

I can hear it in your voice

**The relationship between characteristics of
autobiographical memories and emotion expression of
healthy older people**

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Abstract

Autobiographical memories play a significant role in daily life and function. Research found that they can provide a general positive mood, by regulating emotions, which gets especially important, in the last stage of life. When studying emotions, emotion expressions are often focused on. The goal of this study was to expand the current knowledge by answering the question, how the characteristics of autobiographical memories of older people are related to emotion expression regarding prosodic features and word usage. To answer this question, 11 participants were asked to retrieve and to discuss different memories. For that, an adapted version of the Autobiographical Memory Test was used. It was found that specific memories were told with a higher pitch and intensity, that vivid memories were told with a higher intensity, that valence differentiated in word usage and that memories that contained a perspective change included more sensorial words than memories from only one perspective. These findings can be used for future investigations regarding dementia but also regarding emotion recognition of technologies.

Dutch version of the abstract

Autobiografische herinneringen spelen een belangrijke rol in het dagelijks leven en functioneren. Uit onderzoek bleek dat ze een algemeen positieve stemming kunnen veroorzaken, door het reguleren van emoties. Dit is vooral belangrijk voor oudere mensen. Tijdens het bestuderen van emoties, worden emotie-uitdrukkingen vaak op de voorgrond geplaatst. Het doel van deze studie was de huidige kennis te vergroten, door de vraag te beantwoorden, hoe de kenmerken van autobiografische herinneringen van ouderen gerelateerd zijn aan emotie-expressie met betrekking tot prosodische kenmerken en woordgebruik. Om deze vraag te beantwoorden, werden 11 deelnemers gevraagd om verschillende herinneringen op te halen en te vertellen. Hiervoor werd een aangepaste versie van de Autobiographical Memory Test gebruikt. Het bleek dat specifieke herinneringen werden verteld met een hogere stem en intensiteit, dat levendige herinneringen werden verteld met een hogere intensiteit, dat valentie verschilde in woordgebruik en dat herinneringen die een perspectiefverandering bevatten, meer sensorische woorden behouden, dan herinneringen die slechts één perspectief bevatten. De resultaten kunnen worden gebruikt voor onderzoek met betrekking tot dementia maar ook met betrekking tot het herkennen van emoties door technologieën.

Introduction

The importance of autobiographical memories, emotions and age

The author Sheila Heti once said: ‘I remember going over proofs of this book – my first book – back in 2001, in a bar in Toronto called the ‘Victory Café’, and thinking sadly to myself, ‘This is a very good manuscript but not a very good book’. I don’t know what I meant by that, but I was pretty heartbroken and sure it was true.’ (BrainyQuote, n.d.). This quote is a good example of an autobiographical memory. Autobiographical memories are defined as memories of one's life. These can be memories of past experiences, encounters with other people or facts about oneself (Luchetti & Sutin, 2018; Xu et al., 2017). Since the mid-1980's, the study of autobiographical memories has become increasingly important within the different domains of psychology. It has been found that they play an important role in daily life and function, but also in legal and clinical settings (Wang, Aydin, & Klemfuss, 2015; Harris, Rasmussen, & Berntsen, 2014). According to research, autobiographical memories serve three functions (Bluck, Alea, Habermas, & Rubin, 2005; Bluck, 2003). The first one is the *directive* function. Here, memories of past experiences help solve present problems and help make new plans for the future (Pillemer, 2003; Bluck et al., 2005). The second is the *social* function. Relationships are built and maintained by communicating past experiences and events (Alea & Bluck, 2003; Bluck et al., 2005). The third is the *self*-function. Autobiographical memories contain information about who one was, who one is and who one could be as a continuous individual. It is suggested that they function as building blocks that people use to form a sense of identity and to develop a positive self-image (Conway, 2005; Bluck et al., 2005; Harris et al., 2014; Westerhof & Bohlmeijer, 2014; Luchetti & Sutin, 2018).

However autobiographical memories do not only affect daily life and function, but also mental health and well-being (Bluck & Alea, 2009; Xu et al., 2017). By sharing and remembering positive memories, positive emotions can be relived which enhances the well-being of people (Alea, & Bluck, 2007; Bluck & Alea, 2009). In general, positive memories are used to regulate emotions in order to provide a general positive mood (Bluck & Alea, 2009; Öner & Gülgöz, 2018). Negative memories on the other hand are associated with negative emotions and with mental health problems (O’Toole, Watson, Rosenberg, & Berntsen, 2016; Xu et al., 2017; Öner & Gülgöz, 2018)

Especially, in the last stage of life, remembering becomes important regarding the regulation of emotion, which is, next to maintaining a positive mood, also important in coming to terms with one’s own mortality (Carstensen, 2006; Westerhof, Bohlmeijer, &

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Webster, 2010; Mather, 2016; Westerhof, Alea, & Bluck, n.d.). Even if the processing of emotions still functions well in the later stages of life (Craig & Salthouse, 2011 as cited in Kremer & Uijl, 2016), there are, due to different changes in physiology and psychology, impacts on the perception, regulation and experience of emotions of older adults (Kremer & Uijl, 2016). According to Kremer and Uijl (2016) it is very important to focus on older people when studying emotions, because the number of older people (aged over 60) is growing and will continue to grow in the future. Needless to say, older people will be the clients of tomorrow (Kremer & Uijl, 2016).

When studying emotions, emotion expressions are often the focus (eg. Scheiner & Fischer, 2011; Laukka, 2004; Juslin & Scherer, 2008). By observing emotional expressions, one receives information about the emotional state of another person (Mozziconacci, 2002). Information can be obtained by examining prosodic features, word usage or facial expressions (e.g. Schryer, Ross, St. Jacques, Levine, & Fernandes, 2012; Juslin & Scherer, 2008; Roberson, Damjanovic, & Kikutani, 2010; Bisson, 2019). This study will only focus on prosodic features and word usage.

There are a lot of studies that focus on the relation between autobiographical memories and emotions of older people (e.g. St. Jacques & Levine, 2007; D'Argembeau, Comblain, & Van der Linden, 2003), but there are no found studies that explore the relationship between characteristics of autobiographical memories and emotion expression regarding prosodic features and word usage of older people. Because of the importance of emotions and autobiographical memories, the goal of this study is to expand the current knowledge by analysing this relationship. Therefore, previous research regarding characteristics of autobiographical memories and emotion expression in addition to age differences will be discussed first. Then, further information about this study will be given.

Characteristics of autobiographical memories and age differences

Autobiographical memories can be divided into semantic and episodic memories. Semantic memories provide knowledge about oneself, while episodic memories are bound to time and place and relate to specific events (St. Jacques & Levine, 2007; Holland & Kensinger, 2010). There are differences in how these memories are experienced. Retrieving episodic memories results in a reexperiencing of what one remembers in terms of emotions, smells, thoughts, etc. Retrieving semantic memories on the other hand has to do with conveying a feeling of familiarity (Wheeler, Stuss, & Tulving, 1997; Holland & Kensinger, 2010).

Both types of memories can differ in specificity. Specific memories are memories of

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an event that happened at a specific time and place. These events do not last longer than a day (Kyung, Yanes-Lukin, & Roberts, 2014) and consist of the subtypes Type 1, Type 2 and Type 3 (Singer & Blagov, 2000). In specific memories of Type 1, a singular event from a specific day is described, without narratives outside this event. Also, in narratives of Type 2, such an event is described but here, it is embedded in the autobiographical context and supplemented by general narratives about other events. Type 3 memories are different from Type 1 or Type 2 memories in that they do not only refer to one event on one day but consist either of different Type 1 and Type 2 memories or of a combination of Type 1 or Type 2 memories with extended or generic memories (Singer & Blagov, 2000). Extended memories are not specific because they refer to events that last longer than a day. The same applies to generic memories, which are summaries of events that are repeated over time such as 'going to the market every weekend' (Singer & Blagov, 2000, Kyung et al., 2014).

When it comes to elderly people, Piolino et al. (2006) found a decrease in memory specificity of older people regarding specific memories, extended memories and generic memories. According to them, the ability to retrieve specific details of a memory and to reexperience this memory is reduced with increasing age (Piolino et al., 2006). Regarding the specificity of semantic and episodic memories, St. Jacques and Levine (2007) found that younger people retrieve more episodic details, while older people retrieve more semantic details. In accordance, Levine, Svoboda, Hay, Winocur, and Moscovitch (2002) found that episodic autobiographical memories become less and less specific with increasing age while semantic memories stay stable over time.

Vividness is another characteristic of autobiographical memories. The more emotional and sensorial detail a memory possesses, the more vividly it is experienced (Mather, 2016; Reisberg & Hertel, 2004; Talarico, LaBar, & Rubin, 2004). According to Reisberg, Heuer, McLean, and O'Shaughnessy (1988), the type of emotion the memories convey does not matter. According to them, only the quantity of emotions determines vividness (Reisberg et al., 1988). Nevertheless, Lindeman, Zengel, and Skowronski (2016) found that memories of positive events are experienced more vividly than memories of negative events. In accordance with this, it was found that positive memories are more detailed than negative ones regarding sensorial information and context (D'Argembeau et al., 2003). Episodic memories are also typically experienced as vivid (see Holland & Kensinger, 2010). However, even if elderly people retrieve less detailed episodic memories, it is found that they experience them with an equal or increased degree of vividness compared to younger adults (Luchetti & Sutin, 2018; Siedlecki, Hicks, & Kornhauser, 2015; Janssen, Rubin, & St. Jacques, 2011; Singer, Rexhaj,

& Baddeley, 2007).

Valence is also seen as an important dimension of autobiographical memories (see Berntsen & Rubin, 2006; Sutin & Robins, 2007). It indicates to what extent a memory is experienced as positive or as negative (Sutin & Robins, 2007). It is found that elderly people tend to remember the past in a more positive manner than young people do. Not only do they remember fewer negative events, but they also rate the experienced events as more positive (Ros & Latorre, 2010; Gallo, Korthauer, McDonough, Teshale, & Johnson, 2011; Schryer & Ross, 2011). However, there are also studies that fail to find this effect (Siedlecki et al., 2015; Reed & Carstensen, 2012; Fernandes, Ross, Wiegand, & Schryer, 2008). According to Reed and Carstensen (2012) and Siedlecki et al. (2015) whether this “positivity effect” is found or not depends on the methods used.

Next to these characteristics, people can experience their autobiographical memories from two different perspectives. In the field perspective, which is rich in episodic detail, intensity and vividness, people re-experience an event from their own point of view (Nigro & Neisser, 1983; Akhtar, Justice, Loveday, & Conway, 2017). In the observer’s perspective, which contains less episodic detail, vividness and intensity, people see the event and themselves from the eyes of an observer (Nigro & Neisser, 1983; Akhtar et al., 2017). The perspectives can change within a memory from one to another. It is found that the change from field to observer perspective reduces the emotions felt during the memory. The change from observer to field perspective, however, has no effect on the emotions felt (Berntsen & Rubin, 2006; Robinson & Swanson, 1993). Further it was found, that recent memories are more likely to be experienced in the field perspective, while older memories are more likely to be experienced in the observer perspective (Akhtar et al., 2017). With regard to age, it was found that older people (aged 60 or more) experience their memories more often from an observer perspective and less often from a field perspective when compared to younger adults (Piolino et al., 2006).

Emotion expression and age differences

By analysing voice cues and prosodic features, one gets information about the different emotional states the speaker is in (Mozziconacci, 2002). Voice cues that are typically analysed in the context of emotions are the pitch (fundamental frequency F0), voice intensity (loudness of voice), speech rate and pausing (Laukka, 2004; Juslin & Scherer, 2008).

Different emotions show different patterns of these cues. It is found that the variability and mean of the pitch and voice intensity decreases for sadness and increases for happiness.

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Further it is found, that the speech rate is slower for sadness and faster for happiness (Banse & Scherer 1996; Laukka, 2004). On the other hand, it is found that the pause proportion is higher for sadness and lower for happiness (Laukka, 2004).

Also, the words people use when telling a story or a memory give information about the emotional state of the speaker (Tausczik & Pennebaker, 2010). Regarding older people, Schryer et al. (2012) found that they use positive emotion words more often than younger people when talking about events that are no more than five years old. For older events, no differences between young and old people regarding emotional word usage were found (Schryer et al., 2012). In another study, Ford, DiGirolamo and Kensinger (2016) found no increase in positive word usage of older people compared to younger ones when considering childhood, adolescence, adulthood and recent memories (up to one year old). Thus, the found difference of Schryer et al. (2012) could not be found back in that study. However, they found that older people use less negative words than younger people when telling about their memories (Ford et al., 2016). This is partly consistent with the results of the study of Luchetti and Sutin (2018) which studied turning point events. They found that older people rate their memories as more emotional than younger people do even if they use the same amount of emotional words. So, it can be concluded that between younger and older people there is no difference in word usage regarding positive words but that there are differences regarding negative words and the rating of memories.

This study

As already named, the aim of this study is to expand the current knowledge by analysing how emotional autobiographical memories are related to emotion expression regarding prosodic features and word usage of elderly people. Until now there are no found studies that explore this relationship. So, the research question for this study is: 'How are the characteristics of autobiographical memories of older adults related to emotion expression?' To answer this question, specificity, vividness, valence (pos., neg.) and perspective (observer, field) will be analysed as characteristics of autobiographical memories. In addition, the pitch, voice intensity, speech rate, pausing and word usage (pos., neg., sad, senses) will be analysed as features of emotion expression. The prosodic features and word usage will then be set into relation with the found characteristics of autobiographical memories.

It is expected that the narratives of specific and non-specific memories differentiate in that specific memories are told with a higher pitch, intensity and speech rate and with less pauses than non-specific memories. Vividness is characterised by many emotional and

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sensorial details (Mather, 2016; Reisberg & Hertel, 2004; Talarico et al., 2004). So, it is expected that vivid memories are told with a higher pitch and intensity than non-vivid memories. Furthermore, it is expected that vivid memories are told faster, with less pauses and with more words that describe sensory perceptions than non-vivid memories. Based on previously discussed research (e.g. Banse & Scherer 1996; Laukka, 2004), it is expected that when it comes to positive memories, the participants speak higher and with more intensity than in relation to negative memories. They also should speak faster and with fewer pauses. Furthermore, it is expected that the participants use more positive emotion words and less negative emotion words than participants that speak about negative memories. Since field memories are rich of detail, intensity and vividness (Nigro & Neisser, 1983; Akhtar et al., 2017), it is expected that they are told with a higher pitch, a higher intensity and a faster speech rate than memories of the observer perspective. In addition, they should be told with more emotional words.

Methods

Participants

This study took place in the context of a larger study that investigated how autobiographical memories invoke emotions in older people and how these emotions can be recognized by technologies (see Nazareth et al., 2019). 23 people participated in the larger study of which the data from 11 participants was used for this study. Four of these participants were male, seven were female. Regarding their age, the participants were between 65 and 85 years old ($M= 73,5$; $SD= 27,11$).

Procedure

The study was approved by the BMS Ethics Committee (Nr 107426). For the data-collection an interview design was used.

The participants were found through a newspaper ad. After potential participants would respond to the ad, an information letter (see Appendix A) was sent to inform them further about the study and the requirements of participation. Because the study was focused on memories, only adults without memory problems and traumatic experiences could participate in the study. In addition, the participants had to be at least 65 years old. Since the study was conducted in Nederland, it was also important that all participants could speak and read Dutch. In addition, for the data collection it was necessary that the participants were able

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to hear and to see, optionally with a hearing aid or glasses. Since the heartbeat was measured in the context of the larger study, it was further required that the participants did not have a pacemaker. People that did not fulfil these requirements were excluded from the study.

The data collection consisted of two sessions and was done by two researchers of the larger study. However, for this study, only the outcomes of the first sessions were used, so only the first sessions are explained here. The first sessions were mainly done at the homes of the participants, only one session was done at another location that was familiar to the participant. Therefore, the environmental conditions were different for all participants. At the beginning of the sessions the participants were further informed about the study and asked to sign an informed consent (see Appendix B). Then the interview was carried out.

The participants differentiated much in how quickly they retrieved a memory and in how much information they gave about the memory. In total the sessions took between 29 and 62 minutes ($M= 45,02$). The conversations were first recorded and then transcribed and analysed.

Materials

During the first sessions, an adapted version of the Autobiographical Memory test (Williams & Broadbent, 1986) was used, where participants were asked to retrieve three emotionally loaded memories for two different emotional cue words. The cue words used in this study were 'happy' and 'sad'. The participants were instructed to be brief and concise about their memories and to recall only specific memories. To practice this, two neutral words (grass, bread) were first used before the emotional cue words were introduced. The presentation of the neutral words and the emotional cue words always happened in a fixed order: grass, bread, sad, happy. The conversations were recorded by three microphones. Two lavalier microphones that separately recorded the researcher and the participant and one shotgun microphone that recorded the whole conversation were used. For the analysis of the data the computer programmes Praat, Atlas.ti, Exel, the linguistic Inquiry Word Count Program and SPSS were used.

Analysis of characteristics of autobiographical memories

In order to prepare the analysis, the transcribed interviews were first divided into fragments. Here, it was looked at what content belonged together. Related content was put into a fragment, while for turning points or new themes a new fragment was made. For example, themes such as being jobless, being employed and being in retirement were all annotated

individually, even if they occurred in the same memory.

To study the characteristics of autobiographical memories, the fragments were then coded in ATLAS.ti (see Appendix C for the final code scheme). To be able to recognize the characteristics in the written text, the first version of the coding scheme was based on literature. It was used to code the first five interviews. Coded were the specificity, vividness, valence and perspective. During the coding process the coding scheme was then further adjusted, so that it could also be used by other people. To enlarge the inter-rater reliability, the coding scheme was also tested by a second person who coded the interviews in a nearly identical manner to the examiner. Only regarding the perspective, there were slight differences which were discussed and whereupon the scheme was adjusted again. Then, the rest of the interviews were coded. After coding, the codes were then added to SPSS for further analysis.

Analysis of prosodic features

To prepare the analysis of the emotion expressions, TextGrids for each participant were created in Praat. While listening to the sound waves, the fragments were added on interval tiers through boundaries in the TextGrids and given a name. For each fragment, the pitch, the intensity, the speech rate and the pause durations were calculated. For this the handbook of Mayer (2017) and the Praat Handbook of Boersma and Weenink (2011) were used as a guideline.

To calculate the pitch, first outliers were identified by recalculating the pitch ranges for each interview using the Hirst method (see Mayer, 2017). This was done to avoid miscalculations and falsifications. The Q1 and Q3 values that were calculated with this method were inserted as new range values. For the remaining options, the standard settings were used. After checking the pitch contour, and adjusting the pitch range as needed, the pitch value was measured for each fragment. To reduce workload, a script was used that can be found in Appendix D. For the calculation of the intensity, all standard settings were used so that background noises would not be included (see Boersma & Weenink 2011). As with the pitch, the intensity of each fragment was calculated using a script (see Appendix E). Furthermore, the speech rate was calculated by dividing the number of words by the duration of the fragments. Regarding the pause durations, the silent thresholds were manually set for each participant since the standard settings were not compatible for the interviews. Furthermore, so that not every breath was counted as silence, a minimum silent interval of 0.5 was set. The same value was also set for a minimum sounding interval so that not every tone

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was counted as sound. To be able to compare the pauses with each other, their duration was divided by the duration of the different fragments. All values of the participants were put in Excel tables and added to SPSS.

Analysis of word usage

To analyse the word usage, the transcripts were first copied and then modified according to the operator manual of the LIWC program by Pennebaker, Booth and Francis (2007). Since the fragments should be examined independently, the transcripts were divided into segments. Each fragment formed a segment and was separated from the other fragments by spaces. To keep the database as small as possible, everything outside of the fragments was deleted. The passages of the interviewer within the fragments were also removed, so that only the words of the participants were counted. In addition, fillers such as 'weet je' or 'zeg maar' were adjusted according to the manual as well as stuttering, remarks of the researcher and word abbreviations like ie, 62tig, m'n, ma, niks, z'on and more (see Pennebaker et al., 2007). Analysed were only the psychological processes. The results that were of interest for this study were added to SPSS. These were the categories: positive emotion, negative emotion, sadness and senses.

Analysis with SPSS

In order to avoid bias by personal differences, the z-scores for each value were calculated. In order to choose a test for further analysis with SPSS, it was then tested if the variables were normally distributed or not. The Shapiro Wilk test was given preference over the Kolmogorov-Smirnov test, as the latter has lower power (Razali & Wah, 2011). The results can be found in Table 1. The table shows that only the values of the pitch and the intensity were normally distributed, while all other values were not normally distributed. Based on that it was decided that the non-parametric Kruskal Wallis Test and the Whitney U Test would be used for further analysis, which can be found in the result section. Since these tests only indicate if there is a difference between groups, Dunn-Bonferroni post hoc tests were made to check which groups were different. In order to evaluate the found differences, the effect size (r) of Pearson was also calculated.

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Table 1

Distribution of values

	Shapiro-Wilk Test		
	Statistic	df	Significance
Pitch mean	.993	206	.409
Pitch SD	.996	206	.905
Intensity mean	.993	206	.412
Intensity SD	.993	206	.388
Words per minute	.970	206	.000
Pause duration per interval	.965	206	.000
Words positive emotion	.917	206	.000
Words negative emotion	.815	206	.000
Words sadness	.783	206	.000
Words senses	.941	206	.000

Note. Words per minute= speech rate; SD= standard deviation

Results

The characteristics of autobiographical memories

A total of 206 memory fragments were examined. Tables 2 to 5 give an overview of the frequency of the categories that were found as characteristics of autobiographical memories. Almost every memory fragment had two or more characteristics. Only 5 fragments had just one characteristic. These were mostly statements about a past event in the observer perspective. Strikingly, most of the memories were extended memories, although specific memories were asked for in the interview. So, only 52 of the 206 memory fragments were specific (see Table 2). Moreover, there were more non-vivid than vivid memories (see Table 3). It is further noticeable that although sad and happy memories were asked for, there were many memories recounted that included other emotions, mixed emotions or no emotions (see Table 4). Furthermore, the observer perspective was used far more frequently than the field perspective by the participants when describing their memories. In addition, some memories changed in perspective (see Table 5). In the following it will be tested how the characteristics of autobiographical memories are related to the prosodic features that occur when the memory is told.

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Table 2

Number and Percentage of specificity

Specificity	Number	Percentage
None	11	5.3%
Type 1	15	7.3%
Type 2	22	10.7%
Type 3	15	7.3%
Extended memories	134	65%
Generic Memories	9	4.4%
Total	206	100%

Note. Type 1= one event that happened within one day; Type 2= one event that happened within one day + autobiographical context and narratives about other events; Type 3= at least 2 memories of Type 1 or 2 and 1 extended or generic memory; extended memories: longer than one day; generic memories: summaries of repeated events

Table 3

Number and Percentage of vividness

Vividness	Number	Percentage
Vivid	66	32%
Not vivid	140	68%
Total	206	100%

Note. Vivid= sensorial and contextual detail

Table 4

Number and Percentage of Valence

Valence	Number	Percentage
No emotions	40	19.4%
Happy	57	27.7%
Other positive emotion	12	5.8%
Sad	61	29.6%
Other negative emotion	18	8.7%
Both negative and positive	18	8.7%
Total	206	100%

Note. The category 'both negative and positive' includes happy, sad, other positive, and other negative emotions

Table 5

Number and percentage of perspective

Perspective	Number	Percentage
None	3	1.5%
Observer	134	65%
Field	43	20.9%
Both	26	12.6%
Total	206	100%

Note. The category 'none' will not be used for analysis based on the small number of cases; Field= close to the experience; Observer= distance from the experience

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Table 6

Specificity in relation to the prosodic characteristics and word usage

	Prosodic features						Word usage			
	Pitch mean	Pitch SD	Intensity mean	Intensity SD	Words per minute	Pause duration per interval	Words positive emotion	Words negative emotion	Words sadness	Words senses
Kruskal-Wallis H	19.07	9.96	16.66	22.82	7.34	9.46	7.87	5.10	5.88	5.42
df	5	5	5	5	5	5	5	5	5	5
Significance	.002	.076	.005	.000	.197	.092	.164	.403	.319	.366

Note. Words per minute= speech rate; SD= standard deviation

Table 7

Medians of the significant categories regarding specificity

Specificity	Pitch mean	Intensity mean	Intensity SD
None	.20	.10	.12
Type 1	.22	.02	-.04
Type 2	.03	.18	.17
Type 3	.11	.19	-.04
Extended memories	-.06	-.03	-.05
Generic	.07	.05	.04

Note. Type 1= one event that happened within one day; Type 2= one event that happened within one day + autobiographical context and narratives about other events; Type 3= at least 2 memories of Type 1 or 2 and 1 extended or generic memory; extended memories: longer than one day; generic memories: summaries of repeated events

The hypothesis regarding specificity was that specific memories were told with a higher pitch and intensity, a faster speech rate and with less pauses than non-specific memories. With the Kruskal Wallis test only differences in pitch and intensity could be confirmed. It showed that between the memories of different types of specificity there were statistically significant differences in mean pitch ($H= 19.07$; $p= .002$), mean intensity ($H= 16.66$; $p= 0.005$) and intensity SD ($H= 22.82$; $p= .000$). However, a following post hoc test showed that the found differences in mean pitch were only between extended memories and specific memories of Type 1 ($z= 3.04$; $p= .04$). Looking at the medians (see Table 7), it can be said that the narratives of specific memories of Type 1 were told with a higher pitch than those of extended memories, with an effect size of $r= .24$, which stands for a low effect.

Regarding the mean intensity, a following post hoc test showed ordinary significance values of less than 0.05 between extended memories and specific memories of Type 2 and 3, but this was not confirmed by the adjusted significance which showed values higher than

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0.05. Therefore, no significant differences between the groups could be determined. However, looking at the medians (see Table 7) it could well be said that specific memories of Type 2 ($r = .23$) and 3 ($r = .22$) were told with a higher intensity than extended memories. The effect sizes r for both differences were low.

For the intensity SD it was found through a post hoc test that the differences were only between extended memories and specific memories of Type 2 ($z = 4.29$; $p = .000$). Type 2 memories had a higher intensity SD than extended memories (see Table 7), with an effect size of $r = .34$, which stands for a medium effect. Concluding it can be said that there were slight differences in pitch and intensity between extended and specific memories, but that these differences did not apply to all types of specificity. So, only a part of the hypothesis could be confirmed, while there could not be found any differences in speech rate and pause duration.

Table 8

Vividness in relation to the prosodic characteristics and word usage

	Prosodic features						Word usage			
	Pitch mean	Pitch SD	Intensity mean	Intensity SD	Words per minute	Pause duration per interval	Words positive emotion	Words negative emotion	Words sadness	Words senses
Mann-Whitney-U	3873.50	4338.00	3563.00	3717.00	3924.50	4215.00	4267.50	4061.50	4173.00	3986.00
Z	-1.87	-.71	-2.65	-2.26	-1.74	-1.01	-.88	-1.40	-1.12	-1.59
Significance	.062	.480	.008	.024	.081	.310	.377	.162	.262	.112

Note. Words per minute= speech rate; SD= standard deviation

Table 9

Medians of significant categories regarding vividness

Vividness	Intensity mean	Intensity SD
Not vivid	-.02	-.03
Vivid	.07	.04

Note. Vivid= sensorial and contextual detail

Regarding vividness, it was expected that narratives of vivid memories were told with a higher pitch and intensity than the narratives of non-vivid memories. Further it was expected that vivid memories were told with a higher speech rate, less pauses and more words of the category senses. The Mann Whitney U test showed that the narratives of vivid memories differed from non-vivid memories in mean ($U = 3563.00$; $p = .008$) and SD of intensity ($U = 3717.00$; $p = .024$). Vivid memories were told with a higher mean intensity (see Table 9), with a low effect size of $r = -.18$, and a higher intensity SD, with a low effect size of $r = -.16$. So,

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against the expectations, vivid memories did only slightly differentiate in mean and variation of intensity.

Table 10

Valence in relation to the prosodic characteristics and word usage

	Prosodic features						Word usage			
	Pitch mean	Pitch SD	Intensity mean	Intensity SD	Words per minute	Pause duration per interval	Words positive emotion	Words negative emotion	Words sadness	Words senses
Kruskal-Wallis H	8.26	14.65	9.05	2.06	3.97	9.23	62.89	46.13	34.32	8.58
df	5	5	5	5	5	5	5	5	5	5
Significance	.142	.012	.107	.840	.553	.100	.000	.000	.000	.127

Note. Words per minute= speech rate; SD= standard deviation

Table 11

Medians of significant categories regarding valence

Valence	Pitch SD	Words positive emotion	Words negative emotion	Words sadness
No emotions	.025	-.102	-.145	-.117
Happy	.013	.089	-.148	-.129
Other positive emotion	.054	.163	-.073	-.124
Sad	-.100	-.166	.098	.054
Other negative emotion	.052	-.151	-.039	-.119
Both negative and positive	.080	.072	-.102	-.128

Before doing the analysis, it was expected that positive memories were told with a higher pitch, intensity and speech rate and with less pauses, more positive emotion words and less negative emotion words than negative memories. However, according to the Kruskal Wallis Test, there were only differences in the pitch SD ($H=14.65$; $p=.012$), and in word usage regarding the categories ‘positive emotion’ ($H=62.89$; $p=.000$) ‘negative emotion’ ($H=46.13$; $p=.000$) and ‘sadness’ ($H=34.32$; $p=.000$).

Starting with the pitch SD, a following post hoc test showed ordinary significance values of less than 0.05 between the groups ‘sad’ and ‘happy’ ($r=.25$), ‘sad’ and ‘other negative emotion’ ($r=-.26$), ‘sad’ and ‘both negative and positive emotion’ ($r=-.29$) and ‘sad’ and ‘other positive emotion’ ($r=.29$). This could not be confirmed by the adjusted significance which showed values higher than 0.05. Thus, there were no significant differences in the SD

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of the pitch between the groups. Looking at the medians (see Table 11) it can still be said that memories which contained both negative and positive emotions had the most variation of pitch, and memories that contained sad emotions had the least variation of pitch within their narratives. All differences had a low effect size r .

Regarding the word category positive emotion, there were a lot of significant differences found. These were between the groups 'other negative emotion' and 'other positive emotion' ($z=2.96$; $p=.046$), 'other negative emotion' and 'happy' ($z=-3.98$; $p=.000$), 'other negative emotion' and 'both negative and positive' ($z=-3.97$; $p=.001$); 'sad' and 'other positive emotion' ($z=3.30$; $p=.014$), 'sad' and 'happy' ($z=6.43$; $p=.000$); and 'sad' and 'both negative and positive' ($z=-4.72$; $p=.000$). Further there were also differences between memories with no emotions and memories with happy emotions ($z=-4.33$; $p=.000$) and between memories with no emotions and memories with both negative and positive emotions ($z=-3.43$; $p=.009$). Looking at the medians (see Table 11) it can be seen that within the narratives of memories, with other positive emotions than happiness, the most positive words were used, followed by happy memories and memories that consisted of both negative and positive emotions. Sad memories on the other hand contained the least positive emotion words, followed by memories that contained other negative emotions than sadness. So, the hypothesis that happy memories contain more positive emotion words than sad memories can be confirmed. Regarding the effect size, there were high effects between 'other negative emotion' and 'other positive emotion' with $r=.54$, 'other negative emotion' and 'happy' with $r=-.46$, 'other negative emotion' and 'both negative and positive' with $r=-.66$, 'sad' and 'happy' with $r=.59$ and 'sad' and 'both negative and positive' with $r=-.53$. Further there were differences with a medium effect between 'sad' and 'other positive emotion' with $r=-.39$, 'no emotion' and 'happy emotion' with $r=.44$ and 'no emotions and 'both negative and positive emotion' with $r=.45$.

Compared to positive emotion words, the word category negative emotion had fewer significant differences. A post hoc test showed that there were differences between the groups 'happy' and 'other negative emotion' ($z=-2.99$; $p=.041$), 'happy' and 'sad' ($z=-6.10$; $p=.000$) and 'no emotion' and 'sad' ($z=-4.97$; $p=.000$). It is found that memories with other negative emotion contained more negative emotion words than happy memories (see Table 11), with an effect size of $r=-.34$, which is a medium effect. The same applied to sad memories, which contained even more negative words than memories with other negative emotions. The effect strength of the differences between happy and sad memories was $r=-.56$. There was thus a high effect between the two groups, so the hypotheses that happy memories

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contain less negative words than positive words can be confirmed. Furthermore, it was found that memories without emotional content contained less negative emotion words than sad memories, with a high effect of $r = -.49$.

Regarding the word category sadness, there were four significant differences. These were between the groups ‘both negative and positive’ and ‘sad’ ($z = 3.79$; $p = .002$), ‘other positive emotion’ and ‘sad’ ($z = -3.15$; $p = .024$), ‘happy’ and ‘sad’ ($z = -5.05$; $p = .000$) and ‘no emotion’ and ‘sad’ ($z = -3.76$; $p = .003$). Looking at the medians (see Table 11) it can be seen that sad memories contained more words of the category sad than the other groups. There was a medium effect between ‘both negative and positive’ and ‘sad’, with $r = .42$, a medium effect between ‘other positive emotion’ and ‘sad’ with $r = -.36$ and a medium effect between ‘happy’ and ‘sad’ with $r = -.46$. There was also a medium effect between ‘no emotion’ and ‘sad’ with $r = -.37$.

All in all, the hypothesis that positive memories were told with a higher pitch, intensity and speech rate and with less pauses could not be confirmed. But it could be confirmed that positive memories contained more positive emotion words and less negative emotion words (including words from the category sad) than negative memories.

Table 12

Perspective in relation to the prosodic characteristics and word usage

	Prosodic features						Word usage			
	Pitch mean	Pitch SD	Intensity mean	Intensity SD	Words per minute	Pause duration per interval	Words positive emotion	Words negative emotion	Words sadness	Words senses
Kruskal-Wallis H	2.40	.70	2.00	2.78	1.06	1.19	.99	.65	.94	7.80
df	2	2	2	2	2	2	2	2	2	2
Significance	.301	.705	.368	.249	.588	.551	.610	.722	.624	.020

Table 13

Medians of significant categories regarding perspective

Perspective	Words senses
Field	-.031
Observer	-.123
Both	.032

The hypothesis regarding the perspective of autobiographical memories was that field memories are told with a higher pitch, a higher intensity, a faster speech rate and with more

emotional words than memories in the observer perspective. Against the expectations, the Kruskal Wallis Test showed that there were only differences in word usage in terms of sensory expressions ($H = 7.80$, $p = .020$). A following post hoc test showed that this difference was between memories that were told in the observer perspective and memories that consisted of both perspectives ($z = -2.65$; $p = .024$). So, the hypothesis could not be confirmed. Instead, it could be said that memories that have a perspective change were told with more sensory words than memories that are purely told in the observer (and the field) perspective (see Medians in Table 13), with a low effect size of $r = .21$.

Discussion

The aim of this study was to expand the current knowledge by answering the question of how autobiographical memories are related to emotion expressions regarding prosodic features and word usage. According to the current state of knowledge, this was the first study that examined this relationship. Four characteristics of autobiographical memories were identified and used for further analysis: specificity, vividness, valence and perspective. Further, the pitch, intensity, speech rate and pause proportion were analysed as prosodic features. In terms of word usage, the categories 'positive emotions', 'negative emotions', 'sadness' and 'senses' were examined.

During the research process different hypotheses were built, some of which could be confirmed, while others could not. Regarding specificity, there were slight variations in pitch between Type 1 memories and extended memories and variations in intensity between Type 2, Type 3 and extended memories. Differences in speech rate and pause duration could, against expectations, not be found. Also, regarding vividness, there were only slight differences in intensity between vivid and non-vivid memories, but no differences in pitch, speech rate, pauses and sensorial words. With valence too, the findings demonstrated partly different results than expected. There were differences found in word usage regarding the categories 'positive emotions', 'negative emotions' and 'sadness', in which positive memories included more positive words and negative memories more negative words and words related to sadness. But there were no differences found in pitch, intensity, speech rate and pause duration. The most interesting result could be found in the perspective. Here, it was found, against the hypothesis, that a change in perspective results in a higher use of sensorial words. Other differences were not found. Looking at the results collectively, it is striking that there were no differences in speech rate and pause duration between all characteristics of autobiographical memories and that there were far fewer differences in pitch and intensity

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than expected. So, the first question that arises is: why were there occasionally differences in the features of emotion expression between some of the characteristics of autobiographical memories and occasionally not?

Starting with the pause duration and the speech rate which differentiated between none of the characteristics. Like the other prosodic features, they can give information about the emotion that is felt during the recalling process (Banse & Scherer 1996; Laukka, 2004). At the same time, they may also give information about the recalling process itself (e.g. Hulme, Newton, Cowan, Stuart, & Brown, 1999). So, making pauses and talking in a slow manner during the narrative do not necessarily have something to do with an emotion, but may also arise when the speaker takes time to think about what happened. This can be one of the reasons why there were no differences in speech rate and pause duration between the characteristics of autobiographical memories. Another reason can be attributed to one of the limitations of this study, which will be discussed later.

Coming now to pitch and intensity. It is surprising that the found differences regarding specificity did not apply to all types of specificity, especially the differences in intensity. The reason for this could be found in the process of analysis. The memories were divided into fragments based on their content and then coded. The fragmentation may have affected the coding process and therefore also the results in that, for example, a memory of Type 3 was divided into different fragments and then coded as different Type 1 or 2 memory fragments. Potentially, this could have led to inaccuracies in the results. However, the fragmentation was done deliberately to better analyse the characteristics of autobiographical memories. Of course, there may be other reasons as well such as the type and intensity of emotion felt during the memory or the clarity of the memory. But here, for better understanding, more research is needed. In general, the results now indicate that a specific memory is told with a higher or louder voice than extended memories. It is recommended, for further investigations, not to classify specificity into subcategories in order to avoid inaccuracies through the fragmentation and during the coding process so that definite results can be obtained.

According to research, both the pitch and the intensity should be higher for positive memories and lower for negative memories (see Banse & Scherer 1996; Laukka, 2004). This could not be found back in this study. As previously mentioned, there were also no differences in speech rate and pause duration. So, a big question that arises and that applies to all other properties as well is: Have emotions actually been recalled during the recalling process? According to the current knowledge, this is the first time that such an adapted version of the Autobiographical Memory test was used. The reasons why no effects were

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found can therefore lay in the method, but also elsewhere. Beike (2007) argued that autobiographical memories do not automatically consist of emotions and that it is in general unlikely to experience emotions when recalling emotional autobiographical memories. However, when looking at the results, it sometimes becomes evident from various prosodic features and also from the words used that some emotions were present in the memories. So, the reasons must be somewhere else. According to Walker and Skowronski (2009) the intensity of emotions felt during different events fade over time. So, if the events are remembered months or years later, only a slight emotional reaction is triggered. Here, a fading affect bias is often found: negative emotions that are associated with an event vanish faster over time from event occurrence to event recall than positive emotions associated with an event (Skowronski, Walker, Henderson & Bond, 2014; Ritchie et al., 2015). In this study, this bias could not be found back. However, another influence on the results may have come from the perspective. According to research, memories recalled from the field perspective contain more emotions than memories recalled from the observer perspective (Berntsen & Rubin, 2006). In this study, most of the memories were retrieved from the observer perspective, which is on the one hand consistent with earlier research of elderly people (see Piolini et al., 2006) but which, on the other hand, could also be a reason for the missing effect of valence on prosodic features. Further, emotions can change over time. If a positive emotion was felt during an event, it is possible for a negative emotion to be experienced when the event is later recalled, or vice versa (Walker & Skowronski, 2009). In this study, it was striking that even when happy and sad memories were the only ones requested, there were some memories with other emotions and some memories with mixed emotions. According to Aaker, Drolet and Griffin (2008), mixed emotions are experienced a lot during important events in life. But, they cause a conflict which activates coping mechanisms to regulate the feelings that triggered this conflict. So, these emotions fade quickly over time and are therefore difficult to recall accurately (Aaker et al., 2008). That, too, could have influenced the results.

Findings regarding valence were changes in word usage. Positive memories contained more positive emotion words, and negative memories contained more negative emotion words and words related to sadness. This is in accordance with an earlier study of Bohanek, Fivush & Walker (2005), who analysed the memories of women and found that in the narratives of negative events, more negative emotion words were used and in the narratives of positive events more positive emotion words were used.

The results further showed that the more vividly a memory is reexperienced, the louder the voice is when recounting the memory. In addition, none of the expected differences

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were found between vivid memories and non-vivid memories regarding the usage of sensorial words. This seems surprising considering that vividness was defined by contextual and sensorial detail. However, it may be explained by the fact that only a very small proportion of vivid memories contained sensorial details, while most of the vivid memories only contained contextual details. So, when compiling all memories together there would be no significant differences in sensorial detail. In general, it seems that sensorial detail is not as important for vividness as contextual detail.

Regardless, sensorial detail seems to be important for the perspective. It is found that a change in perspective results in a higher use of sensorial words. So, are memories that contain multiple perspectives more vivid than memories that are told in only one perspective? In this context, research found that the stronger multiple perspectives were perceived within a memory, the more vividly the memory was experienced (Rice & Rubin, 2009). Here, a change from field to observer perspective led to less vivid memories than the change from observer to field perspective (Berntsen & Rubin, 2006). But not only memories that contain a perspective change were experienced as vivid. Memories from the field perspective were also experienced as vivid, while memories from the observer perspective were less vivid (Rice & Rubin, 2009). However, this was not found back in the emotion expressions in this study. An important question that remains is: Does a change of perspective trigger sensorial detail or is it caused by increased detail? Here, further research is needed.

In general, when looking at earlier research, it must further be said that the characteristics of autobiographical memories seem to be partly connected to each other. Detail tells not only something about vividness and perspective change but seems also to be connected to valence and specificity. As already mentioned in the introduction, D'Argembeau et al. (2003) found that positive memories contained more detail than negative ones, while Lindeman et al. (2016) found that positive memories were experienced more vividly than negative ones. Furthermore, Conway and Pleydell Pearce (2000) argued that there are three levels of specificity whereby in the last level events are remembered with sensorial detail. Also, the perspective is connected to some of the other characteristics. As stated before, memories from the field perspective contained many more emotions and increased vividness in comparison to memories from the observer perspective (Nigro & Neisser, 1983; Berntsen & Rubin, 2006; Akhtar et al., 2017). In this study, there were nearly no memories that consisted of only one characteristic. It can be assumed that such connections have had an impact on the results. However, the extent to which such connections exist and how they affect the voice regarding emotion expression has not been examined in this study and would

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be a topic for following research.

There were some limitations that should further be considered when interpreting the results. At the start of the interview, participants were asked to present a picture that fits to the memory. So, it can be that some pauses and a slower speech rate not only arose because of the emotion felt or because the participants were thinking of what to say next, but because some of the participants were looking for suitable pictures during the interview. A possible solution and some advice for further investigations would be to ask for photos at the very end of the interview, so that the participants do not search for the photos during the recalling process. In addition, in the recordings of the interviews, there was some background noise such as coughing, birds, music, or the voice of the interviewer which may have had an impact on the pitch and intensity. In the context of this study, it was not possible to eliminate these sounds, but in order to get the most accurate results it is recommended for further studies to consider that such sounds can be present and to eliminate them. The pitch was also influenced by the individual recalculations and adjustments of the pitch ranges for each interview. This was necessary to avoid miscalculations. However, other pitch ranges would have produced other pitch values. The same applies to the pause duration where the silent thresholds were manually set for each participant. Further, it must be noticed that the LIWC program that was used to analyse word usage only counts words without regarding the context or the content of the narrative. So, words that express something positive in the context of other words could have been counted as negative words and vice versa. In addition, there is no category for happy. The category 'positive emotion' was more for positive emotions in general and included emotions such as love, optimism and achievement which were not examined in this study. As already mentioned also the fragmentation and the coding process may have influenced the results. In this study the coding scheme was not tested regarding its interrater reliability. This would be important to do for further research.

Despite the limitations, this study has shown that it is possible to retrieve emotions with the adapted version of the Autobiographical Memory Test. In addition, a code scheme was constructed that can be used for following research to analyse narratives of autobiographical memories regarding their characteristics without asking participants for their experience. Furthermore, it was possible to provide a detailed picture of the relation between the characteristics of autobiographical memories and emotion expression.

These results could be of interest for future research, especially for future research about dementia. It is found that dementia influences the recognition of emotion and the facial expression of emotion (Keane, Calder, Hodges & Young, 2002; Smith, 1995). To analyse

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what for an effect dementia has on the vocal expression of emotion, this study can be used. On the one hand, the adapted version of the Autobiographical Memory Test can be used to evoke emotions in older people with dementia. On the other hand, the results of this study can be used to make a comparison between healthy older people and older people with dementia regarding prosodic features and word usage. In addition, the results of this study can be used for research that investigates how technologies recognize emotions.

With this study first steps were made but further investigations are necessary to set the findings into a context and to analyse to what extent the results apply to the general population.

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Appendix A – Information letter in Dutch

Informatie over de studie ‘Emoties en Ouderen’

Geachte heer/mevrouw,

U heeft aangegeven geïnteresseerd te zijn in deelname aan de studie ‘Emoties en Ouderen’. Wij willen u alvast bedanken voor uw openheid en interesse. In deze informatiebrief staat meer informatie over de studie. We leggen uitgebreid uit wat deelname voor u betekent. U kunt deze informatie nog eens rustig doorlezen en eventuele vragen die u heeft opschrijven. Bespreek het met uw familie en vrienden. Als u vragen heeft, kunt u terecht bij de onderzoekers, Deniece Nazareth en Michel Jansen of de projectleider, Prof. dr. Gerben Westerhof. U vindt de contactgegevens onderaan deze brief.

Wat is het doel van het project?

Het eerste doel van onze studie is te onderzoeken hoe herinneringen van *mensen van 65 jaar of ouder* positieve of negatieve emoties kunnen oproepen.

Het tweede doel van deze studie is om te onderzoeken of we emoties kunnen herkennen op basis van verschillende metingen: uw gezichtsuitdrukkingen, uw spraak en een aantal lichamelijke signalen zoals hartslag, lichamelijke activiteit (beweging) en huidgeleiding.

Wanneer kunt u deelnemen aan de studie?

Voor deze studie zoeken wij mensen die 65 jaar of ouder zijn zonder noemenswaardige geheugenproblemen. Daarnaast is het belangrijk dat u de Nederlandse taal kunnen lezen en begrijpen. Verder is het belangrijk dat u goed kunt zien en horen, eventueel met bril of gehoorapparaat. Een laatste punt is dat u geen pacemaker heeft.

Wat houdt dit voor u in?

Na het ontvangen van deze informatiebrief zullen wij u binnen een aantal dagen bellen om te vragen of u interesse heeft om mee te doen aan deze studie. Tijdens dit telefonisch gesprek kunt u al uw vragen stellen aan de onderzoekers. Natuurlijk mag u ook eerder of juist later nog een keer bellen voor meer informatie of om aan te geven dat u wilt meedoen. Als u aangeeft dat u wilt meedoen aan de studie zullen we samen een eerste afspraak inplannen. Deze eerste afspraak zal bij u thuis of in een voor u bekende omgeving plaatsvinden en is bedoeld om kennis te maken met elkaar. Deze afspraak zal ongeveer anderhalf uur duren. Als voorbereiding voor de eerste afspraak vragen we u een aantal foto's of documenten te verzamelen waaraan u een positieve of negatieve herinnering heeft. U kunt bij documenten denken aan bijvoorbeeld geboortekaartjes, trouwuitnodigingen of krantenartikelen maar geen voorwerpen die niet in een boek kunnen worden verwerkt. Tijdens de eerste afspraak zullen we u vragen om positieve en negatieve herinneringen te benoemen en deze te laten zien door middel van een foto of document. We zullen deze digitaal opslaan voor uw levensalbum. Een levensalbum is een boek waarin mensen hun levensverhaal vastleggen. Door middel van persoonlijke foto's of documenten kunt u uw herinneringen opslaan en bekijken in het boek. U kunt bijvoorbeeld een herinnering hebben van een gebeurtenis waarin u iets positiefs overkomt of een moment in uw leven waar het u tegen zat. Denkt u bijvoorbeeld aan een foto uit uw jeugd waar u een positieve herinnering aan heeft. Met deze persoonlijke herinneringen en bijbehorende foto's maken wij een digitaal levensalbum dat u doet herinneren aan een aantal van deze gebeurtenissen. Ook zullen er tijdens deze afspraak drie vragenlijsten worden

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afgenomen. Tijdens deze afspraak zullen we alleen audio-opnames maken. Tot slot plannen we een tweede afspraak in. Die zal ongeveer één tot twee weken na de eerste afspraak zijn. Tijdens de tweede afspraak willen we u gaan interviewen over uw levensalbum en de fotos, documenten en verhalen die u heeft uitgekozen. Ter vergelijking leggen we ook een aantal foto's voor die niets te maken hebben met uw herinneringen, dit zijn algemene foto's. Deze afspraak zal maximaal anderhalf uur duren. Tijdens deze afspraak zullen we audio- en video-opnames maken en metingen uitvoeren van de hartslag, beweging en huidgeleiding. Aan het einde van deze sessie willen we u nog een klein presentje als waardering voor uw medewerking overhandigen.

Wat houden de video-opnamen precies in?

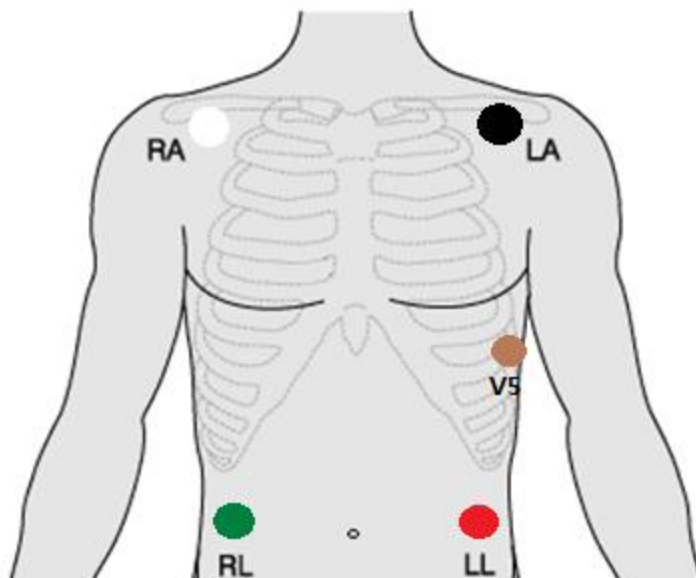
In de praktijk zal het er op neer komen dat er bij de tweede sessie een aantal camera's op statieven worden geplaatst in de kamer om uw gezichtsuitdrukkingen te filmen. Deze camera's zullen alleen aan staan op het moment dat het interview begint.

Wat houden de audio-opnamen precies in?

Er wordt centraal tussen u en de onderzoeker een microfoon geplaatst. Daarnaast krijgen u en de onderzoeker ieder een eigen draagbare microfoon omgehangen zodat we uw stem goed kunnen opnemen.

Wat houden de metingen in?

Voor het meten van uw hartslag worden er een soort pleisters op uw huid geplakt. Deze pleisters zijn anti-allergisch en ontworpen om gemakkelijk verwijderd te worden na de studie. Voordat deze pleisters geplaatst kunnen worden moet de huid op deze plaatsen even schoongemaakt worden met een alcoholdoekje. Er zijn 2 sensoren ter hoogte van het sleutelbeen en 2 sensoren op navelhoogte. De laatste sensor zit links op uw zijkant. De afbeelding laat zien waar we een pleister plakken.



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Voor het meten van de huidgeleiding worden er aan twee vingers meetapparaatjes geplaatst. Hieronder ziet u een voorbeeld hoe deze bevestigd zullen worden.



Een derde apparaatje meet hoeveel u beweegt. Deze wordt om uw pols bevestigd. Hieronder ziet u een afbeelding hiervan.



Alle meetapparaten zullen door de onderzoekers worden bevestigd die er op zijn getraind dit snel en met zo weinig mogelijk last te verwijderen. Ze zijn ontworpen om zo min mogelijk ongemak te veroorzaken. Mocht u hier vragen over hebben, neem dan gerust contact op.

Wat zijn voordelen van deelname?

Uw deelname aan de studie wordt zeer op prijs gesteld. Het draagt bij aan belangrijk wetenschappelijk onderzoek naar hoe levensalbums emoties kunnen opwekken. Deze inzichten kunnen in de toekomst worden toegepast om de stemming van mensen te meten en met levensalbums te verbeteren.

Is mijn deelname vrijwillig?

We geven u graag volledige vrijheid om deel te nemen. Als u niet mee wilt doen, dan hoeft u daarvoor geen reden te geven. Ook als u op dit moment besluit om wel mee te doen, kunt u zich later altijd nog bedenken. Tijdens de studie mag u vragen weigeren als u zich niet comfortabel daarbij voelt of een pauze inlassen als u dat zou willen.

Wat gebeurt er met mijn gegevens?

We gaan zeer zorgvuldig met uw gegevens om omdat we snappen dat het gevoelige gegevens zijn (video en audio gegevens). Uw gegevens zullen worden beveiligd door de Universiteit Twente en zullen niet zonder uw toestemming worden gedeeld. Ook zullen uw gegevens absoluut niet voor commerciële promotiedoeleinden worden gebruikt.

Op de schriftelijke toestemming kunt u aangeven voor welke doeleinden uw gegevens mogen worden gedeeld. Deze doeleinden zijn als volgt:

We geven u de optie om aan te geven of u uw gegevens wilt delen met andere wetenschappelijke onderzoekers die uw gegevens kunnen gebruiken in hun studies. Dit zal gebeuren in de vorm van een database waarin alle gegevens van deze studie zijn opgeslagen. Deze database is beveiligd door de Universiteit Twente. Alle wetenschappelijke onderzoekers die de database willen gebruiken moeten een licentie aanvragen bij de hoofdonderzoekers waarin zij verklaren dat de gegevens niet publiek gedeeld mogen worden of voor commerciële promotiedoeleinden worden gebruikt. Ook moeten ze aangeven de gegevens niet verder te delen en alleen voor hun specifieke studie te gebruiken. Na het ondertekenen van de licentie en goedkeuring van de hoofdonderzoekers, krijgen de wetenschappelijke onderzoekers pas toegang.

Ook geven we de optie om aan te geven of uw gegevens gepresenteerd mogen worden bij colleges voor studenten of bij wetenschappelijke conferenties of presentaties. Dit kan alleen als u hier toestemming voor geeft.

Alle vragenlijsten worden genummerd en apart van uw persoonlijke gegevens bewaard. Zolang het project loopt kunt u al uw gegevens bij de onderzoeker opvragen.

Ondertekenen toestemmingsverklaring

Als u besluit deel te nemen, vragen we u daarvoor schriftelijke toestemming te geven. Dit zal gebeuren tijdens de eerste kennismakingssessie. Hiermee bevestigt u uw voornemen mee te doen. Ook bevestigt u daarmee dat we u voldoende geïnformeerd hebben over de studie.

Ten slotte

Deze studie wordt uitgevoerd na een positief oordeel van de Commissie Ethiek van de Universiteit Twente te Enschede. De voor deze studie internationaal vastgestelde richtlijnen voor de studie en databescherming zullen nauwkeurig in acht worden genomen.

Verdere informatie

U kunt altijd contact opnemen met de uitvoerders van de studie, Michel Jansen (e-mail: m.jansen-1@utwente.nl ; tel: +31534897808) of Deniece Nazareth (e-mail: d.s.nazareth@utwente.nl; tel +31534896590). U kunt met uw vragen ook terecht bij de projectleider, Prof. dr. Gerben Westerhof (e-mail: g.j.westerhof@utwente.nl; tel: +31534896074).

Na het ontvangen van deze informatiebrief zullen wij u binnen een aantal dagen bellen om te vragen of u interesse heeft om mee te doen aan deze studie. Tijdens dit telefonisch gesprek kunt u al uw vragen stellen aan de onderzoekers. Natuurlijk mag u ook eerder of juist later nog een keer bellen voor meer informatie of om aan te geven dat u wilt meedoen.

Appendix B – Informed Consent

Toestemmingsverklaringformulier (informed consent)

Titel van de studie: Emoties en Ouderen

Verantwoordelijke onderzoekers: Deniece Nazareth en Michel Jansen

In te vullen door de *deelnemer*

Ik bevestig dat ik de informatiebrief heb gelezen en ik begrijp de informatie, doel en de belasting van deze studie. Ik heb voldoende tijd gehad om over mijn deelname na te denken. Ik ben in de gelegenheid geweest om vragen te stellen. Deze vragen zijn naar mijn tevredenheid beantwoord.

Als u toestemming geeft kunt u hieronder de gegevens invullen en ondertekenen. Vergeet niet aan te kruisen of u wel of geen toestemming geeft voor het maken van video-opnames voor de studie. Uw gegevens zullen absoluut nooit gebruikt worden voor commerciële doeleinden.

<i>Kruis per stelling in de vakjes aan of u toestemming geeft of niet.</i>		
	JA	NEE
1. Ik geef toestemming voor het maken van audio, fysiologische en video opnames tijdens de studie.		
2. Ik begrijp dat ik op ieder moment kan stoppen zonder enige reden hiervoor te moeten opgeven. Mijn opnames zal dan geen onderdeel uitmaken van de studie.		

	JA , ik geef toestemming	NEE , ik geef geen toestemming
3. Mijn opnames mogen gebruikt worden voor het doel van deze studie.		
4. Mijn opnames mogen getoond worden, bijvoorbeeld voor onderwijs aan studenten of voor wetenschappelijke presentaties en bijeenkomsten waarbij uw gezicht herkenbaar in beeld kan zijn en uw stem herkenbaar hoorbaar is.		
5. Mijn opnames mogen ook voor vervolgstudies gebruikt worden door andere wetenschappelijke onderzoekers en mogen daartoe worden opgenomen in een database.		

Ik weet dat mijn deelname geheel vrijwillig is en dat ik mijn toestemming op ieder

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moment kan intrekken zonder dat ik daarvoor een reden hoeft op te geven.

Naam deelnemer:

Datum:

Handtekening deelnemer:.....

In te vullen door de uitvoerende onderzoeker

Ik heb een mondelinge en schriftelijke toelichting gegeven over de studie. Ik zal resterende vragen over de studie naar vermogen beantwoorden. De deelnemer zal van een eventuele voortijdige beëindiging van deelname aan deze studie geen nadelige gevolgen ondervinden.

Naam onderzoeker :

Datum:

Handtekening onderzoeker:

Appendix C – Final coding Scheme

Table 14

Coding scheme of specificity

Specificity			
Type	Subtype	Key criteria	Example
Specific memory	Type 1	<ul style="list-style-type: none"> -only one event - within one day -no narrative outside the event -naming a time tag that is not part of the event like ‘sometime in eight grade’ does not lower the specificity of the memory 	<p>"ik ben dus katholiek en toen woonden wij in [plek in Nederland 2] en mijn vader ging naar de kerk, ik denk dat ik een jaar of 4, 5 was. En was op een zondag. Mijn moeder was geloof ik thuis gewoon. En ehm, dat ik er zo lang, het duurde zo lang voordat ie weer thuiskwam. En toen ehm, ehm, of hij nou naar de kerk dat weet ik niet of ergens anders, dat kan ook wel. Maar toen ben ik ehm gaan opwachten ergens. Ik weet nog bij een hekje stond ik. En toen zag ik hem aan komen lopen. En eh, ja, daar was ik zo blij van dat hij weer thuiskwam. Was een heel fijn gevoel. Daar werd ik heel blij van." (P16)</p>
	Type 2	<ul style="list-style-type: none"> -only one event within one day is told through one or more statements that are related to that event AND autobiographical context AND general narrative about other events -important indicators: <ul style="list-style-type: none"> a. a statement of the uniqueness in time b. expression of strong emotion c. declaration of the importance of the memory d. imagistic detail e. speech 	<p>“Jaa natuurlijk want uhm wij werden uit mekaar gescheurd je had geen telefoon niks. Je wist niet wie waar zat en en al die dingen meer. Dus je moet maar afwachten naar die drieënhalf jaar was een bevrijding en kwamen bij elkaar. Gelukkig kwam mijn broer uit het jongenskamp dus we ontmoeten elkaar weer. Maar het wachten was op m’n vader. En nou we zaten dus alle in het kamp van de onafhankelijkheidsstrijd zeg maar van Indonesië met Nederland en om ons heen kregen de mensen bericht van of de vader of de zoon het overleefd had of het was overleden maar mijn moeder niet. En ik was altijd degene die die drop uit moest omdat mijn andere zussen zou de</p>

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	<p>Type 3</p>	<ul style="list-style-type: none"> -a. two or more memories of Type 1, 2 or both b. at least 2 specific memories of Type 1 or 2 and 1 episodic or generic memory - not in the same 24 hour period - single events of Type 1 or 2 contain: <ul style="list-style-type: none"> a. precise detail of action OR b. mention of specific moment in time and place AND one of the single events is unique in time 	<p>baan en ik moest dus houtspikkelen en zoeken waar nog eetbare planten zijn en al die dingen meer. En toen kwam ik op een dag thuis en toen hield een van mijn zusters me tegen en die zei, je je mag niet eerst uh binnenkomen. Ja, en en uh en waarom? Ja daar is iets met ma gebeurt. Wat bleek, eindelijk kreeg m'n moeder via het rodekruis bericht dat mijn vader twee maanden voor de bevrijding was overleden en zei had daar zo een shock over gehad dat zij dus onmiddellijk werd opgenomen in het ziekenhuis.” (P3)</p> <p>“Ik had voor mijn gevoel iets van, ja dan moet ik iets mee en toen heb ik eh ... ik heb wel, de, de, de, het zwembad erop aangesproken dat dat eh ik wilde dat ze maatregelen namen. Heb ik geen respons gekregen. Ik had misschien moeten bellen maar ik heb gemaild. En eigenlijk naar aanleiding van het feit dat ze niet voor mijn gevoel daar wat mee deden, heb ik ook de politie geïnformeerd dat ik ook het zwembad geïnformeerd had en hun gevraagd er wat mee te doen omdat ik toch wel vond dat het niet zo voorbij kon laten gaan. En toen gegeven moment ja, het bleek, ik krijg een bericht terug dat zij er heen geweest waren. En daar was ik wel ontzettend blij mee. Gaf mij een gevoel van eh, ja, er wordt naar je geluisterd. Dat was een heel fijn gevoel, was ik heel blij mee. Bleek dat die man op vakantie was van het zwembad en toen dacht ik ja je moet toch elkaars emails lezen. Ja, goed. Dat is niet mijn pakje.” (P14)</p> <p>“Mmm, ... nog meer verdrietige momenten... ja</p>
<p>Overgeneral memories</p>	<p>Episodic/Extended memories</p>	<p>-Longer than one day; period;</p>	

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	OR unclear duration	toen op gegeven moment in der daad toen ik het werk verloor, dat is wat ik net vertelde van de handelskantoor en die bakkerijproducten, dat was wel een heel vervelende periode is dat geweest, want toen was ik 48/49 en de kinderen die gingen toen net zo een beetje het huis uit. Die begonnen met studie en dat soort dingen. En toen heb ik me ook wel heel verdrietig gevoelt, omdat toen, omdat toen, om de tijd was in 1900 ah in 2000 was het veel moeilijker om gewoon weer werk te vinden. Met solliciteren en alles en iedere keer weer die afwijzingen en ja, was ook heel, heeft over een jaar geduurd. Was niet zo heel specifiek misschien.” (P11)
Generic /Categoric memories	-Summaries of repeated events - Only generic if it consists entirely of the generic narrative, if it consists of a specific or episodic event, it is characterized as Type 2 or 3 specific or as episodic	“En ieder jaar, op 6 september, ga ik even naar, ik ga nog vaak genoeg hoor, ga ik naar mijn zoon en schoondochter toe, om op die dag zou hij, is hij ook geboren. En dan ga je toch even bij elkaar zitten allemaal en maar dat is dan veel luchtiger.” (P1)

Note. Adapted from “Classification System and Scoring Manual for Self-defining Autobiographical Memories.” by J. A. Singer and P. S. Blagov, 2000. Retrieved from http://self-definingmemories.homestead.com/Classification_System___Scoring_Manual_for_SDMs.pdf

Note on specificity (taken over from Singer & Blagov, 2000)

- It has to have one statement that is clearly focused upon one particular day and time
- If the statement does not provide any statement of time, emotion, importance or detail, then the memory is not specific
- If the narrative goes over days, weeks or month the memory is not specific

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Table 15

Coding scheme of vividness

Vividness		
Type	Key criteria	Example
Vivid	sensorial detail (see, hear, feel, smell) and/or contextual detail (who, what, where, when, why)	<p>“Maar wat ik nog meer zag, nou wil je toch over hebben?”</p> <p>Die gingen rukken aan die parachutes want die waren van echt zijde” (P3)</p> <p>“Die was eh, 9 maanden. En de volgende morgen zou mijn eh, schoondochter is dat he, zou mijn schoondochter naar het ziekenhuis gaan, naar [plek in Nederland 1] om te bevallen. En zondag 's middags kreeg ze pijn in de buik, en toen belde mijn zoon, die belde mij op, toen ze in [plek in Nederland 1] waren. Ik kom in [plek in Nederland 1] aan, is het kind, was dat doodgeboren net. Dus was helemaal vol, volwaardig...” (P1)</p>

Table 16

Coding scheme of valence

Valence			
Type	Subtype	Key criteria	Example
Positive	Happiness		<p>“En nog, ja dat vond ik ook, ik was ook heel blij dat eh, eh, toen ik directeur werd. Vond ik ook fantastisch. Dat het dus allemaal, dat het ook zo liep. Ik was docent en ik ben slechthorend en ik, ik wist wel, ik wil niet dat mijn 55^{se} voor die klas daar met die puurs, want dat, dat, dat trek ik niet, dat lukt me niet met begroei en, dus ik dacht ik moet iets doen, directie management. En dat is ook gebeurt. Toen ik dat een mal besef dan dacht ik, managementcursus. Ja, de sollicitatie was raak. Naaa, dat vond ik echt. Vond het heerlijk vond ik echt helemaal.” P(13)</p>
		Other pos. emotion	

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		Every positive emotion that is not about happiness	“Ja daar had ik heel veel respect voor die loonwerker en die man kende ik goed en zoals hij dat deed, was gewoon heel goed, het was een heel, echt een heel mooi moment, wel, ja. Ja dan heb ik de drie (lacht). “ (P14)
Negative	Sadness		“Ja, daar kan ik niet over beginnen, zo moeilijk heb ik het daar mee. ... Nouja, het is zo, dol, we waren dol op elkaar. Altijd samen uit en samen thuis. Met vissen dit en vissen dat. En äh, sinds een jaar mag hij niet meer hier komen. Van z'n vader. Z'n moeder ook hoor. En daar heb ik heel veel verdriet van.” (P1)
	Other neg. emotion	Every negative emotion that is not about sadness	“Drama. Echt drama (lacht). Dat was echt een drama. Want die, dat waren twee Moslimmannen, mijn schoonzoon is ook Moslim maar niet overtuigd, dus hij gedraagt zich niet zo. Maar niks mis mee, maar dit, ja ik denk hij heeft ook niet echt iets met Moslimzijn te maken denk ik maar... Weet je wel, zo een man die eh, de baas weet je, dat is vreselijk. Echt vreselijk was het en ja. Ik was al eens daar geweest in het verleden en toen heeft mijn schoonzoon ook al tegen me gezegd, je moet niet tegen die mannen praten, mag ze geen hand geven en dus met dat gevoel was ik daar zo een beetje heen gegaan. Nou het was ook echt niet leuk...” (P14)

Table 17

Coding scheme of perspective

Perspective		
Type	Key criteria	Example
Observer (OP)	Overall, mainly 'you' Distance from the experience Can include: a) View from now over the past like 'Ik weet nog...; Ik denk dat ik toen.' b) The development of an argument, theorizing and position taking,	“Kijk dat kan ik nu zeggen in mooie woorden maar toen zag ik dat allemaal maar kon dat niet plaatsen wat dat precies was. Maar later natuurlijk dan denk je, ja tuurlijk wat heeft zij, want zij als moeder moet haar zoon opofferen. Ja? Terwijl ze dat verstandelijk wel wist maar lichamelijk of ja, hoe noem je dat, uh uh emotioneel natuurlijk, ja,

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	from a present time perspective c) Before, during or after a narrative or a report 'moral of the story'	had ze daar wel moeite mee wat begrijpelijk is natuurlijk." (P3)
Field	Mainly Me, I, Close to the experience Being part of the memory that is told	"Nou, op ieder geval er was een foto, daar is een foto en daar staan drie leuke meiden op. En ik had daarbij willen staan. En ik vond ook dat ik daar recht op had om erbij te staan en ik was heel verdrietig, gekwetst, dat niemand bedacht had van hee, we moeten [naam van geïnterviewde] even, even erbij. Waar is ze? Want ik was in hetzelfde gebouw, ik was erbij. Ze hebben het niet gedaan. En daar heb ik toen wel over gepraat maar ik heb niet de indruk dat ik ze daarmee kon bereiken, dat ik het helder kon maken. Ja, daar was ik heel verdrietig over. Ja, vond ik heel, ik voelde me zo buitengesloten terwijl ik dat niet eerlijk vond. Nee, dus." (P13)

Note. Adapted from "Interviewing for life-histories, lived situations and personal experience The Biographic-Narrative Interpretive Method (BNIM)," by T. Wengraf, n.d.

Appendix D – script pitch (adjusted from Mayer, 2017)

Zoom to selection

Extract visible pitch contour

endeditor

min = Get minimum: 0,0, "Hertz", "Parabolic"

max = Get maximum: 0,0, "Hertz", "Parabolic"

mean = Get mean: 0,0, "Hertz"

sd = Get standard deviation: 0,0, "Hertz"

varkoef = (sd / mean) * 100

Remove

appendInfoLine: " ",fixed\$ (min, 2), " Hz", " ",fixed\$ (max, 2), " Hz", " ",fixed\$ (mean, 2), " Hz", " ",fixed\$ (sd, 2), " ",fixed\$ (varkoef, 2), " %"

Appendix E – script intensity (adjusted from Mayer, 2017)

Zoom to selection

Extract visible intensity contour

endeditor

min = Get minimum: 0,0, "Parabolic"

max = Get maximum: 0,0, "Parabolic"

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EXPRESSION

mean = Get mean: 0,0, "energy"

sd = Get standard deviation: 0,0

varkoef = (sd / mean) * 100

Remove

appendInfoLine: " ",fixed\$(min, 2), " dB", " ",fixed\$(max, 2), " dB", " ",fixed\$(mean,
2), " dB", " ",fixed\$(sd, 2), " ",fixed\$(varkoef, 2), " %"