Research internship report

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1. Introduction
A major part of the master’s degree in Language and Cognition is the internship abroad. It provides students to get a large amount of hands on experience with a research topic of their interest, all while getting to work in an environment that is much different from the one they are used to. When Dr. Keijzer told me about the research that was output by the department of experimental psychology at Ghent university, I quickly saw that the research performed was often extremely in line with my own interests. While my experience up until that point had been mainly in the field of psycholinguistics, I really wanted to learn about different experimental paradigms. More specifically, I wanted to get a large amount of hands on experience with eye-tracking methods. Dr. Keijzer and I reached out to the department, and thankfully Dr. Evy Woumans, from prof. Duyck’s research group, was more than happy to accommodate me. While there was some uncertainty regarding the studies that I could aid in before I went to Ghent, I trusted that the previous research output by this department would lead me into interesting avenues. In the end, the only decision I regret about coming to Ghent for my internship was that I only went for 3.5 months. My internship took place from 1 September 2018 to 15 December 2018.

2. Research lab
While there are multiple research groups at Ghent university, there is some overlap and a large amount of collaboration between groups in the department. The Language education and memory in multilingualism and academia (LEMA) project is a great example of this. In this project multiple research groups banded together to investigate the much discussed bilingual advantage. The department publishes a staggering number of papers on a variety of topics such as self-monitoring, differences between ‘regular’ bilinguals and professional interpreters, frequency effects in bilingual language processing and many more. Since there is such a large variety in research topics, I had a lot of freedom in choosing what I wanted to do during my time in Ghent.

Dr. Woumans, my supervisor, and Dr. Dirix, a researcher with whom I worked together very closely, both work in prof. Wouter Duyck’s research group. In this group there are 4 PhD students, and 11 post-doctoral collaborators. However, I also spent a lot of time in lab sessions of Prof. Hartsuiker’s research group, who has a larger number of PhD students. In short, while I officially belonged to prof. Duyck’s lab, I had the opportunity to converse with researchers from the entire department.

3. Research projects
Before going to Ghent there was some uncertainty regarding the upcoming studies, as the very large LEMA project would end just before my arrival. The main objective of my internship, however, was to learn to utilize eye-tracking equipment, design studies using eye-tracking methods, and of course to process and analyze data of these studies. In the end, Dr. Woumans introduced me to a number of possible research topics by sending me papers of recent publications from the department. This way, I was able to design a study in such a way that I could contact local researchers for support if needed. In the end, I was, and still am, heavily
involved in the expansion of the Ghent Eye-tracking Corpus (Cop, Dirix, Drieghe & Duyck, 2016). With the pre-existing data for this corpus, I did a study of my own regarding processing of emotion words, which I presented as a poster during COM2018. Additionally, I did a smaller ‘side project’ with facial priming; one of Dr. Wouman’s research areas. Furthermore, I did a visual world paradigm eye-tracking study to look whether a non-standard accent could modulate predictions of upcoming information. Lastly, in the same visual world study I investigated whether non-standard accents would be associated with lower status words more easily due to the lower socioeconomic status attached to them. In the upcoming section, I will expand on my research projects. Since there are a relatively large number of individual projects, most studies have not been completed yet. I will discuss the projects to the extent that they are completed at the time of writing. Reference lists for all the articles can be found at the end of this report.

3.1 GECO

Many experimental designs, regardless of how well developed they are, suffer from the problem that the data is collected in a way that is not at all naturalistic. Results, while significant, may not be ecologically valid. This can be caused, for instance, by selecting only certain stimuli or because of the specific experimental paradigm used. Researchers at Ghent university, therefore, decided to create a corpus that was highly unbiased, and representative of reading in a naturalistic environment. They asked monolingual and bilingual participants to read an entire book, while having their eye-movements tracked. This lead to the freely available Ghent Eye-tracking Corpus (Cop, Dirix, Drieghe, & Duyck, 2016). Due to its large size GECO can be used to test hypotheses without the need for data collection. During my internship I was tasked with the collection of data from 10 new participants in order to expand the existing corpus. Due to the nature of the corpus, and the activities I performed, this section will not be written like a conventional research paper. Any activity mentioned was done by me, unless mentioned otherwise.

Materials: The book “the mysterious affair at Styles” by Agatha Christie had been used in the previous iteration of GECO. This work was chosen because it was in the public domain, and because there was both an English and Dutch version. The book had already been divided for the previous version of GECO, such that each page in the experiment represented a paragraph from the book. Each chapter of the book had a number of comprehension questions. These had been made already in the previous iteration of GECO. Additionally, a number of secondary tests were administered that were related to language proficiency in both the L1 and L2. A sociolinguistic questionnaire was used to see how participants rated their own proficiency, and to what extent they used their different languages. Furthermore, participants would be asked to complete two lextale tests (Lemhöfer & Broersma, 2012) in order to make an estimate regarding their vocabulary size. Additionally, two lexical decision tasks were created to look into the speed at which words could be retrieved from the lexicon. Lastly, two spelling tests were used for both English and Dutch. For English the GL&TSCR spelling test was used (Depessemier & Andries, 2009). For English, the WRAT-4 test was used (Robertson & Wilkinson, 2006).

Participants: 10 (9 females) participants signed themselves up for the experiment via Sona systems (Age = 18-27). Participants had normal or corrected to normal vision, but only those
who wore contact lenses were allowed to participate due to the signal distortion that can occur in participants who wear glasses. Participants with cognitive disorders (e.g. dyslexia) were asked not to participate. Each participant was given a gift-card for an electronics store valued at 80 euros.

**Apparatus:** Eye movements were tracked using a tower-mounted Eyelink 1000 eye-tracker (SR Research, Canada). The sampling rate of each recording was set to 1000 Hz. Participants placed their heads into a head-mount, in order to reduce signal interference caused by movement. Recordings were only made of the dominant eye.

**Procedure:** Each participant was asked to complete four two-hour sessions. At the first session, participants gave written informed consent. They were then briefed about the procedure. After this they placed their head on the head-mount and they performed a calibration procedure. Dr. Dirix was present at the first session for each participant to see if there were any issues with the signal that could not be solved by recalibration or repositioning. Participants were then instructed to simply read the text like they would at home, while keeping their head still. At the end of each page, they were asked to press the spacebar, which would trigger a one-point drift check.

After each chapter of the book, a number of questions about the story would be presented on paper. When the reading portion of the session was done, two of the secondary tests were administered. Each participant read chapters 1-4 in the first session, chapters 5-7 in the second session, chapters 8-10 in the third session, and chapter 11-13 in the fourth session. Additionally, a few pages of “Alice in Wonderland” were presented at the start of each session to look at signal accuracy. Half of the participants got the English text in their first two sessions, whereas the other half got the Dutch half in their first two sessions.

The experimenter was present during the entire session to assure that the signal accuracy was maintained at all times. This was done in a number of ways. Firstly, if the value of the drift check that occurred per page exceeded 1.5, a recalibration procedure was started. Secondly, a recalibration was done every ten minutes regardless of drift check scores. Thirdly, the signal was continuously inspected to see whether looks were registered in the correct interest areas.

**Specific tasks done for this experiment:** A large number of tasks was done by me in the weeks leading up to the data collection, the days at which data collection occurred, and in the months after all data had been collected. Before starting with the data collection, I was tasked with recruiting participants, and scheduling testing days. Additionally, I was asked to edit pre-existing versions of the lexical decision tasks in E-prime (Psychology Software Tools, Pittsburgh, PA). In the weeks that data was collected, I sent reminders to participants regarding their upcoming test sessions, I answered their questions, and I helped them reschedule appointments if necessary. Furthermore, after the first sessions, Dr. Dirix and I met to look at the collected data to see if the signal was accurate. The comprehension questions, and spelling tests were also graded by me. Since this project was quite large (100+ hours), and since Dr. Dirix and I were both invested in other research projects, too, at this point, pre-processing of the collected data has not occurred yet. However, approximately in April of 2019, I will return to
Ghent for a short period of time to assist Dr. Dirix with this, as an informal extension to my internship.

### 3.2 Prejudice about socioeconomic status and nonstandard accents

Inhabitants of the Netherlands with a non-western migration background are often discriminated against on the basis of their accents. While this is not fair, it is also not surprising knowing what we know about accents and perception of socioeconomic status. The present study will aim to investigate the status dimension. More specifically, we will employ a visual world paradigm to see whether a low-status Turkish accent elicits a higher proportion of looks towards low-status words.

**Background:**

Studies on how accent and socioeconomic status are intertwined have been published for quite some time in sociolinguistic journals. A famous example are store employees who change to a higher-class accent when the perceived budget of a customer is higher (Labov, 1986; Eberhardt & Downs, 2015). However, this phenomenon is also often found the other way around, in the sense that one’s accent can shape how others perceive their socioeconomic status. This is where the status, or competence dimension comes into play. Zahn and Hopper (1985), for instance, presented a large number of participants with audio recordings from speakers with several accents (African American Vernacular, Appalachian white male, male graduate student, and female graduate student). They then asked to fill out a questionnaire about their attitudes towards these people. This resulted in a principal components analysis where one factor in particular, superiority, was indicative of socioeconomic status. This factor included variables such as literate or illiterate, educated or uneducated, and white collar or blue collar (p. 118). The authors stated that these factors are highly influenced by prescriptivist perceptions of what is a ‘proper’ accent.

These prescriptivist rules seemingly have real-life implications for those that do not or cannot follow them. Morales, Scott, and Yorkston (2012), for instance, found that participants preferred to listen to a spokesperson with a standard - high status - British accent over a speaker with a American Southern - low status - accent. As early as 1989, Riches and Foddy found that Anglo-Australian speakers were more willing to accept the opinion of a speaker with their own accent than that of someone with a Greek-Australian accent. Additionally, Gluszek and Dovidio (2010) found that speakers with a nonnative accent often feel alienated from their L2 culture in part due to their accent. Lastly, it was also found that more prejudiced participants use foreign accent to legitimize their racist viewpoints (de Souza, Pereira, Camino, de Lima, & Torres, 2016). Namely, the researchers found that the prejudiced participants were less likely to hire someone with a foreign accent. And indeed, the central bureau of statistics in the Netherlands found that those with a non-western migration background had much lower rate of employment (2018), although no specific mention of accent was made. In terms of housing, however, Oliveri (2009) found that landlords in the United States were often prone to refuse a family from renting a property if they have a foreign sounding accent.
The sources discussed in this short background strongly suggest that many native listeners prefer to listen to those with a more prestigious, high status accent. Moreover, those with lower status - foreign - accents, are seen as less capable, trustworthy, or intelligent. Additionally, we have seen some of the real-life consequences of this covert bias. Those with a nonnative accent are less likely to get jobs, or housing. This warrants us to investigate the Turkish community in Dutch-speaking countries. Is accent automatically a variable modulating perception of one’s socioeconomic status of these individuals? The present study aims to investigate this by means of eye-tracking methods. While a participant would rarely openly admit to stereotyping those with an accent, eye-movements could potentially show this covert bias towards thinking of those with an accent as having lower socioeconomic status.

Aim

In the present study we aim to investigate to what extent a foreign accent modulates L1 speakers’ expectations of socioeconomic status. More specifically, we will see if a strong Turkish accent elicits a higher proportion of looks towards a lower status item, when a participant is presented with words denoting either high or low status. We expect that implicit stereotyping of those with an accent will lead to a higher proportion of looks towards low-status items, which implies that a foreign accent leads to lower expectations of socioeconomic status.

Method

Stimuli: In order to make sentences, the Subtlex corpus (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014) was employed to find 40 high-low status word pairs. Word pairs were matched on frequency and word length. All word pairs were created such that both could be used in a logical sentence. Furthermore, each sentence was written in such a way that the target word was not the last word in the sentence. This ensured that effects could be measured to the fullest extent possible. An example of a sentence would be:

*Mijn muzieksmaak is al jaren hetzelfde en het liefst luister ik dan ook naar Snoop Dogg (Low status) /Stravinsky (High status) als ik de kans krijg (‘My taste in music has been the same for years, and I like listening to Snoop Dogg (low status)/Stravinsky (high status) the most whenever I get the chance’)*

Since we needed four words on screen in each trial, two randomly picked filler words were chosen from Subtlex. These words matched the target and distractor words on frequency and length. However, as can be seen in the example above, the sentences were written in a constraining manner that should cause participants to anticipate either the target or the competitor. In addition to the sentences created for this experiment, 40 word pairs for experiment 3.4 were created, along with 60 filler sentences.

Apparatus: A tower-mounted eyelink 1000 system (SR-Research, Canada) with chin rest was utilized for the present experiment. The sampling rate was set to 1 KHz. Only recordings of the dominant eye were made.
Speakers: Two male speakers from Ghent (Belgium) were asked to record the sentences. One of the speakers was a younger Turkish-Belgian man who indicated that he was often perceived as a foreigner by native Dutch speakers, despite having lived in Belgium his entire life. The second speaker was also a Turkish-Belgian man. This speaker had a more standard ‘well-educated’ accent, however. Initially the second speaker was asked to help record the sentences with both a Flemish and Turkish accent, in order to minimize interpeaker variation. However, the speaker was not able to attend the second recording session. Each speaker was compensated for their time with a gift card for a store of their choosing. Recordings were split up into individual WAV files, which were sampled at 44.1 KHz. Sound editing was done with Audacity® (Audacity Team, 2018)

Visual world paradigm: A visual world paradigm experiment was made in experiment builder (SR research, 2017) using a template from the SR support website made by user Jiye (2006). The four words were each placed in one quadrant of the screen. In the middle of the screen was located a fixation cross. The experiment was programmed such that there were 16 lists to counterbalance the location of each word.

Questionnaire: A short questionnaire that measured blatant and subtle prejudice was made. The questions from this questionnaire were translated from Coenders, Scheepers, Sniderman, and Verberk (2001).

Implicit association task: An implicit association task was devised using positive terms (e.g. vrijheid ‘freedom’), negative terms (e.g. aanval ‘attack’), Dutch names (e.g. Louise), and Turkish names (e.g. Volkan).

Participants: 50 students of Ghent university participated in the experiment (42 female) for course credit. Mean age was 18.62 (SD=1.23). None of the participants reported any neurological issues, and participants with corrected-to-normal eyesight wore lenses only. Participants who wore make-up were asked beforehand to remove their mascara, as this would interfere with the signal. Data from one male participant was removed due to extremely dark natural eyelashes.

Procedure: Each participant first gave informed written consent. They were then instructed on the task. After this the dominant eye was determined, and the participant took a seat at the head-mounted eye-tracker. Participants were then given verbal instructions by the experimenter regarding the task at hand. The task was to press the word as soon as they heard it. Participants could look wherever they wanted, as long as they kept their head motionless. The same instructions were then presented on screen, too, and participants were told to voice any questions or concerns. Then a 9-point calibration procedure was started, after which the experiment started. Each trial started with a white screen of 500ms after which the audio of the particular sentence started playing. This was repeated 140 trials (40 target for the present experiment. 40 for experiment 3.4, and 60 filler sentences). After this the participant went to a separate room with a laptop computer, where they completed the implicit association task and the questionnaire. Afterwards participants were debriefed on paper and verbally.
Analysis: All data will be preprocessed using Poretta, Kyröläinen, van Rij, and Järvikivi’s (2017) VWPr package, after which it will be analyzed using a logistic mixed-effects regression in R (R Development Core Team, 2018). For the analysis we will employ the a similar method as Loerts, Wieling, and Schmid (2013) did in their visual world paradigm investigation of Dutch grammatical gender. The proportion of looks towards the target versus the proportion of looks towards the competitor (averaged proportion of looks 200ms before onset of the target word until 200 ms after the target word) will be our dependent variable. Independent variables will be gender, trial number, handedness, positions of the target and competitor words, implicit association task scores, and prejudice score.

3.3 Investigating emotional processing in the L1 and L2 with GECO

Emotion words seem to hold a special place in our hearts, figuratively speaking. Quite a large amount of research has been done that suggests that in the L1 both positive and negative words are processed faster than neutral words. Results, however, are still somewhat inconsistent and the chosen stimuli used could be subject to subconscious experimenter bias. Furthermore, studies focusing on emotion words often look at single words or words in single sentence contexts at most. For the L2, on the other hand, research is very scarce, and subject to the same limitations as the publications on L1 emotional processing. For the present study I will use the GECO (Cop, Dirix, Drieghe, & Duyck, 2017), which is an openly available eye tracking corpus of naturalistic reading of both L1 and L2 speakers. The enormous amount of data, as well as the naturalistic manner in which the data was collected will give a much more accurate look into affective processing as it happens in real life reading situations.

Background:

If we want to know how emotion words can be processed differently from neutral words, it is imperative that we first know how emotion words are described in the literature. Scott, O’Donnell and Sereno, who have extensively written on the topic, say that “emotion words are generally characterized as possessing high arousal and extreme valence” (2012, p. 783). Arousal is essentially the intensity with which a word is experienced, whereas the valence dimension classifies a word as either positive or negative. Warriner, Kuperman, and Brysbaert (2013) have a useful table that gives examples of such words (p. 1194). An uninteresting word like “grain” has a very low arousal score, whereas “rampage” is experienced much more intensely. Similarly, a word like “pedophile” is rated with an extremely low valence score, whereas “happiness” has an extremely high score.

Affective processing in the L1: A number of behavioral, ERP, and eye-tracking studies have been done on the subject of affective processing. A problem with these studies is that their results and the conclusions that are made are often conflicting. Scott, O’Donnell, and Sereno (2014), for example, found consistently faster RTs for both positive and low-frequency negative words in a lexical decision task. The emotion words for this experiment had relatively high arousal ratings (i.e. 6 to 9 on a 9 point scale). Conversely, Citron, Weekes, and Ferstl (2014) found longer response latencies to positive high-arousal words (4 to 5.4 on a 7 point scale) in a similar lexical decision task. Kuperman, Estes, Brysbaert, and Warriner (2014) criticized
previous papers by saying that their datasets were often skewed by an excess of extremely negative words, that the experiments did not have enough stimuli, and lastly that they did not take enough potential confounding variables into account. They took 12,658 words that they had previously normed for arousal and valence (Warriner, Kuperman, & Brysbaert, 2013). Additionally they used the English Lexicon Project (Balota et al., 2007) to retrieve behavioral data. Lexical variables such as lexical density, word length, number of syllables and others were also included in the analysis. Their results suggested a monotonic effect for both valence and arousal separately, meaning that negative and highly arousing words have slowest lexical decision RTs, whereas positive and calming words have the quickest RTs. Their results go directly against an inverted U-shape that many studies found, where both tails of the emotion scale had quicker RTs than neutral words. Kuperman and colleagues placed their findings within the automatic vigilance framework, as many other studies in the field have done. Essentially this hypothesis states that negative words hold attention for longer because the brain needs to assess if the stimulus is a threat. This, then, is what elicits the longer RTs. The researchers nuanced their findings by giving multiple alternative explanations of the effect. For instance, in their extremely large dataset, there were slightly more words that were more positive than the mean. This suggests that positive words in general are more frequent, and that therefore priming effects for positive words are larger.

Despite there being numerous papers on affective processing that employed behavioral methods, the number of sources using eye-tracking is very limited. Scott, O'Donnell, and Sereno (2012) investigated the effect of valence and frequency on fixation times in a single-sentence context. They found facilitatory effects of both positive and negative valence ratings in the early measures, namely the first fixation duration (FFD) and the single fixation duration (SFD). Knickerbocker, Johnson, and Altarriba (2014) took a similar approach, but differentiated between emotion and emotion-laden words. They found essentially the same facilitatory effects for emotion words in the early fixation measures. Interestingly, they also found a facilitatory effect of emotion in late measures (e.g. the total reading time). This suggests that the speed at which a word can be accessed in the mental lexicon is determined in part by how positive or negative it is.

**Affective processing in the L2:** Multiple researchers claim that emotion is processed differently in the L2. Costa et al. (2014), for instance, stated that speaking in a foreign language makes it easier for you to dissociate from emotions when presented with moral dilemmas. This leads to more utilitarian decisions. Similarly, Harris, Ayçiçeği, and Gleason (2003) found that skin conductance, a way to assess emotional impact, was significantly lower for L2 childhood reprimands when compared to the L1. This suggests that emotion is not rooted as deeply in the L2, which results in more emotional detachment. Behavioral data on affective processing in the L2 is limited, but the available sources seem to confirm these notions. Segalowitz, Trofimovich, Gatbonton, and Sokolovskaya (2008) developed an implicit affect association task, where participants were asked to categorize pictures and noun phrases as positive or negative by pressing the corresponding key. A condition was congruent if positive phrases and positive pictures had to be indicated with the same key, and incongruent if positive pictures and negative phrases had to be indicated with the same key. As one would expect, participants responded
much slower in their L2, but the incongruency effect was also much smaller. This suggests that the processes underlying the task in the L1 were much more automated than in the L2. One could say that these results are attributable to an overall lack of processing automatization in L2 speakers. However, the authors included results for a semantic classification task with affectively neutral words, and found no correlation between performance on the two tasks.

Eye-tracking data on this subject for the L2 is even more scarce than for the L1. As far as we know, Sheikh and Titone (2016) published the only study where L2 speakers’ affective processing was investigated. They presented sentences to participants which were read for comprehension only. The researchers approached the subject from an embodiment perspective. That is, they theorize that emotional words elicit stronger reactions in the L1 since they have been experienced in real-life experiences. Since the L2 is oftentimes learned in a classroom setting, the words are not grounded in the same experiences. Therefore, the facilitatory effect that is found in the L1 should be absent. Interestingly, however, the researchers found a facilitatory effect for positive words, whereas this effect was not found for negative words. The conclusion made in this paper was that this is likely due to a positivity bias, in that L2 learners are motivated to learn their language. As a result, their language is mostly used in positive contexts.

There are multiple issues with the existing literature on affective processing at the moment. Like Kuperman and colleagues (2014) pointed out, many studies utilize skewed datasets and they do not include proper control variables. Another issue is making the valence and arousal ratings categorical by some arbitrary cutoff. Scott, O’Donnell, and Sereno (2012), for instance categorized negative words as words with a valence score of 1 to 4, while neutral words could range from 4 to 6, and positive words could have scores ranging from 6 to 9. While a word with a valence score of 3.9 would be placed in the negative category, it would likely be more similar to a word from the neutral category. This issue persists in many of the papers (e.g. Knickerbocker, Johnson, & Altarriba, 2014; Citron, Weekes, & Ferstl, 2014; Recio, Conrad, Hansen, & Jacobs, 2014; Sheikh & Titone, 2016). Additionally, the ecological validity of these papers could also be questioned. Kuperman and colleagues (2014), for instance, pointed out themselves that effects of emotion that were found could simply be task specific. Additionally the eye-tracking studies that we discussed here used relatively small stimulus sets with single sentences in which the target words were embedded. While this is more like a naturalistic situation than a lexical decision task, it barely accounts for prediction of upcoming information based on a broader sentential context. One last valid point that Kuperman et al. (2014) mentioned, was that many sources on this topic use the Affective Norms for English Words (ANEW) corpus (Bradley & Lang, 1999). This includes all the eye-tracking sources mentioned here, save Sheikh and Titone’s study (2016). However, even their stimuli set was taken from another study that mostly utilized words from ANEW (Kousta, Vinson, & Vigliocco, 2009). The issue with this corpus is that the words were specifically chosen because they conveyed emotions. Words that were classified as neutral, therefore, do not necessarily represent truly neutral words.
Method:

Since all data had already been collected, please refer to section 3.1 of my report and Cop et al’s (2017) paper on GECO for a more detailed description of the dataset. The following section will only describe how GECO was utilized to make the dataset for the present study. For brevity’s sake, I present only the first fixation duration in this paper. The full paper will include both early and late measures, however.

Materials: Firstly, the complete version of the English GECO was combined with scores of valence and arousal. These scores were obtained from Warriner, Kuperman, and Brysbeart (2013). Additionally, measures of rank (i.e. how many times the specific word had occurred), zipf transformed word-frequencies from the SUBTLEX corpus (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014), neighborhood density scores from CLEARPOND (Marian, Bartolotti, Chabal, & Shook, 2012), and scores for the behavioral tests were added. All instances where a word was skipped were removed, such that fixations of 0ms (i.e. NAs) were not accounted for in the analysis. Subsequently, the first fixation data were log transformed. Then the log transformed eye-fixation data, valence scores, arousal scores, lextale scores, and rank scores were all centered in order for results to become more easily interpretable. This left us with 234,539 instances of 2,444 individual words and 33 participants.

Analysis: Linear regression models for first fixation duration were built in R (R Core Team, 2018) using the lme4 package (Bates, Mächler, Bolker, & Walker, 2014) using a stepwise forward fitting procedure. The base model on which each model was built started as:

First fixation duration ~ arousal + valence + bilingual or monolingual + (1 | Subject) + (1 | Word)

Each step one random intercept or fixed effect was added. The new model and the previously best model were then compared with an ANOVA to see which one performed best. When the best model was determined, random slopes were added one by one.

Results: The best model included fixed effects for arousal, valence, word frequency, whether English was the L1 or L2, and valence * L1 or L2. Additionally, there was a random slope for frequency per participant, and a random intercept for the individual words. There were no interactions. The final model explained 10.9% of the variance. We can see that higher arousal scores increased first fixation durations significantly ($\beta = 0.01$, se = 0.00, $t = 3.857$, $p < 0.001$). Conversely, an increase in valence score resulted in shorter fixations ($\beta = -0.01$, se = 0.00, $t = -2.019$, $p < 0.05$). There was also an interaction between L1 or L2 and valence, such that L2 speakers read negative words significantly slower than L1 speakers ($\beta = -0.01$, se = 0.00, $t = -1.976$, $p < 0.05$). Lastly, there was a very strong effect of word frequency, in that more frequent words elicited shorter fixation times ($\beta = -0.07$, se = 0.00, $t = -9.582$, $p < 0.0001$).

Discussion: The current study investigated the differences in affective processing between L1 and L2 speakers of English. More specifically, we investigated how both valence and arousal affected the first fixation duration. The results of this study should be more indicative of naturalistic language processing since there were more than 2,000 individual stimuli, and more than 230,000 samples in total, whereas other studies utilized much smaller numbers (72 items...
in both Scott et al., 2012, and in Knickerbocker et al., 2014). Additionally, since the only task given to participants was to read a book for comprehension, it can be assumed that the data here reflect naturalistic language processing as closely as possible.

**L1 affective processing:** While many studies found an inverted U-shape for reaction times and fixation times when looking at emotion words, we did not. Our study found a monotonic effect of emotion (i.e. valence), similar to Kuperman et al. (2014), where negative words had the longest fixation times, and positive words had the shortest fixation times. This effect was found both in the L1 and L2. We believe that the lack of this inverted U-shape in our data is caused by the larger normed dataset that Warriner et al. (2013) provided, compared to the relatively small and biased corpus used by a large portion of the studies cited in the background. These results seem to be in line with Kuperman et al.’s (2014) criticism on the many sources that found facilitatory effects for both positive and negative words. On the other hand, however, the slope for valence in the L1 is very moderate. This is different from other eye-tracking studies on the subject, which only used single sentences. This suggests that the context provided by reading an entire book was enough to predict upcoming emotion words.

**L2 affective processing:** While it is no surprise that L2 speakers have slightly longer fixations times due to having less experience reading English than native speakers, the differences in slopes between L1 and L2 speakers was interesting. One can clearly see in the figure in appendix 1, that the slope for valence was steeper for L2 speakers. This shows that negative words were fixated on significantly longer even when taking into account that bilinguals are simply slower readers in their L2. While these results seem to be in line with Sheikh and Titone (2016), who concluded that negative words are disembodied because they are less grounded in real life experience, it depends on which literature is used as theoretical background. A large number of studies found facilitation of emotion, either way around. These studies were criticized by Kuperman et al. (2014), however, for using skewed datasets. If we look at Kuperman et al.’s study, we can see that the L2 data follow the same pattern they described for L1 readers. This is interesting, since some sources claim that negative stimuli have less of an impact in the second language (e.g. Harris et al., 2003).

Our results seem to suggest that affective processing in the L2 utilizes automatic vigilance in the same way as in the L1. However, the L2 speaker seems to take longer to determine whether or not a negative stimulus is a threat. This could be due to an L2 being used in a more positive context, like Sheikh and Titone (2016) proposed, but the exact processes behind this are hard to determine with the present dataset. We know that language proficiency measures did not improve the model fit, which implies that it is unlikely that proficiency alone causes these results. This is in line with Segalowitz et al.’s (2008) theory, which stated that proficiency and affective processing are separate from each other.

**Conclusion:** The results of this study seem to only divide the present literature even further. Many sources claim that L2 affective processing is lacking because processing of emotion words is not facilitated like in the L1. Our results, however, seem to suggest that this facilitation effect of L1 emotion words is only weak when presented in the broader context of a novel. There is a slightly monotonic pattern similarly to Kuperman et al.’s (2014) findings, but overall
the effect is less pronounced than previously found. L2 data, however, seems to follow the exact same pattern that Kuperman et al. found in their study. The exact processes behind this are hard to determine at the moment. A follow up study could perhaps combine eye-tracking with physiological measures such as skin conductance, or perhaps even EEG signals, to determine where the locus of this difference lies.

3.4 Facial priming, accent priming, and non-standard speech variants

Humans are always quick to categorize others based on stereotypes related to for instance age, ethnicity, and perceived socioeconomic status. These categories shape our expectations, and subsequently may affect language processing. The sentence “I went to a crazy techno party yesterday”, for instance, is perfectly grammatical. However, a reader would ascribe the utterance to a 20-year-old quickly, whereas they likely would find it surprising if a 80-year-old had said it. Similarly, Dutch speakers with a non-western migration background are often stereotyped as having subpar knowledge of Dutch grammar. This lack of proficiency often manifests itself in determiner-noun errors, such as “de* meisje” (the girl). The present study, therefore, aimed to investigate whether or not a picture of someone with non-western ethnicity could prime responses to these incorrect determiner-noun combinations (experiment 1). Additionally we investigated if this same effect could be found in a visual world paradigm experiment (experiment 2).

**Background:** The Dutch language has two grammatical genders: neuter and common. Roughly speaking, 75% of nouns are common gender (“de”), whereas the other 25% are neuter (“het”) (Deutsch & Wijnen, 1985). Furthermore, the way that gender is assigned to nouns seems to be so arbitrary that van Berkum dedicated a substantial portion of his dissertation to the academic discussion on whether or not there is any systematicity to be found (1996). It is no surprise then that those who learn Dutch as a second language (L2) have trouble learning this particular aspect of the language (Cornips, van der Hoek, & Verwer, 2006; Blom, Polisenka, & Weerman, 2008). These papers found that Turkish-Dutch and Moroccan-Dutch speakers often overgeneralize grammatical gender. This results in neuter nouns being paired with the common determiner. The occurrence of gender errors seemingly is expected in Dutch speakers with a migration background. Hanuliková, van Alphen, van Goch, and Weber (2012), for instance, found stark contrasts between processing of gender errors depending on the speaker in an ERP study. The P600 correlate, which is associated with grammatical errors, was present when a native speaker made a gender error, whereas it was absent when a Turkish-accented Dutch speaker made the same errors.

It seems that the information about ethnicity that the foreign accent provides primes participants to expect gender errors in any upcoming speech. Hanuliková et al.’s study is just one example of research suggesting that information regarding ethnic background can influence language processing. Li, Yang, Scherf, and Li (2013), for instance, did a picture naming task in Chinese-English bilinguals where participants were primed with a caucasian or asian face. Participants were shown either an asian or caucasian person holding a frame. If the border of
the frame was blue, naming had to be in English, and if it was red Chinese should be spoken. The researchers found that naming latencies were shorter when the ethnicity of the person holding the frame was congruent with the language that picture naming occurred in. Similarly, Woumans et al. (2015) primed Spanish-Catalan bilinguals by having participants have simulated Skype calls where their interlocutor spoke either only Spanish or Catalan in the pre-test phase. Later, they asked participants to do a noun-verb association task. Participants saw either one of the previous interlocutors or an unknown person uttering a noun in Catalan or Spanish. Results showed that participants took more time naming a verb when the language spoken by the person in the video was incongruent with the language they spoke in the pre-test. This effect was only present in early trials, however, as participants quickly caught on to the fact that the stimuli could contain either of their languages. Additionally, Graïnger, Declerck, and Marzouki (2017), found that naming latencies for trials in a French-English lexical decision task were faster if participants were primed by the flag that was congruent with the respective language used.

The sources mentioned above found that culturally specific cues, like faces and flags, are able to shape bilinguals’ expectations to such an extent that it may facilitate or hinder access to one of their languages. This suggests that non linguistic information can influence language processing by priming us for a language associated with it. These studies focussed specifically on bilinguals, however. Clearly, however, Hanuliková and colleagues (2012) found that the information that a foreign accent carries influenced expectations regarding determiner-noun errors in L1 Dutch speakers. The question then is if the visual cues that modulate bilinguals’ language processing can influence expectations regarding determiner-noun errors in the same way that a foreign accent does. This leads us to the following research question and hypothesis:

**Experiment 1**

**Research question:** To what extent will a facial prime of a woman wearing a hijab affect RTs for incorrect stimuli in a Dutch lexical decision task with determiner-noun combinations?

**Hypothesis:** We believe that response latencies for incorrect determiner-noun combinations will be slower when the facial prime is a woman wearing a hijab, since previous research (Hanuliková et al., 2012) suggests that L1 Dutch speakers expect these errors from L2 Dutch speakers with a non-western migration background.

**Method**

**Materials:** A total of 120 determiner-noun combinations were chosen randomly from the Subtlex corpus (Keuleers, Brysbaert, & New, 2010). The nouns were divided in three frequency bands: low frequency (0.02 freq/million), medium frequency (2.88-9.22 freq/million), and high frequency (202.98-1403.81 freq/million). Each frequency band contained 40 nouns (30 common gender, 10 neuter gender). Of the neuter nouns, 5 per frequency band were incorrect. Aside from this, a short sociolinguistic questionnaire was devised that asked participants about the languages they spoke, and their self-reported proficiency. Lastly, 6 questions regarding attitudes towards
migrant backgrounds were made. All experimental items were presented in the middle of the screen with Arial font size 40.

Since the number of items was relatively small (i.e. 15 incorrect words per participant), more participants were required to have a meaningful dataset. Therefore, the online psychology experimental software Psytoolkit was utilized (Stoet, 2010; Stoet, 2017). This software allowed for online data collection, which gave a larger potential participant pool. Each participant only needed a (laptop) computer with an internet connection and a keyboard.

Two photos were used to represent either an L1 Dutch speaker and an L2 Dutch speaker. The L1 Dutch speaker was a blonde woman with European features, whereas the L2 Dutch speaker wore a hijab and had decidedly Middle-Eastern or North-African facial features. The choice for two female faces was made since a hijab is not typically worn by native L1 Dutch speakers without a migration background. This made it easy for participants to associate the woman wearing a hijab with other non-native Dutch speakers. Photos were edited such that the eyes of both women would be in the same place where the fixation cross would appear.

Participants: A total of 109 participants opened the survey. However, a large number of these participants did not complete the experiment. In the end, there were 72 participants (28 male, 39 female, 5 would rather not say). Mean age was 24.5 years old (18-63, SD=8.95). 68 of the participants reported having Dutch as their native language (19 of whom were Flemish).

Participants were recruited online using Facebook, word-of-mouth, and Surveyswap. The latter of these three is a platform where users gain credits by completing surveys of other users. These credits can be ‘spent’ on participants who do the same. Users posting a survey can give an estimated time to complete the survey. If participants finish much quicker or slower than intended, they will be banned eventually. This ensures that users respond to surveys truthfully and seriously.

Procedure: Upon opening the survey, participants were given a message with the requirements of participation: they had to be at least 18 to participate, they could not be dyslexic, and were asked to be in a room with as little distraction as possible. If they agreed with these requirements they were taken to a consent form that informed them about the data that would be collected, the way their data would be processed and anonymized, and who they could reach if they wanted their data to be excluded from the experiment.

Participants were then introduced to Fatima and Louise. A short text introduced both women, and introduced their picture. Participants were randomly assigned to a group, where they would either see Fatima speaking correct Dutch, and Louise speaking incorrect (incongruent condition) Dutch, or vice versa (congruent condition). After they continued they were given the instructions to press on the 1 key if the stimulus was correct, and on the 0 key if the stimulus was incorrect. Then participants were presented with 10 training trials that included feedback to introduce them to the task. Each trial was structured as follows: a fixation cross was shown on-screen for 800 ms. Then one of the photos was shown randomly for 300 ms. After this, the fixation cross was shown again for 300 ms. Then the word was presented on-screen until a response was
recorded, or until 2000 ms passed without any response. After the training phase the actual experiment started, where participants did the the same lexical decision task for the 120 items without pause. When this was done participants were asked to complete a short questionnaire about language proficiency and attitudes towards migrants’ language-use. They were then debriefed and given the experimenter’s e-mail address if any questions had arisen. The entire task took approximately 8 minutes including the questionnaire afterwards.

**Analysis:** For the statistical analyses a linear mixed effects regression will be utilized. The Dependent variable will be the reaction time. Independent variables will be gender, age, questionnaire answers, congruence of stimulus, and the counterbalance (i.e. congruent pre-prime text or incongruent pre-prime text).

**Experiment 2**

As was mentioned before, L1 Dutch speakers seem to expect determiner-noun errors from speakers with a foreign accent (Hanulíková et al., 2012). Therefore, we decided to investigate whether foreign accent could influence prediction of the upcoming noun in an orthographic visual world paradigm.

**Research question:** Will a Turkish accent elicit a higher proportion of looks towards a noun that is incompatible with a previously spoken determiner than a native Dutch accent in Dutch L1 speakers?

**Hypothesis:** Due to expected errors in Turkish-Dutch bilinguals’ speech, the proportion of looks towards the distractor noun will be significantly higher than trials where a native Dutch speaker is heard.

**Materials:**

**Stimuli:** The main objective of this study was to see if participants would have more trouble predicting the upcoming noun when a Turkish speaker uttered a sentence. Since this experiment was embedded in a larger visual world experiment, there were a large number of stimuli (560 different words in total distributed over 140 trials). This is why we opted for an orthographic visual world paradigm. In order to prevent skewed results, it was necessary to find words that were of the same length, equally frequent, semantically related, but with different grammatical genders. The Subtlex (Van Heuven, Mandera, Keuleers, & Brysbaert, 2014) corpus was utilized to find a list of nouns that matched on these qualities. In the end there were 40 noun pairs with different genders (e.g. de badjas ‘the bathrobe’, het badpak ‘the bathing suit’). For each of these nouns a sentence was constructed where either of the two words would fit well. The sentences were made in such a way that there was an adjective between the determiner and the noun. This way participants would have some time to make predictions about upcoming information. Additionally, each sentence was recorded twice, but only with the neuter noun. The only difference was whether the correct neuter determiner, or the incorrect common determiner was used. An example of a word pair would be boeket (‘bouquet’) / anjers (‘carnations’).
Toen mijn moeder vorige week jarig was kwam ik op visite met het/de mooiste boeket dat ik kon vinden (‘When it was my mother’s birthday last week I came to visit with the (correct)/the (incorrect*) nicest bouquet of flowers I could find’).

Since we needed four words on screen in each trial, two randomly picked filler words were chosen from Subtlex. These words matched the target and distractor words on frequency and length.

Recordings: The recordings in this study were from the same speakers as section 3.2

Apparatus: See section 3.2

Visual world paradigm: See section 3.2

Questionnaire: See section 3.2

Implicit association task: See section 3.2

Participants: See section 3.2

Procedure: See section 3.2

Analysis: All data will be preprocessed in the same manner as section 3.2. The proportion of looks towards the target versus the proportion of looks towards the competitor (averaged proportion of looks 200ms after the onset of the determiner until 200 ms after the noun) will be our dependent variable. Independent variables will be gender, trial number, handedness, positions of the target and competitor words, implicit association task scores, and prejudice score.

4. Additional activities

4.1 Meetings

Since prof. Duyck’s lab did not meet regularly at the time of my internship, I asked prof. Robert Hartsuiker whether I could attend his weekly lab meetings. The lab meetings were attended by 14 members, most of whom were postdocs. This provided a great opportunity for me to learn about various types of research within the faculty of experimental psychology. Furthermore, it gave me an insight into the background processes that are needed to run BA level courses.

The structure of the lab meetings was basic and similar each time. Once a week on Tuesday, the lab members met at 12. Each lab member then gave an update on studies they were working on in that particular moment. These lab meetings served a number of purposes. Firstly, they were an easy way to tell a group of researchers about problems you encountered with your own projects. As a result, you would get feedback on for instance the statistical analyses and theoretical background. Furthermore, the researchers at Prof. Hartsuiker’s lab were working on several interesting research topics that I was not familiar with (e.g. Dr. Franken’s work on speech perception and sense of agency).
Additionally, I would have relatively unscheduled meetings with Dr. Nicolas Dirix at least once per week. These meetings would mainly be about the preparations for GECO, issues we encountered during the recording procedure, and the statistical analysis for our joint project that used the current version of GECO. Additionally, since Dr. Dirix has extensive experience with eye-tracking methods, the two of us sometimes met so we could discuss my personal eye-tracking project.

Furthermore, Dr. Woumans and I met in person on a biweekly basis to discuss the progress I was making with my various research projects. We corresponded mainly about major decisions for personal research projects (e.g. what type of stimuli to use, which researchers to contact).

4.2 Study day English as the language of instruction in higher education

In the second week of my internship Dr. Woumans invited me to go to a colloquium about the use of English as the language of instruction in higher education. A number of speakers from multiple universities and institutions separated facts from fiction with ‘fact checks’ (short presentations). Additionally, a debate was organised where speakers with different backgrounds (politics to physics) were able to debate about the degree of Anglicisation of education in Dutch speaking countries. Lastly, there was an opportunity for me to meet some of the researchers working in this field.

This study day was enlightening because it clearly showed differences in attitudes towards Anglicisation between the Netherlands and Belgium, respectively. People in the Netherlands tend to stick to a very laissez-faire approach, where Anglicisation is simply a necessary step in preparing for internationalisation. Belgians, however, seem concerned with losing their cultural identity. This can be seen in the restrictions placed on the number of bachelor degrees that may be taught in English exclusively. Since there were speakers from both countries present, I got a quick lesson in cultural differences between the Belgians and the Dutch.

4.3 Lunch seminars

One aspect of my internship that I really enjoyed were the lunch seminars, which were organised by Dr. Nicolas Dirix. Every two weeks a new postdoc got the opportunity to tell the department about their research topics. In order to encourage others to come, attendees could pick up a free sandwich to eat during the presentation. In these seminars I learned about ongoing research ranging from studies on Alzheimer’s disease to Pavlovian conditioning.

4.4 Volunteering for COM2018

Immediately after my internship ended, the yearly conference COM2018 was held in Ghent. The conference was organized by my supervisor, Dr. Evy Woumans. My main activities during the conference were to man the registration desk, to be available in the case of unexpected issues, and to help with the cleanup after the conference ended.

4.5 Poster presentation COM2018
On the first day of COM2018 I was able to present a poster about one of the studies I did during my internship. A number of researchers showed interest and gave very useful feedback, which helped me immensely. To see the poster look at appendix 1.

4.6 Paper review

At the end of the second week my supervisor received a manuscript that was to be reviewed for one of the research topics that I had expressed interest in. Since I had read a number of articles regarding the topic during the first two weeks, I was asked to help by giving my personal feedback. This exercise helped me to look at some of the methodological and theoretical pitfalls that I could run into.

4.7 Learning Psytoolkit

Since I got quite interested in facial priming research at the start of my internship, I wanted to do a smaller project to investigate whether information regarding ethnicity could influence processing of grammatical errors. I knew that a large portion of my time would be spent working in the eye-tracking lab, and I only had one PC for data collection of my own experiments. To make data collection more efficient, therefore, I decided to learn how to use the syntax of psytoolkit (Stoet, 2010; Stoet, 2017). This open-source software allows researchers to create behavioral experiments that can easily be nested in online questionnaires. This way, I quickly was able to get over 70 participants by advertising on facebook and other social media.

5. Reflections on the internship

As I mentioned before, there was quite a lot of uncertainty regarding the types of tasks I was to do during my internship. In the end, I am incredibly glad that I ‘took my chances’, since the research internship was a very good experience. I could aid in one large study, and I was given the autonomy, freedom, and resources to develop my own studies.

During my internship I learned a lot. For instance, I learned how to recruit, communicate, and troubleshoot with participants in a large research project. Especially for GECO, where participants had to come in for 8 hours in total, communication was key, as loss of one participant would mean loss of a very large amount of data. Additionally, Dr. Dirix and I spent a lot of time checking all the research materials to make sure that everything went smoothly when actual data collection occurred. These skills carried over in my own research projects. For instance, for my personal eye-tracking study, I essentially combined two experiments into one (i.e. section 3.2, and experiment 2 in section 3.4) to spend time as efficiently as possible. Additionally, by preparing procedures and materials thoroughly before data collection, I was able to test 50 participants in this experiment for an hour each within two weeks.

Due to the large amount of freedom I was given, I learned a lot about developing multiple studies at the same time. For instance, while I was writing a literature review for one study, I was already doing the analysis for another study, and in the same timeframe I would have to collect data for yet another study. At first this felt a little like being thrown in the deep end, but in
the end I believe this pressure helped me become a lot more organized and disciplined, or at least less prone to stress. This discipline not only helped me from a professional point of view, but also on a personal level. If I told myself a year ago that I would consistently get up at 6 AM to go work out before doing an 8 hour work day, I would not have believed it.

Another aspect of the internship I thoroughly enjoyed were the many things that did not pertain to research. Thanks to my colleagues, I learned about some amazing Belgian beers, where to find the hidden gems of the city, and I had many a discussion with some of the PhD students about which ‘frituur’ had the best fries. While this did not necessarily make me become a better researcher, it made me feel at home in a department where I was unfamiliar with a lot of the research that went on.

I would like to thank Dr. Woumans for being my mentor during this internship. She introduced me to many studies that were incredibly interesting, and she gave me feedback on research proposals. I am also thankful for her letting my present my preliminary findings at COM2018, where I received feedback from many researchers. Additionally, I would like to thank Dr. Dirix, who gave me countless pieces of advice on working with eye-tracking methods and statistics. Lastly, I would like to thank Dr. Keijzer, who went above and beyond in giving me advice during the internship.
6. References

3.1


3.2


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3.4


Appendix: Poster presented at COM2018
Investigating affective processing in the second language using the Ghent Eye-Tracking Corpus
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Introduction

Eye-tracking
- Words with strong emotional values (both positive and negative) elicited shorter fixations in the first language (L1)
- One study on second language (L2) speakers only found this facilitatory effect for positive words.

Behavioral
- Affective processing in the L2 seems less automatic, even when taking into account proficiency
- Skin conductance measures on L2 speakers suggest that emotion is less deeply rooted in a second language
- Lexical decision data suggest a monotonic processing hierarchy (negative < neutral < positive)

Do fixation times on emotional words differ between L1 and L2 speakers?

Method
- The Ghent Eye-Tracking Corpus: 33 participants (19 bilinguals) read the entire novel “the mysterious affair at Styles” by Agatha Christie.
- Bilinguals read one half in their L1 (Dutch) and the other in the L2 (English). The only task during reading was to simply read the book like they would at home.
- Scores of valence (pleasantness) and arousal (strength) were added, as well as measures of neighborhood density, word length, and rank
- In the end this left us with approx. 230,000 occurrences of 2,400 words on which a linear regression was fitted
- Fixed effects taken into account: Arousal, valence, L1/L2, frequency, word rank, proficiency, and orthographic neighborhood density

Results

Effect of emotion × language on (log) first fixation duration p < 0.05

Effect of emotion × language on (log) gaze duration p < 0.05

Discussion

While it is logical that L2 speakers read slower, negative words seem to elicit proportionally longer fixations
Interestingly, the previously found facilitatory effect of emotion in the L1 seems to have disappeared

The longer fixations on negative words in the L2 have been previously attributed to a positivity bias (i.e., L2 learners are motivated to learn their second language, which causes them to use it more in positive contexts)
While earlier eye-tracking studies found facilitation of emotion words in L1 sentence reading, the additional context that the storyline in a novel provides could have attenuated this effect

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References


Scan the QR code to download the poster