictures are stored in the database. We develop a tool make a digital copy of every facial expression using a synthetic 3D face.
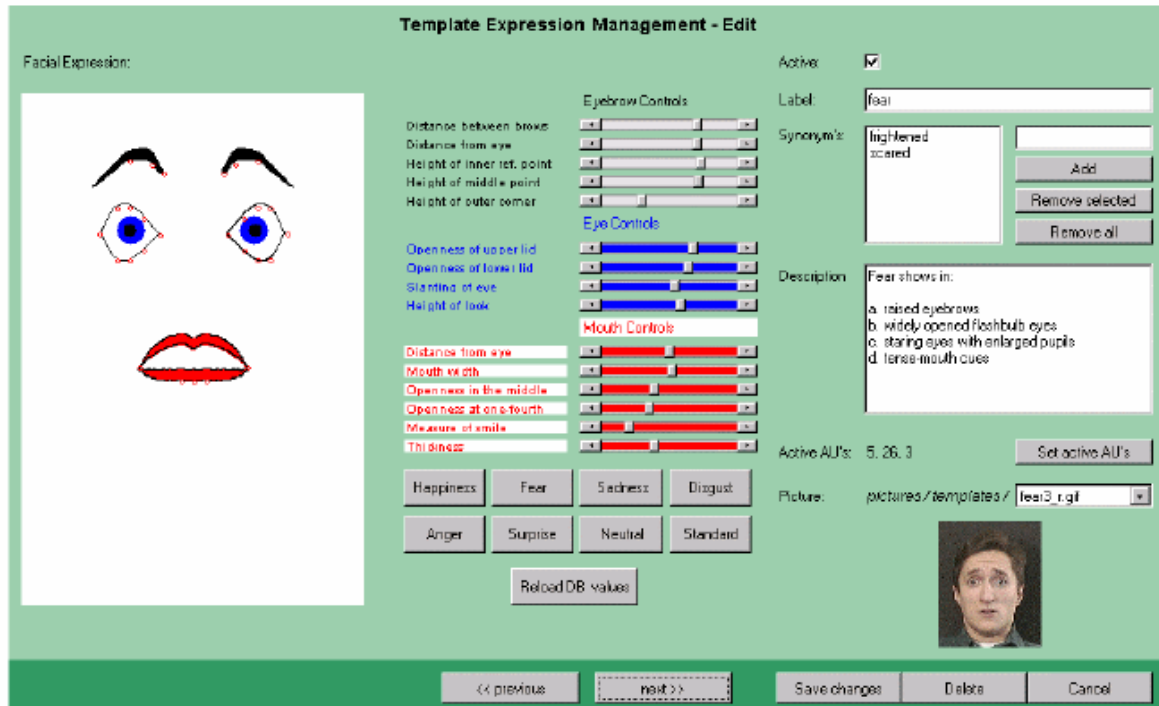
2. 3D synthetic face

In the framework of her PhD – project Ania Wojdel developed a first prototype. The synthetic face was modeled after human model. The develop prototype is based on the AU's. It is possible to generate every facial expression by moving sliders corresponding to the 43 AU's.

The first step in the development of the synthetic face was to design a wire frame (see fig. 5). This wire frame is composed of a triangulation graph of nodes and edges. The graph shows a higher density around specific moving parts of the face, the mouth, eyes and eyebrows. Movements of the sliders can move the nodes and edges in the wire frame.

Figure 5

One of the requirements was to model the face after human model. Special facial points (FP's) cover the face to the human model. These points correspond to special nodes in the wire frame. The human model was required to show lot of facial expressions. These expressions were recorded, using frontal and silhouette views (see fig. 6). Special software was developed to track the FP's. The movements of the real human face were converted via the FP's to the movements of the nodes and its environments of the wire frame. In this way a wire frame 3D face was created which shows natural human expressions. The next step was to create appropriate facial texture and animation of the face. This procedure is not fully automated yet manual adaptation is necessary. The develop prototype is very similar to the original human model. One of main constraints of the current prototype at this moment is that it is impossible to adapt the wire frame to a random face.
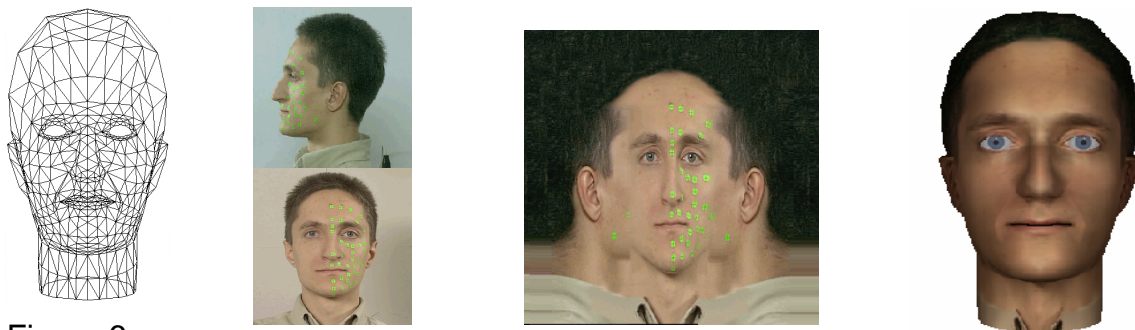
Figure 6

3. <u>Web based applications</u>

World Wide Web allows interactions and transactions through Web pages using speech and language, either by inanimate or live agents, image interpretation and generation, and, of course the more traditional ways of presenting explicitly pre-defined information by allowing users access to text, tables, figures, pictures, audio, animation and video. In a task- or domain restricted way of interaction current technology allows the recognition and interpretation of rather natural speech and language in dialogues. However, rather than the current two-dimensional web-pages, the interesting parts of the Web will become three dimensional, allowing the building of virtual worlds inhabited by interacting user and task agents, and with which the user can interact using different types of modalities, including speech and language interpretation and generation. [5]

A. Help Desk

Help Desk application as a demonstration of our real-time player in a dialogue situation between a customer and a virtual customer service agent. The client player is responsible for playing speech animations of the virtual customer service agent sent by the server and for capturing the user's input and sending it to the server. The server receives the user's input, interprets it, generates a response, computes the associated speech animation, and sends the animation parameters and audio to the client player. To appear realistic in a

dialogue situation, the virtual agent needs to exhibit idle and listening behavior while not speaking.

B. News Reader

An automated newscaster was developed as application that produces multimedia content (video+HTML) that can be streamed to, and played on, client PCs. The automated newscaster application periodically checks the Internet for news updates. The talking head animation is generated entirely automatically from the textual content downloaded from the Internet.

C. E-Cogent

"E-cogent" is application, which helps customers choose a mobile phone. The customer is first asked a couple of questions regarding phone price, weight, and talk time. Then E-cogent presents available choices. The user may choose to see the detailed specifications of the phones, proceed to buying one, or go back to start over.

D. Playmail

PlayMail is a multimedia enhanced e-mail service that translates text messages into animated videos with face models reading the message. The face models are created, customized, and selected by the user. In order to communicate emotions, the sender may use several predefined emotions like :-) for smile or :-(for frown in the text. [6]

VIII. *Conclusions*

The area of multimodal speech synthesis and talking face is still quite new, and a lot of research and development can be expected in the near future. As personal computers grow more powerful, it will be possible to incorporate audio-visual speech synthesis in user interfaces, alongside with automatic speech recognition.

Talking face research attracts attentions for its application potential. It can be applied to synthesize an intelligent desktop agent, a virtual friend, and an avatar either in a chat room, or in a low bit rate teleconferencing setting.

IX. *Reference*

[1] Kristinn R. Thórisson, Face-to-face communication with computer agents. Working Notes, AAI Spring Symposium on Believable Agents, Stanford University, California, August 13-16, 1994, 86-90

[2] Bybeth Azar, Facial Expressions, Two computer programs 'face' off. Pychologists team up with engineers to design computers that read faces. Monitor staff. http://www.apa.org/monitor/jan00/sc1.html

[3] Jun-yong Noh, Ulrich Neumann, Talking Faces, Computer Science Department, Integrated Media Systems Center, University of Southern California, August 2000

[4] Jonas Beskow, Talking heads - communication, articulation and animation Department of Speech, Music and Hearing, KTH, TMH-QPSR 2/1996

[5] Joris Hulstijn, Anton Nijholt, Hendri Hondorp, Mathieu van den Berk & Arjan van Hessen, Dialogues with a Talking face for Web-based Services and Transactions, Centre for Telematics and Information Technology, University of Twente

[6] Eric Cosatto, Jorn Ostermann, Hans Peter Graf, and Juergen Schroeter, Lifelike Talking Faces for Interactive Services, Proceedings of the IEEE, vol. 91, NO. 9, September 2003

[7] http://cslr.colorado.edu/toolkit/main.html

X. *Appendix*

Appendix 1

№	Begin	Middle	End	Expressions	Trigger
Jacek					
Quot1					
1.1	00.01.44 / 36 /	00.01.52 / 38 /	00.01.96 / 49 /	Astonished	Yes, how can I help you?
1.2	00.05.92	00.06.32	00.06.80	Annoyed	Borejko!

	/ 148 /	/ 158 /	/ 170 /		
1.3	00.08.36 / 209 /	00.08.56 / 214 /	00.08.92 / 223 /	Surprise	I am listening.
1.4	00.11.76 / 294 /	00.11.84 / 296 /	00.11.96 / 299 /	Wonder	This door?
1.5	00.13.72 / 343 /	00.14.36 / 359 /	00.15.16 / 379 /	Guess, Remember	Oh, that - so?
1.6	00.20.88 / 522 /	00.21.56 / 539 /	00.22.28 / 559 /	Agree	Oh, I understand.
1.7	00.27.80 / 695 /	00.28.00 / 700 /	00.28.16 / 704 /	Sad, Disappointment	It blows from downstairs very much.
1.8	00.28.16 / 704 /	00.28.28 / 707 /	00.28.48 / 712 /	Disbelief	It is possible
1.9	00.31.84 / 796 /	00.32.20 / 805 /	00.33.28 / 832 /	Excited, surprise	Oh, no I did not.
1.10	00.55.16 / 1379 /	00.55.48 / 1387 /	00.55.80 / 1395 /	Alarmed, Sad	No?
1.11	01.01.64 / 1541 /	01.02.00 / 1550 /	01.03.08 / 1577 /	Anticipating	Why aren't you?
1.12	01.23.96 / 2099 /	01.24.56 / 2114 /	01.25.12 / 2128 /	Disagreement, terrified	No!
Quot2					
2.1	00.00.60 / 15 /	00.00.80 / 20 /	00.01.44 / 36 /	Worried	Pap!
2.2	00.06.36 / 159 /	00.06.56 / 164 /	00.07.16 / 179 /	Sadness	Let's go
2.3	00.08.00 / 200 /	00.08.36 / 209 /	00.08.80 / 220 /	Dispirit	Please
2.4	00.09.80 / 245 /	00.10.00 / 250 /	00.10.64 / 266 /	Desperation	Mom is sleeping now.
2.5	00.11.40 / 285 /	00.11.60 / 290 /	00.12.12 / 303 /	Cautious	Let's go father
2.6	00.21.00 / 525 /	00.21.12 / 528 /	00.23.00 / 575 /	Sad, trouble	This is K, one of them.
2.7	00.26.00 / 650 /	00.28.16 / 704 /	00.30.24 / 756 /	Bored	Most of the surgeons are sadists.
2.8	00.34.00 / 850 /	00.35.00 / 875 /	00.35.56 / 889 /	Tired, sorrowful	I beg you let's go home
Quot3					
3.1	00.03.44 / 86 /	00.03.80 / 95 /	00.04.16 / 104 /	Happy, pleased	You called, yea?
3.2	00.06.52 / 163 /	00.06.68 / 167 /	00.07.20 / 180 /	Smile	So you already know
3.3	00.11.88 / 297 /	00.12.20 / 305 /	00.14.20 / 355 /	Nausea	Bursting of an ulcer on stomach
3.4	00.17.36 / 434 /	00.17.80 / 445 /	00.18.76 / 469 /	Glum	She was.

3.5	00.18.84 / 471 /	00.19.44 / 486 /	00.20.00 / 500 /	Desperation	She was.
3.6	00.34.88 / 872 /	00.35.08 / 877 /	00.35.72 / 893 /	Malice	This charlatan K. told me.
3.7	00.37.80 / 945 /	00.37.88 / 947 /	00.39.88 / 997 /	Angry	She should not get excited.
3.8	00.47.80 / 1195 /	00.48.08 / 1202 /	00.48.32 / 1208 /	Sad, Disappointment	Three weeks
3.9	00.53.68 / 1342 /	00.54.20 / 1355 /	00.55.52 / 1388 /	Enthusiasm, Rapture	With what?
3.10	00.58.00 / 1450 /	00.58.44 / 1461 /	00.58.84 / 1471 /	In amazing	I do not see any problem
3.11	00.58.88 / 1472 /	00.59.00 / 1475 /	01.00.20 / 1505 /	Admiration	
3.12	01.02.16 / 1554 /	01.02.32 / 1558 /	01.02.96 / 1574 /	Surprise	What?
3.13	01.07.44 / 1686 /	01.07.60 / 1690 /	01.07.84 / 1696 /	Surprise	Well, OK.
Quot4					
4.1	00.04.60 / 115 /	00.05.16 / 129 /	00.05.36 / 134 /	Surprise	Yes
4.2	00.12.20 / 305 /	00.12.84 /321 /	00.13.12 / 328 /	Scared	Hallo!
4.3	00.13.12 / 328 /	00.13.76 / 344 /	00.15.36 / 384 /	Pity	
4.4	00.15.76 / 394 /	00.15.92 / 398 /	00.17.00 / 425 /	Angry	What's going on?
4.5	00.18.72 / 468 /	00.19.40 / 485 /	00.19.96 / 499 /	Disgust, Irritate	I'm irritated already!
4.6	00.22.88 / 572 /	00.23.28 / 582 /	00.24.20 / 605 /	Malice	Found what?
4.7	00.32.96 / 824 /	00.33.20 / 830 /	00.34.16 / 854 /	Cautious	How did you get this number?
4.8	00.46.92 / 1173 /	00.47.12 / 1178 /	00.47.28 / 1182 /	Happy	A farm with poultry and two cows.
4.9	00.56.04 / 1401 /	00.56.44 / 1411 /	00.56.60 / 1415 /	Sad	Yes
4.10	01.10.20 / 1755 /	01.13.00 / 1825 /	01.14.00 / 1850 /	Desperation	What you are talking?
4.11	01.14.16 / 1854 /	01.14.56 / 1864 /	01.15.24 / 1881 /	Admiration	Chicken – pox?
4.12	01.18.96 / 1974 /	01.19.20 / 1980 /	01.19.84 / 1996 /	Bored	Chicken – pox
4.13	01.38.48 / 2462 /	01.39.12 / 2478 /	01.39.92 / 2495 /	Arrogance	What do you mean!
4.14	01.40.88 / 2522 /	01.41.08 / 2527 /	01.41.24 / 2531 /	Excitement	Brat!

4.15	01.44.60 / 2615 /	01.45.04 / 2626 /	01.45.64 / 2641 /	Surprise	Where is daddy?
4.16	01.50.24 / 2756 /	01.50.48 / 2762 /	01.51.16 / 2779 /	Sad	O my God. And how is Ida?
4.17	01.55.04 / 2876 /	01.55.68 / 2892 /	01.56.40 / 2910 /	Wonder	And Pulpa?
4.18	02.00.68 / 3017 /	02.01.60 / 3040 /	02.01.88 / 3047 /	Dissatisfied	She is so sad.
4.19	02.06.80 / 3170 /	02.07.16 / 3179 /	02.07.32 / 3183 /	Fierce, Anxiety	O my God!
Quot5					
5.1	00.05.00 / 125 /	00.05.28 / 132 /	00.05.56 / 138 /	Wonder, Surprise	Listen!
5.2	00.14.28 / 357 /	00.14.64 / 366 /	00.14.80 / 370 /		Yes
5.3	00.16.76 / 419 /	00.16.92 / 423 /	00.17.60 / 440 /	Malice, Anger	I heard even you snoring!
5.4	00.37.12 / 928 /	00.38.44 / 961 /	00.38.84 / 971 /	Surprise	She can be right.
5.5	00.45.04 / 1126 /	00.46.56 / 1164 /	00.48.24 / 1206 /	Defeated, Sadness	I heard a horrible scream
5.6	00.49.48 / 1237/	00.50.80 / 1270 /	00.51.32 / 1283 /	Satisfied	That was terrible
5.7	01.10.00 / 1750 /	01.10.20 / 1755 /	01.10.84 / 1771 /	Wonder	Listen to me!
5.8	01.21.80 / 2045 /	01.22.24 / 2056 /	01.22.80 / 2070 /	Wonder, Surprise	All of it is true.
5.9	01.39.68 / 2492 /	01.41.00 / 2525 /	01.41.68 / 2542 /	Sad	It doesn't matter.
5.10	01.54.00 / 2850 /	01.54.60 / 2865 /	01.55.12 / 2878 /	Wonder	At midnight?
5.11	02.22.40 / 3560 /	02.22.96 / 3574 /	02.24.32 / 3608 /	Surprise	At what time?
5.12	02.26.16 / 3654 /	02.26.52 / 3663 /	02.26.80 / 3670 /	Wonder	In one hour. Ok
5.13	02.34.00 / 3850 /	02.34.76 / 3869 /	02.35.20 / 3880 /	Excitement	And what about the noise?
5.14	02.42.88 / 4072 /	02.44.40 / 41110 /	02.45.68 / 4142 /	Regret, Pity	This is what should you worry about.
5.15	02.51.64 / 4291 /	02.52.04 / 4301 /	02.53.08 / 4327 /	Defeated	Don't grumble
Quot6					
6.1	00.01.36 / 34 /	00.01.64 / 41 /	00.02.16 / 54 /	Wonder	Hi
6.2	00.03.92 / 98 /	00.04.36 / 109 /	00.04.92 / 123 /	Happy, Satisfied	That's very nice!

6.3	00.19.24 / 481 /	00.19.56 / 489 /	00.19.96 / 499 /	Fear	Yes
6.4	00.30.20 / 755 /	00.30.36 / 759 /	00.30.64 / 766 /	Excitement	Really?
6.5	00.35.32 / 883 /	00.35.80 / 895 /	00.36.12 / 903 /	Astonishment	Water?
6.6	00.40.12 / 1003 /	00.40.24 / 1006 /	00.40.40 / 1010 /	Grumpy	Here is my stewed fruit
Quot7					
7.1	00.05.84 / 146 /	00.06.24 / 156 /	00.06.60 / 165 /	Exhausted, Tired	What a pity, really
7.2	00.10.92 / 273 /	00.11.16 / 279 /	00.12.00 / 300 /	Admiration, Elated	I heard you, I heard you
7.3	00.29.68 / 742 /	00.30.12 / 753 /	00.32.08 / 802 /	Astonishment	About what?
7.4	00.34.68 / 867 /	00.35.04 / 876 /	00.35.20 / 880 /	Disappointment	I don't think
7.5	00.35.24 / 881 /	00.35.48 / 887 /	00.35.80 / 895 /	Disillusionment	I can cook
7.6	00.49.20 / 1230 /	00.50.72 / 1268 /	00.51.44 / 1286 /	Satisfied, Happy	A book?
7.7	01.01.48 / 1537 /	01.02.56 / 1564 /	01.03.96 / 1599 /	Indifference	OK, my darling
Quot8					
8.1	00.00.72 / 18 /	00.01.28 / 32 /	00.01.76 / 44 /	Angry	The second sister cried
8.2	00.01.80 / 45 /	00.02.16 / 54 /	00.02.36 / 58 /	Sad	Don't worry.
8.3	00.02.60 / 65 /	00.02.76 / 69 /	00.02.88 / 72 /	Happy, Excitement	Everything will be all right.
8.4	00.04.20 / 105 /	00.04.56 / 114 /	00.06.04 / 151 /	Agreed	Oh, that's right.
8.5	00.11.20 / 280 /	00.11.88 / 297 /	00.12.08 / 302 /	Malice	Men are mean animals.
8.6	00.14.08 / 352 /	00.14.72 / 369 /	00.14.96 / 374 /		They both are mean.
8.7	00.15.52 / 388 /	00.16.04 / 401 /	00.16.32 / 408 /		And Pyziak.
8.8	00.17.16 / 429 /	00.17.68 / 442 /	00.17.84 / 446 /	Wonder	He is also mean.
8.9	00.17.88 / 447 /	00.17.96 / 449 /	00.18.60 / 465 /	Grieving	Well, don't worry.
8.10	00.26.28 / 657 /	00.26.60 / 665 /	00.27.00 / 675 /	Happy	Cake will be crumbly.
8.11	00.29.16 / 729 /	00.29.72 / 743 /	00.30.12 / 753 /	Protest	What do you mean "really"?
8.12	00.30.60	00.31.00	00.31.52	Wonder	Do you think I can't do

	/ 765 /	/ 775 /	/ 788 /		it?
8.13	00.38.00 / 950 /	00.38.64 / 966 /	00.39.12 / 978 /	Sad	Hallo?
8.14	00.40.24 / 1006 /	00.40.52 / 1013 /	00.41.20 / 1030 /	Surprise	I'll ask Ida.
8.15	00.46.32 / 1158 /	00.47.28 / 1182 /	00.47.68 / 1192 /	Indifference	He went out.
8.16	00.50.60 / 1265 /	00.51.12 / 1278 /	00.52.92 / 1323 /	Dissatisfied	What a nonsense.
8.17	00.55.08 / 1377 /	00.55.32 / 1383 /	00.55.88 / 1397 /	Happy	I do not agree.
8.18	00.56.44 / 1411 /	00.56.84 / 1424 /	00.57.60 / 1440 /	Surprise	K. just moved his attention to our pap.
8.19	00.59.16 / 1479 /	00.59.56 / 1489 /	00.59.92 / 1498 /	Happy	Father can talk to boys very well.
8.20	01.11.00 / 1775 /	01.11.52 / 1788 /	01.11.84 / 1796 /	Angry	Sure!
8.21	01.15.28 / 1882 /	01.16.28 / 1912 /	01.17.12 / 1928 /	Wonder	W. was terrible afraid of mom.
8.22	01.17.16 / 1929 /	01.17.48 / 1937 /	01.17.96 / 1949 /	Surprise	And what about our father?
8.23	02.03.44 / 3086 /	02.03.96 / 3099 /	02.04.92 / 3123 /	Joyfully	OK
8.24	02.05.52 / 3138 /	02.05.80 / 3145 /	02.06.96 / 3174 /	Satisfied	Sure
Quot9					
9.1	00.04.52 / 113 /	00.05.08 / 127 /	00.05.76 / 144 /	Appalled	Oh, no nothing unusual
9.2	00.06.88 / 172 /	00.07.08 / 177 /	00.07.32 / 183 /	Wonder	I warmed up dinner again
9.3	00.07.36 / 184 /	00.07.88 / 197 /	00.08.36 / 209 /	Happy	It was delicious
9.4	00.19.40 / 485 /	00.20.12 / 503 /	00.21.00 / 525 /	Angry	Oh, aunt, aunt
9.5	00.31.64 / 791 /	00.32.24 / 806 /	00.34.00 / 850 /	Satisfied	So, give me a receipt
9.6	00.42.24 / 1056 /	00.42.56 / 1064 /	00.42.92 / 1073 /	Euphoria	Ok, I'm writing
9.7	00.47.88 / 1197 /	00.48.28 / 1207 /	00.48.56 / 1214 /	Bored, Desperation	How can I get a cacao?
9.8	00.49.52 / 1238 /	00.50.60 / 1265 /	00.52.00 / 1300 /	Sorrowful	It is impossible
9.9	01.10.00 / 1750 /	01.10.36 / 1759 /	01.11.12 / 1778 /	Surprise	Should the bubble together?
9.10	01.24.64 / 2116 /	01.25.12 / 2128 /	01.27.00 / 2175 /	Disgust	Oh, my God.
9.11	01.27.28	01.27.52	01.28.00	Happy	I really want to be good

	/ 2182 /	/ 2188 /	/ 2200/		hostess.
9.12	01.42.48 / 2562 /	01.43.28 / 2582 /	01.43.92 / 2598 /	Smile	And egg whites into a bowl.
Quot10					
10.1	00.05.36 / 134 /	00.05.60 / 140 /	00.06.24 / 156 /	Sorrow	I have colors of earth in my arse.
10.2	00.08.96 / 224 /	00.09.08 / 227 /	00.09.20 / 230 /	Furious	Calm down
10.3	00.15.20 / 380 /	00.15.64 / 391 /	00.16.48 / 412 /	Wonder	Why should I wear something else?
10.4	00.17.92 / 448 /	00.18.36 / 459 /	00.19.64 / 491 /	Surprise	What, aren't they appropriate?
10.5	00.32.88 / 822 /	00.33.68 / 842 /	00.34.48 / 862 /	Astonishment	Why?
10.6	00.39.28 / 982 /	00.39.64 / 991 /	00.40.36 / 1009 /	Indignant	I distinguish myself anyway
10.7	00.49.00 / 1225 /	00.49.52 / 1238 /	00.50.40 / 1260 /	Disturbed	Does it mean
10.8	00.57.12 / 1428 /	00.57.80 / 1445 /	00.58.80 / 1470 /	Angry	I have a dictatorial ambitions
10.9	01.04.40 / 1610 /	01.04.88 / 1622 /	01.05.20 / 1630 /	Disgust	Disgust me.
10.10	01.30.00 / 2250 /	01.31.00 / 2275 /	01.31.24 / 2281 /	Scared, Worried	Of course not!
10.11	01.33.44 / 2336 /	01.33.84 / 2346 /	01.34.00 / 2350 /	Wonder	Sure!
10.12	01.34.00 / 2350 /	01.34.08 / 2352 /	01.35.52 / 2388 /	Doubtful	It is splendid.
10.13	01.43.24 / 2581 /	01.43.44 / 2586 /	01.43.76 / 2594 /	Contempt	A book?
10.14	01.52.16 / 2804 /	01.53.28 / 2832 /	01.54.32 / 2858 /	Bored	Do they like it?

Appendix 2

Ania 1						
Num.	**Begin**	**Middle**	**End**	**Frame**	**Expressions**	**Triggers**
1.1	00.01.040	00.01.280	00.01.840	32	Astonished	Yes, haw can I help you?
1.2	00.05.200	00.05.360	00.05.840	134	Arrogance	Borejko!
1.3	00.07.160	00.07.280	00.07.840	182	Surprise	What?
1.4	00.09.440	00.10.440	00.11.320	261	Worried	This door?
1.5	00.12.680	00.13.120	00.13.520	328	Surprise	I'm listening…
1.6	00.14.080	00.14.240	00.15.040	356	Nausea	So
1.7	00.17.040	00.17.280	00.17.720	432	Defeated	Just that….
1.8	00.18.600	00.18.920	00.19.120	473	Amazed	Just that?
1.9	00.19.120	00.19.800	00.20.880	495	Anxiety	To shut it

1.10	00.26.240	00.26.680	00.27.480	667	Astonished	It possible?
1.11	00.30.600	00.30.960	00.32.240	774	Worried	No, I did not
1.12	00.37.080	00.37.360	00.39.000	934	Disbelief	Very strange
1.13	00.40.960	00.41.160	00.42.520	1029	?	?
1.14	00.44.840	00.45.000	00.45.320	1125	Excitement	Of course
1.15	00.50.360	00.51.000	00.52.560	1275	Shocked	No!
1.16	00.56.720	00.57.120	00.58.120	1428	Amazed	Why aren't you
1.17	01.06.760	01.07.120	01.08.480	1678	?	?
1.18	01.11.960	01.12.240	01.14.120	1806	Suspicion	Torment
1.19	01.16.000	01.16.360	01.16.600	1909	?	Sighing
1.20	01.17.960	01.18.040	01.18.560	1951	Sociable	It's not necessary
Ania 2						
2.1	00.00.640	00.00.760	00.01.080	19	Alarmed	Pap!
2.2	00.01.920	00.02.440	00.02.560	61	Sad	Let's go
2.3	00.03.000	00.03.560	00.03.840	89	Nausea	It's already after
2.4	00.04.560	00.04.640	00.05.200	116	Amazed	Surgery
2.5	00.05.360	00.05.640	00.06.000	141	Indignant	They told you
2.6	00.06.200	00.06.280	00.06.600	157	Disturbed	After all
2.7	00.06.960	00.07.000	00.07.280	175	Request	Everything
2.8	00.08.320	00.08.720	00.08.920	218	? (drunk)	Will successfully
2.9	00.09.040	00.09.240	00.09.720	231	Curious	Let's go – please
2.10	00.10.680	00.10.840	00.11.000	271	Amazed	Mam
2.11	00.12.480	00.12.680	00.12.880	317	Loving	Sleeping
2.12	00.13.240	00.13.600	00.13.920	340	?	Well
2.13	00.16.960	00.17.240	00.17.880	431	Disappointed	You never know
2.14	00.21.520	00.21.760	00.22.240	544	Surprise	This is Kowalik?
2.15	00.30.600	00.31.560	00.31.880	789	Fascinated	Pleasure
2.16	00.34.280	00.34.600	00.34.960	865	Sneer	For God's
2.17	00.35.280	00.35.360	00.35.520	884	?	Sake
2.18	00.36.400	00.36.600	00.37.200	915	Request	I beg you
2.18	00.37.920	00.38.000	00.38.480	950	With despair	Let's go
2.20	00.38.760	00.39.280	00.39.760	982	Concentrated	Yourself
2.21	00.40.400	00.40.840	00.41.200	1021	Awaiting	You are more needed home
Ania 3						
3.1	00.01.680	00.01.960	00.02.160	49	Curious	You called?
3.2	00.02.480	00.02.640	00.02.960	66	Cautions	Yea?
3.3	00.04.840	00.05.080	00.05.320	127	Appalled	You already
3.4	00.05.840	00.06.080	00.06.440	152	Hostile	Know that

3.5	00.06.400	00.06.680	00.07.120	167	Astonished	I kept watch
3.6	00.09.280	00.09.640	00.09.680	241	Question	Bursting
3.7	00.13.800	00.14.360	00.14.800	359	Bore	She was
3.8	00.15.160	00.15.400	00.15.640	385	Inspired	Only we
3.9	00.15.720	00.15.880	00.16.200	397	Shocked	Not know about it
3.10	00.17.960	00.18.400	00.19.280	460	Sad	She drank seed flax
3.11	00.20.640	00.20.840	00.21.080	521	Dissatisfied	She pretended
3.12	00.23.080	00.23.320	00.23.600	583	Desire	Treating herself
3.13	00.24.400	00.24.760	00.25.040	619	Surprise	We were coming
3.14	00.25.760	00.26.120	00.26.600	653	Disgust	Every headache
3.15	00.29.560	00.29.720	00.30.040	743	Elated	Oh, pap
3.16	00.30.640	00.30.680	00.30.880	767	Annoyed	Charlatan
3.17	00.31.840	00.32.000	00.32.160	800	Domination	Told me
3.18	00.32.360	00.32.960	00.33.600	824	Disgust	Cut out half of her stomach
3.19	00.38.200	00.38.520	00.38.840	963	Curious	No stress
3.20	00.41.240	00.41.400	00.41.800	1035	Defeated	How long
3.21	00.43.840	00.44.120	00.44.480	1103	?	Sanatorium
3.22	00.47.040	00.47.560	00.48.200	1189	Flabbergasted	Whit what?
3.23	00.50.480	00.50.720	00.51.160	1268	Sadness	With your everyday life
3.24	00.51.440	00.51.600	00.52.040	1290	Defeated	As I would say
3.25	00.53.240	00.53.520	00.54.080	1338	Neutral	Don't see any problem
3.26	00.55.440	00.56.120	00.56.600	1403	Desperation	What?
3.27	00.59.000	00.59.240	00.59.600	1481	Sadness	Three weeks
3.28	01.00.840	01.00.920	01.01.440	1523	?	OK!
3.29	01.01.920	01.02.080	01.02.240	1552	Fear	If you think so
Ania 4						
4.1	00.04.360	00.04.600	00.05.440	115	Surprised	Yes!
4.2	00.12.000	00.12.560	00.13.200	314	Surprised	Sighing
4.3	00.16.080	00.16.480	00.17.040	412	Request	Hallo!!!
4.4	00.20.400	00.20.680	00.21.360	517	Furious	Irritated
4.5	00.21.920	00.22.320	00.22.520	558	Disagreement	Say it
4.6	00.23.840	00.24.320	00.24.720	608	Angry	Found what?
4.7	00.25.240	00.25.560	00.25.960	639	Sad	What?
4.8	00.27.080	00.27.280	00.27.600	682	Horrible	Listen to me
4.9	00.28.680	00.29.280	00.29.560	732	Amazed	You are frightening me

4.10	00.29.680	00.30.040	00.30.640	751	Frightened	Nonsense
4.11	00.30.920	00.30.960	00.31.200	774	Terrible	Menace
4.12	00.32.400	00.32.560	00.33.320	814	Embarrass	Chicken
4.13	00.34.800	00.35.000	00.35.280	875	Afraid	How did you get this number?
4.14	00.38.320	00.38.480	00.38.640	962	Victorious	Sighing
4.15	00.39.800	00.40.120	00.40.520	1003	Unpleasantly surprised	Why don't you sleep, yet?
4.16	00.44.920	00.45.600	00.45.920	1140	Indignant	My darling…
4.17	00.46.160	00.46.360	00.46.600	1159	Amazed	You can have
4.18	00.47.880	00.48.200	00.48.720	1205	Request	Three chickens
4.19	00.48.880	00.49.400	00.49.760	1235	Joyful	Farm with poultry and two cows
4.20	00.49.840	00.50.000	00.50.880	1250	Happy	You can even have a camel
4.21	00.53.200	00.53.280	00.53.600	1332	Sad	It's already bedtime
4.22	00.58.000	00.58.320	00.58.880	1458	Dissatisfied	Griefly
4.23	01.02.880	01.03.080	01.03.560	1577	Immediate	Good night
4.24	01.06.880	01.07.680	01.08.080	1692	Temporize	Oh
4.25	01.14.160	01.14.640	01.15.720	1866	Surprise	Father look at me and found a chicken
4.26	01.16.800	01.17.280	01.18.000	1932	Alarming	What are you ….talking?
4.27	01.18.720	01.18.920	01.19.560	1973	Curious	Chicken – pox?
4.28	01.21.640	01.21.920	01.22.480	2048	Sad	Oh, how is Pulpa?
4.29	01.23.880	01.24.360	01.24.760	2109	?	?
4.30	01.33.000	01.33.280	01.33.480	2332	Admonition	But in another place
4.31	01.34.080	01.34.440	01.34.840	2361	Domination	Do you have a fever
4.32	01.41.840	01.42.320	01.42.600	2558	Surprise	What do you mean
4.33	01.42.620	01.43.240	01.44.000	2581	Surprise	What do you mean??
4.34	01.44.760	01.45.680	01.46.000	2642	Acquiesce	I'm sure you are bare footed right now

4.35	01.47.600	01.48.080	01.48.640	2702	Afraid	Where is daddy?
4.36	01.51.800	01.51.880	01.52.240	2797	Sad	O my God
4.37	01.52.200	01.52.560	01.53.080	2814	Disappoint	How is Ida
4.38	01.56.520	01.56.920	01.57.360	2923	Perplexed	Cotton – wool soaked in tea
4.39	02.01.280	02.01.560	02.02.240	3039	Disagreement	Actually she is very sad
4.40	02.06.920	02.07.440	02.07.720	3186	Listen to	-
4.41	02.08.840	02.09.040	02.09.760	3226	Indignant	Go to bed immediately
Ania 5						
5.1	00.05.000	00.05.760	00.05.920	144	?	Sighing
5.2	00.06.000	00.06.160	00.06.440	154	Amazed	Ida listen!
5.3	00.07.120	00.07.440	00.07.720	186	Anger	Do you know
5.4	00.07.960	00.08.400	00.08.600	210	Afraid	What happened this night?
5.5	00.10.640	00.11.000	00.11.760	275	Dissatisfied	I could not sleep whole night
5.6	00.14.080	00.14.360	00.14.520	359	Get bored	Morning
5.7	00.15.120	00.15.880	00.16.480	397	?	Yes
5.8	00.18.160	00.18.480	00.18.640	462	Malice	If you want to pretended a sleeplessness
5.9	00.16.040	00.19.400	00.19.760	485	Threaten someone	You should not snore
5.10	00.21.840	00.22.120	00.22.760	553	Surprise	Ok, listen
5.11	00.22.920	00.23.120	00.23.680	578	Dissatisfied	Mrs. Szepanska….
5.12	00.27.080	00.27.560	00.28.080	689	Indignant	She is threatened with fainting
5.13	00.33.920	00.34.440	00.34.720	861	Request	Ida!
5.14	00.36.080	00.36.760	00.37.120	919	?	Something strange at her place
5.15	00.41.280	00.41.880	00.41.960	1047	Agreement	Yes
5.16	00.43.120	00.43.400	00.43.680	1085	Stimulated	I heard
5.17	00.46.000	00.46.280	00.46.600	1157	Surprise	A horrible scream
5.18	00.46.760	00.47.200	00.47.840	1180	Disgust	That was terrible
5.19	00.51.920	00.52.280	00.52.680	1307	Malice	I have heard with my own ears

5.20	01.03.160	01.03.640	01.03.880	1591	Disagreement	Listen to me
5.21	01.05.440	01.06.000	01.06.320	1650	Cynical	First I heard
5.22	01.06.640	01.06.960	01.07.480	1674	Disgust	From the basement a strange noise
5.23	01.13.440	01.13.640	01.14.760	1841	Amazed	Something like knocking or rattling
5.24	01.15.960	01.16.280	01.16.560	1907	Angry	I could hear metallic and annoying crack
5.25	01.18.840	01.19.080	01.19.720	1977	Amazed	All of it is true?
5.26	01.24.280	01.24.480	01.24.760	2112	Curious	Oh, Ida.
5.27	01.29.760	01.30.240	01.30.840	2256	?	First of all
5.28	01.32.440	01.32.880	01.33.320	2322	Malice	She can hear everything
5.29	01.37.320	01.37.760	01.38.120	2444	Threaten someone	Through this hole
5.30	01.41.560	01.41.800	01.42.040	2545	Amazed	I will not dare…
5.31	01.45.480	01.46.240	01.46.800	2796	Threaten someone	Something was doing on under her room
5.32	01.51.600	01.51.840	01.52.200	2831	Perplexed	At midnight
5.33	01.53.120	01.53.240	01.53.560	2901	Aggression	Besides the factory
5.34	01.55.640	01.56.040	01.56.520	3061	Pain	There is a basement's corridor
5.35	02.02.240	02.02.440	02.02.640	3079	Joyful	Aunt prepared tasty pancakes
5.36	02.03.000	02.03.160	02.03.640	3461	Cynical	If there are more of them
5.37	02.17.560	02.18.440	02.18.920	3563	Astonished	At what time
5.38	02.21.600	02.22.520	02.22.920	3725	Threaten someone	Ok
5.39	02.28.760	02.29.000	02.29.160	4026	Domination	We will stop this gap
5.40	02.40.640	02.41.040	02.41.600	4095	Listen to	-
5.41	02.43.560	02.43.800	02.44.080	4142	Disturbed	Don't grumble
5.42	02.45.400	02.45.680	02.45.920	4157	Threaten someone	I think, I heard

5.43	02.46.080	02.46.280	02.46.560	4164	Disgust	A door bell
			Ania 6			
6.1	00.02.000	00.02.360	00.02.760	59	Pleased	Hi
6.2	00.04.440	00.04.560	00.04.760	114	Cynical	That's very nice
6.3	00.04.760	00.04.800	00.04.960	120	Cynical	I'm glad you did
6.4	00.05.200	00.05.360	00.05.480	134	Sarcastic	-
6.5	00.07.120	00.07.400	00.07.560	185	Contempt	-
6.6	00.08.320	00.08.600	00.09.080	215	Disturbed	The last time it was on New Year's Eve
6.7	00.10.960	00.11.080	00.11.200	277	Curious	Would you like to get in?
6.8	00.15.320	00.15.680	00.16.200	392	Irritable	So, get in pal
6.9	0016.680	00.16.840	00.17.240	421	Dissatisfied	We have a chicken – pox epidemic here
6.10	00.19.680	00.19.840	00.20.040	496	Surprise	Yes
6.11	00.21.040	00.21.200	00.21.320	530	Indignant	It is infectious
6.12	00.25.680	00.25.800	00.26.120	645	Amazed	It doesn't matter
6.13	00.30.680	00.30.920	00.31.300	773	Listen	-
6.14	00.35.080	00.35.440	00.35.800	886	Disappoint	Water?
6.15	0041.240	00.41.520	00.41.880	1038	?	Here is my stewed fruit
6.16	00.43.680	00.44.040	00.44.440	1102	Malice	Drink it and do not die right now
6.17	00.46.800	00.47.000	00.47.240	1175	Cynical	Ida sad, so…
6.18	00.48.240	00.48.480	00.48.680	1212	?	Well, I understand
			Ania 7			
7.1	00.05.120	00.05.360	00.05.840	134	Anger	I go back to work from Monday
7.2	00.06.280	00.06.520	00.06.920	163	Desperate	What a pity
7.3	00.10.600	00.10.840	00.11.000	271	Perplexed	Sighing
7.4	00.11.080	00.11.360	00.11.640	284	Surprise	I heard you
7.5	00.27.600	00.27.840	00.28.080	696	Regret	About what?
7.6	00.29.920	00.30.360	00.30.680	759	Listen	-
7.7	00.31.400	00.31.640	00.32.160	791	Desperation	I don't think I can cook
7.8	00.39.920	00.40.040	00.40.200	1001	Contempt	You are right
7.9	00.41.240	00.41.400	00.41.560	1035	Advice	You are right
7.10	00.45.200	00.45.720	00.46.240	1143	Thoughtful	A book…?
7.11	00.54.080	00.54.240	00.54.440	1356	Listen	-

7.12	00.55.400	00.55.640	00.55.960	1391	Anger	All right
7.13	00.56.760	00.56.840	00.57.120	1421	Agreement	Ok, show me this book
7.14	00.58.160	00.58.400	00.58.840	1460	Angry	And now you can go
Ania 8						
8.1	00.00.640	00.00.840	00.01.120	21	Frustrated	The second sister cried
8.2	00.01.720	00.02.200	00.02.320	55	Sad	Don't worry
8.3	00.02.480	00.02.720	00.03.040	68	Perplexed	Everything will be all right
8.4	00.04.320	00.04.480	00.04.800	112	Dissatisfied	Do you cry because the hemstitch
8.5	00.11.000	00.11.240	00.11.560	281	Surprise	Oh, that's right
8.6	00.16.520	00.16.760	00.17.000	419	Disagreement	And Piziak?
8.7	00.17.040	00.17.360	00.17.560	434	Shock	He is also mean
8.8	00.18.120	00.18.200	00.18.640	455	Alarming	Don't worry
8.9	00.21.600	00.22.000	00.22.440	550	Eager	There's the way
8.10	00.22.680	00.22.880	00.23.200	572	Indignant	Cake will be crumbly
8.11	00.27.280	00.27.520	00.27.880	688	Disagreement	All other things
8.12	00.29.520	00.29.800	00.30.360	745	Anger	What do you man "really"
8.13	00.31.200	00.31.360	00.31.760	784	Arrogance	Do you think I can't do it?
8.14	00.34.960	00.35.440	00.35.920	886	Don't understanding	If I will not succeed today?
8.15	00.40160	00.40.520	00.40.800	1013	Cynical	Hallo
8.16	00.41.800	00.42.280	00.42.720	1057	Joyful	-
8.17	00.43.640	00.44.520	00.45.120	1113	Amazed	A!!!!
8.18	00.50.120	00.50.280	00.50.560	1257	Neglect	He went out
8.19	00.55.880	00.56.440	00.57.280	1411	Malice	What a nonsense
8.20	00.57.360	00.57.520	00.57.880	1438	Indignant	Why disability
8.21	01.00.080	01.00.280	01.00.680	1507	Comfort	I do not agree
8.22	01.01.480	01.01.680	01.02.080	1542	Desire	Just move his attention
8.23	01.04.680	01.05.040	01.05.280	1626	Admonition	Father can talk to boys very well
8.24	01.09.400	01.09.920	01.10.200	1748	Curious	Fascinated

8.25	01.10.640	01.11.080	01.11.640	1777	?	That's probably
8.26	01.15.160	01.15.440	01.15.800	1886	Think	-
8.27	01.16.000	01.16.440	01.16.960	1911	Amazed	Sure?
8.28	01.19.960	01.20.600	01.21.000	2015	Terrible	Waldus was terrible afraid of mom
8.29	01.21.520	01.21.760	01.22.200	2044	Perplexed	And what about our father?
8.30	01.31.240	01.32.120	01.32.840	2303	Angry	Don't cry
8.31	01.33.640	01.34.000	01.35.000	2350	Cruel	He was frightened by chicken – pox
8.32	01.35.880	01.36.320	01.36.800	2408	Surprise	You also have something rascal
8.33	01.39.320	01.39.640	01.39.880	2491	Admonition	This boys' weak ness to our pap
8.34	01.49.960	01.50.200	01.50.680	2755	Expect	-
8.35	01.51.960	01.52.440	01.52.920	2811	Trouble	We have to be slim
8.36	01.54.560	01.54.880	01.55.280	2872	Tension	Ok
8.37	02.04.320	02.04.520	02.04.720	3113	Thoughtful	You are a genius
8.38	02.05.600	02.05.760	02.06.120	3144	Express opinion	Sure…
Ania 9						
9.1	00.01.200	00.01.920	00.02.000	48	?	Aunt, hi…
9.2	00.04.600	00.04.840	00.05.680	121	Joyful	Oh, no
9.3	00.06.560	00.06.720	00.06.920	168	?	Nothing usual
9.4	0014.000	00.14.880	00.15.280	372	Angry	Mace a cake
9.5	00.16.520	00.16.680	00.16.880	417	Agreement	Oh, aunt
9.6	00.18.560	00.18.680	00.19.120	467	Admonition	I play basketball after all
9.7	00.21.400	00.21.600	00.21.760	540	?	Fancy – cake
9.8	00.26.400	00.27.160	00.27.480	679	Anger	I will not succeed with it
9.9	00.29.760	00.30.320	00.30.560	758	Dissatisfied	So, give me a receipt
9.10	00.43.440	00.44.000	00.45.040	1100	Disgust	I will waste less products

9.11	00.46.120	00.46.600	0047.520	1165	Regret	It sound reasonably
9.12	00.53.720	00.54.520	00.55.000	1363	Threaten someone	Well, so, listen
9.13	00.58.480	00.58.920	00.59.120	1473	Indignant	Haw can I get a cacao?
9.14	01.00.440	01.00.680	01.01.040	1517	Cynical	Clear?
9.15	01.03.760	01.04.400	01.04.560	1610	Sarcastic	What should bubble
9.16	01.09.120	01.09.600	01.10.240	1740	Amazed	Together
9.17	01.15.840	01.16.160	01.16.720	1909	Afraid	Oh, my God
9.18	01.18.680	01.18.840	01.19.000	1971	Alarming	Be more patience
9.19	01.24.120	01.24.760	01.25.440	2119	Perplexed	Half of glass of what?
9.20	01.28.360	01.28.880	01.29.720	2222	With understanding	This mass
9.21	01.32.160	01.32.640	01.32.720	2316	Interested	Oh, and egg whites into a bowl
9.22	01.37.440	01.37.600	01.37.880	2440	Disagreement	You see
9.23	01.38.320	01.38.680	01.39.000	2467	Amazed	Why did you lower your voice?
9.24	01.41.760	01.42.000	01.42.360	2550	Thoughtful	Because
9.25	01.49.080	01.49.440	01.49.760	2736	Angry	It's all ready the end
9.26	01.54.360	01.54.600	01.55.080	2865	Pleased	Well, we will see
9.27	01.55.560	01.55.800	01.56.240	2939	Cheerful	So, bye – bye aunt
9.28	01.56.960	01.57.560	01.58.040	2965	?	Thinks
9.29	01.58.320	01.58.600	01.58.840	2939	Curious	Gabrisia, my dear child…
9.30	02.02.040	02.02.240	02.03.080	2965	Amazed	Yes
9.31	02.04.800	02.05.960	02.06.000	3056	Arrogance	Aunt, be calm
9.32	02.08.480	02.08.920	02.09.200	3149	Malice	I decided to be a womanly
9.33	02.09.600	02.09.880	02.10.480	3223	Expect	Everything
Ania 10						
10.1	00.05.440	00.05.960	00.06.320	149	Anger	I have colors
10.2	00.06.360	00.06.600	00.07.080	165	Disgust	Of earth in my ass
10.3	00.08.000	00.08.440	00.08.960	211	Malice	Calm down, you malicious brats
10.4	00.12.080	00.12.800	00.13.160	320	Desperate	Sighing

10.5	00.15.240	00.15.720	00.16.660	393	Surprise	I also have colors of earth in my ass
10.6	00.18.280	00.18.560	00.19.280	464	Surprise	Why?
10.7	00.23.960	00.24.120	00.24.600	603	Defeated	In this clothes?
10.8	00.26.320	00.26.560	00.26.920	664	Thoughtful	What, aren't they appropriate?
10.9	00.33.080	00.33.280	00.33.680	832	Sad	Just think about it
10.10	00.38.320	00.38.680	00.39.120	967	Surprised	Why are you so strange
10.11	00.47.320	00.47.720	00.48.360	1193	Thoughtful	Extravagant
10.12	00.49.160	00.49.520	00.49.920	1238	Expect	-
10.13	00.54.680	00.55.080	00.55.320	1377	Surprise	That currently
10.14	00.56.960	00.57.040	00.57.240	1426	Dissatisfied	I distinguish myself from the crowd
10.15	00.58.040	00.58.480	00.59.240	1462	Afraid	I have dictorial ambitions
10.16	00.59.440	00.59.840	01.00.560	1496	Anger	Disgust me
10.17	01.02.400	01.02.680	01.03.120	1567	Disgust	-
10.18	01.05.760	01.06.120	01.06.360	1653	Acquiesce	Full of style
10.19	01.11.960	01.12.160	01.12.520	1804	Amazed	It was great
10.20	01.14.280	01.14.440	01.15.000	1861	Amazed	You are joking
10.21	01.16.880	01.17.480	01.18.160	1937	Agreement	Of course
10.22	01.20.080	01.20.320	01.200.720	2008	Alarming	It is splendid
10.23	01.23.680	01.24.000	01.24.440	2100	Sad	Don't say anything
10.24	01.25.160	01.25.320	01.25.720	2133	Surprised	Tell me
10.25	01.29.480	01.29.920	01.30.160	2248	Disappoint	She threatened
10.26	01.32.240	01.32.360	01.32.880	2309	Malice	A book
10.27	01.33.320	01.33.560	01.33.680	2339	Careful	Perfume
10.28	01.40.240	01.40.480	01.41.160	2630	Amazed	Powder sugars
10.29	01.44.720	01.45.200	01.46.080	2771	Afraid	She don't notice it
10.30	01.50.560	01.50.840	01.50.320	2815	Acquiesce	Nnno, I have only….
10.31	01.52.520	01.52.600	01.52.840	2899	?	Window – sill
10.32	01.55.200	01.55.960	01.57.040	2961	Interest	Do they like it?

10.33	01.58.280	01.58.440	01.58.560	3037	Indignant	Well, no
10.34	02.01.440	02.01.480	02.01.840	3098	Afraid	You should tell them
10.35	02.03.560	02.03.720	02.03.920	3175	Don't understanding	You should also remember about it?
10.36	02.06.280	02.06.600	02.07.000	3247	Think	Let's go

Appendix 3

	Jacek	*Trigger*		*Ania*	
№	*Expression*		*№*	*Expressions*	
Quot1					
1.1	Astonished	Yes, how can I help you?	1.1	Astonished	
1.2	Annoyed	Borejko!	1.2	Arrogance	
1.4	Wonder	This door?	1.4	Worried	
1.5	Guess	Oh, that - so?	1.8	Amazed	
1.8	Disbelief	It is possible	1.10	Astonished	
1.9	Excited, surprise	Oh, no I did not.	1.11	Worried	
1.10	Alarmed, Sad	No?	1.1	Astonished	
1.11	Anticipating	Why aren't you?	1.2	Arrogance	
Quot2					
2.1	Worried	Pap!	2.1	Alarmed	
2.2	Sadness	Let's go	2.2	Sad	
2.5	Cautious	Let's go father	2.9	Curious	
2.6	Sad, trouble	This is K, one of them.	2.14	Surprise	
2.8	Tired, sorrowful	I beg you let's go home	2.18	With despair	
Quot3					
3.1	Happy, pleased	You called, yea?	3.2	Cautions	
3.2	Smile	So you already know	3.3	Appalled	
3.3	Nausea	Bursting of an ulcer on stomach	3.6	Question	
3.4	Glum	She was.	3.7	Bore	
3.6	Malice	This charlatan K. told me	3.16	Annoyed	
3.8	Sad	Three weeks	3.22	Flabbergasted	
3.9	Enthusiasm	With what?	3.25	Neutral	
3.10	In amazing	I do not see any problem	3.26	Desperation	
3.12	Surprise	What?	3.27	Sadness	
Quot4					
4.1	Surprise	Yes	4.1	Surprised	
4.2	Scared	Hallo!	4.3	Request	
4.5	Disgust, Irritate	I'm irritated already!	4.4	Furious	
4.6	Malice	Found what?	4.6	Angry	
4.7	Cautious	How did you get this number?	4.13	Afraid	

4.8	Happy	Farm with poultry, cows	4.19	Joyful
4.10	Desperation	What you are talking?	4.26	Alarming
4.11	Admiration	Chicken – pox?	4.27	Curious
4.13	Arrogance	What do you mean!	4.32	Surprise
4.15	Surprise	Where is daddy?	4.35	Afraid
4.16	Sad	O my God. How is Ida?	4.36	Sad
Quot5				
5.1	Wonder, Surprise	Listen!	5.2	Amazed
5.5	Defeated, Sadness	I heard a horrible scream	5.17	Surprise
5.6	Satisfied	That was terrible	5.18	Disgust
5.7	Wonder	Listen to me!	5.20	Disagreement
5.8	Wonder, Surprise	All of it is true.	5.25	Amazed
5.10	Wonder	At midnight?	5.32	Perplexed
5.11	Surprise	At what time?	5.37	Astonished
5.12	Wonder	In one hour. Ok	5.38	Threaten someone
5.15	Defeated	Don't grumble	5.41	Disturbed
Quot6				
6.1	Wonder	Hi	6.1	Pleased
6.2	Happy, Satisfied	That's very nice!	6.2	Cynical
Quot7				
7.1	Exhausted, Tired	What a pity, really	7.2	Desperate
7.2	Admiration	I heard you, I heard you	7.4	Surprise
7.3	Astonishment	About what?	7.5	Regret
7.4	Disappointment	I don't think	7.7	Desperation
7.6	Satisfied, Happy	A book?	7.10	Thoughtful
Quot8				
8.1	Angry	The second sister cried	8.1	Frustrated
8.2	Sad	Don't worry.	8.2	Sad
8.3	Happy, Excitement	Everything will be all right.	8.3	Perplexed
8.4	Agreed	Oh, that's right.	8.5	Surprise
8.7	?	And Pyziak.	8.6	Disagreement
8.8	Wonder	He is also mean.	8.7	Shock
8.9	Grieving	Well, don't worry.	8.8	Alarming
8.10	Happy	Cake will be crumbly.	8.10	Indignant
8.11	Protest	What do you mean "really"?	8.12	Anger
8.12	Wonder	Do you think I can't do it	8.13	Arrogance
8.13	Sad	Hallo?	8.15	Cynical
8.15	Indifference	He went out.	8.18	Neglect
8.16	Dissatisfied	What a nonsense.	8.19	Malice
8.17	Happy	I do not agree.	8.21	Comfort
8.18	Surprise	K. just moved his attention to our pap.	8.22	Desire

8.19	Happy	Father can talk to boys very well.	8.23	Admonition
8.20	Angry	Sure!	8.27	Amazed
8.21	Wonder	W. was terrible afraid of mom.	8.28	Terrible
8.22	Surprise	And what about our father?	8.29	Perplexed
8.23	Joyfully	OK	8.36	Tension
8.24	Satisfied	Sure	8.38	Express opinion
		Quot9		
9.1	Appalled	Oh, no nothing unusual	9.2	Joyful
9.4	Angry	Oh, aunt, aunt	9.5	Agreement
9.5	Satisfied	So, give me a receipt	9.9	Dissatisfied
9.7	Bored	How can I get a cacao?	9.13	Indignant
9.10	Disgust	Oh, my God.	9.17	Afraid
9.12	Smile	And egg whites into a bowl.	9.21	Interested
		Quot10		
10.1	Sorrow	I have colors of earth in my arse.	10.1	Anger
10.2	Furious	Calm down	10.3	Malice
10.4	Surprise	What, aren't they appropriate?	10.8	Thoughtful
10.5	Astonishment	Why?	10.10	Surprise
10.6	Indignant	I distinguish myself anyway	10.14	Dissatisfied
10.8	Angry	I have a dictatorial ambitions	10.15	Afraid
10.9	Disgust	Disgust me.	10.16	Anger
10.10	Scared, Worried	Of course not!	10.21	Agreement
10.12	Doubtful	It is splendid.	10.22	Alarming
10.13	Contempt	A book?	10.26	Malice
10.14	Bored	Do they like it?	10.32	Interest

Appendix 4

Factor loadings:

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14
P1	0.518	-0.557	-0.106	-0.227	0.224	0.408	0.000	0.103	0.323	-0.150	-0.060	-0.006	-0.027	0.000
P2	-0.197	0.137	0.084	-0.048	0.924	-0.232	-0.061	0.130	-0.022	0.035	0.046	-0.005	-0.009	0.000
P3	0.399	-0.408	0.472	-0.411	-0.066	-0.326	0.346	0.060	-0.168	-0.133	-0.011	-0.038	-0.036	0.001
P4	0.119	0.653	0.529	0.353	-0.019	0.102	0.053	0.332	-0.009	-0.036	-0.168	0.029	0.016	0.000
P5	-0.389	0.412	0.538	-0.126	0.047	0.537	0.229	-0.063	0.008	0.054	0.156	-0.015	-0.013	0.000
P6	0.774	-0.401	0.355	-0.185	-0.051	0.003	-0.160	0.137	0.012	0.089	0.061	-0.017	0.147	0.000
P7	0.636	-0.341	-0.352	0.059	0.238	0.351	0.236	-0.080	-0.282	0.133	-0.104	0.024	0.015	0.000
P8	0.875	0.345	0.120	-0.111	0.058	-0.079	-0.017	-0.194	0.014	-0.082	0.048	0.181	0.001	-0.003
P9	0.261	0.698	-0.269	-0.537	-0.030	0.133	-0.186	0.059	-0.142	-0.063	-0.024	-0.051	0.001	-0.027
P10	0.560	0.559	-0.219	-0.241	-0.043	-0.240	0.301	-0.011	0.280	0.193	-0.037	-0.026	0.001	0.001
P11	0.638	0.098	-0.518	0.336	-0.102	0.000	0.150	0.365	-0.049	-0.067	0.168	0.002	-0.013	0.000
P12	0.788	0.550	-0.044	0.025	0.070	0.056	-0.130	-0.165	-0.066	-0.094	-0.002	-0.082	0.003	0.035
P13	0.713	-0.028	0.221	0.579	0.122	-0.067	0.057	-0.264	0.065	-0.058	0.012	-0.079	0.008	-0.026
P14	0.833	-0.222	0.329	0.015	-0.113	0.020	-0.280	0.090	-0.030	0.177	0.017	-0.005	-0.127	-0.001

Appendix 5

Appendix 6

Appendix 7