

Research Article

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Emotion and Ageing in Discourse: Do Older People Express More Positive Emotions?

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Abstract: Several psychological lab studies have shown that older people feel more positive emotions than younger people. So far, however, there has been little research on whether older people also express more positive emotions in their discourse. This paper reports the findings of sentiment analysis from the Spoken British National Corpus 2014 (Spoken BNC2014) across 10 age groups, with details on eight emotions (anticipation, joy, surprise, trust, anger, disgust, sadness, and fear), followed by structural topic modelling to reveal the thematic concerns of different age groups. This research generally supports earlier psychological lab studies that the older generation's discourse is more positive than that of the younger generation; however, the findings also show that positive and negative emotions fluctuate over the life span, with pronounced dips in overall positivity in the 20s, 40s, and 60s. Subsequent structural topic modelling explains why people are more positive or negative at certain ages.

Keywords: discourse analysis; positive emotion; sentiment analysis; structural topic modeling

1 Introduction

Extensive research has shown that as we get older, the ways we understand and regulate emotions change. Some researchers argue that there's a U-shaped relationship

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between emotion and ageing: happiness level remains the lowest in midlife and are higher in younger and older age groups (Blanchflower and Oswald 2008; Consedine and Magai 2006). However, others proposed an inverted U-shaped curve between emotion and ageing: happiness level increases and peaks at midlife, then it starts to fall. How can the relationship between emotion and ageing be explained?

Psychological lab studies (e.g. Potter et al. 2020) have tried to explore the relationship between emotion regulation and ageing using several theoretical models, among which the most popular one is socioemotional selectivity theory (SST). According to SST, people's perception of time and prioritization of goals change with ageing (Carstensen 2006). Ageing makes people consciously realize that time is finite, so they tend to maintain contact only with whom they deem most valuable and avoid meaningless socializing. Older people tend to prioritize things from which they can gain more emotional meaning and often let go of negative emotions around heated or unpleasant events. Younger people, in contrast, tend to prioritize goals related to knowledge acquisition and tend to defer emotional gratification. Therefore, negative information can be more firmly embedded in younger people's minds than in those of the older generation (Kennedy, Mather, and Carstensen 2004). Moreover, older people have better emotional resilience, adapt better to stressful situations, and are less worried about what others think of them (Peck 1968). Another explanation for emotion regulation and ageing is cohort effects (e.g., Felton 1987), which reflect the role of social and geopolitical changes in shaping people's positive and negative emotions. Shared experiences, such as economic crises and natural disasters, can influence people's positive and negative feelings. This view is held by Sutin et al. (2013), who found that people who lived through the economic crisis of the Great Depression enjoy less emotional well-being than those born during more prosperous times.

Although there are plenty of research on emotion and ageing, they are limited in several ways. First, most studies on emotion and ageing have reported inconsistent results. Many studies have reported a U-shaped relationship between age and life satisfaction, with a dip in people's middle life and higher satisfaction in younger and older groups (e.g. Blanchflower and Oswald 2008). However, an increasing number of researchers have also challenged the well-established relationship between age and well-being and even proposed an "inverted U-shape" curve (Galambos et al. 2020).

Second, very few studies have examined the expression of negative and positive emotions in discourse; instead, most studies have utilized lab tasks to track differences between younger and older people's attention to visual stimuli, such as pleasant and unpleasant pictures and film clips. For instance, Fernández-Aguilar et al. (2018) used a film clip to elicit six target emotions – disgust, fear, sadness, anger, amusement, and tenderness – between young and older adults,

followed by a neutral state, using a Self-Assessment Manikin (SAM) to compare their arousal ratings. Fernández-Aguilar et al. (2018) found that older adults are more likely to recover from intense negative emotions than younger adults; similarly, an eye-tracking experiment conducted by Isaacowitz (2012) showed that older adults recovered more quickly from bad moods when exposed to upsetting videos. These lab-based psychological tests are indeed powerful representations of people's emotional curves; but will similar observations hold true of people's emotions expressed through conversations and speeches? Are older adults more inclined to hide their negative feelings, or do they feel freer to express their positive and negative emotions? In addition, previous studies on emotion and ageing have only focused on the global categories of positive and negative emotions; more nuanced emotions, such as trust and surprise, were not included in the research results.

This study fills these gaps by assessing the relationship between emotion and ageing in discourse using sentiment analysis. Are the developmental paths of people's emotional curves as conveyed in communication different from psychological lab assessments of their general emotional states? If positive ageing also holds true in people's discourse, do negative emotion frequencies fall off a cliff, or are there any twists and turns? Do people feel more content and more satisfied after surviving some midlife crisis, or do multiple losses in one's old age make people feel distressed?

This paper sets out to better understand the association between emotion and ageing by examining the discourse of 10 age groups through corpus-based sentiment analysis. The remainder of this paper proceeds as follows. After providing an overview of emotion and ageing, Section 2 summarizes previous literature on the U-shaped curve, inverted U-shaped curve, and the linear relation between emotion and ageing. In Section 3, we will introduce the BNC2014 corpus, from which discourse materials for the 10 age groups were retrieved; then, we conduct sentiment analysis of men and women in the respective age groups and apply structural topic-modelling to explore what makes people of different age groups happy or sad. Next, the results of semantic analysis and structural topic-modelling are presented, in Section 4. Section 5 concludes our research and discusses avenues and implications for future research.

2 Emotion and Ageing

Numerous studies have tried to explore the relationship between emotion and ageing. However, because of the different methodologies, data sets, and samples used, studies generated inconsistent and even contradictory findings, showing either a

U-shaped, an inverted U-shaped, or a linear relation between emotional well-being and ageing.

The U-shaped relationship assumes that people's emotional well-being is supposed to reach its minimum in midlife and are better in younger and older age groups. One of the first works that generated a U-shaped curve between emotion and ageing is conducted by Clark and Oswald's (1994) who based their studies on the British Household Panel Survey and the General Health Questionnaire and found that the minimum emotional well-being appeared in one's 30s. Ageing, however, is not the sole variable for emotional well-being. It is also moderated by factors such as personality and the developmental levels of different countries. Kim et al. (2023) explored whether the U-shaped curve vary with personality. Their research results generally supported the U-shaped relationship between emotional well-being and ageing, but also found that people's happiness level during old age did not bounce back for people with low agreeableness and high neuroticism. Deaton (2008) carried out a cross-country comparison of the U-shaped curve and concluded that the higher level of emotional well-being during old age is only found in developed countries where the senior citizens enjoy relatively high living standards and are thus happier with their lives. Contrary to the U-shaped relationship, scholars who found an inverted U-shaped curve between emotional well-being and ageing maintained that the happiest moment came during people's middle life (e.g., Easterlin 2006; Mroczek and Spiro 2005). The linear relationship maintains that positive and negative emotions are not significantly influenced by ageing and that there's an even distribution between emotional well-being and age. For instance, Myers and Diener (1995, 11) claimed that "no time in life is notably happiest or unhappier than others". The relationship between emotion and ageing in psychological studies seems to be inconsistent, but how is the situation in discourse studies and how can emotion in discourse be measured?

Emotion has received increasing attention in discourse across several disciplines in recent years, in a so-called emotional turn, because emotion is a multifarious phenomenon that combines psychology, neurology, and communication (Mackenzie and Alba-Juez 2019). In this study, we concentrate on the linguistic rather than cognitive perspectives, view the expression of emotion as a discursive practice (Bednarek 2009, 405), and aim to verify whether the discourse of different age groups reflects their actual affective state as shown in previous psychological lab tests.

Before the advent of corpus linguistics, the analysis of emotion-in-discourse relied on the time-consuming manual annotation of linguistic and paralinguistic features (Bloch 1996). Corpus linguistics has made possible large-scale analyses of

emotional discourse features, such as appraisal (Martin and White 2005), stance (Biber 2006), and semantic prosody (Sinclair 1991). Although these concepts are closely connected, their research scopes and analytical frameworks vary widely. Appraisal analysis (Martin and White 2005), evolved from the theoretical framework of systematic functional linguistics, can be divided into three interacting domains: *attitude* (emotional reactions and judgements), *engagement* (the source of attitudes), and *gradation* (the amplification and blurring of feelings). Though it involves some basic corpus query techniques such as concordancing, appraisal analysis is mainly qualitative.

In comparison, studies of stance (Biber 2006; Conrad and Biber 2000) and semantic prosody (Sinclair 1991, 2004) originate in corpus linguistics. Stance analysis focuses on the examination of recurring words, phrases, and syntactic structures; thus, it seems to enjoy a smaller scope than appraisal analysis does. Semantic prosody refers to the phenomenon in which neutral words can have positive or negative connotations when used in combination with different collocations. Both semantic prosody and stance analyses incorporate extensive search of keywords and collocations.

In contrast, sentiment analysis arises from computational linguistics and uses statistical algorithms to identify emotional states. Since co-occurring words, phrases, and syntactic structures can be factored into positive and negative sentiment frequencies in texts under investigation, sentiment analysis has a much broader scope than stance and semantic prosody analysis. It enables the classification of people's emotions-in-discourse into several branches, including anticipation, joy, surprise, trust, anger, disgust, sadness, and fear.

Until now, far too little attention has been paid to examining changes in people's emotional expressions in their discourse over their life span, let alone how people consciously express and reveal their emotions in daily conversations about leisure, work, etc. There has also been little detailed investigation of the longitudinal development of emotions across different age groups. To address these concerns, we formulated the following two research questions:

1. Whether the U-shaped relationship between age and well-being can also be observed in people's discourse?
2. What are the major concerns of different age groups reflected through emotions displayed in their discourse?

3 Methodology

3.1 Spoken British National Corpus 2014

We used the Spoken British National Corpus 2014 (Spoken BNC2014), which contains face-to-face conversations of British English speakers between 2012 and 2016.¹ This corpus is annotated with rich and standardized metadata, enabling detailed investigation of age groups, gender, dialects, socio-economic status, and so on.

Since we aim to investigate the association between emotion and ageing, we are particularly interested in the metadata on age groups. Spoken BNC2014 has 10 age groups, ranging from children (0–10) to older adults (90–99), as shown in Table 1. Since too many age groups would make the research results difficult to interpret, we classified the age groups into five broad categories. We tried to recategorize the age groups by staying as close as to the standard set by the World Health Organization (WHO). As adolescence is a critical transitional phase between childhood and adulthood, we start by defining this period. The WHO defines adolescents as people aged between 10 and 19 years old, which best suits the second age group in our

Table 1: Age groups in spoken British National Corpus 2014.

Classification	Age range	Number of speakers	Number of words
Childhood	0–10	7	144,273
Adolescence	11–18	42	696,919
Younger adult	19–29	250	4,192,327
	30–39	89	1,661,114
Middle adult	40–49	76	1,630,520
	50–59	77	1,166,898
	60–69	65	1,065,119
Older adult	70–79	33	575,721
	80–89	19	119,823
	90–99	4	84,913
Total		662	11,337,627

Note. We used the regular expression [A–Za–z0–9–]+ to calculate the size of the corpus.

¹ Spoken BNC2014 is gathered by Lancaster University and Cambridge University Press. Texts are freely available from the website: <http://corpora.lancs.ac.uk/bnc2014/>.

corpus. As a result, we labelled the second age group “adolescence”. The age group 0–10 is thus labelled children. For adult groups, we evenly distributed those aged between 19 and 99 into three branches: younger adults, middle adults, and older adults. Our five age groups include childhood (0–10), adolescence (11–18), younger adult (19–29 and 30–39), middle adult (40–49, 50–59, and 60–69), and the older adult (70–79, 80–89, and 90–99). The corpus covers 662 speakers, with a total of 11,337,627 words.

Before conducting further analyses, we need to separate the discourse materials for different age groups, as the original conversation files mix multiple speakers in different age groups. Let us first consider the age group 0–10 years as an example. The first step is to extract a list of speaker IDs from the metadata sheet `bnc2014spoken-speakerdata.tsv.csv` by limiting the age range. By examining the format of each utterance in the text files, we find that each utterance starts with angle brackets indicating the speaker id and ends with the marker `</u>`, as shown in the example below:

```
<u who= “S0115” n= “1”>I used to uh like to listen to classical music uh</u>
```

Therefore, the second step is to compile a txt sheet with regular expressions for retrieving discourse materials in each age group, with each speaker occupying a single line. After obtaining the speaker IDs in each age group, we filled the speaker IDs into the following regular expression, with each speaker occupying a single line:

```
<u n= “\S+” who= “S0140”>[\s\S]*?</u>3
```

Having prepared the speaker ID lists, we extracted the utterances of each age group using PowerGREP. By repeating this process, the discourse materials of each age group were obtained. We also separated male and female discourse for each age group; therefore, we have 20 files in total (10 groups in total, each group with a discourse file for male and one for female speakers): 0–10, 11–18, 19–29, 30–39, 40–49, 50–59, 60–69, 70–79, 80–89, 90–99.

3.2 Sentiment Analysis of Different Age Groups’ Discourse

There are three major approaches to sentiment analysis: machine learning, lexicon-based, and hybrid approaches, and three levels of sentiment classification: document level, sentence level, and aspect level (D’Andrea et al. 2015). Machine learning

² “S0115” is the id of a speaker in Spoken BNC2014.

³ This is the regular expression for extracting discourse materials. To obtain a whole sheet, we only need to fill in the slot behind “who” with the IDs of different speakers.

sentiment analysis assesses the sentiment of a text with classification algorithms while lexicon-based approaches use sentiment lexicon as the main standard for sentiment identification. Both machine learning and lexicon-based approaches have their strength and weaknesses. The strength of machine learning method lies in its ability to generate new trained data or models; however, it has difficulty in dealing with semantic knowledge not learnt from the data. In comparison, the lexicon-based sentiment analysis is easier for users as sentiment lexicons are readily available, but the research results can be limited by the lexicon involved.

Considering the characteristics of our data and the advantages and applicability of each method, we conducted sentence-level, lexicon-based sentiment analysis using the *sentimentr* package with the NRC lexicon (Rinker 2018). We first divided the eight emotions into positive and negative groups and then calculated the ratio between positive and negative frequencies in each age group. We then analysed the semantic frequencies of eight broad emotions (anticipation, joy, surprise, trust, anger, disgust, sadness, and fear) and their relationship with ageing. The results of sentiment analysis are accompanied by qualitative explanations of speech data using examples from different age groups.

To determine the developmental curves for the eight basic emotions, we first detected emotion words based on sentiment analysis and then computed the percentage of each basic emotion against the total frequencies of emotions in each age group. For instance, the frequencies of eight basic emotions for male speakers aged 0–10 are shown in Table 2.

The ratio of anger to total emotions is calculated as:

$$\text{Anger} = \frac{135}{135 + 136 + 112 + 173 + 131 + 121 + 92} * 100 \% = 12.56 \%$$

3.3 Structural Topic-Modelling Thematic Analysis of Different Age Groups’ Concerns

To explain what makes speakers in different age groups more positive or negative, we submitted our texts to the structural topic modelling (*stm*) R package developed by Roberts et al. (2014, 2016) to identify the key thematic terms in different age groups. Unlike traditional keyword analysis, *stm* extracts words with the highest probability. The word clusters in each age group constitute the topics of concern in

Table 2: The frequencies of eight basic emotions for male speakers aged 0–10.

Emotions	Anger	Anticipation	Disgust	Fear	Joy	Sadness	Surprise
Frequencies	135	136	112	173	131	121	92

each age group. Function words such as prepositions and articles are not theme-related but easily skew our research results, so we have removed all the function words while doing *stm*. We extracted the top three topics of each age group to identify people's primary concerns.

4 Results and Discussion

4.1 Results of Sentiment Analysis

As can be seen from Table 1, the number of speakers varied erratically across age groups. There are as many as 250 speakers in the 19–29 age group, while the number of speakers in the age groups 0–10 and 90–99 is only seven and four, respectively. Since contributors to the discourse materials in Spoken BNC2014 are instructed to record their conversations using smartphones, the uneven age group distribution of speakers in Spoken BNC2014 is relatively reasonable considering the smartphone ownership by different age groups in the UK. According to Statista, smartphone penetration is highest among those aged 16–24 and 25–34 – as high as 84 % and 88 %, respectively. However, only 26 % of people aged 65 years or older owned and used smartphones in 2014; thus, it is difficult for researchers to collect as many conversation recordings of people aged above 65 years as of those aged between 16 and 24 and 25–34.

Although the uneven distribution of conversation recordings across different age ranges is thus understandable, we still have to minimize its influence on our sentiment analysis and structural topic modelling. Therefore, instead of reporting the positive and negative sentiment frequencies of different age groups, we calculated the ratio between positive and negative frequencies in the respective age groups, as shown in Figure 1.

As illustrated in Figure 1, the older generation is more positive than the younger generation, as the ratio between positive and negative frequencies for both male and female speakers increases with age. Male speakers are slightly more optimistic than female speakers at a young age, but this changes as they approach their 60s: female speakers in their 60s start to become more optimistic than their male counterparts. The higher positive/negative ratio in old age confirmed the findings of previous psychological lab studies indicating that older adults are less likely to express negative emotions in discourse, but it also shows that people's positive emotions do not move straight up but fluctuate across various age spans. There are several V-shaped curves in Figure 1: two for female speakers, at 19–29 and 40–49, and three for male speakers, at 19–29, 40–49, and 60–79. Similar to previous studies (Blanchflower and Oswald 2008; Consedine and Magai 2006), we find a pronounced dip in people's 40s, but how can we explain the dip in people's 20s?

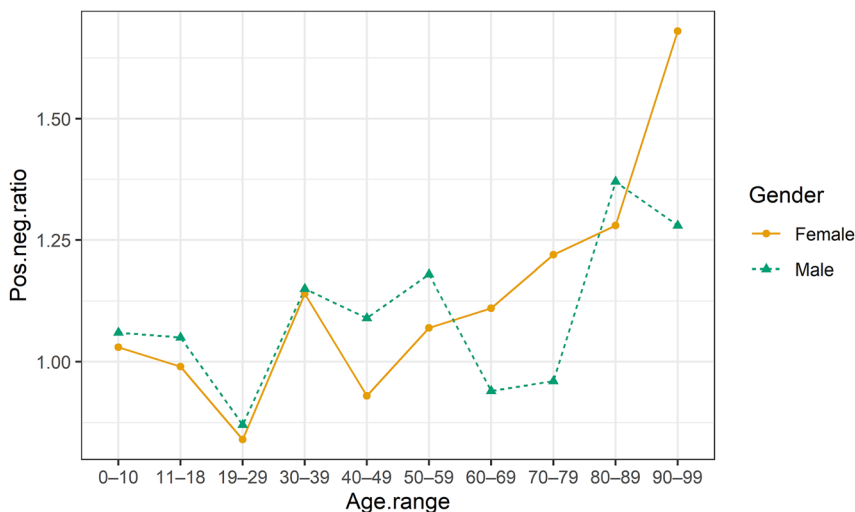


Figure 1: Positive/negative words ratio for people of different age groups.

Male and female speakers' first low ebb in emotions comes at 19–29, when they experience major life transitions. They may lack support in coping with schoolwork, independent-living skills, and relationships. Although people in their twenties are considered energetic, depression is not uncommon as they try to find ways to deal with changes and transitions, which can often trigger depression and irritability. Conversation (1) and conversation (2) are extracted from the Spoken BNC2014 conversations of people aged 19–29 on whether one should stay in college and the pressure of student loans. Two speakers in conversation (1) wonder whether college will be helpful in entering the work field. Speakers in conversation (2), though determined to continue their college studies, are burdened with student loans and taxes.

- (1) S0529: gonna stay in college then? cos I thought you might want to do that
 S0530: I don't know cos er
 S0529: well don't feel like you're pressured to cos
 S0530: no cos I'd rather live with people I like than stay in the college
 S0529: yeah
 S0530: like it's not a big deal to me, staying in the college or not
 S0529: no
- (2) S0632: most of it goes in erm goes in taxes and I like I was paying a lot more tax and paying back my student loan a lot more at, as well so a lot of that money would go out of my account before I'd seen it whereas now I'm on I'm on such a small amount that I don't pay back my student loan

S0631: mm

S0632: at all and I'm paying tax but they taxed me a stupid amount when I arrived and now they can't charge me any more because I've basically I've paid all the tax that I should in a whole year in one go

S0631: yeah put on emergency tax so you would get a rebate until it balanced out

S0632: yeah and now it's like my wages just go in and I just get it

Student debt worries speakers in conversation (2) because a college degree has become a near-necessity in the job market, but tuition fees are quite high, especially the Cameron government massively raised student fees starting in 2012.

The second valley comes at 40–49, with female speakers feeling more depressed than male speakers. There are many reasons for depression in one's 40s: the responsibility of caring for children and ageing parents, financial and work stress, and relationship issues. Women are less likely to be emotionally stable as menopause and perimenopause cause changes in their hormones, which leads to fluctuations in their mood. Conversation (3) shows two women talking about menopause:

(3) S0517: cos some of the treatment for erm cancer puts you into early menopause

S0558: yeah

S0388: doesn't it?

S0558: well she said she went through menopause when she was forty-two

S0517: gosh that's early

S0558: so she must be forty-seven

S0517: gosh

Born between 1966 and 1975, speakers in their 40s in the data are trying to save for retirement, taking care of ageing parents and young children, and struggling for work–life balance.

Overcoming menopause, the emotion curve for female speakers in the data is gradually becoming more positive, while male speakers experience another plunge in their emotions from their 60s until their late 70s. When approaching their 60s, people start to lose their family and friends, and their bodies can also decline sharply. However, women and men differ in the ways they express their emotions. Compared with men, women are more open to share their emotions, which leads to greater happiness. In conversation (4), the two speakers are talking about death:

(4) S0281: have you got any preference? You're going to be buried aren't you? next to your father

S0355: yeah but in a box of ashes if they'd allow me

S0281: oh really?

S0355: to put those in the grave yeah, there's in the headstone for my name

There is also a sharp rise in positivity among female speakers aged 90 to 99, but a decline among male speakers in the same group. This phenomenon can be explained by women's stronger willingness to seek help and treatment when experiencing emotional difficulties, thus allowing them to recover more quickly and be happier than men.

With a general understanding of people's emotion curves, we may wonder how people would express their eight basic emotions: anticipation, joy, surprise, trust, anger, disgust, sadness, and fear? In Section 4.2, we explore the eight basic emotions across different age ranges.

4.2 Eight Basic Emotions Among Different Age Groups

Previous studies only focus on one single emotion such as happiness (Kim et al. 2023), here we take anticipation, surprise, trust, anger, disgust, sadness, and fear into consideration. The developmental paths of eight basic emotions are illustrated in Figures 2–9. As can be seen in Figures 2–5, emotion frequencies for anticipation, joy, surprise, and trust are higher for older adults than for younger generations. The emotion curves for anticipation and joy are generally the same, with pronounced dips in men and women in their 20s and 40s and a low ebb for men in their 60s and 70s. Anticipation is concerned with pleasure or anxiety when considering or waiting for something. Conversations (5) to (7) show the use of verbs such as *eager*, *expecting*, or *adore* to express one's anticipation. Healthy anticipation can help people get through hard times and energize their lives. Conversations (8) and (9) show people's expression of joy through words like *ardent* and *bless*.

(5) S0084: I was just writing I was too *eager* to write it

S0083: so you only heard it recently?

S0084: yeah

(6) S0013: she was fine really wasn't you know we didn't been know she was *expecting* really

S0012: well I thought she was cos she had a big

(7) S0327: you get tourists going in there and of course tourists *adore* it because
It's exactly

S0445: yeah

(8) S0284: what what do you do for a job? you know what do you think about
dwarf throwing?

S0282: yes but was a very *ardent* feminist in my younger days

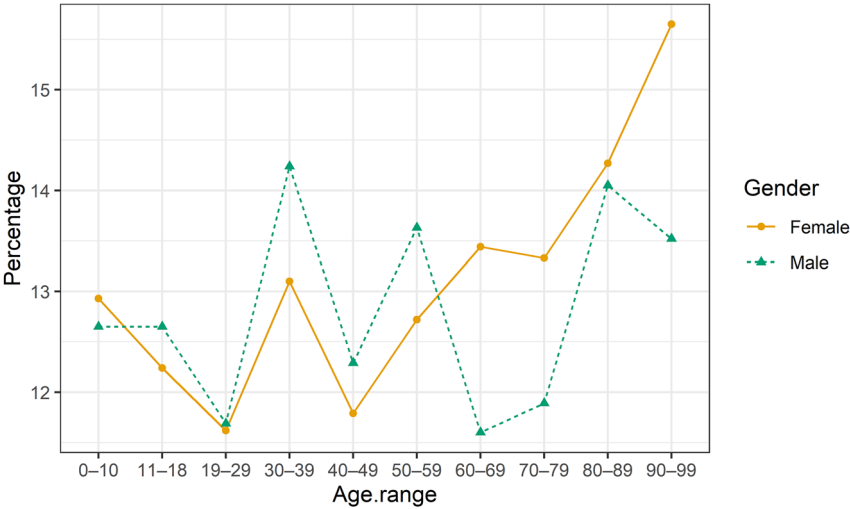


Figure 2: Anticipation frequencies for people of different age groups.

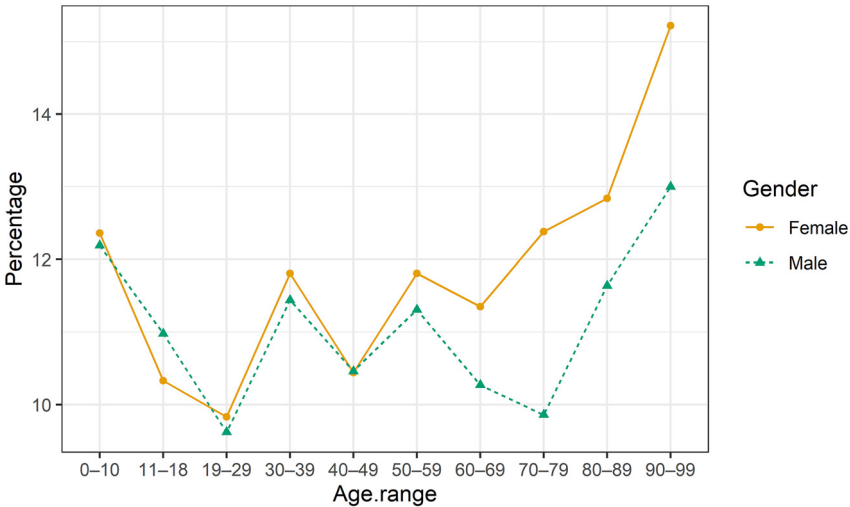


Figure 3: Joy frequencies for people of different age groups.

- (9) S0255: so yeah she said she and she got a bit upset about that and
S0315: oh *bless* her

Regarding surprise, frequencies are relatively high for children aged 0 to 10, as they are enthusiastic and eager to learn all the time. However, the surprise

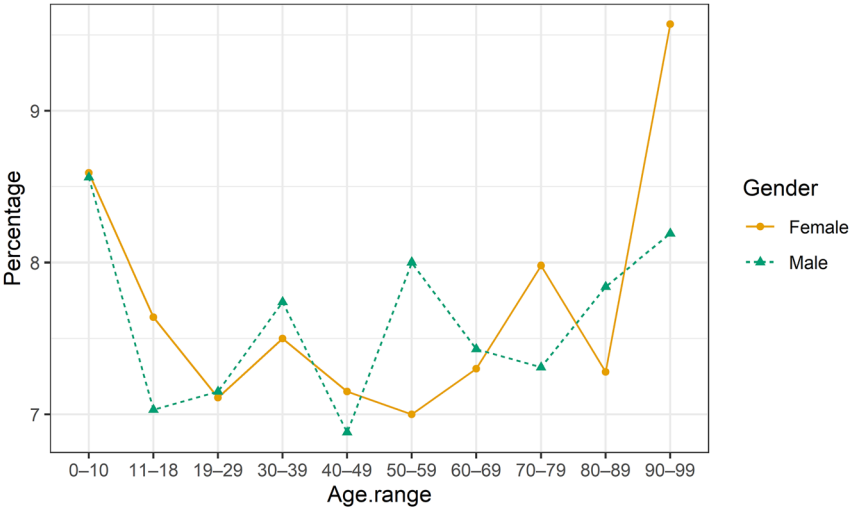


Figure 4: Surprise frequencies for people of different age groups.

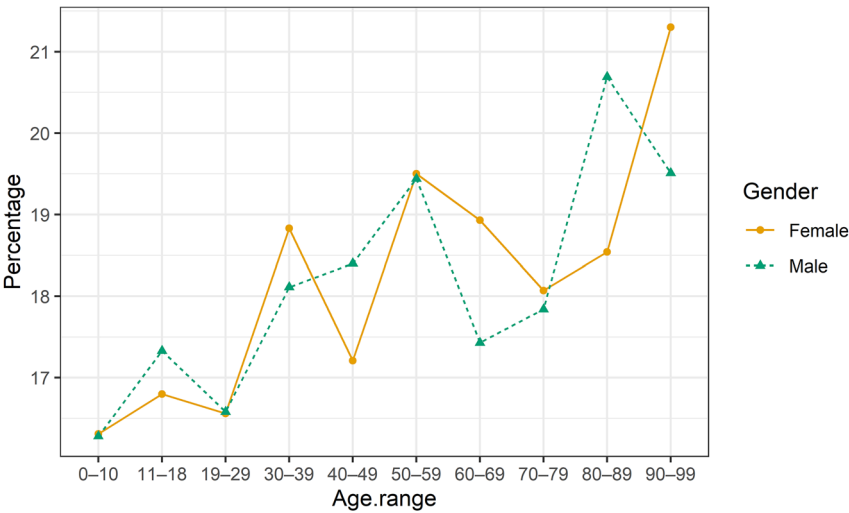


Figure 5: Trust frequencies for people of different age groups.

frequencies quickly fail as people age, more quickly for men than for women. Then, the frequencies gradually regained and fluctuated over time. An example is shown in excerpt 10.

- (10) S0653: hang on hang on hang on a backup in case you don't like?
S0654: in case someone doesn't want enchanted

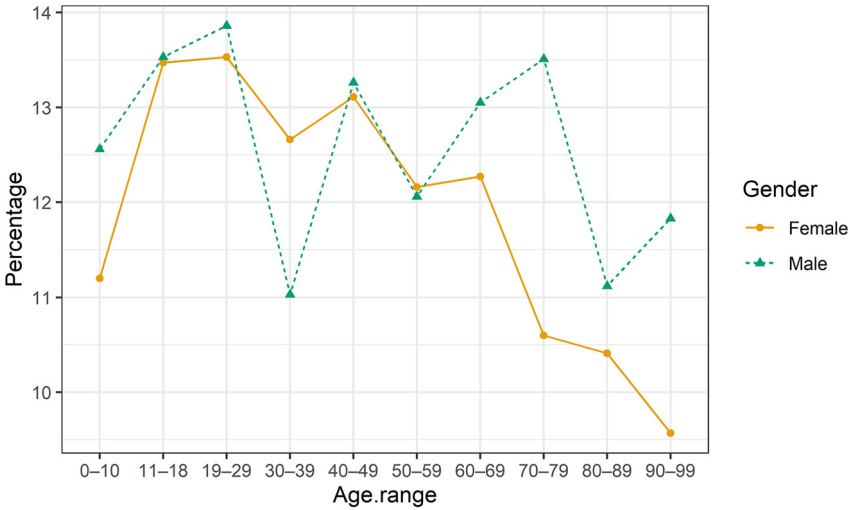


Figure 6: Anger frequencies for people of different age groups.

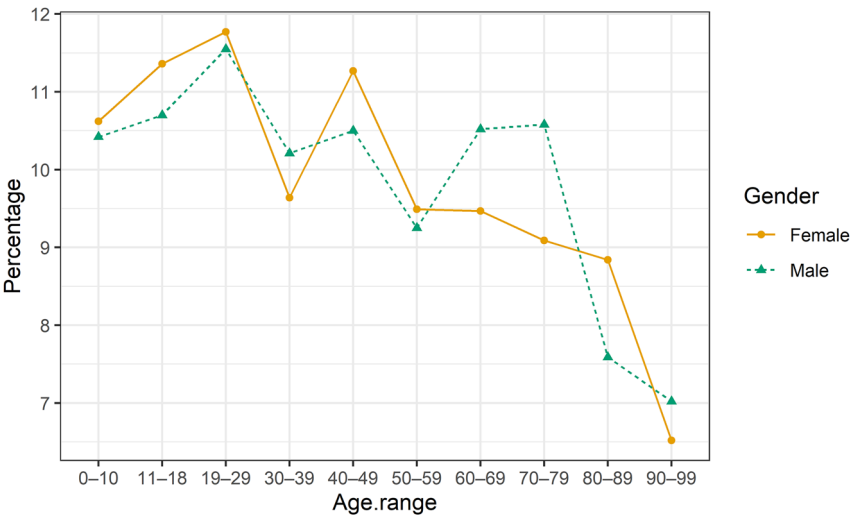


Figure 7: Disgust frequencies for people of different age groups.

S0653: in case someone doesn't want enchanted we could watch
The Slipper and the Rose

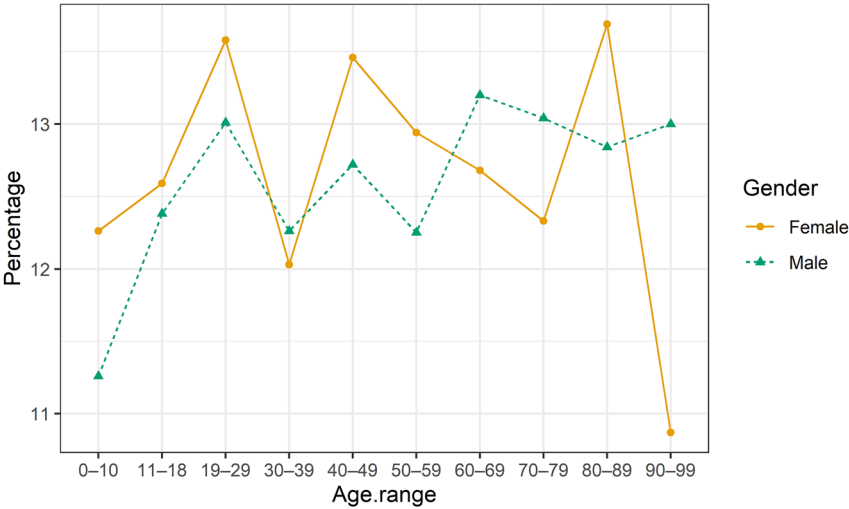


Figure 8: Sadness frequencies for people of different age groups.

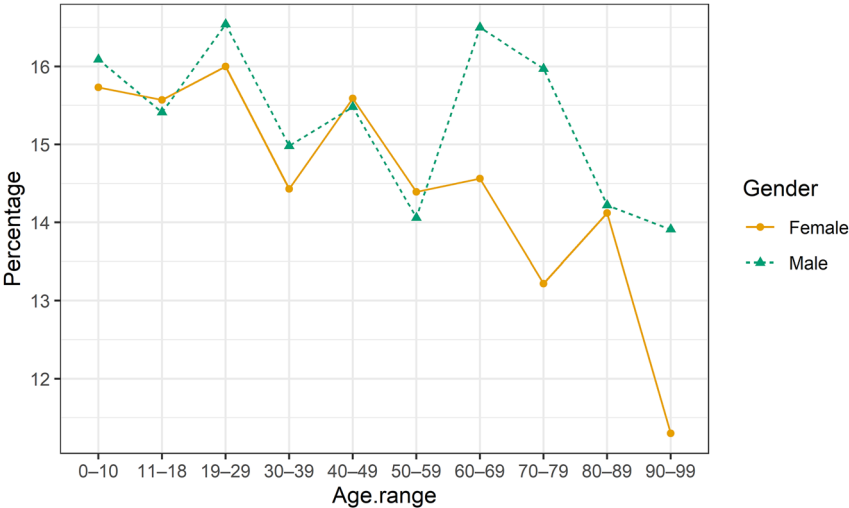


Figure 9: Fear frequencies for people of different age groups.

Unlike anticipation, surprise, and joy, trust frequencies are low for children under 10 years old and then increase as they become teenagers. The low trust frequencies in the early years (babies and children) can be partly explained by the ‘trust and mistrust’ stage in Erikson’s (1963) social-emotional development

model, which begins at birth. During this stage, the infant is uncertain about the consistency and stability of their caregivers. Moreover, nurturing trust with parents takes time. Similar low ebbs in trust frequencies occur in people in their 20s (male and female speakers), 40s (male speakers), 60s and 70s (male speakers), and 70s and 80s (female speakers). Excerpt 11 is an example of a trust expression.

- (11) S0257: at one stage I'm really sorry this like you know, I *assured* you that
 this had been done because I was being told it was look been looked
 after I said, and it and it wasn't done but I sorted it out now I've done
 this done that done the other I said
 S0255: right

When it comes to negative emotions, we find that as people age, they express fewer negative emotions in their discourse compared with their younger counterparts. People are less likely to reveal anger (as shown in conversation 12), disgust (as shown in Figure 7), and fear (as shown in conversation 14). The only exception is sadness – the discourse of older people shows more sadness than that of the younger generation. Chronic diseases and loss of loved ones during old age can give rise to sadness and loneliness during old age.

- (12) S0439: you just killed a bug you *bitch*
 S0441: I'm an actual *bitch*
 S0278: it's *abuse* isn't it?
 S0013: you know? yes it is
 S0094: don't be *afraid* to say if you don't later
 S0021: what
 S0008: and then I thought well, and then I started getting like that the last
 tooth started *aching* a bit
 S0012: mm
 S0008: but not bad enough to just an *ache* not a *pain*
 S0012: yeah

4.3 Structural Topic Modelling of Different Age Groups

After examining the general positive and negative emotion curves of male and female speakers, we turn to structural topic modelling, which sketches the top three thematic topics across age groups. We divided the 10 age groups into five categories: childhood (0–10), adolescence (11–18), younger adult (19–29 and 30–39), middle adult (40–49, 50–59, and 60–69), and older adult (70–79, 80–89, and 90–99). The factors behind people's positive and negative emotions are presented in the following subsections. As people are going through major events and life challenges in different age groups, they may experience changes in their mood. This section

tries to unravel the major life challenges that will influence the expression of their emotions.

4.3.1 Children (0–10)

Table 3 presents the top 10 thematic words for each topic. We assigned short labels to the three topics most discussed for children. The first topic concerns outdoor learning and activities in nature for children. In topic 1, we see words that are concerned with children’s learning and exploration (e.g. *came*, *land*, and *question*). Words in topic 2, such as *witch*, *live*, *must*, and *mind* are related to children’s reading and storytelling. The third topic reflects children’s material needs for food (*yum*, and *yummy*), clothing (*wear* and *hat*), and toys for learning and playing (*train*).

4.3.2 Adolescents (11–18)

Table 4 shows the top 10 thematic words for teenagers, aged 11–18 years. As students enter middle or high school, their discourse centres around their classes

Table 3: Top 3 thematic topics for children.

Topics	Thematic words
Topic 1: Learning and exploration	children, came, land, question, complete, cookie, Tuesday, bottom, hope
Topic 2: Reading and storytelling	far, witch, live, must, mind, rotate, juggle, suppose
Topic 3: Material needs	yum, train, change, hurt, true, round, yummy, wear, hat

Table 4: Top 3 thematic topics for adolescents.

Topics	Thematic words
Topic 1: Classes and after school activities	blah, truth, print, double, coach, insure, wood, shoe, cousin, egg
Topic 2: Care for politics, religion, and value-driven assessment	Muslim, celebrate, support, visit, mafia, attack, fancy, religion, legal
Topic 3: Socializing	women, weather, invite, flavour, response, coffee, product, track, dear, entire

(e.g. *print*) and after-school activities (e.g. *coach* and *shoe*). Topic 2 demonstrates students' care for politics (*mafia*), religion (*Muslim* and *religion*), and values-driven assessment (*legal*). Topic 3 focuses on students' increasing need for socializing and interaction.

Compared with children aged 0–10 years, speakers' concerns have shifted from outdoor learning and nature activities to schoolwork, politics, religion, and socializing. From conversation (16), we observe a slightly negative emotional term, *spooky*. The two speakers need to take the books out of the library but are worried about the cost it may incur each time, because 60 pence can be a considerable amount for students. Several modal particles used in conversation (16) also increased negativity. In the first line, we see a negation word *not* combined with *can*, which indicates the contrast between the speaker's volition to get the book out of the library and the library's rule preventing it. In the second line, another speaker responds with another modal verb *could*, which shows the possibility of taking the book out of the library, but unfortunately, one has to pay for it. In the third line, the speaker responds with another modal verb, which makes the emotions in this conversation even more negative. In the last line, the adjective *spooky* pushes the negativity to a new high.

- (16) S0509: I *can't* get it out of the library so it's got all these things on it
 S0510: well you *could* but you'd just pay money
 S0509: yeah but then you *have to* pay sixty pence for it every time
 S0510: but it is it is a bit *spooky* I think that there are so many books on there
 that you know preloaded

In conversation (17), we see that teenagers are beginning to show concern for politics, expressing their ideas on who should rule their country. Emotional markers such as *sticking*, *not fair*, and *displaced* demonstrate the teenagers' anger for letting someone who has the faintest life experiences in their country decide their rules.

- (17) S0689: I know that's, that's one of the big *sticking* point for me I don't like the
 idea of somebody who's who doesn't live who doesn't live in the coun-
 try who doesn't really have an idea of what the country's all about
 deciding our *rules* that's just *not fair*
 S0688: that's not even touched on all the *displaced* refugees

4.3.3 Younger Adults (19–29 and 30–39)

Table 5 shows the thematic topics for younger adults aged between 19–29 and 30–39. Topic 1 of discourse aged 19 to 29 can be justifiably summarized as 'jobs or activities for the 20s' as we see various professions and careers discussed by the young adults: *apprentice*, *soldier*. Topic 2 is concerned with their ideal cities:

Table 5: Top 3 thematic topics for younger adults.

Age span	Topics	Thematic words
19–29	Topic 1: Jobs or activities for the 20s	apprentice, soldier, sibyl, psycho, whip, MasterChef, lent, cheek, incline, lower
	Topic 2: Ideal cities	dual, restrict, acknowledge, safer, maintain, cyclist, Sheffield, Durham, admin, slower
	Topic 3: Young adult fashion	supper, boom, eleventh, smelt, lawyer, talent, toffee, avatar, perfume, blackberry
30–39	Topic 1: Engagement and getting married	sudden, design, box, theory, text, sign, ring, trip, double, direct
	Topic 2: Dealing with family stress	list, bird, o'clock, hotel, exercise, father, roll, Jewish, star, afford
	Topic 3: Midlife crisis	toilet, discard, wale, player, test, butter, mark, line, Christmas, lesson

Sheffield and *Durham*. Topic 3 can be given the label ‘young adult fashion’, under which we see various things and social activities most favoured by the twenty-somethings: *toffee*, *avatar*, *perfume*, *blackberry*.

For example, we see in conversation (18) that two speakers are talking about apprenticeships, which can be of great benefit to one’s job hunt and future career. One of the speakers may want to know if there are any chances of getting a similar apprenticeship to the speaker’s, but the speaker who responds hesitates to share, as it is hard for teenagers to hunt for jobs when competition is fierce. In conversation (19), an *erm* shows the speaker’s hesitation on how to respond. The speaker also emphasizes that he has only received an internship, not a real job offer. While responding to the question on ways to find an apprenticeship, the speaker only gives a vague answer, ‘online’. We also observe in conversation (19) that people in their 20s prefer fashionable exercises like *Zumba* during their free time to traditional ways of working out.

- (18) S0458: erm it was an *apprenticeship*
 S0456: but how did you find it I mean it’s
 S0458: on online
 S0456: oh right
- (19) S0041: I want *Zumba* and gym. I’m gonna get up on Friday and go swimming
 S0084: really?

Now, we move onto the second branch in the group of younger adults (30–39), as shown in Table 5. Topic 1 of the discourse for people aged between 30 and 39 can be summarized as ‘engagement and getting married’ as we see topic words such as *ring* and *double*. As for the second topic, we see words such as *exercise*, *father*, and *afford*; speakers in this age are beginning to shoulder the responsibility of looking after their families and dealing with family stress. Topic 3 can be labelled ‘midlife crisis’, as we see words such as *discard*, *mark* and *line*. As we can see in conversation (20), people in their 30s are trying to save money. Even a luncheon voucher cannot ease their worries about going out for lunch.

- (20) S0653: hang on I what I don’t want to do particularly is go out for lunch
 because I can’t *afford* it, okay
 S0654: we could use our Frankie and Benny’s voucher
 S0653: that’s still not very much money off I really don’t have much money
 at the moment so

4.3.4 Middle Adults (40–49, 50–59, and 60–69)

Table 6 shows the thematic topics for middle adults aged between 40–49, 50–59, and 60–69. The first topic for people in their 40s is summarized as ‘family life’.

Table 6: Top 3 thematic topics for middle adults.

Age span	Topics	Thematic words
40–49	Topic 1: Family life	evaluate, gear, environ, theme, ultimate, hug, interact, brownie, Lidl, friendship
	Topic 2: Politics and social events	Vietnam, rip, elect, David Cameron, idiot, tool, repress, require, shown, disaster
	Topic 3: Family burden	tip, receive, threw, fireman, graduate, intense, salary, essential, payment, cheque
50–59	Topic 1: Quality of life	rid, switch, educate, fall, west, within, brand, double, dress, garage
	Topic 2: Socializing and avoiding isolation	social, style, where've, remove, sold, site, detail, page, choir, Italian
	Topic 3: Health problems and exercise	gym, lift, exercise, ski, staff, fund, annoy, appoint, butter
60–69	Topic 1: Becoming a grandfather	handy, grandfather, Spain, ident, bullet, confuse, barn, useless, release, steel
	Topic 2: Mental and physical problems	boom, racket, bomb, clip, vicar, serious, pizza, knee, bye, roast

When approaching their 40s, people start to care more about family necessities, and we see words closely connected with family activities: *brownie* and *Lidl*. They also value support from families and friends more: *hug*, *interact*, and *friendship*. In conversation (21), speakers talk about a massage which has led to chronic pain in the speaker's wrist. The speaker shows his negative feelings, with 'shooting pain' and sadness about getting used to this kind of pain.

(21) S0255: are your hands affected by all the *massage* you do?

S0315: no not yeah wrist

S0255: yeah

S0315: yeah wrists are erm sometimes I get a few shooting pains but I think after the years of doing it I think I've got used to it

Friendship in one's 40s is different than at a younger age in that people are learning to maintain friendships with people who share different views and beliefs. In one's 40s, people seek to understand, but not to convince. People in their 40s seek mutual joy and respect. In conversation (22), the speaker shares his views on maintaining friendships with people who have different views. The speaker has used the idiomatic expression 'throw the baby out with the bathwater' to emphasize that we should not overlook the good characteristics of our friends while trying to get rid of the bad qualities.

(22) S0618: of them that they have very different political views and we ended up sort of having the group conversation about how because we're grown-ups we can still maintain a *friendship* with people

S0619: mm

S0618: who feel differently to how we feel and you know almost not *throw the baby out with the bathwater*

S0619: mm

S0618: because there are other aspects of our friendship erm or aspects of that

S0619: mm

People in one's 40s also pay more attention to politics: *Vietnam*, *rip*, *elect*, *David Cameron*, so topic 2 is labelled as 'politics and social events'. People in their 40s are also burdened with family responsibilities: *salary*, *payment*, and *cheque*, as shown in conversation (23). We assign the label "family burden" to Topic 3.

(23) S0525: I can't believe her salary for a twenty-one year old to manage a shop I mean she was managing Lipsy at nineteen which is thirty-two or something plus bonuses

S0517: brilliant

For people in their 50s, topic 1 shows words such as *brand*, *dress*, and *garage*, revealing people's concern for quality of life. The brand itself carries emotional functions, as it reveals a promise of quality and service. Already with enough accumulation in their 50s, older adults are not willing to sacrifice quality for cost. Care for dress codes and garages also shows people's concerns about quality of life. Thus, topic 1 is summarized as 'quality of life'. Topic 2 is given the label "socializing and avoiding isolation" because we observe the co-occurrence of words such as *social* and *style*. From conversation (24), we observe that Facebook still constitutes an important way of socializing for people above 50. For older adults who do not see each other very often, Facebook is a crucial way to keep up on the states and conditions of friends. This is evidenced by research from Statista which shows that the share of Facebook users for people aged between 45 and 54 (15.2 %) is only slightly lower than that of 18–24 (15.7 %). In Topic 3, we see words related to health problems, such as *fat*, *patient*, and *struggle*, as well as people's concerns related to working out (*gym*, *arm*, *lift*, *jump*, and *raise*), so Topic 3 is labelled "health problems and exercise."

- (24) S0690: well I've didn't I see something on *Facebook* that said he worked at
some sort of like this café or something?
S0687: don't know

Now, we approach the final group in middle adulthood (60–69 years). Only two topics are extracted from the discourse of people aged between 60 and 69: 'becoming a grandfather' and 'mental and health problems'. As people age, they suffer from more health problems. People also suffer from synaptic pruning and the loss of neural plasticity, as shown in conversation (25).

- (25) S0018: vocabulary will help you do that more than grammar and how about
Portuguese then?
S0103: well Portuguese I found very *difficult*
S0018: mm
S0103: I couldn't well I suppose I'm older now and memory doesn't stick
quite so well

4.3.5 The Older Groups (70–79, 80–89, and 90–99)

The discourse topics for people in their 70s, 80s, and 90s, as can be seen in Table 7. People recall memories or show how they value their family life. They may also engage in some simple activities to enrich their lives. Conversation (26) captures how two older adults recall their memories.

- (26) S0251: we did find that name on one of the censuses, didn't we?
S0252: yeah, that's nineteen o one

Table 7: Top 3 thematic topics for older adults.

Age span	Topics	Thematic words
70–79	Topic 1: Problems with bones and skin	strong, onion, sauce, sale, spring, aye, bone, broke, health, skin memory, heart, feet, teeth, level, power, ice, bang, island, lift rent, farm, sever, seventeen, sister, town, smaller, human, tie, American
	Topic 2: Problems with memory, heart, and teeth	
	Topic 3: Rural life on the farm	
80–89	Topic 1: Recalling past memories	nineteen, hour, dear, twenty, fact, window, drop, change, turn, war letter, gold, past, bought, buy, find, word, dad, sister, door
	Topic 2: Treasuring family life	
90–99	Topic 1: Simple activities	another, fish, end, far, must, else, part, shop, ill met, wouldn't, first, food, sound, keep, stay, school
	Topic 2: Recalling past memories	

S0251: nineteen o one, so this is the nineteen eleven

S0252: yeah

5 Conclusions

This study aims to test whether the well-established hypothesis of positive ageing also applies to people's discourse, that is, whether people are more likely to show positive emotions in their discourse as they age. To achieve this goal, we used sentence-level, lexicon-based sentiment analysis to track emotional development as people age and delved deeper into eight basic emotions: anticipation, joy, surprise, trust, anger, disgust, sadness, and fear. Subsequent structural topic modelling analysis captured the topics each age group was most concerned with.

Results of sentiment analysis showed that the older generation talks more positively than the younger generation overall, but also that people's negative emotions do not fall off a cliff as they age but fluctuate over the life span, with pronounced dips in their 20s, 40s, and 60s. The first low ebb in people's emotional curve comes in their 20s, when they experience major transitions from school to work and unavoidable feelings include frustration and lack of control. In their 30s, people's positive emotions rise again as they gradually get used to work and achieve a better work–life balance. However, female speakers experience depression again in their 40s, around the time they reached menopause. After menopause, women described their lives as more positive as they became older, whereas another pronounced dip occurred for men as they approached their 60s when they started to lose their families and loved ones. With the general emotional curve in mind, we moved on to sketch the trend for the eight basic emotions. We have also provided examples and interpretations to show how various emotion lexical items are reflected in the discourse of various age groups.

Structural topic modelling demonstrated that people's conversation topics changed as they became older. For children aged between 0 and 10, conversations are mainly concerned with outdoor learning and nature activities, reading and storytelling, and children's material needs. Teens aged 11–18 pay more attention to classes, afterschool activities, politics, religion, and socializing. When approaching one's 20s, the top priorities have become jobs and fashion, followed by family burden and midlife crisis in one's 30s and 40s. When it comes to people in their 50s, it is quality over quantity that matters for both life and friendship. Older adults reorient their goals as they increasingly suffer from health problems and appreciate that time is finite. For people over 60, their talks revolve around their illnesses, their memories, and rural life.

Although the number of speakers in the age ranges 0–10 (7 speakers) and 90–99 (4 speakers) is limited because of the difficulty in acquiring enough linguistic materials, the findings of this study will be of interest to psychological researchers who want to gain deeper insight into the association between emotion and ageing. Sentence-level, lexicon-based sentiment analysis complements previous lab studies on emotion and ageing. To develop a comprehensive picture of emotion and ageing, one can also take into consideration the influence of dialect regions (e.g. the North, Midlands, and South of the UK) and social grade classifications (e.g. higher managerial, supervisory, and skilled and semi-skilled workers), which are also annotated in the metadata of Spoken BNC2014.

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