Master Thesis

The development of a comprehensive coding scheme for facial expressions of sadness

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Abstract

Objectives - Sadness is one of the most elementary emotions humans can feel. The experience of this emotion is often reflected in facial expressions which portray sadness in a non-verbal way. Research on non-verbal facial expressions of emotion and former coding schemes strongly focus on facial muscle movements as relevant for the recognition of expressions, but sadness knows also other modes of expression that are not solely based on muscle movements. The present study aimed to develop a comprehensive and reliable coding scheme for non-verbal facial expressions of sadness that supplements former coding schemes by addressing also more subtle forms of expression that are not solely based on muscle movements. Furthermore this study investigated how the different forms are distributed in and between individual persons, as well as between women and men, and different age-groups. It was expected that women will show sadness more often and more intense forms than men and that older people will show sadness more often than younger ones.

Method – By means of a previous literature study and subsequent observations of two analysts of sadness in a digital collection of oral history interviews (*N*=12) addressing war and violence in Croatia different forms of non-verbal facial expressions could be distinguished. Inclusion and exclusion criteria of the different forms, constituting the coding scheme were established and refined in three observation phases. Calculations of frequencies, means per minutes, and standard deviations provide information about the differences in expression in and between individuals, and between men and women, and different age-groups.

Results – Five different forms of non-verbal facial expressions of sadness could be distinguished, idle glance, inner eyebrow raiser, intense inner eyebrow raiser and lip corner depressor, tearful eyes, and weeping. The different forms of expressions with their accompanying inclusion and exclusion criteria were compiled into a coding scheme and a decision tree. Besides variation in expressing sadness in and between individual persons, it was found that women showed more intense forms than men. Furthermore older persons showed more intense inner eyebrow raisers and lip corner depressors than younger persons while younger persons showed more weeping than older ones.

Conclusion – The developed comprehensive coding scheme and decision tree are important innovations in the research field of non-verbal emotion expression, providing reliable tools for the detection of and differentiating between various forms of non-verbal facial expressions of sadness.

Discussion – Differences in the expression in and between individuals, as well as between women and men, and different age-groups are discussed. Moreover several avenues for further research on the non-verbal facial expression of sadness are considered.

Samenvatting

Doelstelling – Verdriet is een van de meest elementaire emoties die mensen kunnen voelen. De ervaring van deze emotie is vaak te herkennen in gezichtsuitdrukkingen die verdriet op een non-verbale wijze tonen. Onderzoek naar non-verbale gezichtsuitdrukkingen van emoties en codeerschema's zijn sterk gericht op spierbewegingen van het gezicht voor de herkenning van uitdrukkingen, toch kent verdriet ook andere uitingsvormen, die niet alleen op deze spierbewegingen zijn gebaseerd. Het doel van deze studie is om een uitgebreid en betrouwbaar codeerschema te ontwikkelen voor non-verbale gezichtsuitdrukkingen die wijzen op verdriet. Dit codeerschema vult eerdere codeerschema's aan doordat het ook subtielere vormen van expressies omvat die niet alleen zijn gebaseerd op spierbewegingen. Bovendien heeft deze studie onderzocht hoe de verschillende vormen verdeeld zijn tussen en binnen individuele personen en tussen mannen en vrouwen en verschillende leeftijdsgroepen. Aangenomen wordt dat vrouwen vaker verdriet en meer intense vormen tonen dan mannen en dat oudere mensen vaker verdriet tonen dan jongere mensen.

Methode – Door middel van een voorafgaande literatuurstudie en observaties van verdriet in een digitale collectie van oral history interviews (*N*=12) omtrent oorlogservaringen in Kroatië, uitgevoerd door twee analisten, konden verschillende vormen van non-verbale gezichtsuitdrukkingen worden onderscheiden. Tijdens drie fases werden inclusie en exclusie criteria voor de verschillende vormen opgesteld en verfijnd. Berekeningen van frequenties, gemiddelden per minuut en standaarddeviaties bieden informatie over de verschillen in expressie in en tussen individuen, tussen mannen en vrouwen en verschillende leeftijdsgroepen.

Resultaten – Vijf verschillende vormen van non-verbale gezichtsuitdrukkingen van verdriet kunnen worden onderscheiden, lege blik, binnenste wenkbrauwen trekker, intense binnenste wenkbrauwen trekker en neerwaartse mondhoek neiging, tranen in de ogen en huilen. De verschillende vormen van uitdrukkingen met hun bijbehorende inclusie en exclusie criteria werden in een codeerschema en een beslisboom samengesteld. Naast verschillen in expressie in en tussen individuen bleek dat vrouwen intensere vormen toonden dan mannen. Verder toonden ouderen mensen meer intense binnenste wenkbrauwen trekker en neerwaartse mondhoek neiging dan jonger mensen en jongere mensen meer huilen dan oudere.

Conclusie - De ontwikkelde uitgebreide codeerschema en beslisboom zijn belangrijke innovaties op het gebied van onderzoek naar non-verbale uitdrukkingen van emoties. Ze zijn betrouwbare instrumenten voor het opsporen van en het onderscheid maken tussen verschillende vormen van niet-verbale gezichtsuitdrukkingen van verdriet.

Discussie – Verschillen in de expressie in en tussen individuen, tussen vrouwen en mannen en tussen verschillende leeftijdsgroepen worden besproken. Bovendien worden enige implicaties voor verder onderzoek naar non-verbale gezichtsuitdrukkingen van verdriet beschouwd.

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Introduction

A smile, a scrunched up nose, eyes wide open, a bowed head, a deep sigh, or tears in the eyes – human beings express their emotions in a number of different ways and with different intensity. The present study addresses the differences with which one of the most common emotions – sadness – can be expressed. In this respect the research focus is on the non-verbal facial expression of sadness. The development of a comprehensive coding scheme for detecting and distinguishing the different expressions is the central theme of this study. For the development of this coding scheme a large collection of audiovisual testimonies on war-related experiences in Croatia's past is used (CroMe, 2014).

Emotions and their function

Sadness is one of the six basic emotions (Ekman & Friesen, 1971). Basic emotions are also called primary emotions. These emotions are classified as the basis for all other emotional states (secondary emotions), while basic emotions self cannot be reduced to even more fundamental emotions. Many evolutionary psychologists believe that basic emotions are based on psychological mechanisms that developed through natural selection over the course of evolution (Reisenzein, 2010). Due to this biological basis basic emotions seem to be universal (Berk, 2008).

The experience of emotions promoted the survival of the human species (Berk, 2008). The functionalist approaches of emotion may clarify the useful function and purpose of emotions. These approaches state that "the broad function of emotion is to energize behavior aimed at attaining personal goals" (Berk, 2008, p. 400). The most noted functionalist approach is Nico Frijda's general emotion theory (1986). Frijda describes an emotional process that consists of several steps.

The first step in the process is called primary appraisal. In this step emotional reactions result from an individual's subjective appraisal of an internal or external stimulus that is considered as being either harmful or beneficial to one's well-being (Kunzmann & Grühn, 2005). This means that a thought or situation itself does not give rise to emotions, but the meaning one gives to it (Konijn, 2000). The first appraisal runs mainly automatically and it is assumed that the appraisal is hardwired for the most part, at least for the six basic emotions (Korrelboom & ten Broeke, 2012). The appraisal of a situation as loss that cannot be restored and for which no culprit can be determined, has shown to result in sadness (Kunzmann & Grühn, 2005).

In the second step of the emotional process an elicited emotion triggers a tendency to do something, an action tendency. This is the urge to act, to refrain from action, or to suppress an action to change the relationship between the person and the environment (Konijn, 2000). The experience of negative emotions such as sadness has important motivational functions, e.g. it

redirects ongoing behavior that would lead to dysfunctional outcomes. The experience of sadness has therefore been considered a means to achieve personal growth and improved psychological well-being (Kunzmann & Grühn, 2005). Action tendencies can result in different outcomes of the emotional process. They can cause physiological changes that enable persons to accomplish the tendencies, e.g. arousal, accelerated heartbeat, changes in blood pressure, etc. Furthermore action tendencies lead to noticeable behavioral expressions such as verbal and non-verbal behavior and facial expressions (Konijn, 2000).

In summary, it can be concluded that an emotion "is a rapid appraisal of the personal significance of the situation, which prepares you for action. An emotion then, expresses your readiness to establish, maintain, or change your relation to the environment." (Berk, 2008, p. 400). This action tendency is accompanied by physiological changes and verbal and non-verbal expressions.

Verbal and non-verbal expression of the emotion sadness

The verbal and non-verbal expressions have an expressive signal function. They convey important information to observers, because the observers draw inferences from the emotional reactions they observe at others. Humans and other primates are able to infer the emotional state of others, their disposition and important information about the situation as such (Hareli & Hess, 2012).

On the one hand humans express their emotions through verbal means. This expression encompasses spoken or written language (Abercrombie, 1972). The human language knows a long list of adjectives which express emotions, and hence sadness. However many people have difficulties in recognizing and describing their own emotions precisely.

On the other hand people can express their emotions non-verbally. Non-verbal expression of emotion includes various channels. Sadness, too, can be expressed through all of the different channels. One channel are prosodic characteristics, these describe the rhythm, stress, and intonation of speech (Banse & Scherer, 1996). Furthermore sadness can be expressed through static body postures, using parts of the body, such as torso, arms, and legs (Coulson, 2004; Tan & Nareyek, 2009). Additionally movements of body parts, gestures, can portray the feeling of sadness (Tan & Nareyek, 2009). Last but not least sadness can be expressed through facial expressions (Keltner & Ekman, 2000).

Although verbal means can play an important role in the expression of sadness, the information content of non-verbal expressions seems to precede that of verbal expressions. According to Daniel Goleman (1997) more than 90% of the expression of emotion is articulated non-verbally. Other authors support this claim about the primacy of the non-verbal channel over the

verbal channel and stress the particular importance of the visual channel, including especially the face, in recognizing emotions (Argyle, Alkema, & Gilmour, 1971; Burns & Beier, 1973; DePaulo, Rosenthal, Eisenstat, Rogers, & Finkelstein, 1978; Mehrabian & Ferris, 1967; Zaidel & Mehrabian, 1969). Though other researchers have found contradictory results (see e.g. O'Sullivan & Scherer, 1980), the non-verbal channel seems to play an important role for the recognition of emotions, especially basic emotions, under which sadness falls. And although vocalization, body postures, and gestures provide some information, researchers have relied mostly on facial expressions.

Facial expressions are displayed by using body parts of the head region, e.g. eyebrows, eyes, mouth, and lips (Tan & Nareyek, 2009). They play an important role in the recognition of emotions, and especially basic emotions. It is assumed that sadness can be directly inferred from facial expressions. Furthermore the facial expressions seem to be universal (Berk, 2008; Ekman & Friesen, 1971). This means that sadness as basic emotion seems to be expressed similarly across cultures and that it can be recognized in the same way across different cultures, too. The universality of the facial expressions emphasizes the fact that sadness as one of the six basic emotions is "a product of our evolution, with some biological givens" (Ekman, 1992, p. 550).

Necessity of a new coding scheme for the non-verbal facial expression of sadness
In line with the importance of the non-verbal channel in expressing emotions in general and the importance of facial expressions in particular, the present study concentrates on the non-verbal, facial expression of sadness. This study attempts to capture the various forms of non-verbal facial expression of sadness and places emphasis on the development of a new and comprehensive coding scheme.

The necessity of the development of a new coding scheme for the non-verbal facial expressions of sadness is based on several reasons. Although it is assumed that sadness can be directly inferred from facial expressions, this inference does not have a 100% accuracy. Beaudry, Roy-Charland, Perron, Cormier, and Trapp (2014) for example aimed to clarify the role of different facial parts in the recognition of the six basic emotions. The accuracy of recognition was e.g. examined while participants viewed partial and full facial expressions. In their study sadness was one of the least accurately identified emotions. Another example is a study of Ekman and Friesen (1971), who investigated the recognition of the six basic emotions in a cultural group of New Guinea. They showed participants a group of three pictures showing different basic emotions and simultaneously read a story. They asked the participants to point to the picture in which the person's face showed the emotion in the story. In the story describing sadness, the participant was told about the dead of his or her child, and that he or she feels very sad. Dependent on the two other basic emotions on the

pictures, participants could recognize sadness with a 69% to 87% accuracy. Distinguishing between sadness and surprise seems to be most challenging. The expressions of both emotions rely on a movement of the eyebrow area. During the expression of both emotions the inner brow gets raised (Beaudry et al., 2014). Likewise the eye and brow area is the most important facial feature for recognizing sadness (Beaudry et al., 2014; Boucher & Ekman, 1975; Ekman, 1979). Nevertheless, as already seen, this area does not contain a unique feature of sadness (Beaudry et al., 2014), which influences an accurate recognition negatively.

To circumvent this difficulty, so-called facial action coding systems were developed. The most known coding system is that of Ekman and his colleague Friesen, first published in 1978. This anatomically based system aims to measure any facial expression a human being can make. These expressions can be systematically categorized in emotional expressions of basic emotions. The identification of a facial expression depends on facial movements. The movements of facial muscles cause an alteration of the facial features from a baseline level, so to speak a neutral facial expression. These movements can be categorized in so-called action units. The combination of several action units constitutes a particular emotional expression (Paul Ekman Group, 2014). The raising of the inner eyebrow is the most important action unit associated with sadness. It is considered to be a very reliable sign of sadness because just a few people can make this movement knowingly or deliberately (e.g. Gosselin, Perron, & Beaupré, 2010; Ekman, 1979; Kanade, Cohn, & Tian, 2000; Rughiniş, Petria, & Milescu, 2013). This holds also true for the combination with a lip corner depressor, another facial movement related to the expression of sadness.

A disadvantage of these coding systems is the fact that they rely solely on facial movements. The action units and therefore the particular emotions are only coded if the person moves muscles in his or her face. But the emotion of sadness knows also other modes of expressions that are independent from muscle movements. Examples are a lost focus in the eye, which makes the eyes appear veiled and dull (Pierer's Universal Lexikon, 2014; Rueetschli, 2014). This effect is strengthened by the fact that sad people seem to bend their head slightly (Tan & Nareyek, 2009), which causes the upper part of the eyes, which is normally reflecting the light, to be concealed. Another example are tearful eyes, where someone is full of visible tears, but they have not flowed (Pierer's Universal Lexikon, 2014). Tearful eyes are strongly associated with probably the most noted expression of sadness, crying (e.g. Balsters, Krahmer, Swerts, & Vingerhoets, 2013; Huijsman, 2012; Jellesma & Vingerhoets, 2012; Murube, Murube, & Murube 1999). This expression of sadness is not considered in facial action coding systems, either. While crying tears are expelled any excess fluid that will not go into the puntum, the juncture between the eyeball and the lower eyelid, will fall over the eyelid and produce tears that are cried, a full-fledged flow of tears.

For that reason, systems which rely solely on facial movements are not able to recognize and decode more subtle emotional expressions that do not involve facial muscle movements. Because of this the present study aims at the development of a new coding scheme that not only involves facial movements but also other modes of expressions, to detect sadness more comprehensively.

Differences in expressing sadness

The present study will not only investigate different forms of the non-verbal facial expression of sadness, with the aim to develop a coding scheme, but, as a second aim, will also examine how these forms are distributed in and between different people. There seem to be several blind spots in the knowledge about the differences in and between people in expressing sadness. Due to this the current study will investigate whether, and if so how, emotional expressive behavior can be influenced by the membership of the demographical groups sex or age, or by the individuality of a person.

Earlier studies that investigated the difference in the expression of sadness between the sexes concentrated on the difference in crying (e.g. van Hemert, van de Vijfert, & Vingerhoets, 2011; Murube et al., 1999). Women seem to cry more than men (Murube et al., 1999) and the duration of a crying fit is four times shorter in men than in women (Sajnani, 1994, as cited in Murube et al., 1999). A possible explanation for the fact that women seem to cry more and longer can be the human's evolutionary history. Men have been brought up as strong defenders and cunning hunters which conflicts with the expressions of emotions like sadness, because they are often interpreted as weakness. A demonstration of weakness would not only be dangerous for the men themselves, because they could lose their role, but also for the women of the group, who could feel unprotected and at risk and therefore reject a man (Murube et al., 1999). The present study will supplement the further studies and investigate differences in frequency between the sexes not only for crying but also for the different forms of expressing sadness.

One direction of research that deals with the relation between the aging process and the expression of sadness emphasizes a rise in the expressions of sadness with age. This research direction argues that when people age they are faced with several irrevocable losses, which are thought to be the antecedent conditions for sadness (Seider, Shiota, Whalen, & Levenson, 2011). Examples are losses in vigor, physical health and fitness, cognitive functioning, independence, professional activities and social networks, as well as the loss of loved ones, e.g. the death of one's spouse or friends (Kunzmann & Grühn, 2005; Seider et al., 2011; Shulman, 2007). Thus, the antecedent conditions for sadness are likely encountered with increasing frequency as we age. The increased exposure to losses is likely to have lasting influence on the emotional reactivity, i.e. the

intensity of emotional responses, in a way that reactivity to sadness increases with age. This reactivity encompasses among other aspects expressive behavior (Seider et al., 2011), including the non-verbal facial expression of sadness. Therefore it is likely that the elderly will display sadness more often than middle-aged persons, especially when confronted to losses. It can be assumed that various forms of losses will occur in the war-related topics of the audiovisual videos.

Differences in expressing sadness may not only be influenced by belonging to a certain demographical group, but also by the individuality of persons. Differences in temperament, character, personality, and learning history cause these differences (Korrelboom & ten Broeke, 2012). These characteristics can e.g. have influence on the primary appraisal of Frijda's (1986) general emotion theory, the meaning which someone gives to a thought or situation. Where one person sees a situation as threatening, another might see it as inevitable or challenging (Konijn, 2000).

The present study

The objective of the present study is the development of a comprehensive coding scheme for the non-verbal facial expression of sadness. Therefore this study seeks to explore different ways with which sadness can be expressed. Having established the different ways of expression, it will be investigated how these expressions are distributed in and between the interviews. This means it will be investigated how often sadness is expressed and in which forms on an individual-level. Moreover it will be examined if differences in the emotional expression can be found between women and men, and different age-groups. Hereafter the research questions and associated expectations are summed up in a clearly outline:

Research questions:

1. In which forms does sadness as a non-verbal facial expression of emotion occur in visual life-story interviews about war-related events in Croatia's past?
2. How are these expressions distributed in and between the interviews?
3. Is there a difference in the codes and frequency of these expressions between women and men, and different age-groups?

    It is expected that women will show sadness more often and more intense codes than men, and that older interviewees will show sadness more often than younger ones.

Method

The method section of this paper consists of several parts. In the first place the CroMe project (2014) will be further elaborated, because the videos of this project form the basis for the development of a coding scheme for the non-verbal facial expression of sadness. The videos collected by this project were used for observation and coding. Therefore background information on the CroMe project (2014) will be reviewed in the *Dataset CroMe* section. After that the used videos of the present research will be discussed in the *Used Data* section. The stepwise development of the coding scheme in form of a Likert-type scale, which will answer the first question of this research, can be found under the heading *Development of the Coding Scheme*. The statistical analyses which are necessary to answer the second and third research question can be found in the *Statistical Analysis* section.

Dataset CroMe

To answer the research questions, audiovisual testimonies of the project CroMe (2014) were used. This project consists of a public available database of videos. In these videos witnesses of certain war-related events in Croatia tell their personal memories of pre-war, war, and post-war experiences and detention. The project brings into focus the Second World War (1941-1945), the period of socialist Yugoslav (1970-1980), and the war of the nineties (1990-1998). For the project more than 1,000 citizens of the whole territory of Croatia were contacted and asked to participate in this research undertaking. The process of selecting included contacting public bodies and potential interviewees directly. Interviewees from different places and areas affected by the wars and particularly those places which have suffered severe damage and destruction or those areas around which certain political controversies exist, were included. To participate in the CroMe project people need to have gained personal war-related experiences in the former mentioned wars. The project was interested in people from the region who are interested in contemporary, local history, especially witnesses and actors of war events. Moreover a special emphasis was on women and marginalized ethnic minorities and on victims, particularly former inmates and family members of killed and missing persons. Beside these groups of people, others participated as well, such as war veterans, refugees, civilian victims, or human rights fighters. To provide a certain level of representativeness the researchers took into account age, sex, ethnicity, and origin of the interviewees. Eventually more than 400 videos were recorded, from which almost half are publicly available on the website of the project. The participants of the project, whose videos are publicly available on the website, have given their informed consent and approved that the recordings of their personal memories are available for scientific research (CroMe, 2014).

The interviews were designed as semi-structured interviews. The conducting and recording of the interviews was subject to several guidelines. Participants were required to give their informed consent before the interviewing started and received a video recording of their personal memories. Interviewers were graduates from social science disciplines and early professionals. Each interview followed a certain order. Before the beginning the interviewer filled in a protocol which included several basic information of the interviewee. This information could be used as guideline for asking questions during the interview (CroMe, 2014). At the beginning of each interview the participants were asked to introduce themselves and to tell about the occupation of their adults. During the interview the questions became more personal and at the end of the interview the interviewees had the chance to talk about their own, individual experiences. Most of the interviews last between one and two hours, but depending on experiences and memories of interviewees can last even longer (CroMe, 2014).

Used Data

The present study made use of twelve videos of the CroMe project (2014). This number of videos was manageable within the available time of this study and provided sufficient video material for the development of a reliable coding scheme. The twelve videos were chosen to obtain an even distribution, i.e. videos of six women and six men were included. Moreover interviewees in the approximate age range from 20 to 80 years of age were selected. By reason of this selection the third research question can be answered. Averagely the used videos had a duration of 50 minutes, with a range from about 28 minutes to 76 minutes.

In the following an overview is given about the features of the interviewees of the present study. All of the twelve interviewees experienced the war of the 1990s and eight of them have experienced Operation Storm, the last major battle of this war. The Yugoslav period was witnessed by three interviewees. WWII was experienced by one interviewee but the families of five interviewees suffered losses in this war which also affected the interviewees through certain deprivations. Seven interviewees suffered material losses, especially destroyed houses and five interviewees suffered personal losses such as killed relatives. Seven of the twelve interviewees were refugees and were passively involved in war-related events. One interviewee took an active role as soldier and one belongs to a political party. After the ending of the war two interviewees initiated a lawsuit concerning war crimes and two other interviewees became member of war-related organizations or associations.

Development of the Coding Scheme

  Procedure. The development of a coding scheme for the non-verbal facial expression of sadness that serves the answering of the first research questions was carried out in three phases and by two analysts. Because the reliability of the coding scheme should be controlled more thoroughly with the phases, the number of the observed and coded videos increased by one with every phase. The precise set up and content of the phases are explained below.

  Phase one: The initializing phase. The initializing phase was implemented to make the analysts familiar with the non-verbal expression of sadness. The first step of this phase was a literature research concerning the non-verbal facial expression of sadness. In this literature research information from different sources, such as scientific articles, textbooks, and lexical entries about those expressions were collected and discussed by both analysts. Subsequently the most important indications were compiled to a 5-point Likert-type scale, consisting of several inclusion criteria. This scale was ranging from items with lesser intensity to items with greater intensity.

  In a second step of this phase both of the two analysts coded three videos of the CroMe collection independently of one another. The observation and coding of the videos took place with the annotation program ELAN 4.6.2. This program allows a comprehensive observation because of a segmentation-on-the-fly mode and the creation of annotations. With the aid of the 5-point Likert-type scale the analysts could indicate how intense the interviewees expressed their feelings of sadness. Besides the intensity of sadness the analysts also scored the beginning, end, and the thereby arising duration of the emotional expression.

  The codes of both analysts were compared to investigate the inter-rater reliability. To accomplish this analysis the videos were segmented into units of three seconds of duration. Each of these units was provided with the corresponding value of the Likert-type scale or, in the case of no non-verbal expression of sadness, with a zero. In the event of overlapping, which means that the single seconds of a three-second unit actually have different values, the higher value was chosen for that unit. If for example the three-second unit encompasses minute 10, 01 – 10,03 and an expression with code 2 was coded from 9,54 to 10,02 and a more intense expression with code 3 was coded from 10,03 to 10,10, the unit 10,01 – 10,03 gets code 3.

  In case of poor agreement between both raters a consideration ought to take place to calibrate the Likert-type scale. In this consideration discrepancies and uncertainties could be discussed and further literature could be referred to resolve them. In this way not only further inclusion but also exclusion criteria for every value could be determined and a revised Likert scale was developed.

Phase two. The performing phase. While the initializing phase was intended to make the analysts familiar with the facets of the non-verbal expression of sadness, the performing phase targeted the thorough utilization and refinement of the Likert-type scale. With the aid of the revised 5-point Likert-type scale, four videos were coded by each analyst independently. Once again the results of both analysts were compared. In case of further discrepancies and uncertainties these could be discussed in a second consideration and an additional literature research could help to clarify them. Newly formulated inclusion and exclusion criteria lead to a revised Likert-type scale.

Phase three: The controlling phase. The third and last phase aimed at controlling the applicability and usefulness of the revised Likert-type Scale. Both analysts observed and coded five videos of the CroMe collection apart of one another. Yet again the results of both raters were compared to investigate the degree of accordance. The exact value of this calculation of the inter-rater reliability can be found in the results section of this paper.

Additionally the three videos of the initializing phase and the four videos of the performing phase were coded again with the latest version of the Likert-type scale, so that all videos were coded with the actualized inclusion and exclusion criteria. In this way it was assured that the obtained data of the different phases is comparable. The new coding of these videos was distributed among both analysts, so that not every video was coded by both analysts once again.

Statistical analysis

For the statistical analysis of the present research version 21 of the Statistical Package for Social Sciences (SPSS) was used. To examine the inter-rater reliability separate calculations of Cohen's Kappa (κ) were conducted for all phases. In literature it can be found that a κ of .60 can be considered as the minimum value that should be aspired, because it indicates an acceptable extent of agreement. Kappa values of .80 of higher represent a *good* or *satisfactory* agreement (Heuvelmans & Sanders, 1993). The present study follows this valuation and considers a κ between .61 and .80 as sufficient, resp. *substantial*. At best, the value of Cohen's Kappa falls in between .81 and 1.0, which indicates an *almost perfect* agreement.

To answer the second research question that asked how the expressions are distributed in and between the videos several descriptive statistics of the facial non-verbal expression were calculated. Firstly, frequencies were calculated for the whole population (*N*=12) to get an overview, secondly this was done for each person apart. Furthermore means per minute were computed to take into account the different lengths of the videos for the different individuals.

To assess if there are differences in the codes and frequency of the expression of sadness between women and men, and different age-groups, and thus to answer the third research question, frequencies and means per minute were also calculated for the sexes and the different age-groups. The codes are a measure for intensity, because they are arranged in a 5-point Likert-type scale and the frequency indicates how often a certain expression of sadness is shown.

For the two sexes six independent samples t-tests were conducted for each code and the total frequency of expressions apart. The same was done for the two age-groups. With these tests it could be assessed if differences between the two sexes and age-groups are statistically significant. The t-tests refer to the means per minute per person. The calculations concerning the second and third research questions are based on the codes of the author.

Results

The results of this study are described in three sections. Each section describes the findings concerning the three research questions. In the first section the final coding scheme with its accompanying inclusion and exclusion criteria as results of the developmental process will be presented, as well as a decision tree that is a complete visual representation of the coding scheme. Furthermore the most important adjustments while the developmental process will be discussed. Additionally the inter-rater reliability of the newly developed coding scheme will be described. In the second section it will be depicted how the non-verbal facial expressions of sadness are distributed in and between the individual videos. In the last section differences in the codes and frequency of these expressions between women and men, and different age-groups will be described.

In which forms does sadness as a non-verbal facial expression of emotion occur in the interviews?
During the development of the coding scheme five different forms of non-verbal facial expressions of sadness were identified. These forms were complied into a 5-point Likert-type scale. The different codes of this scale have to be understood in an ascending order, ranging from lesser extent of intensity to a greater extent of intensity. The different codes of the Likert-type scale are: 1 = idle glance, 2 = inner eyebrow raiser, 3 = intense inner eyebrow raiser and lip corner depressor, 4 = tearful eyes and 5 = weeping. The photographs which are shown in Figure 2 display examples of typical appearances of the five different codes. Each of these codes is accompanied by several inclusion and exclusion criteria. These will be described below. The final coding scheme based on these criteria can be found in Table 1. Additionally a decision tree was developed, to support especially less experienced analysts. The answering of simple yes/no questions guides the analyst through the different branches of the tree and leads him or her to the right code. The decision diagram takes into account all relevant inclusion and exclusion criteria and therefore is a complete visual representation of the coding scheme. It can be found in Figure 1.

     Idle glance. The most important inclusion criterion of this category is a lost focus in the interviewee's eyes, accompanied by a dropping of the upper eyelid. For this code to start the interviewee has to look away, i.e. he or she does not look the interviewer in the eyes anymore. Furthermore an idle glance needs to be coded further even if the interviewee looks the interviewer in the eyes again but still has dropped eyelids and not regained the focus in the eyes. Code 1 needs also be coded further if the dropping of the upper eyelids is followed or intermitted by a prolonged closing of the eyes. An idle glance is also classified as being continued when the dropping of the upper eyelid is accompanied by a short raiser of the whole eyebrows, but the eyelid is still dropped.

Besides these inclusion criteria, there are also criteria that exclude an idle glance. These are frown wrinkles between the eyebrows, twitching pupils that move rapidly back and forth, as well as frequent blinks of the eyes.

Inner eyebrow raiser. The inner eyebrow raiser is characterized by the raising of the inner eyebrow causing short wrinkles to appear or deepen in the center of the forehead. An inner eyebrow raiser is not given if the whole eyebrow is raised. This movement causes wrinkles on the whole forehead and can thus be clearly differentiated from an inner eyebrow raiser.

Intense inner eyebrow raiser and lip corner depressor. An intense inner eyebrow raiser includes more intense movements of the eye/eyebrow area than an inner eyebrow raiser and also movements of the cheek area. While an intense inner eyebrow raiser the upper eyelids get relaxed, which causes them to lower. Furthermore the skin around the eyes is pulled in, causing this area to wrinkle, and the cheeks are slightly raised. This expression is additionally accompanied by a slight depression in the ankle of the mouth, inducing the corners of the mouth to sag. In some persons this depression is combined with a pushed up chin and / or lowered lower lip, which makes the chin wrinkle. This code is not given if a slight depression of the mouth is accompanied by a rising of the whole eyebrow, which causes the whole forehead to wrinkle.

Tearful eyes. The most important inclusion criteria for this code are bleary eyes. These can be combined with an inner eyebrow raiser and / or lip corner depressor or not, but they always lead to this code. An exclusion criterion for this code is when the interviewee is blotting dry the eyes with a tissue, which hinders the sight in the eyes. Furthermore tearful eyes are not coded when tears are rolling down the cheeks. This can be accompanied by the blotting dry of the eyes or not.

Weeping. Weeping is characterized by a flood of tears, causing tears to roll down the cheeks.

Table 1.

Final Coding Scheme for the Non-Verbal Facial Expression of Sadness Inclusive of Inclusion and Exclusion Criteria

Value	Description	Inclusion criteria	Exclusion criteria
1	Idle glance	Interviewee looks away for this code to start (later interviewee can look interviewer in the eyes again) Lost focus in the eyes Dropping of the upper eyelids Dropping of the upper eyelids is sometimes followed by a prolonged closing of the eyes Dropping of the upper eyelids is sometimes accompanied by a complete brow raiser (as conversational signal)	Frown wrinkles appear between the eyebrows Twitching pupils Frequent blinks of the eye
2	Inner eyebrow raiser	Raising inner corner of the eyebrow, which causes the appearing or deepening of wrinkles in the center of the forehead	Raising of the whole eyebrow, which causes wrinkles on the whole forehead
3	Intense inner eyebrow raiser and lip corner depressor	Relaxation of the upper eyelids Pulling in of the skin around the eye Slight raising of the cheeks Slight depression in the ankle of the mouth Sometimes pushing up the chin Sometimes lowering of the lower lip, which causes a wrinkling of the chin	Slight depression of the mouth but accompanied by raising of the whole eyebrow
4	Tearful eyes	Bleary eyes (with or without inner eyebrow raiser and / or lip corner depressor)	Tears rolling down the cheeks and/or Interviewee blots eyes dry with a tissue
5	Weeping	Flood of tears	

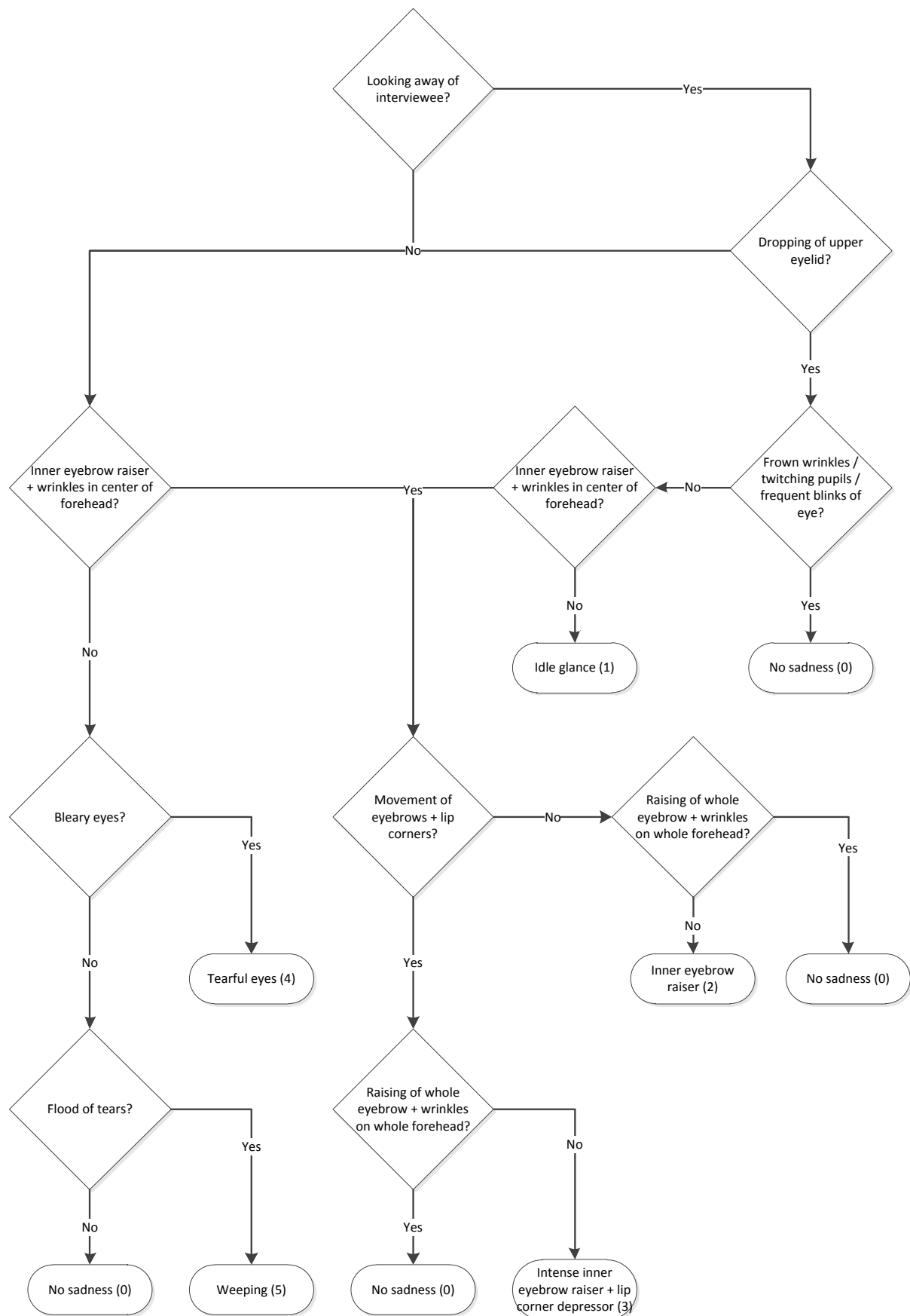*Figure 1.* Decision Tree for the Non-Verbal Facial Expression of Sadness

Code 1 – Idle glance

Code 2 – Inner eyebrow raiser

Figure 2.1. Photo Examples of the Individual Codes

Code 3 – Intense inner eyebrow raiser and lip corner depressor

Code 4 – Tearful eyes

Figure 2.2. Photo Examples of the Individual Codes

Code 5 – Weeping

Figure 2.3. Photo Examples of the Individual Codes

Results of the first phase. The value of Cohen's Kappa (κ) for this phase is .38. This means that the agreement between both raters is *fair* (see Heuvelmans & Sanders, 1993).

Code 1, an idle glance, starts when the interviewee looks away, thus does not look the interviewer in the eyes any more, to ensure that the interviewee certainly loses the focus in the eyes. Moreover an idle glance only ends when the eyelid is raised up and the interviewee fixes something again. Due to this a short look in the interviewer's eye with still dropped eyelids is no sign for the ending of this code. Beside these inclusion criteria certain exclusion criteria were established for code 1. One exclusion criterion is frown wrinkles. Although some people show this in combination with an idle glance, the expression of sadness fades into the background. According to Ekman (1979) frown wrinkles are associated with other emotions, especially anger. Another exclusion criterion is twitching pupils. In this case the participant searches for a focus and does not lose it, so that one cornerstone of code 1 is missing.

Concerning code 3 it was observed that some people depress their lip corners slightly but raise their whole eyebrow. Ekman (1979) emphasizes that this expression is either associated with positive rather than negative emotions, e.g. surprise or interest. Additionally a study of Beaudry et al. (2014) points out that the eye/eyebrow area is more important for the expression of sadness than the mouth area. Due to this the whole eyebrow raiser in combination with a lip corner depressor is determined as exclusion criteria, even though one inclusion criterion fulfilled.

Code 4, tearful eyes, is indicated when the interviewee has bleary eyes whether the participant shows the facial expression of code 3 or not, because the tears predominate in both expressions. Furthermore code 4 is not indicated when the interviewee blots hers or his eyes dry with a tissue. According to the analysts this action is no signal for sadness but for the occupation with the own appearance or of feeling uncomfortable due to the wetness. Furthermore this action hinders the analysts' sight on the tears.

Results of the second phase. The value of Cohen's Kappa for this phase is .83. which indicates an *almost perfect* agreement between both raters. Nevertheless, to be a reliable coding scheme good Kappa values need to be reached in the longer term. Moreover specific uncertainties existed concerning certain codes.

While expressing an idle glance some interviewees show a prolonged closing of the eyes. This means that a person closes hers or his eyes for several seconds, so that there can be no talk of the blink of an eye. A literature search showed that closed eyes happen in non-attentive states e.g. emotional tearing, in which lacrimal secretion is triggered by emotions (Murube et al., 1999). One prominent emotion which can trigger emotional tearing is sadness. Because of this sadness and

closed eyes seem to have a close link, so that the closing of the eyes while or after an idle glance is included in code 1.

Some interviewees show the inclusion criteria of code 1 but also a prolonged movement of their eyelids, frequent blinks of the eye. In literature it can be found that adults blink about 15 times per minute on average or every 2.8 to 4 seconds (Moses, 1987). This means that blinks of the eye with a ratio of every second or even more often exceed the normal level of eyelid movement. Frequent blinks of the eyes are therefore classified as exclusion criterion for code 1, because the frequent movement of the eyelids impedes the full relaxation of the upper eyelid which is a principal criterion for code 1.

Some interviewees show a raise of their complete eyebrow for a short moment, while the eyelids are still dropped, accompanied by a lost focus in the eye, which indicates code 1. Ekman (1979) points out that this facial expression appears in surprise, but functions as conversational signal, too. In this function the raising of the whole eyebrow can take several roles. It can e.g. stress a particular word or sentence or emphasize a question. These functions do not exclude the feeling and expression of sadness. Because of this an idle glance can be coded further, even though a person raises the whole eyebrow briefly at the same time.

Inter-rater-reliability. To test if the revision of the coding scheme has increased the agreement between both analysts the Cohen's Kappa was calculated for the controlling phase. The codes of both analysts and the value of Cohen's Kappa concerning the third and last phase can be found in Table 2. In this phase the Cohen's Kappa is .87, which corresponds to an agreement of 98.4% between both raters. This value indicates an *almost perfect* association. For this phase the value is still higher than for the performing phase which implies that the agreement between both raters could be enhanced with the inclusion and exclusion criteria that were added in the second consensus. Because the agreement between the raters was more than satisfactory for the last two phases, it was decided to make no more accommodations, because the aim of developing a reliable coding scheme was reached.

Table 2.

Codes of Both Raters and the Inter-Rater Reliability of the Controlling Phase (N=5)

	Analyst 2					
Analyst 1	Codes	0	1	2	3	Total
	0	4428	13	8	4	4453
	1	29	148	0	0	177
	2	11	1	128	2	142
	3	0	0	3	16	19
	4	7	0	0	0	7
	Total	4475	162	139	22	4798
						κ=.87

Note. Code 0 = No expression of sadness; Code 1 = Idle glance; Code 2 = Inner eyebrow raiser; Code 3 =Intense inner eyebrow raiser and lip corner depressor; Code 4 = Tearful eyes; Code 5 = Weeping.

How are the non-verbal facial expressions of sadness distributed in and between the videos?

The following section describes the variety in and between the single interviewees concerning the expression of different codes and the frequency of expressing sadness. At first the most important results per individual will be described which consider the single interviewees and differences between them. In a second step the frequencies of the codes will be discussed in general to get a broader overview. Table 3 gives a comprehensive overview of the quantities per individual.

The interviewee V.C. shows the largest number of expressions of sadness. Altogether V.C. displays 77 expressions. Furthermore this interviewee clearly exhibits the highest number of expressions per minutes with a ratio of 1.925. This means that V.C. displays nearly two expression of sadness per minute. The interviewees M.B. and J.B. show a high number of expressions of sadness, too, respectively they display 40 (*M p/m*: .5405) and 38 (*M p/m*: .5588) expressions of sadness. This corresponds to an expression of sadness nearly every two minutes for both interviewees. It is striking that the interviewee J.B. shows only idle glances (code 1).

While these interviewees often express sadness during the interview, others show sadness less frequent. Especially M.R. displays only four times sadness and if this person shows this emotion she uses solely idle glances. The interviewee shows expression .1429 times per minute, which means that she approximately shows an idle glance every ten minutes. The interviewee M.L. displays all in all eight expressions of sadness, nearly every five minutes (*M p/m*: 1739). This interviewee expresses more intense forms, she has three times tears in the eyes (code 4) and weeps two times (code 5). These codes are not common in the whole sample. Only two other interviewees have tears in their eyes during the interview and no one else cries.

In general 303 expressions of sadness were shown, with an average per minute of .5075. The frequency of the codes decreases with an increasing extent of intensity in the expression of sadness. This means that idle glances (code 1) were shown most often while weeping (code 5) scarcely occurs. Idle glances (code 1) were shown 148 times (*M p/m*: .2479), followed by inner eyebrow raisers (code 2), which were expressed 122 (*M p/m*: .2044) times. Furthermore idle glances were used by all of the interviewees, with one exception (S. B.). Inner eyebrow raisers, too, were shown by many interviewees; two thirds of them used this kind of expression. Intense inner eyebrow raisers in combination with lip corner depressors were shown less often. One third of the interviewees express sadness by this means and the code was given 25 times (*M p/m*: .0419). Tearful eyes (code 4) were shown by three of the twelve interviewees and all in all six times (*M p/m*: .0101). The less used code was code 5 (weeping) which was shown two times (*M p/m*: .0034) by one of the interviewees.

Table 3.

Number of the Expression of Sadness and Means per Minute of the Individual Codes for Each Person Apart (N=12)

Initials	Expression of Sadness Number Mean p/m	Code 1 Number Mean p/m	Code 2 Number Mean p/m	Code 3 Number Mean p/m	Code 4 Number Mean p/m	Code 5 Number Mean p/m
M.L.	8 0.1739	2 0.0435	0 0.0000	1 0.0217	3 0.0652	2 0.0435
S.R.	18 0.3396	8 0.1509	10 0.1887	0 0.0000	0 0.0000	0 0.0000
V.C.	77 1.9250	10 0.2500	54 1.3250	13 0.3250	0 0.0000	0 0.0000
R.Z.	13 0.4063	2 0.0625	11 0.3438	0 0.0000	0 0.0000	0 0.0000
J.B	38 0.5588	38 0.5588	0 0.0000	0 0.0000	0 0.0000	0 0.0000
M.B.	40 0.5405	36 0.4865	1 0.0135	2 0.0270	1 0.0135	0 0.0000
M.R.	4 0.1429	4 0.1429	0 0.0000	0 0.0000	0 0.0000	0 0.0000
M.Da.	19 0.3878	17 0.3469	0 0.0000	0 0.0000	2 0.0408	0 0.0000
M.S.	23 0.3026	20 0.2632	3 0.0395	0 0.0000	0 0.0000	0 0.0000
M.Du.	11 0.2444	1 0.0222	10 0.2222	0 0.0000	0 0.0000	0 0.0000
P.G.	21 0.5250	10 0.2500	11 0.2750	0 0.0000	0 0.0000	0 0.0000
S.B.	31 0.6739	0 0.000	22 0.4783	9 0.1957	0 0.0000	0 0.0000
Total	303 0.5075	148 0.2479	122 0.2044	25 0.0419	6 0.0101	2 0.0034

Is there a difference in the codes and frequency of the non-verbal facial expressions of sadness between women and men, and different age-groups?

To assess differences in the codes and frequency more comprehensively, not only individual differences were investigated, but also differences between women and men, and different age-groups.

Women and men. As can be seen in Table 4 men showed 180 expressions of sadness in total. When the different lengths of the videos are taken into account, men showed on the average .6635 expressions per minute (*SD*: .6281). Women expressed sadness averagely .3733 times per minute (*SD*: .2111) and totally 123 times. This means that the men of this sample showed more expressions of sadness than the women, but this difference was not statistically significant (p>.05).

Moreover men and women showed differences in the use of the five different forms of expressions. Men expressed sadness predominantly through inner eyebrow raisers (code 2), which were expressed 97 times or .3989 times per minute (*SD*: .4789), while women mostly displayed idle glances (code 1), which were expressed 81 times or averagely .2258 times per minute (*SD*: .2088). The second most used form of expressing sadness for men are idle glances (*M p/m*: .2037; *SD*: .1672) and inner eyebrow raisers (*M p/m*: .0863; *SD*: .1927) for women. Intense inner eyebrow raisers and lip corner depressors (code 3) were shown less often by women (*M p/m*: .0362; *SD*: .0786) than by men (*M p/m*: .0587; *SD*: .1309), without this differences being significant.

Significant differences in the expression of sadness between men and women were found for the last two codes. There was a significant difference for tearful eyes (code 4), t(10)=-1.304, p=.003 between men (*M p/m*: .0023; *SD*: .0055) and women (*M p/m*: .0177; *SD*: .0284). A significant difference between men (*M p/m*: .0000; *SD*: .0000) and women (*M p/m*: .0072; *SD*: .0177) was also found for weeping (code 5), t(10)=1.000, p=.031. These results suggest that the non-verbal facial expression of sadness through tearful eyes and weeping differs with the sex of the interviewee. Specifically, the results suggest that women express their sadness more often through tearful eyes and weeping than men.

Table 4.

Means per Minute and Standard Deviations of the Individual Codes for Men and Women (N = 12)

	Men (n = 6)			Women (n = 6)			
Code	n	M p/m	SD	n	M p/m	SD	p
1	67	.2037	.1672	81	.2258	.2088	.53
2	97	.3989	.4789	25	.0863	.1927	.23
3	15	.0587	.1309	10	.0362	.0786	.41
4	1	.0023	.0055	5	.0177	.0284	.00*
5	0	0	0	2	.0072	.0177	.03*
Total	180	.6635	.6281	123	.3733	.2111	.19

Note. Code 1 = Idle glance; Code 2 = Inner eyebrow raiser; Code 3 =Intense inner eyebrow raiser and lip corner depressor; Code 4 = Tearful eyes; Code 5 = Weeping.

*p < .05.

Age-groups. Besides the individual and sex differences in the expression of sadness, differences in two different age-groups were also assessed. As shown in Table 5 the frequency of expressing sadness differs with age. The six interviewees in their young or middle adulthood (35-65 years of age) have shown 104 expressions of sadness, which occur averagely a little less than every two minutes (*M p/m*: .3547; *SD*: .1697). The six interviewees which have reached late adulthood or old age (from 65 years of age) have shown 199 expressions. These occur averagely .6821 times per minute (*SD*: .6296). This means that the interviewees in the older age-group expressed sadness more often than the interviewees in the younger age-group, without this difference being significant.

Furthermore the two different age-groups showed differences in the use of the five different forms of expressions. Interviewees in the older age-group showed inner eyebrow raisers (code 2) and idle glances (code 1) nearly equally often, namely 89 (*M p/m*: 3483; *SD*: 5242) resp. 86 (*M p/m*: 2402; *SD*: 2092) times. The younger age-group most often expressed idle glances with 62 times (*M p/m*: .1894; *SD*: .1631), followed by 33 inner eyebrow raisers (*M p/m*: .1368; *SD*: .1531). Tearful eyes (code 4) were shown twice as often by the younger age-group than by the older age-group, without this difference being significant.

Significant differences in the expression of sadness between the age-groups were found for two codes. The difference between the younger age-group (*M p/m*: .0081; *SD*: .0127) and the older age-group (*M p/m*: .0868; *SD*: .1405) for intense inner eyebrow raisers in combination with lip corner depressors (code 3), t(10)=-1.365, p=.002 was significant, as well as the difference between the younger age-group (*M p/m*: .0072; *SD*: .0177) and the older age-group (*M p/m*: .0000; *SD*: .0000) for weeping (code 5), t(10)=-1.000, p=.031. These results suggest that the age of the interviewee seems to be related to the expression of sadness through intense inner eyebrow raisers combined with lip

corner depressors and weeping. Specifically, the results suggest, that the older age-group expresses its sadness significantly more often through intense inner eyebrow raisers in combination with lip corner depressors than the younger age-group, while the younger age-group significantly shows more weeping than older one.

Table 5.

Means per Minute and Standard Deviations of the Individual Codes for Different Age-Groups (N = 12)

Code	Young / Middle Adulthood (35-65 years of age) (*n* = 6)			Late Adulthood / Old Age (from 65 years of age) (*n* = 6)			
	n	M p/m	SD	n	M p/m	SD	p
1	62	.1894	.1631	86	.2402	.2092	.62
2	33	.1368	.1531	89	.3483	.5242	.10
3	3	.0081	.0127	22	.0868	.1405	.00*
4	4	.0131	.0261	2	.0068	.0167	.49
5	2	.0072	.0177	0	0	0	.03*
Total	104	.3547	.1697	199	.6821	.6296	.16

Note. Code 1 = Idle glance; Code 2 = Inner eyebrow raiser; Code 3 =Intense inner eyebrow raiser and lip corner depressor; Code 4 = Tearful eyes; Code 5 = Weeping.

*p < .05.

Discussion

Relevance

The present study aimed at the development of a comprehensive coding scheme for non-verbal facial expressions of sadness. With the aid of the newly developed coding scheme different non-verbal facial expressions of sadness can be detected and distinguished. This coding scheme supplements former coding schemes, such as facial action coding systems, which code facial expressions of emotion solely based on facial movements, by addressing also forms of expression that can be expressed without using the expressive musculature. These expressions bear a strong reference to the eye area. Alterations in the appearance of the eyes, especially veiled or dull eyes and the occurrence of tears provide indications for the expression of sadness.

Main results

Five different forms of expressing sadness. Concerning the first research question a comprehensive model including five different forms of expressing sadness could be developed. Witnesses of war-related events in Croatia express their sadness through idle glances, inner eyebrow raisers, intense inner eyebrow raisers and lip corner depressors, tearful eyes, as well as weeping. These expressions range from a lesser extent of intensity to a greater extent of intensity. The five different forms of non-verbal facial expressions of sadness were compiled into a coding scheme and also into a decision tree, which enable the detection and distinguishing between the different forms on the basis of defined distinguishing marks. While the coding scheme provides a clearly arranged but at the same time comprehensive overview of the different forms of expression, the decision tree is particularly helpful for novice coders, who can benefit from its clear and easy to follow yes/no-structure. Both the coding scheme and the decision tree can be useful in future research, especially in the field of emotional psychology, as they help to detect and distinguish between non-verbal facial expressions of sadness.

The present study compiled the findings of various literature sources on the non-verbal facial expression of sadness (Balsters et al., 2012; Huijsman, 2012; Jellesma & Vingerhoets, 2012; Murube et al., 1999; Paul Ekman Group, 2014; Pierer's Universal Lexikon, 2014; Rueetschli, 2014; Tan & Nareyek, 2009) together into a more comprehensive model. In doing so it contributes to earlier studies and coding schemes, which mainly rely on facial muscle movements (Paul Ekman Group, 2014). Most notably it addresses also more subtle expressions of sadness, such as idle glances or tearful eyes, which arise in the eye area. Furthermore the new coding scheme considers a graduation in emotional tearing, because it differentiates between tearful eyes and weeping. This clearly distinguishes the present study from earlier research, which does not take this graduation into account. Additionally the different forms of expressing sadness were arranged from a lesser to a

greater extent of intensity in expression. In future research this new model can help to detect and differentiate between the different forms more profound.

Differences in non-verbal facial expressions of sadness. With reference to the second research question it was found that expressions of sadness are shown approximately every two minutes by the interviewees, ranging from nearly every half minute to every tenth minute. Furthermore the frequency of a certain form of expression decreases while the extent of intensity in the expression of sadness increases. This means that idle glances as the form of expressing sadness with the less intensity are shown most often while weeping as the form of expressing sadness with the greatest intensity is shown less often: With one exception all interviewees use idle glances to express their sadness, two thirds show inner eyebrow raisers, one third makes use of intense inner eyebrow raisers and lip corner depressors, one fourth has tearful eyes, and just one person is weeping.

Consistent with these results Diefendorff and Greguras (2009) found that a great number of people are of the opinion that the expression of sadness in social situations is appropriate, but should be expressed with less intensity than was felt. This partial expression of sadness may have social benefits, e.g. it may lead to more sympathy and help from others (Clark, 1996) or that one is better liked (Tiedens, 2001). Nevertheless the undiluted expression of sadness is connoted with rather negative associations. People which express their sadness forthrightly are perceived as more submissive and to have lower power and status (Hareli, Shomrat, & Hess, 2009).

A possible explanation for the individual differences in expressing sadness can be the membership of a certain demographical group. Therefore the third research question asked if there are differences in codes and frequency in the non-verbal facial expression of sadness between women and men, and different age-groups.

Sex. Women show more intense forms of the expression of sadness than men. Although both sexes mainly made use of less intense forms, especially idle glances and inner eyebrow raisers, women of this sample additionally displayed more intense forms than men, particularly tearful eyes and weeping. However, it is worth to mention that only one female and no male interviewee is weeping during the interviews. Consistent with these results, Murube et al. (1999) found that the expression of sadness by men through crying is often interpreted as a sign of weakness, which conflicts with current stereotype roles that regard men as the stronger sex, which is less prone to particularly weak emotions like sadness and their expression. Nevertheless the frequency figures (see Table 4) suggest that the expression of sadness by men through less intense forms than crying seems to be more accepted, because those forms were shown quite often and almost exclusively.

Additionally the use of more subtle forms by men suggests that the expression of sadness is more difficult to detect in men than in women. This may play an important role for psychologists and related professions that deal intensively with the affective state of a person. The newly developed model can help those professionals to detect sadness more comprehensively.

Moreover, against the expectations just one single woman cries during her interview and just two have tearful eyes. This finding may reflect a recent trend for women to show sadness less frequent through more intense forms. Further research on sex specific expressions of sadness that considers especially less intense forms is warranted. Investigations on differences in expressing sadness through more subtle forms and including a larger sample would be fruitful in understanding the influence of sex on the expression of sadness. Moreover these results call for longitudinal research that examines the importance of sex differences and stereotypes in expressing sadness more pronounced.

Furthermore no difference between women and men concerning the total frequency of expressing sadness was found. A possible explanation for this unexpected finding can be the topic of war-related events in Croatia's past. For most people war is a very exceptional and affecting situation. While expressing sadness in everyday life can be interpreted as demonstration of weakness or unmanliness (Murube et al., 1999), expressing sadness in exceptional situations can be seen as acceptable for men.

Age. Interviewees in their late adulthood show around seven times as much intense inner eyebrow raisers in combination with lip corner depressors than interviewees in their young adulthood. However, one interviewee in its young adulthood displays its sadness through weeping, while no interviewee in its late adulthood uses this expression. Concerning the other codes and the total frequency of expression no differences between the older and the younger age-group were found. These results are barely consistent with the branch of research that emphasizes that the expression of sadness increases with age, due to the exposure with age-related, irrevocable losses (Kunzmann & Gühn, 2005; Seider et al. 2011, Shulman, 2007). According to this research direction the elderly display sadness more frequent than middle-aged persons, especially when confronted with events involving loss (Kunzmann & Gühn, 2005; Seider et al. 2011). These events can encompass a range of stimuli, e.g. reminiscence (Seider et al., 2011). The interviewees in the present study were confronted with the reminiscence of various war-related material and sentimental losses, but despite this confrontation persons in their late adulthood only displayed more expressions of one code.

A possible explanation for these partly unexpected outcomes and the fact that one person in its young adulthood expresses its sadness through weeping while no interviewee in its late adulthood uses this expression can be cohort effects. These describe the effects of being born and raised up in a

particular time or situation and being influenced by certain cultural or historical conditions. It may be the case that Croatian people born before the fifties were raised up differently concerning the expression of sadness, e.g. to show alleged weak emotions like sadness less or less intense, which could be reflected in the results of this study. The findings of the present study call for longitudinal research that on the one hand examines the influence of cohort effects on the facial expression of sadness and on the other hand the supposed changes in emotional expressions from young to late adulthood.

A notable fact of the recognition of non-verbal facial expressions of sadness in different age groups is the aspect that the aging process causes wrinkles, creases, and fine lines to manifest in the face. The cheeks and eyebrows of aging people droop in. Among others this symbolizes sadness (Murube et al., 1999). An example are sagging corners of the mouth. Because of these findings it is more difficult to identify sadness in the elderly. It is possible that these facial characteristics have influenced the results of the present research in a way that certain forms of expressing sadness were more often detected in the elderly. Further research should regard this complication. It might be necessary to refine the newly developed model for the application in older populations, so that it will consider the special facial characteristics of the elderly. This could e.g. be done through the formulation of more comprehensive distinguishing marks.

Individual differences. While sex and age of an interviewee can explain a certain amount of variance between the individual interviewees, other characteristics play an important role, too. Examples are personal differences in temperament, character, and learning history (Korrelboom & ten Broeke, 2012). Especially the personality of a person plays an important role in tendencies to show specific emotional reaction in particular situations. Certain personality features, which cannot be referred as emotional by themselves can function as moderators between specific environmental incidents and emotional reactions (Krohne & Tausch, 2013). This means that certain personality features have influence on the emotional reaction, and hence on the expression of sadness. The death of a loved one moves several people to tears, while others react apathetically.

Furthermore individuals differ in their expressiveness of emotion. Besides differences that are related to bodily variations, such as facial plasticity and morphology, individuals differ also in their frequency of intense expression, and overall rate of expression (Kanade et al., 2010). These characteristics are well established and make up an important aspect of the individual identity (Manstead, 1991, in Kanade et al., 2000). The findings of the present research, which indicate a considerable variance in expressing sadness in and between the interviewed persons, reflect the findings of Krohne and Tausch (2013) and Kanade et al. (2000), which deal with variations in the individual expression of emotions. Further research on individual differences in expressing emotion

and especially sadness that includes a larger sample than the present research can assess individual differences more pronounced.

Strengths and Limitations of the Present Study

The present study sets itself apart from other studies on non-verbal facial expressions of sadness because it compiled the findings of several studies on this topic and merges them together in a new and more comprehensive model. Furthermore it supplements former coding schemes which code facial expressions of emotion based on facial movement, by addressing also modes of expression that are not solely based on facial movements, such as idle glances and tearful eyes. These expressions of sadness are more difficult to recognize than expressions that involve facial muscle movement, such as inner eyebrow raisers as well as the probably most noted expression of sadness, crying. Therefore more subtle forms of expressing sadness seem to receive less attention in former research. Nonetheless these more subtle forms seem to play an important part in the expression of sadness, because those forms were shown most often in the current study (see Table 3). The newly developed model can help to detect and to distinguish between different forms of expressing sadness and can be used in different fields of research, such as future research in emotional psychology or the practical field of work, e.g. by psychologists or therapists.

A strength of the new model developed in the current study is the almost perfect degree to which the two observers give consistent estimates of the expressions of sadness. This is a strong indication for a reliable model. Nevertheless it should be noted that the concordance could be influenced by the experience the researchers have gained during the development of the model. Due to the intensive dealing with the different forms of expression to formulate convenient distinguishing marks, the observers knew exactly what needs to be looked for. This could have influenced the concordance in its favor. For future research it is therefore recommended that novice coders make use of the decision tree and take the example photographs as aid to become familiar with the coding procedure. Whereas the coding scheme can support more experienced coders. Furthermore it is suggested that the coding is executed by two observers as well, at least at the beginning, to ensure that the distinguishing marks of the codes are correctly understood.

Another strength of the present study is related to the way in which the observation took place. The analysts, who do not have command over the Croatian language, did not make use of the English subtitling while observing the videos. Due to this the coding was not influenced by verbal cues, such as topic.

A further point of strength is the fact that the expressions of sadness were observed at authentic witnesses of war-related events in Croatia's past. For this reason the sadness of the interviewees was a true emotion, i.e. that it was actually felt and expressed by them. The use of a

sample showing true emotions sets this study apart from earlier studies investigating non-verbal facial expressions, which predominantly made use of actor's that imitate emotion (Kanade et al., 2000). But there seems to be a subtle difference in the actual experience and the imitation of an emotion. Directed facial action differs in visual appearance, because other facial muscles are used, producing a less symmetric expression. Furthermore differences in timing were observed (Kanade et al., 2000; Zeng, Pantic, Roisman, & Huang, 2009).

Nevertheless the use of this sample entails certain drawbacks, either. The used audiovisual testimonies of the CroMe project (2014) were not collected with the intention to study emotional expression. Due to this the video footage does not suit the objective of this study in all cases. Camera shots, low lighting, and seat position made the recognition of expressions, especially of expressions not involving any facial movement somewhat difficult. In future research use of video footage that consist of spontaneous facial behavior and is recorded with the aim to study emotional expressions can overcome this shortcoming.

Another limitation of this study is the relatively small sample size of twelve interviewees. Results on the basis of small sample sizes need to be interpreted with care. Small samples are more likely to not include all important facets of the target population which prevents the sample from being representative. Further research on this newly developed model that includes a larger and various sample is warranted.

A further point of limitation is associated with cultural differences. The used sample is of Croatian origin while the author of this study, as well as the second analyst, are German. Although sadness seems to be a universal emotion, the expression of sadness through non-verbal means may be influenced by culture. The Croatian cultural norms for the expression of sadness can differ from those in Germany. However the development of the model was based on the norms the analysts are familiar with.

A different limitation of the present study is the division of the videos into three-second units, which enables the calculation of the inter-rater reliability. Nonetheless these automatic time intervals remind of a more computer-like approach, because they only capture the presence or absence of a certain form and its duration. In a more human approach the observers of emotion automatically take the context in which an emotional expression occurs into account (van Rootselaar, 2010). In a clever experiment the Russian director Kuleshov illustrates that the context in which an expression is shown determines the impression it leaves on the observer. He showed an audience three different silent movies, all ending with the same shot of the face of an actor. Though the face in the three films was exactly the same it was interpreted in different ways, deep sorrow, heavy pensiveness, and a light happy smile where all seen (Russell & Fernández-Dols, 1997, in van Rootselaar, 2010). The developmental process of the new model seems to fall in between a

computer-like and human approach. On the one hand the different expressions were converted into a rigid format as it is found in automated systems. On the other hand the observations took place by human coders that have the property to take the context into account (van Rootselaar, 2010). The current study took the context into account by observing the whole interview so that the course of it was known. According to the author of this thesis future research will develop especially in the computer-based research field. In the next few years technology will steadily improve so that it can support the recognition and analysis of facial expressions in a considerable amount. Nevertheless, at least concerning the author, it is unlikely that this increasingly automated technology will take over the whole interpretation procedure because it lacks properties of humans, e.g. as was illustrated to take the context into account. Due to this the final interpretation and controlling will probably still be in the responsibility of the human researcher.

Future Directions

The present study provides a sort of pioneering work. With the aid of this research a new model of non-verbal facial expressions of sadness could be developed. This model combines different non-verbal facial expressions of emotion. Therefore this study concentrated on one non-verbal modality, to capture it more comprehensively.

One avenue for future research is to systematically vary the events that elicit sadness, because there are diverse kinds of events that cause the experience and expression of sadness and the expressions may vary considerably depending on the particular eliciting incident. The current study made only use of one possible event, war-related experiences, in which material and sentimental losses are core elements. Studying the occurrence and frequency of the expression of sadness elicited by different events, e.g. segregation, farewell, and disappointment will allow researchers to study whether and how the expressions of sadness might vary by those sadness-eliciting incidents.

The present study places emphasis on one modality of expressing sadness, facial expressions. However, such restricted expression of sadness scarcely occurs in nature (App, McIntosh, Reed, & Hertenstein, 2011). A second avenue for future research should examine how different expressive non-verbal modalities such as prosodic characteristics, gestures, or body postures work in tandem. Scherer & Ellgring (2007), for example, have shown that sadness has a strong link with a slow speech tempo. This multimodal expression helps people to discriminate expressed sadness from other negative connoted emotions, especially disgust, despair, and fear. Such investigations would be fruitful in supporting the detection and differentiating of sadness expressions in a more comprising and natural way.

Human communication mainly takes place at a non-verbal and verbal level. The interaction of both channels can give a more complete account of a narrator's story. Truong, Westerhof, Lamers, and de Jong (2013) combined both channels in their study by comparing the results of an automated verbal and non-verbal analysis in the CroMe collection (2014). Therefore they compared the percentage of positive and negative emotion words with the prosodic features pitch, vocal effort, and pause duration. In their study verbal and non-verbal characteristics were unrelated. Future research is needed that investigates the relation between non-verbal and verbal expressions of sadness systematically and includes the different channels of non-verbal expressions. The newly developed model can serve as a basis to study the relation between the different facial expressions of sadness and verbal expressions, such as negative emotion words, topic of speech, or grammatical structures.

A last avenue for future research is to examine non-verbal facial expressions of sadness culturally comparative. For though the experience of sadness seems to be universal, it is likely that the expression is a socially constructed phenomenon and therefore i.a. culturally determined. Fernández, Carrera, Sánchez, Páez, and Candia (2000), for example, have made a good starting point in assessing the role of culture in expressing sadness and other emotions. It would we valuable to know how the cultural background influences the non-verbal facial expression of sadness.

Conclusion

The present study has shown the complexity of non-verbal expressions of sadness by considering various forms that manifest in different components of the face, especially the eye, brow, and mouth area as well as facial movements. While some forms can be detected relatively easily, especially crying, other forms are more difficult to recognize. They have been neglected or at least have not been investigated in depth up until now. Nonetheless the more subtle forms play an important role in the expression of sadness, too. The model of the present study is the first model that incorporates several forms of expressing sadness in a non-verbal facial way and does justice to the complexity of this modality.

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