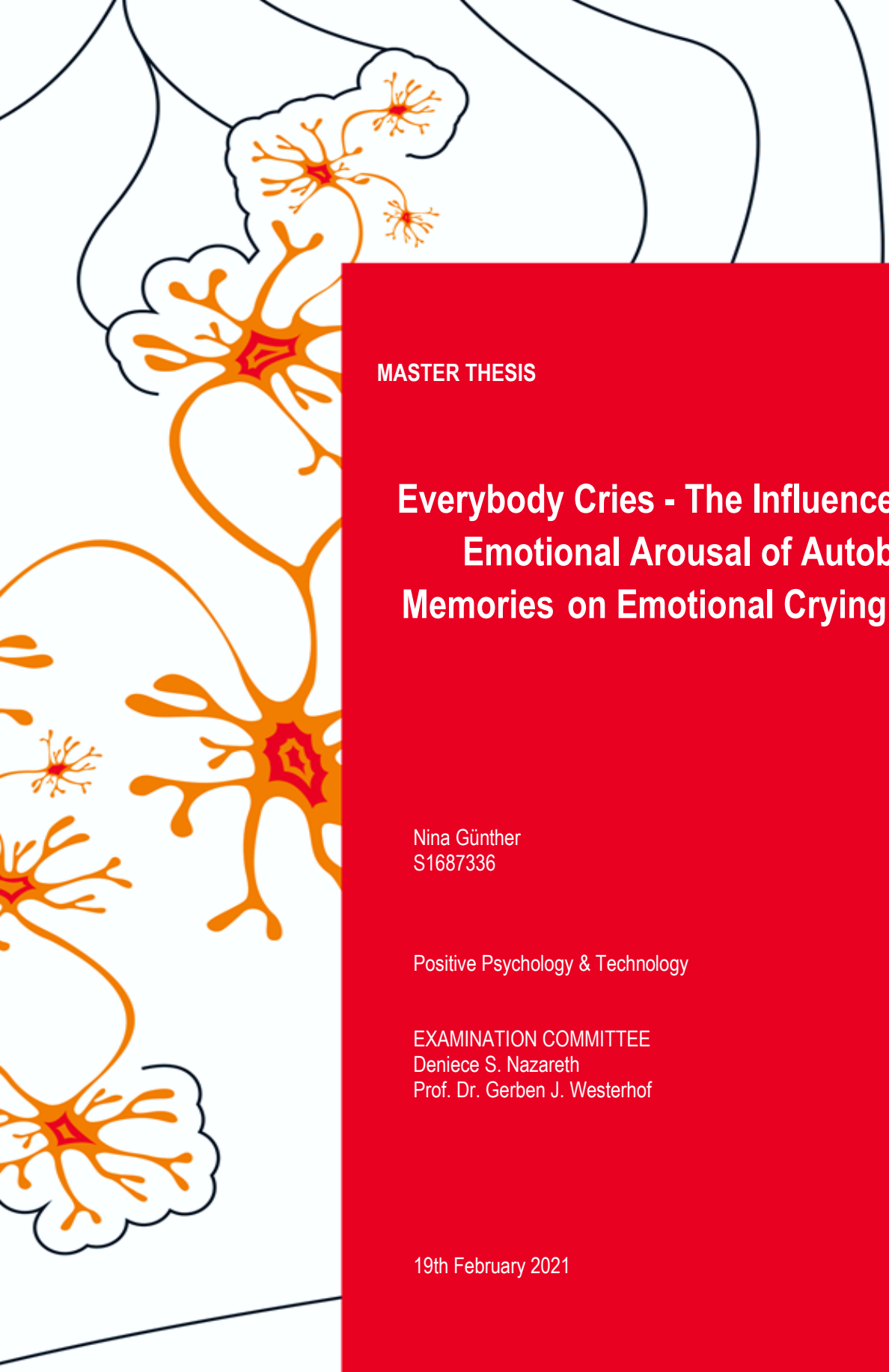


MASTER THESIS

# Everybody Cries - The Influence of Valence and Emotional Arousal of Autobiographical Memories on Emotional Crying in Older Adults

Nina Günther
S1687336

Positive Psychology & Technology

EXAMINATION COMMITTEE
Deniece S. Nazareth
Prof. Dr. Gerben J. Westerhof

19th February 2021

UNIVERSITY OF TWENTE.

**Abstract (EN)**

The aim of the study at hand was to establish which qualities of sad autobiographical memories are related to emotional crying in older adults, since emotional crying in older adults remains scientifically unclear until now. Video recordings of participants ($n$=23, $M_{age}$=74) recalling sad autobiographical memories found within the MEMOA database (Nazareth, Jansen, Truong, Westerhof, & Heylen, 2019) were qualitatively analyzed regarding emotional valence (1), emotional arousal when the event happened (2), emotional arousal during the recall (3) and underlying factors (4). The valence was assessed by use of the Valence of Emotional Memories scale (VEM), emotional arousal via a Self-Assessment manikin (SAM) and underlying factors were coded using a bottom-up approach. The eight crying inducing memories were compared to the memories that did not induce crying ($n$=53) with regard to the mentioned qualities and were then analyzed individually. The results showed that autobiographical memories that induced crying can be characterized by a low valence and a combination of the underlying factors 'Feeling of Powerlessness', 'Non-Acceptance', 'Situation was not Resolved' and 'Sadness/Disappointment'. Furthermore, 'Compassion' seemed to be related to emotional crying. With regard to arousal, it was found that the arousal during the recall was lower in memories that did induce crying than in memories that did not induce crying, while the negative feelings during the event were rated as more intense in crying inducing memories than it was in the memories that did not induce crying. Overall, the reasons for crying in older adults cannot be fully explained by the qualities valence, arousal and underlying factors, further research including other qualities that might be related to crying, is needed to pinpoint this complex topic. Recommendations for future research are to focus on personality differences or the factor specificity of the memory recall. Moreover, the findings of this study supported the intrapersonal theory of crying, which suggests that crying may be cathartic, and future research should focus on further clarifying this.

*Keywords: emotional crying in older adults, crying in elderly, powerlessness, crying antecedents, valence of emotional Memory Scale, MEMOA,*

**Abstract (NL)**

Het doel van de studie was te exploreren welke kwaliteiten van verdrietige autobiografische herinneringen samenhangen met emotioneel huilen in ouderen, omdat dit onderwerp tot nu toe niet geëxploreerd werd. Video opnames uit de MEMOA database werden gebruikt om de autobiografische herinneringen van participanten op een kwalitatieve manier te analyseren met betrekking tot valentie (1), opwinding tijdens het belevenis (2), opwinding tijdens het vertellen (3) en andere onderliggende factoren (4).Valentie werd bepaald met behulp van de Valence of Emotional Memories schaal (VEM), emotionele opwinding via de Self-Assessment Manikin (SAM) en onderliggende factoren werden door gebruik van een ‚bottom-up' aanpak gecodeerd. De acht herinneringen die tot huilen leidden werden daarna met de herinneringen vergeleken die niet tot huilen leidden (*n*=53) op de basis van de vooraf beschreven kwaliteiten en factoren. De resultaten tonen aan dat autobiografische herinneringen die huilen induceren door een lage valentie en een combinatie van onderliggende factoren kunnen worden typeert. De factoren die vaak gecombineerd optraden binnen de herinneringen die tot huilen leidden zijn ‚Machteloosheid ', ‚Non-Acceptatie ', ‚Situatie werd niet opgelost' en ‚Bedroefdheid/ Wanhoop '. Daarnaast leek 'Compassie' gerelateerd te zijn aan emotioneel huilen. Bovendien gaven participanten aan rustiger te zijn tijdens het vertellen van herinneringen die tot huilen leiden dan tijdens het herhalen van herinneringen welke niet tot huilen leiden, terwijl zij die intensiteit van de negatieve gevoelens tijdens het belevenis hoger inschatten in herinneringen die tot huilen leidden. Samenvattend moet worden gezegd, dat huilen in ouderen niet compleet verklaart kan worden aan de hand van de kwaliteiten valentie, opwinding en onderliggende factoren. Vandaar is het van belang, dat meer studies zich op dit onderwerp gaan concentreren, zodat we een beter begrip voor ouderen en hun emotioneel binnen-leven kunnen ontwikkelen. Toekomstige studies zouden concentreren op de invloed van persoonlijkheid en specificiteit van de herinnering op emotioneel huilen. Verder ondersteunen de resultaten binnen deze studie de intrapersoonlijke theorie van emotioneel huilen, welke huilen als reinigend beschrijft, en toekomstige studies zouden erop focusseren of de intrapersoonlijke of interpersoonlijke theorie huilen beter beschrijft.

*Zoektermen: huilen in oudere mensen, machteloosheid, antecedenten huilen, valence of emotional Memory Scale, MEMOA,*

**Table of Contents**

## Introduction

As the pop-band R.E.M. put it so nicely back in the 1990's: 'Everybody cries and everybody hurts' (Berry, Buck, Mills, & Stipe, 1992). Probably everybody can agree with this simple statement since crying is one of the basic emotional expressions. It is not only a big topic in modern art, literature and philosophy, but has been since the ancient past. Even though it is so common and such a big topic in every human's life, there is a lack of scientific studies concentrating on this topic, which makes crying an interesting and important focus of research. The most studied kind of crying nowadays is the crying of human infants. There are also some studies out there that are concerned with the emotional crying of younger adults (e.g., Cornelius, 1997; Sung et al., 2009; Vingerhoets & Van Assen, 2009), while the development of crying over the human lifespan remains relatively unclear (Vingerhoets & Bylsma, 2016).

Especially when it comes to older adults, emotional crying is barely studied. Crying during adulthood is often considered as a single developmental phase that does not develop further with age even though the changes in emotional processes of older adults have long been researched and confirmed. In an earlier theory Carl Jung (1933) stated that older adults are living a "life of severed emotional intensity and that their emotional capacity is deteriorating". He made this statement based on the fact that other cognitive functions are getting compromised with age. More modern research on the other hand suggests that the opposite is the case when it comes to, at least some parts, of emotional processing. Different studies looked at the different emotional processes and found that there are only a few emotional processes that do decline with age. Older adults for example have more difficulties detecting sadness in another individual than younger adults (e.g., MacPherson, Phillips, & Della Sala, 2002; Moreno, Borod, Welkowitz, & Alpert, 1993). Yet, most emotional processes stay on the same level or are even enhanced, such as emotional problem solving (Blanchard-Fields, 2007) and positive affect (Carstensen et al., 2011). This enhancement in positive affect can also be observed when it comes to the recall of autobiographical memories.

Autobiographical memories are the collective of the memories of one's life and while they are often used to study the emotional expression and the emotional life of younger adults, there are also some studies focusing on older adults. Most of these studies concentrate on how the emotional evaluation of those memories change (e.g., Berntsen & Rubin, 2002; Ikier & Duman, 2020;). Those studies found that older adults often evaluate their memories as more positive than younger adults do (Carstensen et al., 2011). One explanation for this, as proposed by Carstensen, Fung and Charles (2003), is that every human is operating according to a combination of core goals and that those goals change with age. Carstensen and her colleagues (2003) believe that as older adults have less time left in their lives, their focus shifts from self-actualization and gathering information towards emotional satisfaction and momentary happiness. Subsequently, since studies already show that the emotional evaluation and the core goals differ within the different stages of adulthood, it should also be looked at the emotional expression between those different age groups. While the emotional processes of older adults have been studied, to the authors' knowledge

there are almost no studies that focus on which factors might influence if an older adult cries or does not and what the reasons and goals of crying are within this age group. This study aims to make the first step in getting a deeper insight into the emotional crying of adults. From our point of view, it is important to gain a better understanding of the emotional experience of older adults since the western population is growing older (World Population Prospects, 2019) and understanding their emotional life will help us to better understand their needs.

To make this first step, the research at hand will focus on the examining of emotional crying via emotional autobiographical memories of older adults. The aim is to better understand how the emotional evaluation in terms of emotional valence and emotional arousal is related to emotional crying in older adults. Moreover, different underlying factors will be looked at that are believed to be linked to crying, including a feeling of powerlessness and the loss, or feared loss, of social bonds.

In the next chapter the theoretical background is laid out, including information on human crying in general, functions and common antecedents of emotional crying. Furthermore, the relation between emotional crying, autobiographical memories and the definition of valence and emotional arousal of memories including how they are measured will be discussed. This information, the theories and their relations will then finally lead up to the research questions of this thesis.

## Theoretical Background

To understand why older adults cry and what differs in comparison to the crying of younger adults, it is important to first look at how human emotional crying can be defined and described in general.

### Human Crying

When talking about crying, we commonly first think about the shedding of tears. But crying is a combination of acoustical features, mimics and tears. It is also important to make a distinction between three different kinds of crying: basal crying, reflex crying and emotional crying (Murube, 2009). Basal crying can be described as the fluid that keeps the human eye moist in day-to-day life. The function of those tears is to protect the eye from external influences, such as dust or bacterial infections. The second kind of crying, the reflex crying, do have the same function as basal tears. The lacrimal gland produces tears in response to external influences such as chopping onions, tear gas or while yawning. Reflex tears and basal tears are made up of the same chemical composition (Murube, 2009). The research at hand is going to focus on the third kind of crying tears, the emotional crying. Emotional crying does not only differ from its two counterparts with regard to function, chemical composition and antecedents, they are also found to be only shed by human beings. The definition of emotional crying according to Patel (1993) is the “complex secretomotor phenomenon characterized by the shedding of tears from the lacrimal apparatus, without any irritation of the ocular structures”. Subsequently, emotional crying can be described as a reaction to an emotional state (Patel, 1993).

#### *Functions of Crying*

As mentioned before, emotional crying seems to be unique in comparison to the two other kinds of crying. While the function of basal as well as reflex tears is clear and no point of discussion, theorists such as Darwin (1998) for a long time doubted if emotional tears had any function at all. Over the years many theorists and researchers found that this assessment was not true at all (e.g., Vingerhoets, 2013; Vingerhoets & Bylsma, 2016). To understand the function of emotional tears and weeping, one must look at the development of crying in infants. In comparison to other infants, the human infant is unique in its helplessness (Gračanin, 2018). Humans are one of the species that have to rely on their caregivers for the longest time. While other animals have the possibility to stay close to their mother by clinging to her or by following her around, the human infant must rely on its physical appearance and its voice to get the caregivers’ attention (Gračanin, 2018). It is thus believed that the, mainly vocal crying, of a human infant has its origin in the separation and distress calls of other mammals and birds (Newman, 2007).

Bowlby (1969, 1980) stated that the main purpose of acoustical crying is to maintain and get the proximity and care of the primary caregiver. It is thus considered an ‘attachment behavior’ (Bowlby, 1980), also named “the acoustical umbilical cord” (Ostwald, 1972). In support of this theory, studies show that infant crying occurs less in cultures in which infants are carried around by their caregiver continuously (Vingerhoets et al., 2009). A study by Riem, van Ijzendoorn, de Carli, & Vingerhoets (2017) also proposed

that the shedding of tears in this time evolved to buffer the possible negative consequences of the vocal crying, such as abuse and aggression. The purpose of crying during the early stages of life thus is to secure being cared for, it subsequently is a function of crying during this life stage. This in turn opens up the question of why adults cry, since they usually do not have to rely on caregivers to fulfill their basic needs.

There are two basic theories that try to explain that phenomenon: the intrapersonal theory and the interpersonal theory of crying. The basic belief of the researchers supporting the intrapersonal theory of crying is that emotional crying is used for catharsis (e.g., Breuer & Freud, 1974). They assume that the shedding of tears helps to even out an emotional imbalance and in turn helps the crying individual feel better. This theory did also fuel lay beliefs such as “crying is healthy and holding tears back is bad”, but studies show mixed results when it comes to affirming this hypothesis; while participants of self-report studies often say, that crying does help them feel better (Simons, Bruder, van der Lowe, & Parkinson, 2013), experimental studies show that the participants feel the same or even worse shortly after crying (Cornelius, 1997; Rottenberg, Bylsma, & Vingerhoets, 2008). Cornelius (1997) looked at several quasi-experiments which were concerned with participants that were watching an emotional movie and found that participants who cried during the movie often felt worse immediately after the movie, which serves as a strong argument against the intrapersonal theory. He also proposed that psychological, personal and situational factors play a role when it comes to the question whether crying is cathartic or not. Moreover, it is difficult to differentiate between the real effects of crying and the by-products, i.e., getting the care and attention of others by being soothed. Gračanin et al. (2015) used a quasi-experiment in which 72 participants ($M_{age}$ = 23.80 years) were asked to watch a sad movie to study the effect of those by-products. During the movie, video recordings of the participants’ eyes were taken and analyzed to see if they were crying. The participants were then asked to rate their mood after the movie, where they not only looked at the immediate effects, but also the effects on the mood after 20 and 90 minutes. While the measure of the mood immediately after the movie shows the same results as the study by Cornelius (1997), that the participants felt worse after crying, the measure after 90 minutes shows that participants felt better than before the movie. As an explanation, Gračanin et al. (2015) proposed that an individual might feel better after crying because he or she got attention and help from others as a reaction.

This leads up to the second basic theory of the function of crying, the interpersonal theory of crying. The main belief behind this theory is that crying in adults still mainly has the function to get attention, help and sympathy from others (Hasson, 2009). This theory is perceived more likely in modern research since the function would be very similar to the original function of infant crying. Hendriks and Vingerhoets (2006) also found that strangers reacted more positively and supportive to the faces of sad individuals if tears were displayed, in comparison to sad faces without tears, showing that tears indeed are a way to elicit empathy and social support. Moreover, several studies show that adults are more likely to cry when they are with their mother or their partner, which supports the interpersonal theory since sympathy and care is to be expected from close social contacts (Fox, 2004; Vingerhoets, 2013). Different studies (e.g., Sung et al., 2009; van der Veen, Jorritsma, Krijger, & Vingerhoets, 2012) also show that college students in a

relationship cry significantly more often than their single counterparts, even though the latter report lower well-being. Vingerhoets (2013) explanation for this is, that crying serves as a social attachment behavior since the probability of a prosocial reaction is higher when with intimates than with strangers. These two studies correspond to the interpersonal hypothesis. All in all, this overview of the different proposed functions of emotional crying shows how little is known about emotional crying in humans. And the function of crying is not the only point of discussion, the antecedents of crying are as unclear.

### *Antecedents of Crying*

Until now, the different types of crying, the definition of emotional crying and the functions in infants as well as in adults were discussed. Another thing that distinguishes emotional tears from the two other forms of tears are the antecedents of emotional crying. While basal and reflex tears are a direct reaction to external influences, the explanation for why humans start to shed emotional tears in specific moments is not as straightforward, since the reasons for shedding emotional tears seem to be endless. Vingerhoets (2013) extensively studied the antecedents of crying. Overall, he found that adult crying can be described as a combination of biological, psychological and social factors. Based on that he described a possible model which entails the different factors that influence if a person cries or not (Vingerhoets, 2013, see Appendix D). Those factors are (1) the objective situation (2), the personal (re)appraisal (3), the current emotional state and (4) other moderating factors. All those factors are suspected to influence the person's emotional reaction to the situation. The way those factors interact on the other hand is not clear yet. Once the individual starts to show an emotional reaction (e.g., cry), a feedback loop, including the reactions of the environment, starts and shapes how the individual will behave further (Vingerhoets, 2013). This model nicely shows that there cannot be any definitive antecedents that do make each individual cry since the subjective valuation and external circumstances do have a major influence. Nonetheless, it can be helpful to look at feelings and situations that are most common to make humans cry.

Within another study Vingerhoets and colleagues (1997) focused on the question of which emotional states could be associated with emotional crying. The study that was conducted focused on the emotions of a group of female participants. Next to other interesting findings, they also found that women that were crying reported a mix of three or four different emotions accompanied by the feeling of powerlessness, when asked to fill in a self-report form. Common combinations of emotions within that group of participants were anger and powerlessness, sadness and powerlessness, frustration and fear and powerlessness (Vingerhoets, van Geleuken, van Tilburg, & van Heck, 1997). Powerlessness thus seemed to play a significant role in eliciting emotional tears. Vingerhoets and colleagues (Vingerhoets et al., 1997) believe that the feeling of powerlessness leads to performing passive coping which crying is an outing of. The individual does not feel able to cope with the situation, gives in to the feeling of helplessness and cries. Sometimes the aim might also be to show the social environment the perceived powerlessness, in hope to elicit the mentioned prosocial behavior in others by shedding tears (Vingerhoets, 2013). The theory of powerlessness as a feeling responsible for eliciting crying would also explain tears in anger and deny the

possibility of pinpointing crying to one single emotion like sadness. One can feel powerless in positive situations as well, for example when witnessing childbirth or when finally getting the promotion one was working on for a long time.

Furthermore, Vingerhoets (2013) put together a list including the most common antecedents of emotional crying in adults, positive and negative (see Table 1). In general, he stated that all elicitors of crying that can be found in the table below do have one common base, they either elicit (1) a combination of feelings that together form a feeling of powerlessness or the feeling of being (positively) overwhelmed or are (2) concerned with the loss, or feared loss, of social bonds (Vingerhoets, 2013). He describes these two factors as the most important fears or feelings that seem to elicit crying. Humans can be described as social beings and the feared loss, or the loss of social bonds is a primal fear. This explains why it does elicit strong emotions within humans. The loss, or feared loss, of social bonds can for example be found in the 'Romantic break-up', 'Separation', 'Conflicts' as well as in the 'Feeling of Loneliness', while powerlessness on the other hand seems to play an important role in the events 'Childbirth', 'Defeat', 'Feeling Old' and 'Ultimate Happiness' (Table 1).

**Table 1.**

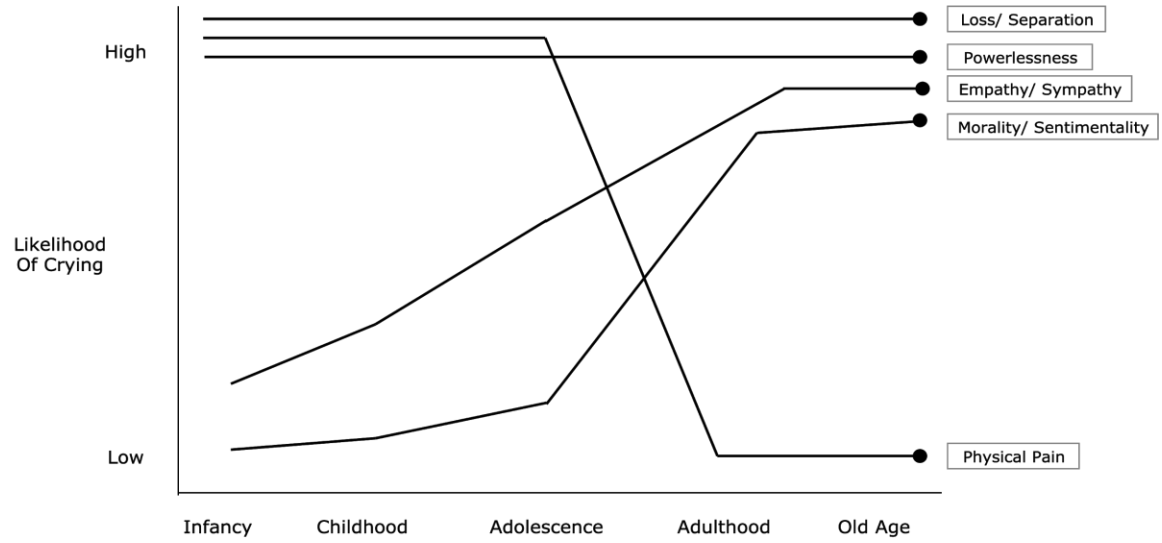
*Antecedents of Adult Tears (Vingerhoets, 2013).*

| Negatively rated events/stimuli/emotions | Positively rated events/stimuli/emotions |
|---|---|
| Death/Loss | Childbirth |
| Divorce/Romantic break-up | Weddings |
| Separation | Reunions |
| Conflict | Harmony, Comradeship |
| Loneliness, solitude | Social bonding, union |
| Defeat | Victory |
| Powerlessness, failure | Extraordinary Performance |
| Emotional suffering | Ultimate happiness, rapture |
| Feeling old, discarded, worn out | Young, vulnerable, with potential |
| Sin, egoism, the world is bad | Justice, altruism, the world is good |
| Tiny, vulnerable, helpless | Overwhelming, (al)mighty, awesome |
| Physical pain | Orgasm |

## Crying and Older Age

The antecedents mentioned in Table 1 show the most common reasons for crying among adults in general and do not distinguish between the antecedents most common in younger and the ones most common in older adults. And even though it seems as if emotional crying within older adults remains relatively undiscussed, one thing found by Vingerhoets (2013) was that it seems as if the reasons for crying do change over the course of one's life. As Figure 1 shows, the feared loss of social bonds and separation and the feeling of powerlessness do remain probable elicitors of crying over the course of a lifetime. Physical pain on the other hand seems likely to make infants and children cry. As soon as they become adults, the likelihood of physical pain as an elicitor of crying does decrease. The two other common elicitors, empathy or sympathy, thus feeling for others, and morality/ sentimentality, only start to become important once grown up. Those two reasons for crying seem to be especially prevalent in older adults. One explanation for that might be that, as explained earlier, older adults score higher on positive affect, which might lead to being overwhelmed faster, fitting with Vingerhoets hypothesis that emotional crying does occur, if humans do not feel able to cope with overwhelming emotions in any other way (Vingerhoets, 2013).

**Figure 1.** *Aging and Tears: A Model (Vingerhoets, 2013).*



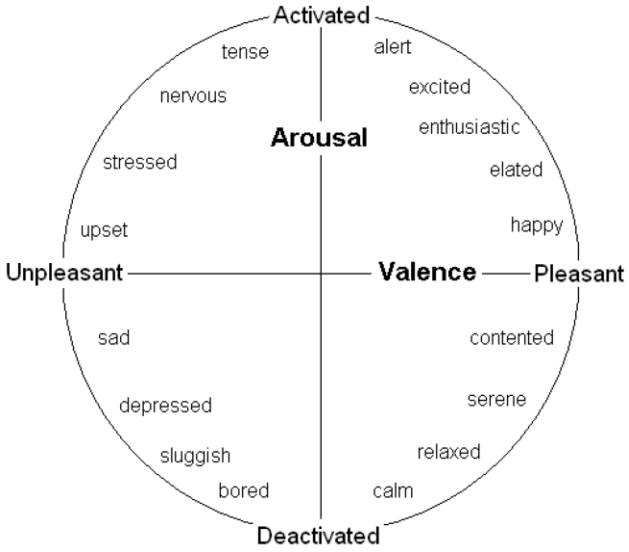

## Crying and Autobiographical Memories

To be able to study the crying of older adults in a realistic setting, emotions that are associated with crying are often triggered using the recall of autobiographical memories. Autobiographical memories can be described as the collected meaningful memories an individual has of his life (Meeter & Hendriks, 2012). Those memories might differ over a human's lifespan and are emotionally re-evaluated several times over a life course. The memories can consist of self-images, past experiences and social contacts (Luchetti & Sutin, 2018). Moreover, the narrative of autobiographical memories is also always a verbal construction,

which means the narrator always has the possibility to choose if he or she is going to talk about specific events if they are considered too hurtful or socially unacceptable.

Autobiographical memories do have a twofold relationship with emotions. First of all, memories are retrieved differently and more vividly if the experience was highly emotional when it happened (Brown & Kulik, 1977). According to Brown & Kulik (1977), how good the memory is remembered depends on the personal involvement in the situation and the emotional arousal experienced in the situation, which will be explained in the next paragraph. Secondly, the retrieval of autobiographical memories can influence the emotional state of the individual during and after the retrieval (Holland & Kensinger, 2010). Talking about autobiographical memories can thus easily act as a trigger for different emotions, because it might make the individual relive and re-experience the experience. This makes the work with autobiographical memories especially interesting when it comes to studying emotions and emotional expressions such as crying. To rate how much emotion or which emotion is triggered by the autobiographical memories, the circumplex model by Russell (1980) can be used (see Figure 2). The model is based on the dimensional classification theory of emotion which was first proposed by Wundt (1905). The belief behind this theory is that emotion can best be described by using multiple dimensions. The three dimensions Wundt proposed being valence (positive - negative), arousal (calm-excited) and tension (tense - relaxed). All emotions can thus be rated on those three dimensions and be placed at a specific point between those three axes. Since later research by Russell (1980) found that the latter two dimensions seem to overlap, most studies focus only on valence and arousal (e.g., Russell, 1980). Emotions and emotional reaction can be rated on those two dimensions using different methods such as self-report measurements or the measurement of physiological reactions. The two dimensions are going to be explained in further detail, including the possible measurements, in the next two paragraphs.

**Figure 2.** *The Circumplex Model by Russell (1980)*.




*Note*. X-Axis = Valence, Y-Axis = Arousal

### *Arousal*

The arousal dimension describes if there is a heightened or weakened physiological reaction to a memory or an emotion. When looking at Figure 2 the axis between activated and deactivated describes the emotional arousal. The best way to understand emotional arousal is by looking at the emotions highest and lowest on the scale. Feeling bored is the emotion with the least emotional arousal, while feeling tense has the highest arousal. When feeling bored or calm, humans are usually not physically active, while when feeling stressed, the body tenses up. Other emotions that are typically considered to be connected to high emotional arousal are anger and joy, while sadness is mostly characterized by low emotional arousal. When an individual is in a state of high emotional arousal chemicals are released that create a state of readiness. The sympathetic nervous system (SNS) prepares the body for action, while the parasympathetic nervous system (PNS) is the one to react to low emotional arousal which helps the body to relax. Studies found that memories that evoke high emotional arousal are remembered more vividly due to the release of glucose and other stress-inducing hormones and an activation of the amygdala which help to form a long-lasting memory (McGaugh, 2018). Studies conducted with patients suffering from focal amygdala damage are supporting this theory. The participants recall of emotional memories was not better than the recall of neutral memories (e.g., Adolphs, Cahill, Schul, & Babinsky, 1997; Brierley, Medford, Shaw, & David, 2004). Which would in turn support the hypothesis that the activation of the amygdala during high emotional arousal does play a major role in why emotionally loaded stimuli are remembered better than less emotionally loaded things or events. One study even found that high emotional arousal even had a memory boosting effect on an unrelated task. In the study by Tambini, Rimmele, Phelps and Davachi (2016) participants were exposed to an emotionally arousing stimulus half an hour before learning and results showed that the learned information was remembered better than before the participants were exposed to the arousing stimulus or without the stimulus. This memory enhancing effect can be found not only for younger adults, but also for older adults since there is relatively little structural decline found in the amygdala in older age (Wright, Wedig, Williams, Rauch, & Albert, 2006).

### *Valence*

While the arousal dimension describes how activated an individual is by an emotion, valence describes how positive or negative a person perceives a memory or an emotion. Even though some theorists disagree (e.g., Briesemeister, Kuchinke, & Jacobs, 2012), valence is usually seen on a bipolar continuum between pleasantness and unpleasantness. Valence is often used to describe emotions (e.g., Talarico, LaBar, & Rubin, 2004).

In contrast to arousal there have been no clear findings until now regarding the question if valence does influence the quality of memory recall. Different studies, using different emotional stimuli, all came to different results. While some studies showed that if and how good a memory is recalled does not differ between positive and negative stimuli (e.g., Kensinger, Brierley, Medford, Growdon, & Corkin, 2002), studies using verbal prompts or pictures as stimuli showed that negative stimuli were remembered better

and recalled more precisely (e.g., Charles, Mather, & Carstensen, 2003). Other studies, using autobiographical memories as a stimulus, on the other hand, showed the exact opposite: positive autobiographical memories were recalled more easily and more vividly (e.g., White, 2002). Those significant differences in findings are explained by the theory that information that is most relevant to an individual's current goals is remembered best. If an individual for example ran into a snake in the wilderness, the information that will probably be remembered best, is everything he ever learned about how to see if a snake is dangerous and how to behave in such a situation. One will probably not be able to recall a happy memory as easily in this situation. Other studies also found that it is easier to recall memories in which emotional valence is similar to the individual's current mood (Loeffler, Myrtek, & Peper, 2013).

Regarding the valence of memories and emotions in older adults, studies found that older adults do in general report a higher valence when it comes to autobiographical memories in comparison to younger adults. This shift in emotional experience is described as the so-called ‘positivity effect’. The effect of this phenomenon is that older adults are in general happier than younger adults and perceive less anger and sadness (Carstensen et al., 2011). Studies with older adults show that they seem to recall positive events easier than negative events from their past. Another study by Carstensen (1993) also showed that older adults remember negative (not positive or neutral) autobiographical memories more vividly in comparison to younger adults, which is understood as a sign that older adults appraise the negative memories more positively when talking about them. A proposed reason for that is, that the adults rated the negative events more positively than younger adults, which is in line with the ‘positivity effect’. This positive re-evaluation is in turn suspected to increase the vividness of the memory as supported by White (2002).

## Research Questions

In order to examine the emotional crying of older adults, this study will focus on the valence of the memory, the arousal of the memory, the arousal when the event happened and other underlying factors. Those underlying factors being the specific feelings connected to that memory and the antecedents of crying. The research questions at hand will be focusing on sad autobiographical memories only, since the participants did not cry within the sample at hand when talking about happy memories. The first research question will be focused upon sad memories in general and how they can be characterized regarding their valence, emotional arousal and other underlying factors. As described earlier, older adults do often rate the valence of memories more positively than younger adults would. They thus perceive negative events as more positive and the negativity less intensely. It will thus be interesting to see how older adults rate the arousal of their sad autobiographical memories. Moreover, it will be of interest to see if sad memories can be characterized by emotional arousal or have specific underlying factors in common. The first research question is thus going to be:

1. *How can sad autobiographical memories be described with regard to the qualities valence, arousal and underlying factors?*

After having a look at the sad autobiographical memories in general and how they are related to the qualities valence, arousal and underlying factors, the focus will be laid upon the crying inducing sad memories. The emotional valence of autobiographical memories and its possible influence on emotionally crying is a topic barely discussed. Some studies, such as one by Lang and colleagues show that ratings on the valence dimension, as well as on the arousal dimension, are related to specific physiological responses and facial expressions (Lang, Bradley, & Cuthbert, 1990). For example, the study showed that the activity of the corrugator muscle, which is responsible for lowering the eyebrows, is heightened with more negative valence (less pleasure) (Lang, Bradley, & Cuthbert, 1990). Which leads to the hypothesis that more negative valence is directly related to a person's affective state and to facial expressions, but the findings have not been directly linked to emotional crying. Moreover, a model by Vingerhoets (Vingerhoets, 2013) suggests that the main elicitors of crying in general, and specifically in older adults are powerlessness, fear of social loss, empathy and morality, but there are no extensive studies about this, and it has never been looked at autobiographical memories with regard to those factors. It is questionable whether memories can elicit the same feeling of powerlessness as the actual event can. Moreover, emotional autobiographical memories cannot be described by using only quantifiable factors such as valence and arousal but are highly complex. To get a more inclusive overview it will not only be looked at factors such as powerlessness and the feared loss of social bonds, but all emotional and situational factors that might play a role in eliciting crying. To see the differences between sad memories that elicited crying and those that did not elicit crying, the second research question is going to be:

2. *How are the qualities valence, emotional arousal and other underlying factors related to emotional crying during the recall of sad autobiographical memories?*

To get an answer to this research question, two sub-questions will be formulated. The first sub-question will concentrate on how crying inducing memories set apart from memories that do not induce crying with regard to the qualities valence, arousal and underlying factors. Looking at the difference is important to understand what distinguishes crying inducing memories from memories that did not induce crying. The first sub-question is going to be:

*2.1. What is the difference between crying inducing memories and memories that did not induce crying with regard to the valence, arousal and other underlying factors of autobiographical sad memories?*

Afterwards, it will be of importance to understand the crying inducing memories on an even deeper level. The individual crying inducing memories will be analyzed not only in comparison to the memories that did not induce crying, but also on their own and it will be looked at the possible interrelations between the factors valence, arousal and other underlying factors and how they are related to emotional crying. The process of emotional crying was found to be a complex combination of different influencing factors. Subsequently, it is important to not only concentrate on the separate qualities as in the first sub-question, but to also examine how the different qualities work together. The last sub-question is thus going to be:

*2.2. How are the specific crying inducing memories characterized by the qualities emotional valence, arousal and other underlying factors?*

## Methods

### Participants

As base of this study the Multi-Modal Emotional Memories of Older Adults (MEMOA) database (Nazareth, Jansen, Truong, Westerhof, & Heylen, 2019) was used. Within the MEMOA database there were twenty-three (11 male, 12 female) participants. The participants were aged between 65 and 85 years ($M_{age}$ = 74 years, SD=5,86). They were recruited through local newspaper advertisements and were included if they could speak and understand Dutch fluently, were aged 65 or older and if their vision and hearing were either normal or corrected. They were excluded if they had traumatic experiences in the past, a pacemaker or memory problems. The study was conducted either in the participants home or another place where they felt comfortable. After agreeing to be part of the study, participants were informed about the study process via an extensive information letter. After inspection of the video data, it appeared that five different participants (2 male, 3 female) were crying. Between those five participants eight instances of crying were found.

### Material

#### *MEMOA Database*

The MEMOA is a multimodal database for the automatic recognition of emotions in older adults. The database consists of interviews with nineteen older adults (see Table 2). Each of them had to complete two different interviews, the first session acted as an autobiographical memory recall session and the second session to discuss these memories deeper by using a life story book, put together using the memories retrieved during the first session.

**Table 2.**

*Summary of the MEMOA Database (Nazareth et al., 2019).*

| | Session 1 | Session 2 |
|---|---|---|
| Participants in the study | 23 | 23 |
| Participants in the database | 19 | 19 |
| Hours of video/audio | 10h 55min (audio only) | 26h 18min |
| Elicitation method | AMT | LSB, IAPS |
| Questionnaires | TAS-20, IPIP 5-50, MOCA | TOPICS-MDS |
| Self-report ratings | n.a. | Valence, Arousal |
| Recorded signals | Audio | Video, Audio, ECG. HR movement |

In the first session a revised version of the autobiographical memory test (AMT), which is a word association task used to recall memories related to specific cue words, was used. The cue words that were used in the study at hand were “sad” and “happy”. The participant was asked to share three autobiographical memories for each of those cue words and a photograph or another document related to each of those memories. Afterwards they filled in the personality tests TAS-20 (Trijsburg, Passchier, Duivenvoorden, & Bagby, 1997) and IPIP-5-50 (Goldberg, 1992) and the Montreal Cognitive Assessment (MOCA) (Thissen, van Bergen, de Jonghe, Kessels, & Dautzenberg, 2010) to screen for cognitive impairments.

The second session was then based on the topics that were discussed in the meeting before and aimed at getting a deeper understanding of the memory. After this session, the participants were asked to rate the emotional arousal the memory caused. This was done by using a Self-Assessment Manikin (SAM).

### *Self-Assessment Manikin (SAM) Emotional Arousal Rating*

The Self-Assessment Manikin was concerned with the valence and the arousal the participants felt when the event happened, when they talked about it and after they talked about it. Since participants reported difficulties when rating the intensity of their feelings using the items planned to measure arousal, which made the results unreliable it was decided to use the scores planned on being used for valence for arousal instead. The items do measure the intensity of the positive respectively negative feeling, it thus does include the arousal dimension.

The questions participants were asked were “How did you feel during the event?”, “How did you feel while talking about the memory?” and “How do you feel now?”. The arousal was then rated on a scale from - 100 to 100, with -100 being (negatively) aroused and 100 being calm. The scores were then divided by 100. For the research at hand the first two questions regarding how the participants felt during the event (*Arousal when the Event Happened*) and how they felt during the recall (*Arousal During Recall*) were used.

## Procedure

For the study at hand only the video recordings and the transcripts of the second session of the MEMOA input were used. Before the session, three wireless Shimmer sensors used to record physiological reactions of the participants were attached to the participants’ body. The first of those sensors was attached to the body of the participant and was used to record the heart rate (HR), a second sensor was attached to the participants’ non-dominant wrist and was used to record the galvanic skin response (GSR) and the third sensor was attached to the dominant wrist with the aim to record the participants movements (accelerometer). At the beginning of this session participants had to fill in a demographic questionnaire containing eight questions. Afterwards they were presented with a digital life story book (LSB) which contained pictures and verbal cues that were related to the events that were recalled within the first session (Nazareth et al., 2019). The aim of those life story books was to elicit more information and emotions

connected to the memories. The different pages of the LSB were shown to the participants one by one and each memory was discussed in greater detail after seeing the corresponding page of the LSB.
After each memory participants were asked to rate the memory on four questions related to the valence of this memory and four questions related to the arousal of this memory (SAM). When they were finished with the LSB they were asked to also rate a set of six standardized pictures, three sad and three happy, on valence and arousal to compare the outcomes of this standardized emotion eliciting method and the eliciting of emotions through autobiographical memories. Afterwards they were asked to fill in a selection of the older persons and informal caregivers survey minimum dataset (TOPICS-MDS). Finally, participants received a small gift to thank them for their participation.

## Analysis

### *Coding*

**Crying.** For all sad memories of all participants within the MEMOA database crying was coded (0 = no crying, 1 = crying) per memory by using ELAN 5.8 (Sloetjes & Wittenburg, 2008). The data were screened for every instance of crying by looking at the video footage of the interviews. Memories were coded as containing crying if the participants' eyes teared up at least once during the whole memory. Moreover, it was looked at which point of the memory recall the crying started and what specifically the participants were talking about at this moment.

**Valence.** The Valence of Emotional memories scale (VEM) was used to describe the autobiographical memory and to test the relationship between the valence of a memory and emotional crying. For this, all the retrieved memories were rated on their general valence using the VEM (Tournier, Truong, Nazareth, & Jansen, 2019). The VEM is a list of 53 different life events that are rated on a scale from 1 to 7, 1 being a negative valence and 7 being a highly positive valence (see Appendix A). It is based on the valence of life events acquired across different studies (Berntsen & Rubin, 2004; Erdoğan et al., 2008; Grysman & Dimakis, 2017; Janssen, 2015; Janssen & Rubin, 2011; Rubin et al., 2009) and specific Dutch keywords (Moors et al., 2013). The scale was priorly used to rate the valence of the memories described within the first session that was part of the study to collect information for the MEMOA database (Nazareth et al., 2019). Within this prior use the inter-rater agreement was substantial ($\kappa = .774$, $p < .001$) (Landis & Koch, 1977).

Moreover, the rating on the VEM includes the possibility of using a subjectivity score, which is either +1 or -1. It considers that valence cannot be generalized and is rather influenced by the participants subjective emotional experience. For example, one's own wedding can be the happiest day of one's life and thus also has a high general valence score of 6.33. But one's wedding day can also be perceived as a total disaster due to stress or because it did not go as planned. If this were a participants' experience, the subjectivity score would be implemented and would reduce the valence score of 6.33 to a score of 5.33. By

weakening or amplifying the valence score that is given to a life event, the subjectivity score thus is a representation of the differences in experience.

For the research at hand two independent raters decided which of the given events on the VEM (see Appendix A) fit best with the memory. This was done for all available memories. Moreover, it was decided for which memories subjectivity scores were needed to represent the actual valence for the specific individual. The interrater reliability of the rating on the VEM scale was computed using Cohen's κ and was found to be κ = 0.87, the values thus seem to be relatively reliable. There were no new life events added to the VEM.

**Underlying Factors.** Lastly, the memories were coded with regard to other, more qualitative, underlying factors that seemed to play a role during the recall of the sad autobiographical memories. This was done by using Atlas.ti 8 Windows and a bottom-up approach. All in all, 14 codes were developed based on the verbal statements of the participants and also on the antecedents of crying found by Vingerhoets (2013). The codes can be categorized into three different themes. An overview of the codes and the overarching themes can be found in Table 3 and some examples will be further discussed within the results section.

**Table 3.**

*Coding Scheme Underlying Factors*

| Outcome of the event | Feeling of influence | General Feeling |
|---|---|---|
| Turned out good in the end | Powerlessness | Anger |
| Situation was resolved | Passive reaction | Sadness/ Disappointment |
| Situation was not resolved | Acceptance | Compassion |
| Seeing the positive things | Non-Acceptance | Fear |
| Growth | Dealing actively with the situation | |

The aim of analyzing the memories with regard to those qualities was to understand which qualitative and situational factors occurred during the memory recall. While the codes within the code group '*Outcome of the Event'* were concerned with the factual level of the story, for example if the situation the participant talked about was resolved or not, the two other code groups '*Feeling of Influence'* and '*General Feelings'* were concerned with the emotional level of the memory. The codes were achieved by going through all the memories several times. First, every statement that was believed to be of importance was coded with a code that described the feeling or the circumstances that played a role. In the next step, if one code was redundant and had the same meaning as another one, those codes were merged. In the last step, those codes were divided into the three different code groups. Codes that describe the same factor were put

together in a group. For example, the code '*Situation was Resolved*' and the code '*Situation was Not Resolved*' are put together within the group outcome of the event, even though they describe opposite situations.

***Analysis***

After the data was coded, the codes, as well as the scores on the two self-rating scales for arousal were analyzed by computing the mean scores for the sad memories in general, the non-crying memories and the crying inducing memories. Those mean scores were then used to describe the qualities of the sad memories and to compare the crying and the non-crying memories. It was looked at which quality was related to emotional crying and if there was anything that stood out about the specific memory. The data was not analyzed using quantitative methods since the distribution was too skewed to get reliable results due to the fact that there were too few instances of emotional crying. Therefore, the focus was laid more upon qualitative matters. Similarities within the group of crying inducing memories were analyzed by looking more intensely at the stories told within the interviews and by looking for commonalities within those stories.

# Results

## Characteristics of Sad Autobiographical Memories

Within the data set there were 61 sad memories recalled by the participants. Those autobiographical memories differed greatly regarding topics and the participants' emotional reaction. The following paragraph is aimed at answering the first research question '*How can sad autobiographical memories be described with regard to the qualities valence, arousal and underlying factors?*'. To answer this question, it was looked at those three qualities separately and the frequency of the different codes were analyzed.

### *Valence of Sad Memories*

As explained above, the VEM consists of 53 life events and each of those events has a corresponding score between one and seven. Out of those 53 life events 19 were found within the data of sad memories. Most of those life events ($n$ = 15) had a score beneath three and can thus be described as life events with a negative valence.

Table 4 shows the frequency of each of those 19 life events including their valence score for all the sad memories that were recalled, as well as for the crying memories and the memories that did not induce crying. The most common life events that were found within the sad memories were 'Death of a Parent', 'Family Quarrels', 'Death of a Partner' and 'Serious Disease'. Only three instances of life events with a positive valence above four be found (Travelling, Hobby, Birth of Grandchild) were found. Those, in general positive, life events can be explained by the fact that the participants had negative experiences during, for example, travelling. To show that those events were not viewed as positive a subjectivity score of - 1 was subtracted from the corresponding scores.

**Table 4.**

*Frequency of VEM Life Events for All Sad Memories (n = 61).*

| Life Event | VEM Scores$_1$ | Frequency | | |
|---|---|---|---|---|
| | | Crying Memories | Non-Crying Memories | Overall |
| Death Partner | 1.17 | 2 | 3 | 5 |
| Own Divorce | 2.00 | 2 | 2 | 4 |
| Psychological Problems | 3.00 | 2 | 0 | 2 |
| Death of a Parent | 1.40 | 1 | 10 | 11 |
| Death of a Friend | 1.76 | 1 | 2 | 3 |
| Family Quarrels | 2.45 | | 10 | 10 |
| Serious Disease | 1.92 | | 5 | 5 |
| Neglected by Children | 1.50 | | 4 | 4 |
| First Rejection | 1.74 | | 3 | 3 |
| Death Sibling | 1.33 | | 3 | 3 |
| War | 1.56 | | 2 | 2 |
| Career Failure | 2.00 | | 2 | 2 |
| Travelling | 6.14 | | 1 | 1 |
| Birth Grandchild | 6.66 | | 1 | 1 |
| Death Child | 1.14 | | 1 | 1 |
| Death Grandparent | 1.60 | | 1 | 1 |
| Hobby | 4.86 | | 1 | 1 |
| Caring for Parents | 2.75 | | 1 | 1 |
| In an accident | 2.30 | | 1 | 1 |
| TOTAL | | 8 | 53 | 61 |
| Mean (*SD*) | | 1.31 *(.57)* | 2.09 *(1.04)* | 1.98 (*1.02*) |

*Notes.* $_1$ VEM Scores excluding Subjectivity Scores

***Emotional Arousal of Sad Memories***

As mentioned within the method section, arousal scores were achieved by using the ratings on the Self-Assessment Manikin. What did stand out is that most of the scores describing the arousal during the recall were positive, while the arousal during the event happened was mostly described as negative. There was a difference of 0.65 between the arousal during the event and the arousal during the recall. The standard deviation in arousal was rather high between the different sad memories.

**Table 5.**

*Mean Score Arousal During the Event and During Recall.*

| | Mean Score *(SD)* | | |
|---|---|---|---|
| | Crying Memories | Non-Crying Memories | Overall |
| Arousal During the Event | -.65 (*.28*) | -.51 (*.42*) | -.52 (*.43)* |
| Arousal During Recall | .21 (*.67*) | .12 (*.41*) | .13 (*.41)* |

***Underlying Factors in Sad Memories***

**Outcome of the Event.** There are five codes that can be put in the code group '*Outcome of the Event*'. The most common code with 17 occurrences within all the sad memories was '*Seeing the Positive Things*' (see Table 6). This code was used when participants seemed to concentrate on the upsides of a negative experience instead of focusing on the negative consequences and feelings. Another thing that stood out was that the majority of the events the memories revolved around turned out good in the end or at least were resolved. Only eleven of the situations were not resolved, while 29 were coded with '*Situation was Resolved*', '*Seeing the Positive Things*' or '*Turned out Good in the End*'.

**General Feelings.** The underlying factors within the code group '*General Feelings*' are the main feelings that seemed to play a role during the recall of the memories. The most prevalent code was '*Sadness/Disappointment*' with a frequency of 48 within all sad memories (see Table 6). Another feeling that seemed to play a big role was compassion for others ('*Compassion*'), which occurred 23 times.

**Feeling of Influence.** The third code group is the '*Feeling of Influence'*. This code group consists of five different codes. The feeling of influence seemed to play a main role when recalling the memories. The mostly used code is '*Powerlessness*' with a frequency of 30 (Table 6). Acceptance also seemed to play a major role, since it has a frequency of 25.

**Table 6.**

*Code Frequency of Underlying Factors per Code Group*

| | Code Frequency | | |
|---|---|---|---|
| | Crying | Non-Crying | Overall |
| Outcome of the Event | | | |
| Seeing the positive things | 1 | 16 | 17 |
| Situation was resolved | 0 | 5 | 5 |
| Situation was not resolved | 5 | 6 | 11 |
| Growth | 0 | 4 | 4 |
| Turned out good in the End | 0 | 7 | 7 |
| General Feeling | | | |
| Sadness/Disappointment | 8 | 40 | 48 |
| Compassion | 6 | 17 | 23 |
| Anger | 1 | 11 | 12 |
| Fear | 0 | 4 | 4 |
| Feeling of Influence | | | |
| Powerlessness | 7 | 23 | 30 |
| Acceptance | 1 | 24 | 25 |
| Dealing actively with the situation | 1 | 17 | 18 |
| Non-Acceptance | 6 | 9 | 15 |
| Passive Reaction | 1 | 4 | 5 |

**Comparison Between Crying-Memories and Non-Crying Memories**

The following part of the result section is focused on the research question 2.1, thus on the comparison between crying inducing memories and memories that did not induce crying. Eight memories that induced crying were recognized; they were divided between five participants. All those memories were part of the memories the participants recalled when they were asked to talk about sad memories. The crying inducing memories were first compared to the memories that did not induce crying with regard to the valence scores, as well as the two arousal scores and the underlying factors.

***Comparison Between the Valence of Crying and Non-Crying Memories***

As Table 4 shows, the valence scores of memories that induced crying were in general lower than the valence scores of the memories that did not induce crying. When looking at the data, it can be seen that crying occurred while recalling memories of a wide array of life events. Most of the memories that brought participants to cry revolved around the death of a family member and thus had a valence of around 1 - 1.5. The other memories that induced crying focused on the life events 'Psychological Problems' and their 'Own Divorce'. Since only four of the 24 memories that revolved around the death of a close one (see Table 4) elicited crying, the question, why the participants that recalled the 20 other memories did not show the same emotional reaction, remains.

The memories that did not induce crying, on the other hand, did mostly include the life events 'Death of a Parent', 'Family Quarrels', 'Serious Disease' and 'Neglected by Children'. Participants did not cry when talking about being 'Neglected by Children', their 'First Rejection', the 'War' or a 'Serious Disease', even though the VEM score of those life events is relatively low.

***Comparison between Emotional Arousal in Crying Memories and Non-Crying Memories***

When looking at Table 7 there does not seem to be a clear relationship between emotional arousal scores and emotional crying. While the mean score of the arousal when the event happened is *M*= -.51 in non-crying memories, it was around *M*= -.65 for crying inducing memories. When looking at the arousal during the recall, the non-crying memories have a mean score of *M*= .12, while the mean score for the crying memories was *M*=.21. What does stand out is, that the negative emotions during the event seemed to be more intense in memories that did induce crying. Moreover, the positive feelings during the recall were more intense within crying inducing memories than in memories that did not induce crying as well.

***Comparison of Underlying Factors in Crying Memories and Non-Crying Memories***

The underlying factors will be discussed within the three code groups '*Outcome of the Event'*, *'General Feelings'* and '*Feeling of Influence'*. Table 6 provides an overview of which codes were more frequent in crying memories and which were more frequent in non-crying memories.

**Outcome of the Event.** The code '*Situation Turned out Good in the End*' and '*Situation was Resolved*' did not occur within the crying inducing memories at all, even though it was one of the most occurring codes within the category '*Outcome of the Event*' in the non-crying memories. Moreover, the code '*Situation was Not Resolved'* was found relatively more often in the crying memories than in the non-crying memories.

**General Feelings.** Within this code group the most noticeable difference between non-crying memories and crying memories was the fact that '*Compassion*' seemed to play a bigger role within the memories that did induce crying. While six out of eight crying memories were coded with '*Compassion*', only 17 out of 53

non-crying memories were coded with the same code. Moreover, the codes '*Fear*' and '*Anger*' were found less within the crying inducing memories.

**Feeling of Influence.** In relative comparison, the codes '*Non-Acceptance*' and '*Powerlessness*' seemed to play a more important role within the crying inducing memories than within the memories that did not induce crying. Moreover, the code '*Acceptance*' was only found once within the memories that induced crying, while it was found 24 times within the memories that did not induce crying.

All in all, one distinct underlying factor does not seem to explain if a participant cries or not. All the factors discussed earlier were found within the non-crying memories as well. They might thus all have an influence on the emotional reaction of the participant, but one factor alone does not seem to have enough influence on the participants emotional reaction to explain why one participant cries and the other does not. This already gives some information on how crying inducing memories can be characterized, but to really understand the factors and what is happening, the memories that did induce crying need to be analyzed more closely.

### Crying Inducing Memories Characterized by the Qualities Valence, Arousal and Underlying Factors

The last part of the result section is going to focus on answering the second sub-question to the second research question ('*How are the specific crying inducing memories characterized by the qualities emotional valence, arousal and other underlying factors?')*. To understand how the three qualities valence, arousal and other underlying factors are related to emotional crying, there is a need to have a closer look at the specific crying inducing memories and how each of the three qualities is represented. All memories that induced crying are going to be discussed in more detail to then see if they have some interrelations between the three qualities in common. A summary for the crying inducing memories including the valence scores, the arousal scores and the underlying factors for each memory can be found in Table 7.

**Table 7.**

*Crying Inducing Memories Analyzed with Regard to Valence, Arousal and Underlying Factors*

| Memory | VEM | | Arousal | | Underlying Factors |
|---|---|---|---|---|---|
| | Life Event | Score | When it happened | During recall | |
| Participant 5 | | | | | |
| SM3 | Psychological Problems | 2.00[1] | -[2] | -[2] | Powerlessness, Compassion, Situation was not resolved, Sadness/Disappointment |
| Participant 8 | | | | | |
| SM1 | Death of a Parent | 1.40 | -.65 | -.63 | Powerlessness, Non-Acceptance, Sadness/Disappointment, Compassion, Situation was not resolved |
| SM2 | Death of a Friend | 1.76 | -.59 | .01 | Powerlessness, Non-Acceptance, Sadness/Disappointment, Compassion, Seeing the positive things |
| SM3 | Death of a Partner | 1.17 | -.85 | -.64 | Powerlessness, Non-Acceptance, Sadness/Disappointment, Compassion Situation was not resolved |
| Participant 14 | | | | | |
| SM1 | Own Divorce | 2.00 | -.44 | .57 | Powerlessness, Non-Acceptance, Sadness/Disappointment, Situation was not resolved |
| SM2 | Own Divorce | 2.00 | -.16 | .87 | Powerlessness, Non-Acceptance, Sadness/Disappointment, Passive Reaction, Situation was resolved |
| Participant 18 | | | | | |
| SM1 | Psychological Problems | 2.00[1] | -.55 | -.25 | Powerlessness, Compassion, Non-Acceptance, Situation was not resolved, Sadness/Disappointment |
| Participant 21 | | | | | |
| SM2 | Death of a Partner | 1.17 | -1.0 | 1 | Sadness/Disappointment, Compassion, Dealing Actively with the Situation, Acceptance |

*Notes.* [1] = VEM Score was modified by the Subjectivity Score with -1

[2] = No Arousal Scores obtained for this Participant

***Participant 5***

Within his third sad memory participant 5 talked about his daughters struggles with mental illness. He did not cry during the whole time he was telling his story, right until the end. Even though the memory was not about the participants' own psychological problems but about the daughter's struggles, it was coded as the life event 'Psychological Problems' and thus has a VEM score of 1.92 (see Table 7). The two arousal scores are missing since the participant was too aroused to answer the questions of the SAM after recalling his memory. Directly before starting to cry the participant talked about how he found out that the son of his daughter seems to struggle with the same diagnose as his mother:

*"Now we know that it is autism [..] and now her son is autistic as well"*

The statement can be understood as an outlook into a difficult future for his daughter as well as for his grandson and this brought him to tears. Before that he talked about the long ongoing struggles of finding the right diagnosis for his daughter and how she changed from being a happy child to a grown up struggling with life and how difficult it was for him to watch that change happen. Due to this, the memory was coded with the underlying factors '*Powerlessness*' and *'Situation was not Resolved'* and '*Compassion*'. The main feeling that came across during the recall was that the participant did not seem to know how to help his daughter and his grandson and this made him feel helpless and powerless.

***Participant 8***

Participant 8 was crying during all three sad memories. Those three memories were focused on the death of a person close to him. The first memory revolved around the death of his mother and was thus coded as 'Death of a Parent' on the VEM with a score of 1.4 (see Table 7). He rated the emotional arousal he experienced when the event happened as -.65 and the emotional arousal when talking about it as -.63. The intensity of the negative feeling was thus still high when taking account that the death happened several decades ago. One explanation for this might be that the relationship between him and his mother was rather good or because the death was unexpected. Right before he started to cry, he said:

*"And then at one moment she had a heart attack [...] it was very unexpected"*

The participant's second sad memory was focused on the death of his mother-in-law. Since there was no life event for that specifically, it was coded as 'Death of a Friend' on the VEM and did thus have a valence score of 1.76. On the arousal dimension the participant rated the event when it happened as -. 59 and the memory when recalling it as 1. He thus seemed to feel far more aroused when the event happened and not aroused during the recall of the memory. The participant talked a lot about the good relationship he had with his mother-in-law and before he started to cry, he said:

*"I miss them tremendously, all three of them."*

This statement refers to not only the death of his mother-in-law, but also his mother and his partner. He brings all the sadness he feels over the death of these three women together and this brings him to tears. This might explain why the arousal during the recall was much more positive; the memory of the death of his mother and his partner might in comparison be more emotional and might be related to the tears more than the actual memory of his mother in laws death.

In his third sad memory the participant talked about the death of his wife. The life event on the VEM is thus 'Death of a Partner' and has a score of 1.17. The arousal was rated as - .85 when the event took place and as - .64 when recalling the memory. The intensity of the negative feeling was thus still high. The participant seemed emotional during the whole recall of this memory and he started to cry when he said:

*"Why, why did it have to happen to her [...]. I always say it would have been better if it had been me"*

This was a strong statement and shows that the participant was still not accepting the turn of events. He still seemed to be asking himself the question of how it could happen and had the feeling that life is not fair.

All three memories were codded with the underlying factors '*Powerlessness*', '*Non-Acceptance*', *'Sadness/Disappointment'* and *'Situation was not Resolved*', since the feeling and the perception of the different losses seem to be similar for the participant, only to a different degree. '*Non-Acceptance*' and '*Powerlessness'* seem to play the main role when it comes to the third memory, as one can see at the according quote. He says that he wished he would have died instead of his wife. This quote says that he would do everything in his power to change what happened, but there is nothing he can do. When he talks about the deaths of all three of them during the second memory the sadness ('*Sadness/Disappointment'*) about all three deaths is shown and shows that the situation and the feelings regarding those deaths are still very intense and not resolved ('*Situation was not Resolved'*). The second memory was also coded with '*Seeing the Positive Things*' since the participant did realize that it might have been better for his mother-in-law to die when she did without prolonging her suffering.

***Participant 14***

Participant 14 mainly talked about the relationship with her late husband in her sad memories and how his illness changed their relationship. In her first sad memory she talks about how he was admitted to a care home and how after a while she had the feeling that the two of them were not really married anymore. She then decided to take off her ring even though it was difficult for her. The life event that fits best with the memory is 'Own Divorce' and the valence was thus scored as 2.0. The participant rated the arousal when it happened as - .44 and the arousal during the recall of the memory as .57 (see Table 7). When looking at the participants story it is easy to see that her divorce story does differ from the usual. She did not talk about a divorce because the love went away or the partners could not stand each other anymore, but a

divorce that stemmed from an illness of her husband. It seemed as if she did not enter divorce because she did not want to be with her husband anymore, but because she had the feeling that the relationship was already lost due to his illness. This can also be seen in the statement:

*"At a certain moment I just didn't see us as married anymore [...] you just feel so powerless"*

The participant also said that the divorce made it easier for her to lower her expectations and handle the situation better. Still, she said that she felt powerless, maybe because she expected the things to turn out differently than they did. This is why this memory was coded with the underlying factors '*Powerlessness*', '*Sadness/Disappointment*', '*Non-Acceptance*' and '*Situation was not Resolved'*. She seemed to still love her husband and would have stayed with him if everything had gone differently but felt that it was the right thing to go through with the divorce. Moreover, during the recall she still seemed to struggle with the disappointment about the situation and with accepting how her marriage ended. The situation thus did not turn out positive in the end and she did not feel as if it was resolved.

Her second memory was focusing on the relationship to her husband and how it changed during the course of his illness as well. Within this memory she talked about how difficult it was for her during the time her husband was in the hospital. She rated the arousal during the event as -.16 and the arousal during the recall as .87. The arousal during the intensity of the negative feeling during the recall was thus much lower than when the event happened. This event was rated as '*Own Divorce*' as well, since even though the illness did play a major role within the memory, the underlying topic still seemed to be the divorce of her and her husband.

The participant described that when her husband was laying in the hospital, she wanted to lay in bed with him, just to be close to him, but the staff did not allow that. Here again she seemed to feel powerless ('*Powerlessness*'), because she did have the feeling that the staff did not understand the situation and because she did not act against the will of the employees. This also seemed to make her feel disappointed ('*Sadness/ Disappointment'*), which can be seen within the statement:

*"But it would have been the most beautiful thing I could have done. But they did not allow it, they could not even tell me why. I did not fight it either. Too bad"*

Another factor that seemed to play a role within this memory is '*Non-Acceptance*' because she still thinks that the employees did react wrongly, and she seemed to still struggle with the fact that she just accepted the employees decision and did not do anything against it.

***Participant 18***

Participant 18 did cry during her first sad memory. In this memory she talked about the psychological issues of her daughter. She described the whole situation and the development until today Psychological Problems' very detailed. The life event of the VEM that fits best with her description is 'and was thus rated

with a valence score of 3.0. The participant reported an arousal of -.55 when the event took place and an arousal of -.25 when she recalled the memory (see Table 7). During the whole description of the development and the current situation the participant did not cry. She just started to cry when she said:

*"She said: I will never be beautiful again. I found that so terrible. Not because you must be beautiful, but you want to be an attractive woman"*

Here she talks about her daughter not feeling beautiful and the fear of never being beautiful again. It seemed as if this was a statement that really touched her. One possible explanation for that might be that this statement was focusing more on the future and the loss of hope that it would get better. She seemed to feel compassion for her daughter, but also seemed to be personally hurt when thinking about her daughter as an unattractive woman. The past did not seem to make her cry, but the negative outlook into the future well.

Regarding the underlying factors this memory was coded with '*Powerlessness*', '*Compassion*', '*Non-Acceptance'*, '*Situation was not Resolved*' and '*Sadness/Disappointment'.* For the participant it seems to be difficult to accept the fact that her daughter will "never be beautiful" again and that she is not able to lead the life she wants for her. Moreover, as mentioned before, the situation is not resolved since the daughter does not feel better and there is no possibility to look into a brighter future.

***Participant 21***

During the recall of the second sad memory participant 21 talked about the sudden death of her late husband. This memory is the only one of the crying inducing memories in which powerlessness did not play a major role. The participant cried at two points of the memory, the first time she cried was when she talked about her family coming to support her after the death of her husband, the second time when remembering the funeral and how one of her husband's colleagues was crying. Overall, the event was very emotional for her, what can also be seen at the arousal score of -1 when the event happened, but it seemed as if she found a way to deal with the experience and did not describe a feeling of powerlessness, which also reflects in the arousal score of 1 during the recall of the memory. The main underlying factors for crying within this memory were found to be '*Sadness/Disappointment*' and '*Compassion*'. Compassion was found in the moment the participant started to cry, since she said:

*"We were driving away from the church and there stood a colleague of my husband, a really big and tall guy, he stood there, sobbing really badly"*

The memory was also coded with the underlying factors '*Dealing Actively with the Situation*' and '*Acceptance*'. The participant only started to cry when thinking about the fact that a colleague of her husband was crying at the funeral, while she herself dealt with the situation actively be organizing everything and standing up against critics. Of course, she was sad as well, but during the recall of the

memory she shows that she is accepting what happened and does not question why her husband had to die.

Overall, there are some interesting things to notice when it comes to the crying inducing memories. One interesting fact is that the two times the life event ‘Psychological Problems’ was found within the data, the participants started to cry, even though the usual valence score is in comparison relatively high (3.0). The valence of those two memories was subsequently reduced with the subjectivity score of -1. Both of those memories were revolving around the psychological problems of the participants children, not around the psychological problems of the participants themselves. Which suggests that the suffering of their own children was emotionally loaded and a major burden for them. Furthermore, those memories show that powerlessness did not only lead to shedding emotional tears when the feeling was directed toward one's own experience, but that it can also be elicited if an individual does not feel able to help others.
Moreover, half of the life events that were found within the memories that induced crying revolved around the death of a close one.

Another thing that was found was that the combination of underlying factors might play a role in how the participant reacts to recalling a memory. For example, two of the eight instances of crying were coded with ‘*Compassion’* and ‘*Powerlessness’*, while the five other instances of crying were coded with the codes ‘*Powerlessness’, ‘Non-Acceptance’ and ‘Sadness’/’Disappointment’.* It thus seems as if this combination of underlying factors together heightened the probability of emotional crying. Those underlying factors combined with a relatively low valence might be the best predictor of emotional crying during the recall of autobiographical memories yet. Further, a low valence and the priorly mentioned combination of underlying factors seemed to occur together relatively often and might thus be interrelated.

# Discussion

## Main Findings

As described within the introduction and the theoretical background of the thesis at hand, emotional crying within older adults is barely studied until now. This research's aim was to get a clearer picture of the qualities of sad autobiographical memories and how they are related to crying in older adults by answering two research questions. The first being: '*How can sad autobiographical memories be described with regard to the qualities valence, arousal and underlying factors?'*. The results suggest that sad memories in general are characterized by a low valence and a highly negative arousal when the event happened. The arousal during recall was slightly more positive than the arousal of when the event happened. The life events of the VEM that were discussed in the sad memories most often were 'Death of a Parent', 'Family Quarrels', 'Death of a Partner' and 'Serious Disease'. What stands out is the fact that three out of those four life events are related to the family, thus social contacts that are closest to the participant. When looking at the frequency of the codes regarding the qualitative underlying factors a distinction between the three code groups *Outcome of the Event, General Feelings* and *Feeling of Influence* must be made. The codes that were most prominent within the code group *Outcome of the Event* were '*Seeing the Positive Things*' and '*Situation was not Resolved*'. Within the code group *General Feelings* '*Sadness/Disappointment*' was the most prevalent code. The codes that were most common within the third code group, *Feeling of Influence*, were '*Powerlessness*' and '*Acceptance*'.

The second research question laid the focus more upon the crying inducing memories specifically: '*How are the qualities valence, emotional arousal and other underlying factors related to emotional crying during the recall of sad autobiographical memories?'.* Crying did seem to occur when life events had a lower valence and concerned social losses. There did not seem to be a clear relation with arousal. Regarding the underlying factors crying memories seemed to be related to situations that were not resolved or if the participant could not accept the situation. Moreover, feelings of compassion and powerlessness often played a role within memories that induced crying. However, none of these aspects was enough to induce crying. A combination of non-resolved and non-accepted situations in which people felt sad and powerless appeared to play a role.

### *Interpretation of Findings Regarding Sad Autobiographical Memories*

As mentioned above, the sad autobiographical memories were generally often characterized by a low valence and the life events often revolved around the loss or feared loss of social contacts. This can be related to findings in prior research that show that the prevalence of loneliness is high in older adults (National Academies of Sciences, Engineering, and Medicine, 2020). It was also found that losing interpersonal relations often leads to the fear of separation and the loss of other social contacts especially in older adults (Khademi & Rashedi, 2015). This could possibly be an explanation for why those topics also played a major role within the recall of the sad autobiographical memories. If older adults do fear being

lonely, or even worse do feel lonely at the moment of the memory recall, memories where they did lose social contacts come to mind easier and more intensely. This also is supported by the finding that memories that are congruent to one's current mood are easier and more vividly recalled than memories that do not fit with the current emotional state (Loeffler, Myrtek, & Peper, 2013).

Regarding the emotional arousal during the event and during the recall of the memory, the findings were not as clear. The reported arousal when the event happened was slightly more negative than during the recall of the memory. An explanation for the fact that the participants felt rather calm during the recall is that the intensity of the arousal was found to decrease over time (Ritchie et al., 2006). The temporal distance to the events could subsequently lead to the low arousal during the recall. Another explanation for the decrease in intensity of the negative feeling could be given by the findings of Ikier and Duman (2020). They found that older adults do evaluate negative memories more positive, which can be explained with the positivity effect. It is thus possible that participants do remember how bad they felt back when the event happened (*Arousal when the Event Happened*), but they do evaluate the negativity of the events less intensely now (*Arousal during Recall*). This finding thus is in line with prior findings regarding the positivity effect (Carstensen et al., 2011).

The finding that the codes '*Seeing the Positive Things*' and '*Acceptance*' were found especially often within the underlying factors might be explained by the positivity effect as well. Even though the valence was relatively low, as described priorly, the participants often talked about it in an accepting way and highlighted the positive aspects of what happened. This is especially noticeable since another code that often occurred was '*Situation was Not Resolved*'. This shows that even if the participants had reasons to evaluate the situation negatively, because it did not turn out positive, they still concentrated on the positive things.

All in all, the findings regarding the sad autobiographical memories in general are thus in line with prior findings regarding the emotional life of older adults. Even though they talked about life events with a negative valence, they evaluated the situation relatively positively and were rather calm during the recall which supports the positivity effect (Carstensen et al., 2003).

### *Interpretation of the Findings Regarding Crying Inducing Memories*

When looking at the difference between sad memories that did induce crying and memories that did not induce crying, it was found that the valence of the memories that did induce crying was even lower than the valence of the memories that did not induce crying. This result suggests that crying in younger and older adults is similarly affected by the quality valence since it was found to influence facial expressions in younger adults as well. As described within the introduction, lower valence was linked to the activation of the corrugator muscle, which is activated when frowning or crying (Lang, Bradley, & Cuthbert, 1990). The low valence within the crying memories does support this finding for older adults as well.

The findings with regard to the emotional arousal within the crying memories were as unclear as within the sad autobiographical memories in general. What was found, was that the negative feelings during

the recall were rated less intense within the crying memories than within the non-crying memories. A possible explanation for this unexpected finding is that crying might have helped to release some of the negative arousal, as it is hypothesized within the intrapersonal theory of emotional crying (e.g., Simons et al., 2013). As mentioned within the introduction, this theory states that crying acts as a sort of catharsis and helps to release tension which in turn helps the subject feel better. Sadly, the data is not sufficient to give a clear answer to point out that the intrapersonal theory in fact holds true, so more research would be needed.

Regarding the underlying factors, it was found that the main difference between crying memories and non-crying memories was that crying memories were mostly not resolved, while almost all the non-crying memories were. Furthermore, the codes '*Powerlessness*' and '*Non-Acceptance*' seemed to play a more important role in crying inducing memories than in non-crying memories. This result is thus in line with the findings of Vingerhoets (2013) who supposed that crying is often a result of a feeling of powerlessness and is then used as the only remaining coping mechanism to deal with an overwhelming situation. It thus seems as if this antecedent of crying is true for older adults. Interesting about this finding is that the feeling of powerlessness seems to be overwhelming even if the individual does not experience the event at the current moment but is just recalling it. Even remembering the feeling of powerlessness and the inability to cope with a situation does thus seem to suffice to elicit emotional crying.

Within the table by Vingerhoets (2013) (see Table 1) he also described sympathy and the loss of social bonds as important antecedents for crying in older adults. This was supported by the finding that compassion played a major role within crying inducing memories. Especially, when talking about feeling compassion towards their own children participants started to cry. Vingerhoets (2013) found that the proneness of crying due to feeling for somebody else does increase with older age. Research also found that even though the children are grown up, parents often still feel responsible for their life and especially their problems (Fingerman, Cheng, Birditt, & Zarit, 2012), which might even increase sympathy.

Furthermore, the analysis showed that a combination of the feelings of powerlessness, non-acceptance, sadness and the fact that the situation was not resolved often seemed to play a role within the crying inducing memories. This corresponds with the findings of another study by Vingerhoets (1997) that described that crying often is the result of not one distinct feeling, but a combination of different feelings accompanied by a feeling of powerlessness.

Overall, low valence and a combination of underlying factors thus seem to be related to emotional crying in older adults. The connection to arousal is not as clear, even though the results do indicate an influence of crying on arousal. The memories that induced crying were very diverse and there is more research needed to pinpoint which qualities are related to crying.

**Strengths & Limitations**

The study's main limitation is the small sample size. While the database consisted of 19 participants and overall, 61 sad memories, the sample of crying participants consisted of only five participants and 8 memories. This did have an effect on the data analyses. The small data amount made it impossible to analyze the data in a quantitative way. With a greater data set correlation analyses would have been possible, but due to the skewed distribution it was not. Those analyses would have been a great addition to the qualitative analysis of the underlying factors and would have entailed the possibility to make the results more quantifiable.

Another limitation is the coding of the underlying factors. Since scientific information regarding different factors that might influence crying is missing, the coding was mainly achieved by using a bottom-up approach based on the interview data that were available. Moreover, the antecedents found by Vingerhoets (2013) were used in some codes, but the other underlying factors were missing scientifically supported background. With more scientific background the codes would have been clearer and might have led to stronger results.

A strength of the research, on the other hand, is that it takes a step into an almost unstudied terrain. The research does provide an overview of how much we still do not know about the topic of emotional crying in older age. Moreover, the qualitative design considers not only the factors that can be rated quantitatively, but also considers feelings and factors which cannot be quantifiable. It does thus take a close look at the complex interrelations when it comes to what makes humans cry. Especially looking at the underlying factors such as ‘Powerlessness’ considers the highly subjective appraisal of events and memories. For us, this also is of importance when it comes to the topic of emotional crying.

**Future Research & Practical Implications**

While the study at hand indicates that life events with a low valence and underlying factors such as powerlessness, non-acceptance and situations that were not resolved are related to crying, more research would help to get a clearer picture of the complex topic of emotional crying.

To establish a clearer relationship, future research should first and foremost include a bigger sample size. A greater sample size with more crying participants would also allow for quantitative analyses and make the results quantifiable. For this, it would also make sense, to provide a research environment that makes it more likely for the participants to cry. One possible design would be to have two participants who know each other and feel close to each other in a room and ask them to talk about the memories they are presented with within their life story books. That would possibly make the situation more personal and might lead to more crying. This could be compared to a control group which is asked to recall autobiographical memories within the same setting as was used within the study at hand. The expectation that the first group would be more likely to cry is based on the findings by Vingerhoets (2013) and Fox (2004). They found that individuals are more prone to crying when with close social contacts or family members. Using this research design would thus entail the possibility of finding answers to the question

whether the intrapersonal or the interpersonal theory is most fitting when it comes to emotional crying. This could be done by instructing the neutral researcher in the control group to not sooth the participant when crying but letting the two participants in the first condition sooth each other when crying. Afterwards the participants would be asked to rate how they feel. While the current research and the finding that the intensity of negative feelings seemed to be decreased by emotional crying supports the intrapersonal theory which regards crying itself as cathartic, most researchers found that the interpersonal theory seems to describe the functions of crying more adequately (e.g., Cornelius, 1997; Gračanin et al., 2015). They thus found that the care that is received through others after or during crying does alleviate the mood. To test which of those theories holds true the participants would be asked to rate their mood at different points in time (e.g., before, directly after, 30 minutes and 90 minutes after the recall).

Another interesting study design would be to set up a research including a control group consisting of younger adults. This would provide researchers with the possibility to compare the emotional reaction and expression between groups and thus show clearer results regarding the question how the emotional expression and especially emotional crying changes with age. This study could also focus on the feeling of powerlessness, the loss or feared loss of social bond and sympathy for others to compare if it has the same influence on both groups.

Furthermore, the fact that the chosen factors do not seem to have the power to fully explain emotional crying during the recall of autobiographical memories, suggests that there could be some other factors that were not included in the study that are related to the emotional reaction of the older adults. Subsequently, future research should also look at other qualities of autobiographical memories and emotion that might influence crying. It could for example be looked at the specificity of autobiographical memories and how they could possibly influence emotional crying. Studies found that the specificity of autobiographical memories does influence how emotional the memory is, with high specificity being related to higher emotional affect (e.g., Raes, Hermans, de Decker, Eelen, & Williams, 2003; Williams, 1996). But until now it was not researched if the same relationship can be found with regard to older adults and crying. It would be expected that a higher specificity might be related to a higher probability of emotional crying. Another factor that could be researched would be personality traits. Since not one of the chosen factors was a clear indicator for emotional crying, the difference might be a difference in the participants personal reaction to and the handling of emotional memories and emotions in general. Since only 5 out of 23 participants cried, personality traits might be an explanation. Earlier research by Peter, Vingerhoets and Van Heck (2001) which used the Five-Factor Personality Inventory (Hendriks, Hofstee, & Raad, 1999), found that emotional stability was negatively correlated with emotional crying, but there were no other studies found that focused on the relationship between personality and emotional crying. To include those personality traits, follow-up studies should include a personality questionnaire, such as the Five-Factor Personality Inventory (Hendriks, Hofstee, & Raad, 1999). A similar result as in the study by Peter et al. (2001) would be expected.

As the crying inducing memories were found to be characterized by a combination of the underlying factors '*Powerlessness*', '*Non-Acceptance*', '*Situation was not Resolved*' and '*Sadness/Disappointment*', the possibility for interventions aimed at the well-being of older adults might also diminish crying in older adults. A possible intervention to influence and enhance those factors would for example be an acceptance-based therapy form, such as mindfulness training. Such an intervention, especially customized for older adults, based on positive psychology would aim at accepting the things the participant cannot change, would by that change their emotional reaction and in turn hopefully also improve their mental wellbeing and quality of life.

## Conclusion

As mentioned within the introduction, emotional crying in general seems to be a complex topic that is not easy to pinpoint. Earlier research tried to get a clear picture, but were not able to, since a majority of different factors do seem to play a role. Especially when and why older adults cry is barely discussed and complicated to research, since the probability of crying is lower in older adults due to the positivity effect. The aim of this study was to make the first steps to start a discussion about this specific topic and this it did. The results suggest that the antecedents of emotional crying of older adults are very similar to the antecedents of crying in younger adults and do support earlier research (e.g., by Vingerhoets, 2013). Specifically, it was found that specific life events of the VEM seemed to be connected to autobiographical memories that did induce crying. Those life events mostly revolved around the loss or the feared loss of a social connection. Moreover, a combination of underlying factors including '*Powerlessness*' were found to be related to emotional crying. A combination of a low valence and those underlying factors thus seem to lead to emotional crying. This opens up the opportunity for new treatment options to enhance the well-being and life satisfaction of older adults. Overall, the findings do support prior research by Vingerhoets (2013) who proposed that crying is related to different external and internal influences and there does not seem to be one factor that can safely predict emotional crying. It is recommended to start focusing research even more on the emotional experience and expression of older adults to better understand and react to what they need when it comes to society in general and especially their emotional needs.

References

Adolphs, R., Cahill, L., Schul, R., & Babinsky, R. (1997). Impaired declarative memory for emotional material following bilateral amygdala damage in humans. *Learning and Memory*, *4*, 291–300.

Berntsen, D., & Rubin, D.C. (2004). Cultural life scripts structure recall from autobiographical memory. *Memory and Cognition*, *32*(3), 427-442.

Berry, B., Buck, P., Mills, M., & Stipe, M. (1992). Everybody Hurts. [Recorded by R.E.M.]. On *Automatic for the People*. Los Angeles, California: Warner Bros.

Blanchard-Fields, F. (2007). Everyday problem solving and emotion: an adult developmental perspective. *Curr. Dir. Psychol. Sci., 16*(1), 26–31. doi: 10.1111/j.1467-8721.2007.00469.x

Bowlby, J. (1969). Attachment and loss (Vol. 1). New York: Basic Books.

Bowlby, J. (1980). Attachment and loss (Vol. 3): Loss, sadness, and depression. New York: Basic Books.

Breuer, J., & Freud, S. (1974). Studies on hysteria. Harmondsworth: Penguin Books (originally published in 1895).

Brierley, B., Medford, N., Shaw, P., & David, A. S. (2004). Emotional memory and perception in tempo-ral lobectomy patients with amygdala damage. *Journal of Neurology, Neurosurgery and Psychiatry*, *75*, 593–599.

Briesemeier, B.B., Kuchinke, L., & Jacobs, A.M. (2012). Emotional valence. *Sage Open*, https://doi.org/10.1177/2158244012466558

Brown, R., & Kulik, J. (1977). Flashbulb memories. *Cognition*, *5*, 73–99.

Carstensen, L.L., Fung, H.H. & Charles, S.T. (2003). Socioemotional Selectivity Theory and the Regulation of Emotion in the Second Half of Life. *Motivation and Emotion, 27*, 103–123. doi: https://doi-org.ezproxy2.utwente.nl/10.1023/A:1024569803230

Carstensen, L. L., Turan, B., Scheibe, S., Ram, N., Ersner-Hershfield, H., Samanez-Larkin, G., et al. (2011). Emotional experience improves with age: evidence based on over 10 years of experience sampling. *Psychol. Aging*, *26*, 21–33. doi: 10.1037/a0021285

Charles, S. T., Mather, M., & Carstensen, L. L. (2003). Aging and emotional memory: The forgettable nature of negative images for older adults. *Journal of Experimental Psychology: General*, *132*(2), 310–324. https://doi-org.ezproxy2.utwente.nl/10.1037/0096-3445.132.2.310

Cornelius, R. R. (1997). Toward a new understanding of weeping and catharsis? In A. J. J. M. Vingerhoets, F. J. van Bussel & A. J. W. Boelhouwer (Eds.), *The (non)expression of emotions in health and disease* (pp. 303–321). Tilburg, The Netherlands: Tilburg University Press.

Darwin, C. (1998). The Expression of Emotions in Man and Animals, ed. P. Ekman. London: HarperCollins. (Orig. published 1872.).

Fingerman, K. L., Cheng, Y.P., Birditt, K. S., & Zarit, S.H. (2012). Only as happy as the least happy child: Multiple grown children's problems and successes and middle-aged parents' well-being. *Journals of Gerontology: Psychological Sciences*, *68*, 184–193.

Fox, K. (2004). The Kleenex © for Men Crying Game Report: A study of men and crying. Oxford, UK: Social Issues Research Center.

Goldberg, L.R., (1992). The Development of Markers for the Big-Five Factor Structure. *Psychol. Assess.*, *4*(1), 26-42.

Gračanin, A., Bylsma, L.M., & Vingerhoets, A. J. J. M. (2018). Why only Human shed Emotional Tears. Evolutionary and Cultural Perspectives. *Human Nature, 29*, 104–133. https://doi-org.ezproxy2.utwente.nl/10.1007/s12110-018-9312-8

Gračanin, A., Vingerhoets, A. J. J. M., Kardum, I., Zupčić, M., Šantek, M., & Šimić, M. (2015). Why crying does and sometimes does not seem to alleviate mood: a quasi-experimental study. *Motivation and Emotion*, *39*(6), 953–960. https://doi.org/10.1007/s11031-015-9507-9

Hasson, O. (2009). Emotional tears as biological signals. Evolutionary Psychology, *7*, 363–370.

Hendriks, J., Hofstee, W., & Raad, B. (1999). The Five-Factor Personality Inventory. *Personality and Individual Differences*, *27*, 307-325. Doi: 10.1016/S0191-8869(98)00245-1.

Hendriks, M., & Vingerhoets, A., (2006). Social messages of crying faces: Their Influence on anticipated person perception, emotional and behavioral responses. *Cognition and Emotion*, *20*(6), 878-886.

Holland, A.C., & Kensinger, E. A., (2010). Emotion and autobiographical memory *Physics of Life Reviews*, *7*(1), 88-131.

Ikier, S., & Duman, Ç. (2020). The happiest and the saddest autobiographical memories and aging. *Curr. Psychol.,* Doi: https://doi-org.ezproxy2.utwente.nl/10.1007/s12144-020-00993-w

Jung, C. G. (1933). *Modern man in search of a soul*. New York: Harcourt, Brace.

Kensinger, E. A., Brierley, B., Medford, N., Growdon, J.H., & Corkin, S. (2002). The effect of normal aging and Alzheimer's disease on emotional memory. *Emotion, 2*, 118–134.

Lang, P. J. (1980). Behavioral treatment and bio-behavioral assessment: computer applications. In J. B. Sidowski, J. H. Johnson, & T. A. Williams (I!&.), *Technology in mental health care delivery systems,* (pp. 119-137). Norwood, NJ: Ablex.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97*, 377-398.

Loeffler, S.N., Myrtek, M., & Peper, M. (2013). Mood-congruent memory in daily life: Evidence from interactive ambulatory monitoring. *Biological Psychology*, *93*(2), 308-315.

Luchetti, M., & Sutin, A.R. (2018). Age differences in autobiographical memory across the adult lifespan: older adults report stronger phenomenology. *Memory*, *26*(1), 117–130.

MacPherson, S. E., Phillips, L. H., & Della Sala, S. (2002). Age, executive function, and social decision making: A dorsolateral prefrontal theory of cognitive aging. *Psychology and Aging*, *17*, 598–609.

McGaugh, J. L. (2018). Emotional arousal regulation of memory consolidation. *Current Opinion in Behavioral Sciences*, *19*, 55–60. https://doi.org/10.1016/j.cobeha.2017.10.003

Meeter, M., & Hendriks, M. (2012). Geheugen. In R. Kessels, P. Eling, R. Ponds, J. Spikman, & M. Van Zandvoort (Eds.), *Klinische neuropsychologie*, 197-218. Amsterdam: Boom.

Moreno, C., Borod, J. C., Welkowitz, J., & Alpert, M. (1993). The perception of facial emotion across the adult lifespan. *Developmental Neuropsychology, 9*, 305–314.

Murube, J. (2009). Basal, reflex, and psycho-emotional tears. *The Ocular Surface*., *7*(2), 60-66.

National Academies of Sciences, Engineering, and Medicine. (2020). *Social Isolation and Loneliness in Older Adults: Opportunities for the Health Care System*. Washington, DC: The National Academies Press. https://doi.org/10.17226/25663.

Nazareth, D.S., Jansen, M.P., Truong, K.P., Westerhof, G. J., & Heylen, D. (2019). MEMOA: Introducing the Multi-Modal Emotional Memories of Older Adults database. *International Conference on Affective Computing and Intelligent Interaction (ACII).*

Newman, J. D. (2007). Neural circuits underlying crying and cry responding in mammals. *Behavioural Brain Research*, *182*, 155–165.

Ostwald, P. (1972). The sounds of infancy. *Developmental Medicine and Child Neurology*, *14*, 350–361.

Patel, V. (1993). Crying Behavior and Psychiatric Disorder in Adults: A Review. *Compr. Psych.*, *34*, 206-211.

Raes, F., Hermans, D., de Decker, A., Eelen, P., & Williams, J. M. G. (2003). Autobiographical memory specificity and affect regulation: An experimental approach. *Emotion, 3*(2), 201–206. https://doi-org.ezproxy2.utwente.nl/10.1037/1528-3542.3.2.201

Riem, M. M. E., van Ijzendoorn, M. H., De Carli, P., Vingerhoets, A. J. J. M., & Bakermans-Kranenburg, M.J. (2017). Behavioral and neural responses to infant and adult tears: The impact of maternal love withdrawal. *Emotion*, *17*(6), 1021–1029.

Ritchie, T. D., Skowronski, J. J., Wood, S. E., Walker, W. R., Vogl, R. J., & Gibbons, J. A. (2006). Event self-importance, event rehearsal, and the fading affect bias in autobiographical memory. *Self and Identity, 5*(2), 172-195.

Russell, J. A. (1980). A circumplex model of affect. *J. Pers. Soc. Psychol., 39*, 1161–1178. doi: 10.1037/h0077714.

Rottenberg, J., Bylsma, L. M., & Vingerhoets, A. J. J. M. (2008). Is crying beneficial? *Current Directions in Psychological Science*, *17*, 400–404.

Simons, G., Bruder, M., van der Lowe, I., & Parkinson, B. (2013). Why try (not) to cry: Intra- and inter-personal motives for crying regulation. *Frontiers in Psychology*, *3*, 1–9.

Sloetjes, H., & Wittenburg, P. (2008). Annotation by category - ELAN and ISO DCR. In: Proceedings of the 6th International Conference on Language Resources and Evaluation (LREC 2008).

Sung, A. D., Collins, M. E., Smith, A. K., Sanders, A. M., Quinn, M. A., Block, S. D., & Arnold, R. M. (2009). Crying: Experiences and attitudes of third-year medical students and interns. *Teaching and Learning in Medicine*, *21*, 180–187.

Talarico, J. M., LaBar, K. S., & Rubin, D. C. (2004). Emotional intensity predicts autobiographical memory Experience. *Memory and Cognition*, *32*, 1118–1132.

Tambini, A., Rimmele, U., Phelps, E., & Davachi, L. (2017). Emotional brain states carry over and enhance future memory formation. *Nat Neurosci*., *20***,** 271–278. https://doi.org/10.1038/nn.4468

Thissen, A. J. a. M., van Bergen, F., de Jonghe, J. F. M., Kessels, R. P. C., & Dautzenberg, P. L. J., (2010). Applicability and validity of the Dutch version of the Montreal Cognitive Assessment (moCA-d) in diagnosing MCI, *Gerontol. Geriatr., 41*(6), 231-240.

Trijsburg, R.W., Passchier, J., Duivenvoorden, H., & Bagby, R.M., (1997). The Toronto Alexithymia Scale (Dutch version). Rotterdam: Department of Medical Psychology and Psychotherapy, Erasmus University.

Tournier, E., Truong, K.P., Nazareth, D.S., & Jansen, E. (2019). Valence of Emotional Memories: A study of lexical and acoustical features in older adult affective speech production. Radboud University of Nijmegen.

Van der Veen, F. M., Jorritsma, J., Krijger, C., & Vingerhoets, A. J. J. M. (2012). Paroxetine reduces crying in young women watching emotional movies. Psychopharmacology, *220*, 303–308.

Vingerhoets, A. J. J. M., & Bylsma, L.M. (2016). The Riddle of Emotional Crying: A Challenge for Emotion Researchers. *Emotion Review*, *8*(3), 207-217.

Vingerhoets, A. J. J. M., & Scheirs, J. (2000). Sex differences in crying: Empirical findings and possible explanations. In A. H. Fischer (Ed.), *Gender and emotion: Social psychological perspectives*, 143–165. Cambridge, UK: Cambridge University Press.

Vingerhoets, A. J. J. M., & van Assen, M. A. L. (2009). Love and tears. Poster presented at the Biannual Meeting of the International Society for Research on Emotion (ISRE), Leuven, Belgium.

Vingerhoets, A. J. J. M. (2013). *Why only humans weep. Unraveling the mysteries of tears.* Oxford, UK: Oxford University Press.

Vingerhoets, A. J. J. M., van de Ven, N., & van der Velden, Y. (2015). The social messages of emotional tears. Manuscript under review.

Vingerhoets, A. J. J. M., van Geleuken, A. J. M. L., van Tilburg, M. A. L., & van Heck, G. L. (1997). The psychological context of crying episodes: Toward a model of adult crying. In A. J. J. M. Vingerhoets, F. J. van Bussel & A. J. W. Boelhouwer (Eds.), The (non)expression of emotions in health and disease (pp. 323–336). Tilburg, The Netherlands: Tilburg University Press.

White, R. (2002), Memory for events after twenty years. *Appl. Cognit. Psychol., 16*, 603-612. https://doi-org.ezproxy2.utwente.nl/10.1002/acp.819

Wright, C. I., Wedig, M. M., Williams, D., Rauch, S. L., & Albert, M. S. (2006). Novel fearful faces activate the amygdala in healthy young and elderly adults. *Neurobiology of Aging, 27*(2), 361–374. doi: 10.1016/j.neurobiolaging.2005.01.014

Wundt, W. (1905). *Grundzüge der physiologischen Psychologie*. Leipzig: Engelmann.

# APPENDIX

## APPENDIX A: Valence of Emotional Memories scale (VEM)

| Life Events | Specifics | Valence |
|---|---|---|
| Death | Child | 1.14 |
| | Grandchild | 1.14 |
| | Partner | 1.17 |
| | Sibling | 1.33 |
| | Parent | 1.40 |
| | Grandparent | 1.60 |
| | Friend | 1.76 |
| Neglected by children | | 1.50 |
| War | | 1.56 |
| First rejection | | 1.74 |
| Serious disease | | 1.92 |
| Divorce | Own | 2.00 |
| | Parents | 2.08 |
| Career Failure | | 2.00 |
| Infidelity | | 2.12 |
| Financial Troubles | | 2.21 |
| In an accident | | 2.30 |
| Operation | | 2.40 |
| Family quarrels | | 2.45 |
| Caring for parents | | 2.75 |
| Psychological problems | | 3.00 |
| Empty nest | | 3.83 |
| Prepare for death | | 4.13 |
| Move | | 4.13 |
| Other child's milestones | | 4.20 |
| Puberty | | 4.68 |
| Military service | | 4.85 |
| Hobby | | 4.86 |
| Retirement | | 4.97 |
| Youth | | 5.00 |
| Leave home | | 5.22 |
| Begin school | | 5.53 |
| High school | | 5.55 |
| First sexual experience | | 5.64 |
| College | | 5.88 |
| Birth | Sibling | 5.40 |
| | Child | 6.34 |
| | Grandchild | 6.66 |
| Achievement | First job | 5.48 |
| | Career success | 5.94 |
| | Buying a house | 6.06 |
| | Driver's license | 6.24 |
| | Big achievement | 6.28 |
| | The 'right' job | 6.37 |
| | Graduation | 6.54 |
| Travelling | | 6.14 |
| Having friends | | 6.30 |
| Marriage | Own | 6.33 |
| | Child | 6.47 |
| Falling in love | | 6.34 |
| Child's college graduation | | 6.66 |
| Family holidays | | 6.67 |
| Celebrations | | 6.75 |

*Notes.* Left: specifics are arranged based on a common factor. Right: life events are sorted from low to high valence score (Tournier et al., 2019).

**APPENDIX B: Underlying Factors in Non-Crying Memories**

| | Memory | Code 1 | Code 2 | Code 3 | Code 4 | Code 5 | Code 6 |
|---|---|---|---|---|---|---|---|
| **P1** | **SM1** | Compassion | Acceptance | | | | |
| | **SM2** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Anger | Situation was not resolved | Seeing the Positive Things |
| | **SM3** | Powerlessness | Non-Acceptance | Sadness/Disappointment | | | |
| **P2** | **SM1** | Powerlessness | Situation was resolved | | | | |
| | **SM2** | Powerlessness | Fear | | | | |
| | **SM3** | Powerlessness | Sadness/Disappointment | Acceptance | | | |
| **P3** | **SM1** | Powerlessness | Acceptance | Situation was not resolved | | | |
| | **SM2** | Compassion | Situation was not resolved | | | | |
| | **SM3** | Powerlessness | Acceptance | Seeing the Positive Things | | | |
| **P4** | **SM1** | Anger | Sadness/Disappointment | Dealing Actively w the Situation | Powerlessness | | |
| | **SM2** | Sadness/Disappointment | Acceptance | Powerlessness | Passive Reaction | Seeing the Positive Things | |
| | **SM3** | Sadness/Disappointment | Dealing actively with the Situation | | | | |
| **P5** | **SM1** | Sadness/Disappointment | Compassion | Acceptance | | | |
| | **SM2** | Powerlessness | Sadness/Disappointment | Non-Acceptance | Dealing actively with the situation | Turned out good in the end | |
| **P6** | **SM1** | Powerlessness | Dealing actively with the Situation | Acceptance | | | |
| | **SM2** | Anger | Acceptance | Dealing Actively w the Situation | Powerlessness | Compassion | |
| | **SM3** | Sadness/Disappointment | Dealing actively with the Situation | Seeing the Positive Things | | | |
| **P7** | **SM1** | Acceptance | Seeing the Positive Things | Sadness/Disappointment | | | |
| | **SM2** | Acceptance | Seeing the Positive Things | Sadness/Disappointment | | | |
| | **SM3** | Sadness/Disappointment | Anger | Non-Acceptance | Powerlessness | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **P9** | **SM1** | Powerlessness | Sadness/Disappointment | Non-Acceptance | Passive Reaction | Anger | |
| | **SM2** | Situation was resolved | Turned out good in the end | Sadness/Disappointment | Acceptance | | |
| | **SM3** | Powerlessness | Sadness/Disappointment | Passive Reaction | Acceptance | | |
| **P10** | **SM1** | Sadness/Disappointment | Acceptance | Seeing the Positive Things | | | |
| | **SM2** | Sadness/Disappointment | Compassion | Acceptance | Dealing actively with the situation | Seeing the Positive Things | |
| | **SM3** | Sadness/Disappointment | Compassion | Anger | Acceptance | | |
| **P11** | **SM1** | Powerlessness | Sadness/Disappointment | Situation was not resolved | Dealing actively with the situation | | |
| | **SM2** | Non-Acceptance | Sadness/Disappointment | Compassion | | | |
| | **SM3** | Sadness/Disappointment | Passive Reaction | Dealing Actively w the Situation | Situation was resolved | | |
| **P12** | **SM1** | Anger | Compassion | Turned out good in the end | | | |
| | **SM2** | Sadness/Disappointment | Non-Acceptance | Seeing the Positive Things | | | |
| | **SM3** | Dealing actively with the situation | Sadness/Disappointment | Acceptance | | | |
| **P13** | **SM1** | Situation was not resolved | Powerlessness | Sadness/Disappointment | Dealing actively with the situation | | |
| | **SM2** | Anger | Sadness/Disappointment | Dealing Actively w the Situation | Turned out good in the end | | |
| | **SM3** | Dealing actively with the situation | Anger | Sadness/Disappointment | | | |
| **P14** | **SM3** | Powerlessness | Compassion | Situation was not resolved | | | |
| **P16** | **SM1** | Fear | Powerlessness | Compassion | | | |
| | **SM2** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Growth | Anger | |
| | **SM3** | Sadness/Disappointment | Seeing the Positive Things | | | | |
| **P17** | **SM1** | Sadness/Disappointment | Fear | Growth | | | |
| | **SM2** | Fear | Non-Acceptance | The Situation was resolved | Dealing actively with the situation | | |
| | **SM3** | Sadness/Disappointment | Acceptance | Seeing the Positive Things | | | |
| **P18** | **SM2** | Compassion | Sadness/Disappointment | Anger | Acceptance | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **P19** | **SM1** | Sadness/Disappointment | Turned out good in the end | | | | |
| | **SM2** | Sadness/Disappointment | Seeing the Positive Things | | | | |
| | **SM3** | Compassion | Acceptance | | | | |
| **P20** | **SM1** | Sadness/Disappointment | Compassion | Seeing the Positive Things | Acceptance | | |
| | **SM2** | Sadness/Disappointment | Compassion | Seeing the Positive Things | Dealing actively with the situation | Situation was resolved | |
| | **SM3** | Sadness/Disappointment | Compassion | Turned out good in the end | | | |
| **P21** | **SM1** | Sadness/Disappointment | Acceptance | Dealing Actively w the Situation | | | |
| | **SM3** | Sadness/Disappointment | Acceptance | Seeing the Positive Things | Compassion | | |
| **P22** | **SM1** | Sadness/Disappointment | Acceptance | Powerlessness | Growth | | |
| | **SM2** | Sadness/Disappointment | Turned out good in the end | Dealing actively with the situation | | | |
| | **SM3** | Powerlessness | Growth | | | | |
| **P23** | **SM1** | Sadness/Disappointment | Seeing the Positive Things | | | | |
| | **SM2** | Acceptance | Powerlessness | Compassion | | | |

## APPENDIX C: Underlying Factors in Crying Inducing Memories

| | Memory | Code 1 | Code 2 | Code 3 | Code 4 | Code 5 |
|---|---|---|---|---|---|---|
| **P5** | **SM3** | Powerlessness | Compassion | Sadness/Disappointment | Situation was not resolved | |
| **P8** | **SM1** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Compassion | Situation was not resolved |
| | **SM2** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Compassion | Seeing the Positive Things |
| | **SM3** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Compassion | Situation was not resolved |
| **P14** | **SM1** | Powerlessness | Non-Acceptance | Sadness/Disappointment | Situation was not resolved | |
| | **SM2** | Powerlessness | Sadness/Disappointment | Non-Acceptance | Passive Reaction | |
| **P18** | **SM1** | Powerlessness | Non-Acceptance | Compassion | Sadness/Disappointment | Situation was not resolved |
| **P21** | **SM2** | Acceptance | Sadness/Disappointment | Dealing actively w the situation | Compassion | |

**APPENDIX D: Model of Adult Crying (Vingerhoets, 2013)**