

Reception of anglicisms by beginning readers – an eye tracking study

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List of abbreviations

AoA	Age of Acquisition
AOI	Area of Interest
DRC	Dual Route Cascaded Model
EC	European Commission
FF	First Fixation
GD	Gaze Duration
GPC	Grapheme-Phoneme-Correspondence
LDT	lexical decision task
lme	linear mixed effect models
n.s.	not statistically significant
NA	Not assessed
OECD	Organization for Economic Co-operation and Development
PDP	Parallel Distributed Processing Connectionist Model
PISA	Program for International Student Assessment
RT	Reaction Time
RV	Probability of Revisit
SD	standard deviation
SWIFT	Saccade-Generation With Inhibition by Foveal Targets
TT	Total Reading Time
VIF	variance inflation factor

1. Introduction

“Le temps altère toutes choses; il n’y a pas de raison pour que la langue échappe à cette loi universelle.” - “Time changes all things; there is no reason why language should escape this universal law”¹

The present study uses eye tracking to investigate the reception of anglicisms by school children during the reading process. A fundamental question is whether differences in the reception of anglicisms compared to other words can be determined by observed changes in eye movement behavior. A cross-sectional study with participants from grades 2 and 4 will provide respective information.

1.1. State of research

To lay the foundation and provide an impulse for this thesis, the current state of research is presented, particularly for two fields of research. First, the linguistic research on loan words that have their origin in anglophone countries is discussed. Linguistic investigations with the research object *anglicism* have so far focused on the analysis of static written language corpora especially in domains predestined to the use of English such as press, media, fashion, economics, or sports. In the late 1970s, Duckworth had already critically reflected on the corpus used for his study as it contained evidence from newspapers (Duckworth 1979: 228). The investigations mainly concentrate on the collection of corpus data such as frequencies of anglicisms and the examination of their structural integration into the German language system, elaborating normative data of morphological and syntactical integration. Another subject of investigation is the examination of differences in the use of anglicisms contrasting two different language systems as well as their public acceptance (e. g. Adler 2004, Burmasova 2009, Götzeler 2008, Jacobi 2011, Kuke 2011). In addition, there are empirical studies on the frequency of anglicisms in relation to their acceptance within a specific language (Kinigadner

¹ De Saussure, Cours de linguistique générale (1916), p. 112

2012). It is a common feature of all investigations mentioned above that they analyze written language and corpus data that is predominantly received by adults.

A gap in the field of research on anglicisms with a focus on children's reception of anglicisms is evident. During the literature review, only one publication could be found that approaches this topic. In her master's thesis, Gäbler (2013) investigates the use and comprehension of anglicisms by elementary school children in grades 2 and 3. A case study is used to investigate the extent to which children between the ages of 7 and 10 have already integrated anglicisms into their everyday vocabulary and which social factors and framework conditions (media use in the form of PC/laptop or game console, influence of older siblings) correlate with the study results.

The central task of this thesis is to conduct an empirical study on the prevalence of anglicisms in children's language as it is not surprising that children come into contact with this language variety at an early age. The influence of English as a lingua franca (cf. Eisenberg 2018: 46) in a globalized world is evident not only in the fields of international exchange, technical language communication in business, and the mobility sector (e. g. air traffic communication) but also in daily life. English words and lexical borrowings from English are part of the daily speech of Germans. The present study investigates school children's reception of anglicisms during the reading process by means of an eye tracking study. A basic question is whether differences in the reception of anglicisms compared to other words can be determined by a change in eye movement behavior.

Therefore, the purpose of this study is to determine the effects of eye movement behavior when school children read anglicisms using the eye tracking method. A basic question is whether differences in the reception of anglicisms compared to other words can be determined by a change in eye movement behavior.

While eye movements have been intensively used to investigate how adults read and process written text, the research addressing the reading behavior of children is comparatively scarce. However, this endeavor is worthwhile as it can generate insights on the process of learning to read and provide support for didactic work. Against this background, the data collected must always be placed in relation to the reading

development of children. Anglicisms are particularly suitable for this type of study as they can address the phonological component as a lot of them do not obey German regular phonetic properties. It is known that the phonological component is an essential element in the process of word recognition especially for beginning readers. Therefore, anglicisms which are irregular in terms of their phonological properties can be used as agents to investigate reading processes.

1.2. Methods

In order to draw as holistic a picture as possible of the reception of anglicisms in conjunction with reading comprehension and in language production, different research methods are used for the same object of research. In the sense of a mixed-methods approach, the data obtained will be correlated with each other and channeled into a statistical model.

In total, 40 students of grades 2 and 4 participated in an experimental design comprising an eye tracking experiment, a mental lexicon query and a questionnaire gathering metadata.

The use of eye tracking in linguistics, especially in basic research on reading, opens new possibilities regarding research into the question of what goes on in the readers' minds, here, in the mind of children when they read. Visual attention and cognitive processes are closely coupled with eye movements due to the assumption of the eye-mind hypotheses (Just & Carpenter 1980) stating that eye movements directly relate to cognitive processes. Eye tracking has become a valid instrument when investigating cognitive processes such as reading (König et al. 2016, Rayner 1998).

The basis for the main hypothesis of this study are the phonological irregularities concerning the grapheme-phoneme correspondence (GPC) of certain anglicisms, which do not correspond to the German written language system². In general, the translation of

² The grapheme-phoneme correspondence rules in German were developed by Manfred Bierwisch. In his essay "Schriftstruktur und Phonologie" (1976) he presents rules for the relations

orthographic representations into phonological ones requires rules called grapheme-to-phoneme rules. Graphemes are the distinctive units of a writing system. Coltheart et al. (2001) refer to a “grapheme” as a letter or letter sequence that corresponds to a single phoneme. For a review of the writing system and the alphabetic principle for different writing systems and especially on GPCs for English see Rayner et al (2001: 33). Each letter or grapheme can be assigned a specific phonetic expression (a phoneme), because "(b)e a language with alphabetic writing, the word writing in the core area is based on regular relations between sounds and letters (more linguistically correct: between phonemes and graphemes)" (Eisenberg 2018: 321). In German, anglicisms borrowed directly from English, the direct or evident anglicisms (cf. Carstensen 1979), are not phonologically integrated into the German phonetic system. Their pronunciation does not correspond to the German core vocabulary (Eisenberg 2018: 326). These directly borrowed anglicisms are interesting for the study because it is assumed that even reading novices are able to decode these anglicisms correctly and to grasp them semantically in their entirety, although it is not possible for children to read them in the method of syllable-by-syllable reading and sounding-out single GPCs as learned at the beginning of written language acquisition. This assumption is also supported by the Dual Route Model by Coltheart (1978). This model describes reading comprehension at the word level. The model assumes that there are basically two approaches to processing reading material. The first, non-lexical route leads via systematic grapheme-sound translation to lexical recognition of a word. In this bottom-up process, the visual stimuli are processed step by step and result in the cognitive representation of the word (Coltheart et al. 2001). Alternatively, words consisting of sequences of letters already well known to the reader can be retrieved directly through the lexical route in the mental lexicon. Experienced readers can use this direct access as a knowledge-guided (top-down) process, since a more complex and extensive knowledge structure already exists. In principle, these bottom-up and top-down processes in Coltheart's model start in parallel using the strategy that leads to a result earlier (Horse Race Theory).

between written language (graphemes) and spoken language (phonemes) for the German language.

For projected investigations, this model serves as a theoretical basis since it can be assumed that novice readers will initially use mainly the indirect route via syllable-by-syllable reading (Schründer-Lenzen 2013). However: "The worse the grapheme-to-phoneme relationship is, the more the influence of the orthographic (direct) path to the lexicon increases" (Zwitserslood & Boelte 2008: 484). This assumption justifies the use of anglicisms as stimuli within the eye tracking experiment.

Further, the corpus linguistic data (the frequency) of the stimuli and a dataset for the stimuli's Age of Acquisition (AoA³), which was also queried by 34 raters as part of this work, build the database upon which statistical models have been established.

1.3. Outline

The research presented in this thesis strives to combine the fields of cognitive linguistics, corpus linguistics and reading strategies with the agent *anglicism*. Thus, there is not one theoretical foundation but rather a set of basic principles that are brought together in a mixed methods research design. An overview of the chapters and their main content is given in the following:

Chapter 2 establishes the theoretical foundation for reading acquisition processes. As the reading experiment is conducted with children, it is obligatory to understand the models that describe the processes and stages of reading acquisition (section 2.1.). Since the use of anglicisms addresses the differing GPCs of English and German, the role of phonology as a crucial component in reading acquisition is described (section 2.2.). A summary emphasizes the relevance of distinct components for the experimental design.

In **chapter 3** a definition of the term *literacy* helps to position this thesis and concretize the associations and relevance for the experiment (section 3.1.). An overview of the levels involved in lexical processing and common models for the

³ Age of acquisition (AoA) refers to the age at which people learn a word and the AoA effect refers to the phenomenon that early acquired items are processed more quickly and accurately than those acquired later.

description of cognitive processes related to the skilled reading process are outlined (section 3.2.). In a concluding section, the involved components of the reading process are examined from the perspective of cognitive science, highlighting the relevance of word recognition.

Chapter 4 discusses in detail word recognition and provides the link to the methodology. Theoretical model approaches are illustrated (sections 4.1. and 4.2.) and conclude in the Dual Route Model approach as the major theoretical foundation for the empirical study of this work (section 4.3).

Chapter 5 presents the state of the art for corpus linguistic studies dealing with anglicisms (section 5.3.) by first specifying the term *anglicism* (section 5.1.) and then attempting to classify the term (section 5.2.). Section 5.4. discusses why anglicisms may be used in a reception study on the basis of the theoretical considerations made in the previous chapters and results in highlighting the kind of anglicism relevant for this research (section 5.5). A summary merges the issues and shapes the common ground for the hypotheses.

In **chapter 6** the hypotheses are derived from the considerations made so far.

Chapter 7 discusses the empirical research design and methodology of eye-tracking as the chosen approach. The physiological and technical principals are illustrated (section 7.1.1. and section 7.1.2.) and eye movements during the reading process are specified (section 7.1.3.). The influencing parameters on eye movements during reading are explained to build the foundation for the study design (section 7.1.4.) and the constraints are summarized (section 7.1.5.). In the following section 7.2., the specifications of eye-tracking research with children are emphasized. Reading strategies of beginning readers and the way they are assessed by the method of eye-tracking is discussed in section 7.3. Likewise in this chapter, the role of phonology is embedded in the framework of eye-tracking and early literacy (section 7.4.). A summary closes the chapter, providing arguments for the chosen empirical methodology.

Chapter 8 describes the empirical data acquisition process, discusses the methodology and provides reasons for applying a mixed methods approach

(section 8.1.). In the subsequent section 8.2., the acquisition and the characteristics of the participants are introduced before the composition of the reading material is presented (section 8.3.). For this purpose, already existing studies are reviewed and stimuli selection is critically reflected. This is followed by two sections describing the further components of the experiment (section 8.4. and section 8.5.). The concept of triangulation for experimental linguistics and its added value for the work is explained in section 8.7 followed by the description for the test set-up and realization. The chapter closes with a summary (section 8.8.) showing the interrelationships and reciprocal conditions between the chosen components for the study design.

Chapter 9 presents the results of experimental study's analysis.

Chapter 10, the last chapter, summarizes the elementary findings and discussed critical reflections (section 10.2.). The main effects that could be detected regarding the question of whether there is a difference in gaze behavior when children encounter anglicisms or a German reference word in written language are highlighted (section 10.1.). An overview of research questions that remain unanswered by this study is provided. It is attempted to give an outlook on the implementation of the results and observations made within the study (section 10.3.).

2. Reading acquisition

“Reading proficiency is essential for a wide variety of human activities – from following instructions in a manual; to finding out the who, what, when, where and why of an event; to communicating with others for a specific purpose or transaction.” (PISA 2018 Results, 2019: 15)

International comparative studies, such as the PISA (Program for International Student Assessment) study, organized by the Organization for Economic Co-operation and Development (OECD) repeatedly highlight the importance of reading literacy. Thus, it attracts much attention in the social and cultural science research (Castles et al. 2018).

The ability to read is considered to be of great importance as a basic key competence not only for the acquisition of knowledge but also as a prerequisite for participation in social life and equal opportunities (Hurrelmann 2002, Christmann & Groeben 2002).

The Federal Ministry of Education and Research goes even further in its educational research report (Artelt et al. 2007) and claims that the written language transmits not only information and facts, but also ideas, values and cultural content. The authors suggest that literacy is a universal cultural tool (p. 5). Further, the authors emphasize that the importance of reading literacy is also a key qualification in a changing media landscape, especially in terms of media literacy⁴. This view is currently reflected in the curricula formulated by the Ministry of Education of Rhineland-Palatinate, which emphasizes the promotion of reading and a focus on the importance of reading skills both methodologically for teaching content and as an important element of social behavior.⁵ In the preface to the current curricula, the importance of reading is emphasized as sine qua non and its importance is stressed throughout the document for all school types and grade levels. Especially in a world of digitalization, the curricula see reading as a prerequisite to conquer challenges in an information society. Reading is participation in social life and a key to culture and communication. Competent readers are those who deal critically with the entire range of media, and reading is indispensable for developing complex knowledge even in the age of modern media. It remains undisputed that the frequency of reading and familiarity with literature are important for dealing with different texts support the subsequent developing of information and capability to use communication technologies (curricula: 24).

⁴ The European Commission (EC) defines media literacy as “the ability to access the media, to understand and to critically evaluate different aspects of the media and media contents and to create communications in a variety of contexts.”

<https://www.cedefop.europa.eu/en/news/european-approach-media-literacy-digital-environment> last accessed 2022/02/7. In another publication the competent, self-determined interaction with the media is said to be a “crucial skill for all citizens” and “a pre-requisite for a vibrant, modern democracy” <https://digital-strategy.ec.europa.eu/en/policies/media-literacy> last accessed 2022/02/07.

⁵ https://studienseminar.rlp.de/fileadmin/user_upload/studienseminar.rlp.de/fs-nr/Download/Lehrplan_Deutsch_Hauptschule.pdf, last accessed 2022/12/11.

The importance of literacy and reading acquisition is also in line with the learning objectives defined by the Ministry of Education of Rhineland-Palatinate.

Particularly at the primary school level, a focus is placed on the special nature of language teaching. Accordingly, this is stressed in the foreword to the framework education plan for the primary school level, stating that German lessons are not just one learning experience among others, but rather have a fundamental cross-sectional function for all areas of learning beyond the inherent objectives. Linguistic communication, reading and writing, understanding texts and extracting information from various media as well as research and presentation are basic requirements for successful learning in all areas. This not only applies to primary educational experiences, but throughout life. In addition, the proper use of language enables social interaction with is regarded a crucial ability. ⁶

The curriculum also refers to the general requirement of the so-called 'diversity of methods'. This is not just to be primarily interpreted in the sense of a motivating and varied everyday teaching routine. Rather, the didactic-intentional justification is fundamental. The key question that is formulated in the curriculum is: How can the concrete educational and professional aspects be developed for the children, taking into account the actual learning abilities? The investigation of anglicisms in daily language use of beginning readers may contribute to the development of methods in the context of reading lessons and education, as findings of word frequency combined with irregular word spelling may arise that are helpful for teaching concepts.

Organizations such as the Common European Framework of Reference for Languages (CEFR)⁷ promote the significance of language and communication skills. The tasks of the CEFR were assigned at the suggestion of the European Council. One of the tasks is to reduce the barriers and differences between languages. For example, the aim of the CEFR is to offer an objective comparison between different languages within Europe and to provide a uniform benchmark for assessing language skills. Different language

⁶ [Lehrpläne: Lehrpläne: Bildungsserver Rheinland-Pfalz \(bildung-rp.de\)](#), last accessed 2024/02/22.

⁷ The CEFR Levels - Common European Framework of Reference for Languages (CEFR) (coe.int), last accessed 2024/02/22.

levels of various languages are objectively assessed, presented and graded on a six-level scale (A1, A2, B1, B2, C1, C2), beginner to almost native speaker language skills. The innovative approach of the CEFR is that the evaluation of the individual language skill is not tied to a particular test. The CEFR levels refer to a collection of can-do statements and addresses the overall performance in using a foreign language. The CEFR levels correspond to any given level of proficiency. Within the educational framework, the evaluation may support the teacher in designing lessons to address the gaps in a foreign language learner's knowledge. In a scholastic environment with a growing share of children whose first language or mother tongue is not German⁸, the CEFR also provides suggestions for course planning and detailed specifications of content. One key concept stated by the CEFR as promoted on their website underlines the actuality of the research question of this thesis:

The CEFR distinguishes between plurilingualism and multilingualism. In the same way it distinguishes between multiculturalism and pluriculturalism. This distinction aims to facilitate understanding of two very different views of linguistic and cultural diversity. Multilingualism/multiculturalism considers languages and cultures as separate and somehow static entities that co-exist in societies or individuals.

Plurilingualism and pluriculturalism aim to capture the holistic nature of individual language users/learners linguistic and cultural repertoires. Learners/users are seen as social agents who draw upon all sorts of resources in their linguistic and cultural repertoires and further develop these resources in their trajectories.

Plurilingualism/pluriculturalism stresses the dynamic use of multiple languages/varieties and cultural knowledge, awareness and/or experience in social situations.

Both plurilingualism and pluriculturalism focus on interconnectedness of different languages and cultures rather than on their differences and stress the importance of evolving profiles that value even the most partial competences in and awareness of languages and cultures.⁹

⁸ Kinder und tätige Personen in Tageseinrichtungen und in öffentlich geförderter Kindertagespflege am 01.03.2022 (destatis.de), last accessed 2024/02/22.

⁹ <https://www.coe.int/en/web/common-european-framework-reference-languages/plurilingualism-and-pluriculturalism>, last accessed 2024/02/22.

Within this framework, the influence of other languages, as investigated here in the present thesis, may shed light on contemporary effective use of multilingual elements in the daily language use of primary school children and thus catch up with current trends in educational goals.

2.1. Stages of reading development

To understand the process of learning to read, it is first important to realize that several tasks must be accomplished. The prerequisite for learning to read is the understanding that writing represents spoken language. In this context, writing is like a system of symbols with which, in principle, everything can be written down (Schründer-Lenzen 2013: 15). The ability to read must be learned and is the result of a long developmental process ending in reading proficiency. With regards to the developmental aspect, models describing the process of learning to read emphasize qualitative stages or phases that describe the transition between different reading strategies.

This subchapter lays the groundwork for the research question of this thesis. The conceptual framework of reading acquisition is introduced with the focus of the interplay of written language and the corresponding phonetic system, as the research question relates to irregular words, respectively anglicisms, that do not correspond to the regular German phonology system. The selection of the models introduced here is motivated by the research question.

Since the 1980s, various stage models have been used to conceptualize children's acquisition of written language and reading. Most models include three or four stages and already place the first stage, the beginning of reading, in the preschool period. It is assumed that children already have reading-relevant prior knowledge before entering school and that school entry does not represent the "zero hour" of reading literacy (Schneider 2017: 18). In this context, a child goes through several developmental stages, from recognizing and re-identifying visual features (for example the McDonald's golden M) to mastering the alphabetic writing system, which is generally acquired in grade 1 of elementary school. The German orthography is based on a phonological system, the

characters (letters or graphemes) represent the sounds (phonemes) of the spoken language. This relationship is called Grapheme-Phoneme Correspondences (in the following referred to as GPC) (Schründer-Lenzen 2013: 26).

The skill to match specific graphemes to their corresponding phonemes is an early skill, that children learn in beginning lessons at school, where alphabetic strategies are used to acquire and successfully use the GPC. In the German education system, children have learned all the basic GPC by the end of the first year of school. In this context, a distinction is made between the processes of recoding and decoding (cf. Schneider 2017: 19):

Recoding: a sequence of letters is transmitted into a rule-conforming sequence of sounds, translation of the graphemes to the corresponding phonemes (without capturing the meaning of the word).

Decoding: grasping the meaning of the word after the recoding process is completed, i.e., lexical access.

Regardless of the writing system, children need to learn the ability to systematically map graphemes onto oral language. When entering elementary school, children must learn how letters and written words map onto their phonological form or as Perfetti and Marron (1995: 4) put it: “[...] the essential problem of literary acquisition is to come to know how one’s writing system works.” This expression refers to the alphabetic principle¹⁰ of GPC assigning graphic units to phonological units. Castles et al. (2018) refer to this prerequisite ability as the children’s ability of “cracking the alphabetic code”. Children’s increasing ability to read words by means of decoding is the crucial element within theories and modelling of the process of learning to read. Thus, in

¹⁰ German (as English) are *alphabetic* writing systems. Besides this system where letters represent particular sounds or phonemes, there are *syllabic* (e. g. Japanese, symbols representing syllables) and *morphophonetic* (e. g. Chinese, symbols representing elements of both sound and meaning) writing systems which are not further discussed here (Castles et al. 2018). In this consideration of the process of learning to read, only theories and considerations that relate to alphabetic writing systems (as well as German and English) are presented.

learning to read the processes of visual word recognition take on a prominent role, i.e., to become a good reader, the ability to decode words must necessarily develop.

Researchers have identified phases that children move through in the course of becoming a skilled reader. Ehri (1995) formulated a theory of how these word reading skills develop. Ehri's model of *sight-word theory* (1997) describes four stages of development from beginning reader to proficient reader. On the term *Sight Word Theory* she says:

“The term sight indicates that sight of the word activates that word in memory, including information about it’s spelling, pronunciation, typical role in sentences, and meaning” (Ehri 1997, S. 168).

The theory postulates that sight words – words known by sight – can be recognized, both in pronunciation and meaning – automatically without effort by the reader. However, this requires going through phases until words can be read as sight words. Ehri distinguishes between a pre-alphabetic phase, partial alphabetic, full alphabetic and consolidated alphabetic phase (cf. Ehri 2005: 173). In the pre-alphabetic phase, children first try to recognize visual cues for known words from their oral vocabulary. They are not yet able to assign concrete graphemes to the corresponding phonemes; for example, they can recognize the stop traffic sign due to its visual features, in Germany the octagonal shape with bold white letters on a red background and assign this visual input to the corresponding meaning. In the partial alphabetic phase, children cannot yet read out whole words, but they show that they can already use letter-sound cues and match them appropriately, for instance they may recognize the letter M as they once encountered the letter being the first letter in ‘Mama’. This is referred to as phonetic cue reading (Ehri 2005a: 144) as children use a phonetically known letter as a cue to identify a word using context. In the next step, in the full alphabetic phase, beginning readers can make complete connections between the written letters and their pronunciation as they have learned GPC. Similar to Coltheart et al. (2001), Ehri (1992, 1995) assumes that the relationship between spelling and phonology can best be described by a set of rules of grapheme-phoneme correspondences, which a learner starts to acquire when leaving the pre-alphabetic phase. They can therefore decode words they have never read before (Ehri 1995: 120). To familiar sight words, they have quick, direct lexical access. In the

last consolidated phase, sight words are continuously added to the lexicon. Letter patterns and their associated GPC are transformed into larger units (morphemes, syllables) so that more complex unknown words can be read and entered into the lexicon. The individual phases build on each other, but one phase does not have to be fully completed before the next begins; rather, overlap is possible (Ehri 2005: 176).

Another empirically well-known orthographic learning theory was established by David Share (1995). In Share's self-teaching paradigm (Share 1995), phonology is the sine qua non in learning orthographic representations. By reading a word alphabetically several times, multiple entries and links between orthography, semantics and phonology are created, so that gradually the lexical fast route of word reading can be used. Through this automated orthographic reading strategy, the child continues to increase reading speed, adding more and more words to the mental lexicon until almost any word can be read as a sight word at quick glance. This hypothesis is not restricted to whole words but also applies for GPC as a conditional prerequisite allowing children to decode more and more words which, in return, results in the expansion of their lexicon. The model operates phase-independent, an entry in the mental lexicon occurs via repeated exposure.

Share proposes a new interpretation of the two-way model: He sees the two-way model as nothing other than an expert-novice paradigm. According to his argumentation unfamiliar letters and letter patterns (assuming that all letter patterns or words are unfamiliar to beginning readers at first encounter) must be read with the help of algorithms and pronunciation rules. This corresponds to reading with the help of the non-lexical way.

Share (1995) points out in his "self-teaching" model the special importance of a phonological recoding capability for the construction of an orthographic lexicon (Share 1995: 96). By recoding unknown words, beginners acquire the word-specific orthographic knowledge necessary for automated word recognition. In a kind of implicit self-teaching mechanism, the ability to consider larger linguistic units in terms of lexical access is acquired through phonological recoding. Without a phonological recoding ability, the construction of an orthographic lexicon and thus the acquisition of a higher reading strategy becomes more difficult.

Both theories of learning to read have in common, that they sketch the development from the beginning to a proficient reader, claiming that beginning readers rely more on phonology (as they sound out for comprehension) whereas skilled readers are able to directly access orthographic and semantic representations (Milledge & Blythe 2019: 3). In addition, both emphasize the centrality of the knowledge of GPC and phonetic skills to anchor a word in the long-term memory. Both theories are close to each other and complement each other in some ways. Research supports Share's self-teaching hypothesis indicating that students expand their lexicon after recognizing initially unfamiliar words via phonetic decoding (Cunningham et al. 2002). Ehri refers directly to this study and states, that "[t]his study shows that decoding helps students build a sight vocabulary" (Ehri 2005: 149). Following this idea, it seems only logical to assume that the frequency of words that are not decodable due to irregular GPC and therefore can only be read from memory or the lexicon, influences the quality of decoding and the success of reading these words.

A major claim of stage models is that they attempt to determine developmental status and predict further developmental trajectories based on experimentally determined reading performance. Furthermore, the models can be used to investigate which strategy is poorly or insufficiently developed. The two theories were used here for the reasons mentioned above: they attempt to explain the relationships between orthography and phonology and are dual-route based.

2.2. The role of phonology for reading acquisition

Another important skill that, unlike learning to read, is automatically acquired is the spoken-language skill, i.e., the knowledge of the meaning of many spoken words (Castles et al. 2018). This ability supports the children on their way to becoming proficient readers, as the role of phonology is a crucial element:

“Oral language acquisition precedes written language acquisition, and so, a child's earliest cognitive representations of words include phonology and

semantics; only later, as they learn to read, do those phonological and semantic representations map onto orthographic forms.” (Milledge & Blythe 2019: 1)

There is widespread agreement that children initially recode words (indirectly, via phonological translation of individual graphemes), but with increasing reading skills they use direct orthographic-semantic connections and move from sub-lexical to lexical reading (Grainger et al. 2012, Milledge & Blythe 2019).

Phonological awareness is also seen as a precursor skill to learning to read and write. The term phonological awareness refers to the cognitive ability to abstract from the meaning of words and to focus on the phonetic aspect of language. Children must therefore be able to shift attention from the content aspect of language to its sound and word structure and vice versa in order to read successfully (Schründer-Lenzen 2013: 86).

Theories proposing this development of an increasingly direct lexical access promoting direct orthographic-semantic links claim that the contribution of phonology to successful lexical access becomes less important with increasing reading proficiency (Ehri 1995, 1997, 2005). Newer research in the fields of eye tracking however supports findings “that children continue to process phonology during lexical identification as their reading skill increases” (Milledge & Blythe 2019: 2). The operational change is characterized by

“a progression from early, overt decoding (the conscious, effortful sounding out of printed letters to identify a word) to more sophisticated, covert phonological recoding (the rapid, covert, pre-lexical processing of a printed word’s phonology).” (ibid.)

Castles et al. (2018) point out that the acquired phonics instruction (teaching GPC) is very effective and allows children to link an unfamiliar printed word with a familiar word in their oral vocabulary (p. 14). The phonics method of reading instruction is seen as a key method to teaching reading (Blythe et al. 2015) because it allows children to apply phonological decoding which is the conscious association of written words or text with their sound. Through phonological decoding, the reader is able to identify a word during reading. This is a key strategy especially for beginning readers as “phonological recoding acts as a self-teaching device or built-in teacher enabling a child to

independently develop the word-specific orthographic representations essential to skilled reading and spelling” (Share 1995).

To sum up, phonology as the mapping of individual sounds onto letters and syllables plays a crucial role in the process of learning to read. In the later course of proficient reading, this skill is still essential, but shifts in weighting towards other sub-skills can be observed. In the beginning, the role of phonology in terms of translating orthography into phonology and thereby accessing meaning is more pronounced in smaller units (letter-by-letter, syllable-by-syllable) where in later stages it is proposed that these units become greater “chunks” (Seidenberg & McClelland 1989, Blythe et al. 2014). In this way, phonological decoding is known to be important especially for beginning readers as they need to build up their mental lexicon (Share 1995) and the introduced models argue that within the early stages of learning to read, children strongly rely on phonology versus more automated printed word recognition with direct semantic access in the later course. However, adults also use phonological decoding as a core component of lexical identification in silent reading and there is evidence that adults start to preprocess phonology of upcoming words before they directly fixate these words (cf. Blythe et al. 2015). Milledge & Joseph (2019) argue that it is “widely recognized that adults continue to make use of phonology to aid lexical access and identification during reading” (p.8) but emphasize that this fact has not been introduced into the empirical literature on children’s reading development. In their study Blythe et al. (2015) compared the sensitivity to phonology of children and adults. They found that children in general rely more on phonological information than adults. Comparatist studies investigating different aspects of phonology try to explain the proposed stages of the conceptualist model presented above and attempt to describe the individual components of word recognition and reading as well as their respective importance during different stages of proficiency. This is precisely where this study aims to pick up. Since children of grade 2 and 4 are the focus of the investigation, the development process in particular can be depicted well.

2.3. Summary

To sum up, the models attempt to describe how the particular components in the development of learning to read interact and to define the time span of the stages involved. From the perspective of cognitive psychology, the continuing research in the fields of linguistics aims to experimentally target individual components by manipulation of words, sentences or texts in order to concretize the models using the findings about interactions. The dual route models were primarily proposed to describe skilled reading processes; however they also form the basis of the influential theories about the underlying processes of learning to read (cf. Ehri 1992, Share 1995). Within the current reading research, this perspective has entered the debate and promotes the understanding of the process of learning to read. It is assumed, that here are two ways to get from print to meaning, however the interplay is not yet determined holistically, as Grainger et al. (2012) put it:

“What is less generally agreed upon, on the other hand, is the nature of the processing involved in accessing such whole-word orthographic representations, and how the beginning reader might develop such representations.” (p. 280)

They also add that there is “very little research, either empirical or theoretical, investigating the development of orthographic representations during reading acquisition” (ibid.). Further, despite extensive research on reading processes, no study yet exists to the author’s knowledge that examines anglicisms in terms of irregular words within the framework of reading development.

Reading acquisition processes are in the focus of cognitive psychology research in order to understand the strategies children use on their way to become proficient readers. The aim of the efforts made by this research is to provide answers to the questions about how reading should be taught and how to deal with individual difficulties during reading development. Despite the comprehensive research on the topic, there is no ultimate common consensus about the perfect way to teach reading. For instance, in their publication *Ending the Reading Wars: Reading Acquisition from Novice to Expert*, Castles et. al (2018) describe the ongoing scientific disputes between those who emphasize the centrality of decoding skills through the introduction of phonics (GPC)

and those who place a stronger focus on other aspects such as experience in terms of repetition of words (cf. Share) in reading acquisition. Ultimately, these debates and the research around reading acquisition are about figuring out what strategies underlie reading processes in beginning readers and how to operationalize them for educational practice (Gasteiger-Klicpera 2021).

As described in the models of literacy development by Share (1995) and Ehri (2005) in this chapter, children learn to associate letters and their corresponding sounds, they identify word sequences, and finally they understand a word together with its content-related meaning. Very soon, children develop the ability to recognize short words and their meaning as a whole instead of going through a step-by-step phonological recoding (sound-by-sound, syllable-by-syllable). Repeated, multiple recoding thus creates a lexicon in which a word is stored with all its properties such as orthography, phonology, morphological and syntactic information. Becoming a confident and successful reader means that children learn to recognize words as a whole or at least chunk-wise in the case of longer words and access their meaning rapidly without several intermediate steps of translating individual graphemes to sounds (Ehri 2005 for a review). Traditionally it is assumed that there is a strict order of development from effortful decoding to rapid direct lexical access (cf. Milldedge & Joseph 2019). It is further commonly argued that both approaches to the lexicon always proceed in parallel and depend on the task (whether a familiar word or an unfamiliar word is read) until one route is successful (Grainger & Ziegler 2011, Blythe et al. 2015).

The phase models describe reading acquisition, but they do not explain the underlying cognitive processing and thus cannot provide explanations for why problems or deficits may exist (Costard 2011: 12). Likewise, it was questioned early on whether the frequently modeled three or four stages of children's reading acquisition are undergone in the sequence mentioned by Ehri (visual cue reading - phonetic cue reading - phonological recoding). It could be shown in several studies that beginning readers also safely used the rapid, prelexical and unconscious activation of abstract phonological codes (for a review Blythe et al. 2014).

Castles et al. (2018) argue that “it is important to understand how children progress to this more advanced form of word recognition and how teaching practice can support

this” (p. 6). Following the self-teaching hypothesis of Share (1995), it can be assumed that the exposition of children to words in terms of frequency is a crucial prerequisite that also accounts for the reported frequency effects in children (Joseph et al. 2013, Rau et al. 2014, Tiffin-Richards & Schroeder 2015). It may also be postulated that children are equally able to store phonemes that do not correspond to German GPC in the lexicon if they have already heard or read them several times as phonology is thought to be a “powerful self-teaching device” (Milledge & Joseph 2019: 2). The question that is not yet sufficiently explored is from which state on children are able to encounter printed words through whole word recognition. In this sense, the proposed study using anglicisms may contribute to the research gap as phonological decoding that is dependent on the standard German phoneme-inventory of about 40 phonemes (Linke et al. 2004) and its associated GPC is switched off. Children in this study must rely on direct orthographic semantic links. In order to properly address the fact that the single matching of GPC will not work for a certain group of anglicism due to their irregular phonetic properties with regards to the German phonetic system, anglicism shall be used in this study. By contrary, studies so far have operationalized pseudo homophones (e.g. *worta* for *water*) or homophones (e.g. *whether* and *weather*) to investigate effects in word processing due to phonological manipulation (cf. Milledge & Joseph 2019 for the relevant studies). In either case, there may be disruptions due to nonsense words or false semantic meaning. Using anglicisms may deliver more authentic and noise-free observations as they represent real and authentic words, which is also applicable for homophones. However, it must be noted that the study investigating homophone effects does not include beginning readers due to the fact, that no sufficient age-appropriate homophone pairs are available for this age group (ibid.).

3. Skilled reading

In cognitive science, the skilled reading process is represented by cognitive processing models. Prominent models that have been designed to describe the complex skill of reading are presented in the following subchapters. But first, the concept of reading literacy is discussed (section 3.1) followed by a description of which components are

involved in reading and how these components such as word recognition, syntactic parsing and global coherence building are intertwined (section 3.2). The chapter concludes by highlighting the relevant issues that must be taken into account for the experimental study and the further analysis of the recorded eye movement measures.

3.1. Definition of reading literacy and conceptual considerations

Literacy is a very broad term. The term basically describes a process of perception and processing (Ehmig 2019). But the significance of reading goes far beyond the technical level according to Rayner et al. (2001) who identify a relationship between literacy and reading and concretize these concepts as follows: “reading is understood as a number of distinct literacy activities that have specific functions” (p. 34). This means that reading not only reflects individual aspects of reading and comprehension but is also embedded in a socio-cultural and historical context (Lenhard 2013: 48). In this sense, literacy is necessary to successfully cope with real life and to participate in socio-cultural life. This can apply to reading bus schedules, road signs, but also instructions and information, for example, preparing a tax return (Rayner et al. 2001: 34). In this sense, reading is a basic skill or a “basal cultural technique” (Richter & Christmann 2009: 25) which was described in early models as a passive reception of meaning of the content of a text (Christmann & Groeben 1999: 145). However, more recent concepts assume that reading is more than direct decoding of meaning of pure text, but rather represents a constructive act (Hurrelmann 2009: 277). Accordingly, it is assumed that a cognitive performance or several partial performances take place during the reading process. In addition to recoding, i.e., recognizing letters and words and decoding or filling these words and word particles with meaning, an important sub-process is the cognitive active linking of the message contained in the text with the previous and world knowledge of the recipients (Christmann & Groeben 1999: 146, Artelt et al. 2000: 70). Here, reading is considered a cognitively constructive process: by linking the individual sentences in a written text a coherent mental representation emerges (‘local and global coherence formation’) (Christmann & Groeben 1999: 157). In this dimension, reading is the ability to comprehend written texts which can be referred to as reading comprehension. This

ability based on cognitive representations can be learned and trained (Müller & Richter 2013). This definition includes considerations of developmental psychology studies and deals with methods of reading education. Therefore, here too, there are different approaches to defining the concept of reading and even confounding use of the terms literacy and reading.

In the context of the present study, which is in the field of empirical research in cognitive science, the psycholinguistic efforts to describe the process of reading is most suitable. Technically, this is the transformation of visual input of written language into a mental representation along with its comprehension, or simply put the “most common definition” of reading is “[r]eading is getting meaning from print” (Rayner 2001: 34). Based on this definition, reading is the starting point for literacy in the sense of reading skills (Rayner et al. 2001: 34), i.e. the ability to recognize spoken and written words and to assign them to existing semantic concepts. Thus, a transformation takes place and already implies a process. There is a consensus that during reading, numerous sub-processes take place within the course of transforming a visual input to a mental representation of the text that was read.

As with all other cognitive linguistic and cognitive psychological processes, models are used to explain the mental processes, since direct insight into the human brain, the ‘black box’¹¹, is not possible. The models that attempt to represent the reading process and thus reading literacy come primarily from research on reading difficulties such as visual word recognition (dyslexia) or difficulties in general language comprehension (hyperlexia), or a combination of both (Seidenberg 2007). What is indisputable for all models built is the presence of two components in the reading process: the encoding process and lexical access as formulated by the many, sometimes competing, theories of the reading process and learning to read (Christmann & Groeben 1999, Richter & Christmann 2009, Coltheart et al. 2001, Ehri 2005, Gough & Tumber 1984, Perfetti 1989, Perfetti 2001, Seidenberg & McLelland 1989, Share 1995).

¹¹ The 'black box' is a psychological model in which both the input (input) and the output (output) are known, but not the cognitive processes that occur "inside" the black box (Stangl 2021).

Reading and the understanding of written words comprises more than the two components of recoding visual input and assigning semantic concepts. PISA 2012 defines literacy as “[a] person’s ability to understand, use, and reflect on written texts in order to achieve one’s own goals, develop one’s own knowledge and potential, and actively participate in society” (Prenzel 2013: 23). This statement shows that literacy or reading is more than just deciphering signs. The variety of goals and benefits interpreted into the reading process in this quote suggests that reading is a complex process and cannot be explained by a one-dimensional model. The complex construct of reading comprehension involves different levels of cognitive processes. The two components frame what is generally agreed upon as successful reading skills, with word recognition or identification of the written word as the initial step and the assignment of a semantic concept as the result of the successful reading. Further processing steps such as global coherence formation, i.e., the embedding of word meanings in general prior knowledge and the referencing to non-linguistic factors (Richter & Christmann 2009: 42) are not included in all models. In this sense, the two core elements of word identification and lexical access are, to a certain extent, the lowest common denominator of all reading process theories. For the investigation of the reading process cognitive science operationalizes the component processes of reading to explain differences in individual performance. For example, reaction times are diagnostic measures indicating efficiency of cognitive processes (Richter et al. 2012). The importance and weighting of the individual process components vary depending on the model and focus on different aspects. Verbal efficiency theory (Perfetti 1989) places a lot of weight on the level of word recognition. According to this theory, reading comprehension depends on how well word recognition is performed. According to the Simple View of Reading (Gough & Tunmer 1986), comprehension relies mainly on reading comprehension. Regardless of the explication of the individual model ideas, these models consistently draw on basic levels in the reading process.

3.2. Levels of lexical processing in reading

The complex process of reading is described with several subprocesses. For a long time, reading literacy was explained through process models. Basically, the various theories and models explaining the reading process argue that reading is a complex process consisting of several flexible and context-dependent subprocesses at the word, sentence, and text levels (cf. Christmann & Groeben, 1999).

At the **word level**, or level of letter and word recognition, letters and words are recognized (recoded) and word meanings are captured (decoded), which means that a word is assigned to an entry within the mental lexicon. Perfetti (2007) emphasizes the importance of this first step as sine qua non of the reading process. Readers with an un-routinized and incompetent ability of visual word recognition show difficulties on higher processing levels as cognitive resources are occupied (Perfetti 1985). In this sense, the level of word recognition represents the basis for good reading skills. For skilled readers, these low hierarchy subprocesses on the word-level are well routinized. They are a necessary, but not yet a sufficient prerequisite for good reading comprehension (Müller & Richter 2013). Therefore, the context in which the word is placed can also support word recognition and help to make corrections for reading errors.

At the **sentence level**, syntactic and semantic analysis of word sequences take place and relationships within sentences are established. Understanding sentences requires integration of the individual words into a coherent meaning. In addition to word recognition, the structure of the sentence is analyzed using morphological information such as the inflection of words (syntactic parsing). In addition, semantic integration of word meaning and thus sentence meaning is performed.

On the **text level**, inter-sentence relations are established and information from preceding levels is combined to form an overall picture. The contents of the individual sentences are transferred to larger meaning structures and integrated into a meaningful context. This process covers linguistic relations above the sentence level and the construction of a coherent text structure (integration). Further, reading comprehension succeeds only when words, parts of sentences, and whole sentences are interpreted on the basis of individual prior knowledge (Christmann 2004: 431). Finally, theoretical

modelling resulting in a mental representation of the text content takes place (cf. Christmann & Groeben, 1999: 148, Hurrelmann 2002: 28).

Word recognition and sentence comprehension are not seen as sequential processing stages but as interacting processes, since semantic, syntactic, and pragmatic information from the sentence context is also used for word recognition (Richter et al. 2012).

Newer concepts about word processing pick up the assumptions of sequential processing. About 20 years ago, eye-movement control during reading became a part of the field of cognitive science. As an extension to the conceptual ideas of Christmann and Groeben, computational modelling is driving current research questions. These approaches will be discussed in chapter 7.

3.2.1. Data-driven vs. concept-driven

There are differences in how the interaction of these levels and subprocesses is interpreted. Two types of models are established due to the current state of research: modular and interactive-connectionist models (Christmann 2004: 420). In modular models, it is generally assumed that the individual levels of the reading process are connected in series. For this paradigm, one processing step must be completed before the next processing step is started. Here, the running direction of this sequence is differentiated into bottom-up and top-down. So, either the concepts of the models work data-driven (starting by decoding letter-by-letter, word-by-word) or they work concept-driven (starting with cognitive higher levels of processing). In the following, prominent models are presented to illustrate which basic ideas and theories describe how the individual subcomponents are interrelated and or interact with each other. This theoretical consideration is essential to lay the foundation for the later cognitive-psychological discussion, in the analysis of the results of the eye tracking experiment, with which conclusions are to be drawn on the performance of the individual levels of the reading process.

Modular theories (Perfetti 1989, Gough & Tummer 1986) postulate that the subsystems involved in the reading process are autonomous and basically work independently of

each other. Within the modular perspective, for instance in the case of a data-driven paradigm, higher subprocesses do not start until processing at the lower levels is completed.

For example, Gough's (1972) model operates strictly in series. A visual input during fixation first leads to an image (icon) on the retina. In a further step a mental scanner searches for patterns (pattern recognition) within a "database", in which the GPC are stored. As a result, a phoneme sequence is found with the help of which the matching entry can be found in the lexicon. The model has long been outdated as it is an "empirically untenable conception" (Günther & Pompino-Marschall 1996: 912) and the research of, for example, Rumelhart (1977) showed that the perceptual processes are affected by context and familiarity.

Therefore, interactionist approaches (McClelland & Rumelhart 1981, Stanovich 1980, Christmann & Groeben 1999) assume that bottom-up and top-down processes can run in parallel. It is assumed that there is no mandatory sequence of hierarchical sublevels (word level, sentence level, text level), but that the subprocesses interact and influence each other.

Figure 1 depicts the prevailing models:

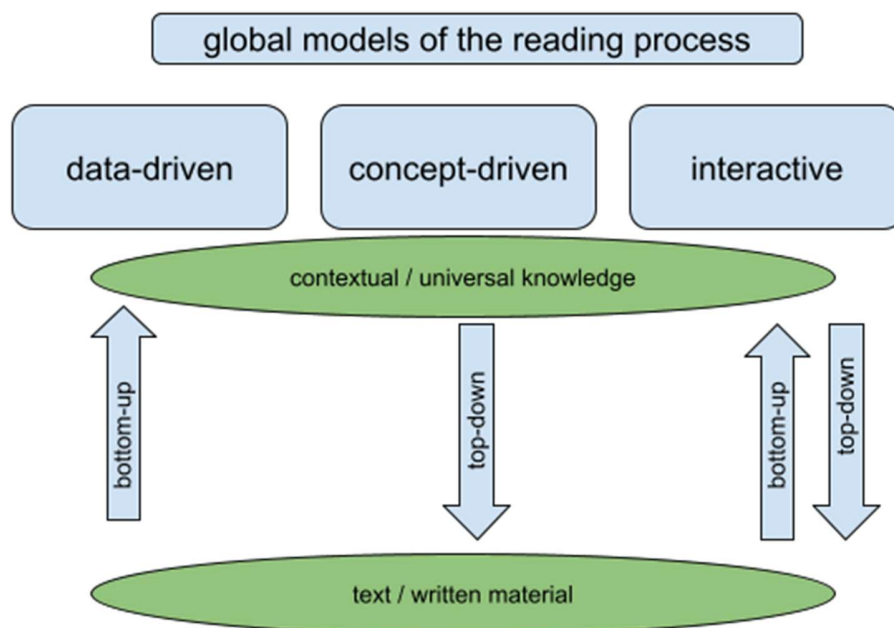


Figure 1: global models of the reading process (cf. Christmann 2004)

However, it is characteristic of these various models that they each focus on certain aspects. Still, the different models and theories that emerged over the decades have the common goal of comprehensively mapping and explaining the reading process. Also, they all divide the reading process into several sub-processes as shown schematically in Figure 1, either hierarchically organized or interacting or both.

It is important to note that the key difference between the data-driven and concept-driven models is the distinction of how and from where the translation process is started. Here, translation process stands for the process of getting from print to meaning or literally speaking, translating a visual input to a semantic concept. Within the data-driven perspective, this translation process is initiated on the level of letter or word identification and then subsequently proceeds to larger linguistic units ending in meaning. Context does not matter until the word is identified. In contrast to this, concept-driven models work the other way round. They assume that the translation process starts from higher cognitive levels, i.e., the level of meaning and universal knowledge and thus they influence all inferior levels. The reader starts by hypothesizing

about the meaning of a word or a linguistic unit. In the moment of initiating reading, at the moment the sequence in question appears, expectations are activated by means of the reader's contextual or universal knowledge. The ongoing reading process is a testing of the hypothesis, a 'psycholinguistic guessing game' (Goodman 1967), in which either the supposed expectation about the visual information proves to be correct and the reading process continues while maintaining the meaning construct, or the assumption is discarded. If the assumption is discarded, the hypothesis is revised, a more suitable meaning is searched for in the existing knowledge and a new hypothesis is generated; or the reader remains neutral until the ongoing reading and decoding process reveals an apparent hypothesis (Pearson 1978, Christmann 2004). Since it has become accepted that the reading process is interactive, models of conceptual importance for the research work of this thesis will be discussed in more detail in the next section.

3.2.2. Interactionist models

As modular models are rarely restrictively bottom-up (only the early model of Gough 1992 may meet the criteria of being a solely bottom-up model) nor top-down (here Goodman's 1968 model may fit best), the processes can be best described when the two mechanisms interact. The assumption that information processing at the different levels also proceeds in parallel is postulated in interactive models. Feedback takes place between the basal and the higher processing levels, which finally leads to a mental representation of the facts described in the text. In this sense, interactionist approaches assume that lower hierarchy and higher hierarchy process levels can be activated simultaneously or in temporal overlap, i.e., higher processes already start before lower ones are fully completed. Within the reading process, the reader starts to generate hypotheses about meaning and at the same time initiates the decoding process of identifying letters and words. Feedback is given between the basal and the hierarchy-high processing processes, which finally lead to a mental representation of the material read.

However, there are also hybrid versions of theories, which are referred to a *restrictive-interactive models* (Perfetti 2016: 35). Perfetti's model of *verbal efficiency* assumes that

a faster and more efficient recall of words facilitates cognitive processing of higher hierarchical processes. The better word identification works, the more resources are available to the reader for inference formation (Perfetti 1985).

For instance, if visual word recognition is not sufficiently routinized, cognitive resources are tied up and are then no longer available for hierarchy-higher reading and learning strategies (theory of verbal efficiency, Perfetti, 1985). The verbal efficiency theory (Perfetti 1985) assumes that reading comprehension depends primarily on processes at the word recognition level. The more efficient and automatized a person recognizes words, the better the reading comprehension as it frees resources that can then be devoted to higher-level linguistic processing. The verbal efficiency model is a hybrid model because it combines two features of modular and interactive models, namely that it postulates interactive interaction between the levels of processing but restricts them in the same contexts.

A similar perspective is postulated in the *Simple View of Reading* theory (Gough & Tunmer 1986). Individual differences in reading comprehension within this theory are described as the product of two partial abilities, namely the ability to decode written words and a general ability of language comprehension, which also underlies reading comprehension. The Simple View theory states the simple equation of $R = D * C$ (Reading is Decoding times Comprehension) and, as in all formulas with multipliers, $R = 0$ if either D or C equals 0. The definition of decoding within this context is word recognition, arguing that “sounding out is (at most) only a primitive form of decoding” (Gough & Tunmer 1986: 7).

Like the theory of verbal efficiency, the *interactive-compensatory model* developed by Stanovich (1980) sees lexical access in word recognition as central to the reading comprehension process. His compensatory model was able to explain apparent anomalies in experiments when, for example, poor readers showed greater sensitivity to contextual constraints than did good readers. In contrast to the theory of verbal efficiency, Stanovich (1980) assumes that deficits at this level can be compensated for by recourse to sentence context. Since these processes are less automated, individuals with a poor reading ability need more time for the reading comprehension process (Richter & Christmann 2009: 47).

3.3. Summary

The purpose of this chapter was to illustrate the skilled reading process and to present the respective conceptional models. First, a definition of what is understood as reading within the field of cognitive science was discussed (section 3.1.), emphasizing that, depending on the perspective, different approaches to reading are available. The conceptualization ranges from a coarse-grained rather technical definition of assigning a semantic meaning to visual input, to a global approach that addresses the term of *literacy* including social and cultural aspects.

It was pointed out that all efforts of defining and describing the reading process assume the involvement of different levels. These were presented in section 3.2. and their interplay and interaction due to prominent theories were explained (section 3.2.1. and 3.2.2.). There is a distinction in both modular and interactionist models explaining the interactive reading processes on the word level, the sentence level and the text level. Further, the direction of processing is considered to be either bottom-up (data-driven), top-down (concept-driven) or a mixture of both, being interactive and assuming that processes run autonomously and in parallel.

Regarding the method applied within this research, the principal understanding of which subprocesses are involved in the reading process and how they interact is mandatory. As manipulations of reading materials and the recording of the eye movements tries to further investigate specific subprocesses, this chapter described the theoretical concepts that can be employed for analyses.

In the described theories, still contemporary approaches to psychological modelling, skilled word reading is seen as a necessary determinant for the ability to read larger text structures successfully. The key statement of the theories mentioned above is that, no matter how good readers perform at higher-level processing, the reliable ability of word recognition is mandatory for proficient reading comprehension.

Christmann (2004) calls this ability "basal perceptual processes" and locates the beginning of the reading process at this "lowest level" (p. 422) where visual stimuli are fixed and processed. These perceptual processes are recorded with the methodology of

eye movement measurement. In the following section, therefore, the level of word recognition will be examined in more detail since this is where the foundations for the methodology applied here can be found.

4. Word recognition processes (lexical access) in skilled reading

In the context of this work, reception processes during reading of anglicisms are investigated with the help of eye tracking. As a further theoretical consideration, word recognition is introduced since the built-in manipulations, respectively the object of research, refer to the word level. Statements about text or sentence comprehension were not investigated since manipulations on the syntactic level have not been integrated.

The reading process begins with the identification of letters and words and the recognition of their meaning. The assignment of meanings to visually perceived sequences of letters (words) is called lexical access. A written word is understood when the graphic or phonemically transposed information activates a concept in the reader's mind. In this context, the lexicon metaphor emerged in the 1970s (cf. Günther & Pompino-Marschall 1996: 912) to address the question of lexical access. Lexical access makes it possible to identify the signaled word by the visual stimulus with the help of stored knowledge. Like the modeling attempts of global reading processes, the models for visual word recognition can be divided into two main branches: connectionist and dual-route approaches (Coltheart 2006, Seidenberg 2007: 186). Dual-route models tie in with the modeling of single-word processing within the logogen model¹² (cf. Morton 1969) and have long dominated theoretical and empirical research on reading. In contrast to connectionist models, the dual-route models assume two separate processing strategies for word recognition (Coltheart 1978, Coltheart et al. 2001) whereas

¹² Logogens are mental units in which all relevant information about the spelling, pronunciation, function in the context of the sentence, and meaning of the word is stored. Morton (1969) distinguishes between a "cognitive system" where knowledge about a word's meaning is stored and a system of knowledge about word forms, the "logogen [word generation] system" (Coltheart et al. 2001: 209).

connectionist models assume that there are no distinctive routes of converting print to a mental concept, but that there is rather a neural network in the mind of readers and that inhibitive and promoting processes are responsible for the activation of lexical access (Rumelhart & McClelland, 1981; Rumelhart & McClelland, 1986, Seidenberg & McClelland, 1989).

Parallel to the interaction of different components in the competent reading process, the level of word recognition is also described by subcomponents. In the following sections, two contrasting kinds of models are presented as they explain the two most prominent perspectives on word recognition (Rayner & Reichle 2010: 788) – connectionist and dual-route models.

4.1. Connectionist models

To understand how connectionist models work, the operating mode of the *Interacting Activation Model* (Rumelhart & McClelland, 1981) is briefly explained: The word recognition process is seen as an activation process in which an interactive flow of information between three levels takes place. It assumes three processing levels that are interconnected in the form of nodes: visual feature level, letter level, word level. According to this, the processing of visual features (also graphic elements that make up the individual letters) leads to the activation and inhibition of corresponding letters. Once a certain level of activation is reached, the process continues at the word level. Parallel processing at the different levels is assumed. If the critical activity threshold is reached, the corresponding letter/word is activated. With increasing reading experience, the activation levels of the nodes in the resting state change, i.e., words or word components that are frequently activated can be retrieved faster than rarely occurring words and word components due to their increased activation state (cf. McClelland & Rumelhart 1981: 377).

The model was extended as a computer-simulated network model by Seidenberg and McClelland in 1989, the *Parallel Distributed Processing (PDP) Connectionist Model*. Within their network model, Seidenberg & McClelland (1989) do not assume different

processing pathways. They adopt the processing of a word based on an activation pattern in the mental network specific to that word (item-based). Orthographic, semantic, and phonological codes are available in this network for the word. This model is also sensitive to the reader's reading experience, as information such as context develops through activation potentials and connections between representations. They assume that knowledge about words is developed through experience and practice with written language building neural networks which can be accessed unconsciously. There is no single lexicon; rather, the information is stored in the individual nodes of the network.

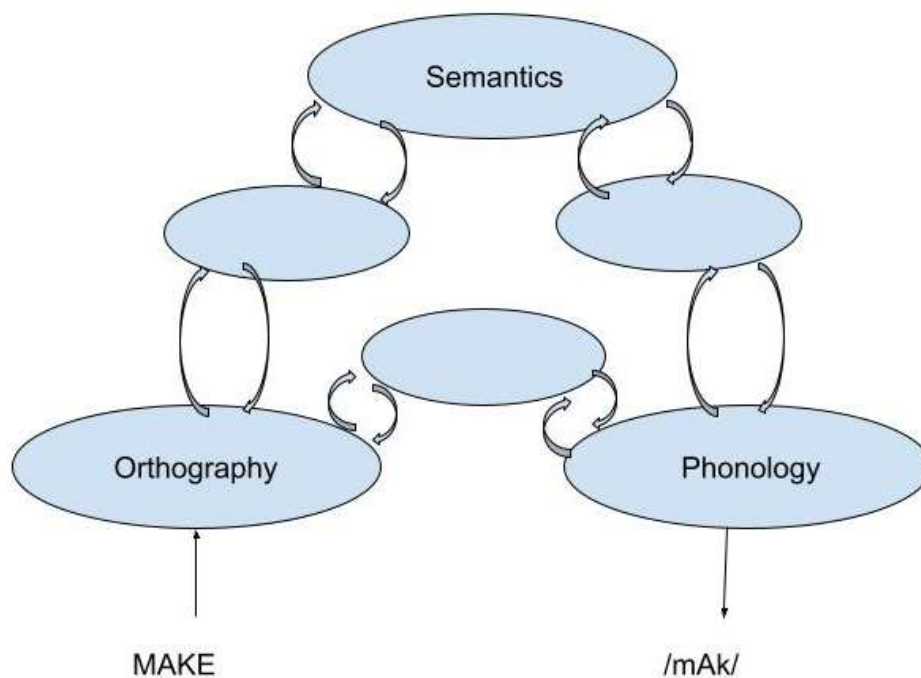


Figure 2: Parallel Distributed Processing (PDP) Connectionist Model (as in Seidenberg & McClelland 1989: 526)

According to this model, internal hidden units containing orthographic, phonological, and semantic information are built up during the process of learning to read. These units are represented in the model, Figure 2, as empty ovals (“hidden units”). The model assumes that the reading of words is not based on matching their phonetic patterns stored in the lexicon, but rather orthographic, phonological, and semantic features are elaborated during the learning process. Their interconnection is advanced and intensified

to such an extent that effortless, correct word recognition is possible. The relationships of the individual units are not formed by rules but by probabilities. For the computer-simulated model this means that it works with probabilistic connections which lead to an activation of the different representational units (Seidenberg & McClelland, 1989). It is argued that network models thus mimic the structure of the human brain in that they are learning, and repeated activation in the network reinforces the connection and activation patterns between individual representations. For non-words, codes are also activated for similarity patterns to existing words.

To conclude the presentation of connectionist - or network - models, it can be summarized, that word recognition is explained as a function of the link strengths of the orthographic units stored in memory and their phonological equivalents. Connectionist models have been criticized however because they make decisions due to learnt patterns and samples. Identification of non-words (lexical decision tasks) are not modelled correctly by this approach (Coltheart 2006: 12) and especially for beginning readers the model can only be applied inadequately, as beginning readers or weak readers do not have the "knowledge" as presented in the models here (Coltheart 2006: 14, Mannhaupt, 2001: 21).

4.2. Dual-route models

The most prominent models of the dual-route approach postulate, that words can basically be read via two different access routes (Coltheart 1978, Coltheart et al. 2001). It is assumed that all orthographic, phonological, and semantic information of a word is present in the reader's mental lexicon. In fact, the mental lexicon forms the core of the model. All paraphrasing properties such as phonological, semantic, and orthographic information of known words is stored within the mental lexicon. In order to access the appropriate entry for the corresponding visual input, two possible processing mechanisms are available to the reader. On the one hand, the direct way allows an orthographic encoding of the written image through which an entry in the mental lexicon is directly activated. In the case of the **lexical route**, the pronunciation of the word is also directly available. For words that are not stored in the lexicon, the indirect path

must be chosen. Via this **non-lexical** route, the word must be read letter by letter and simultaneously translated through grapheme-phoneme mapping as in the serial decoding strategy of Gough (1972). Especially among beginner readers, it can often be observed how in reading aloud they try to match the word with similar phonological entries in the "inner lexicon" to identify a possible meaning (Doctor & Coltheart 1980: 195).

This simple basic model, on which other more differentiated theories and models are based, illustrates two diametrical processes in reading and reading comprehension. On the one hand, bottom-up processes (linear decoding, starting from the text) and on the other hand, top-down processes (starting from the knowledge of the recipient). The bottom-up process can be associated with the indirect path and the top-down process with the direct path (Figure 3).

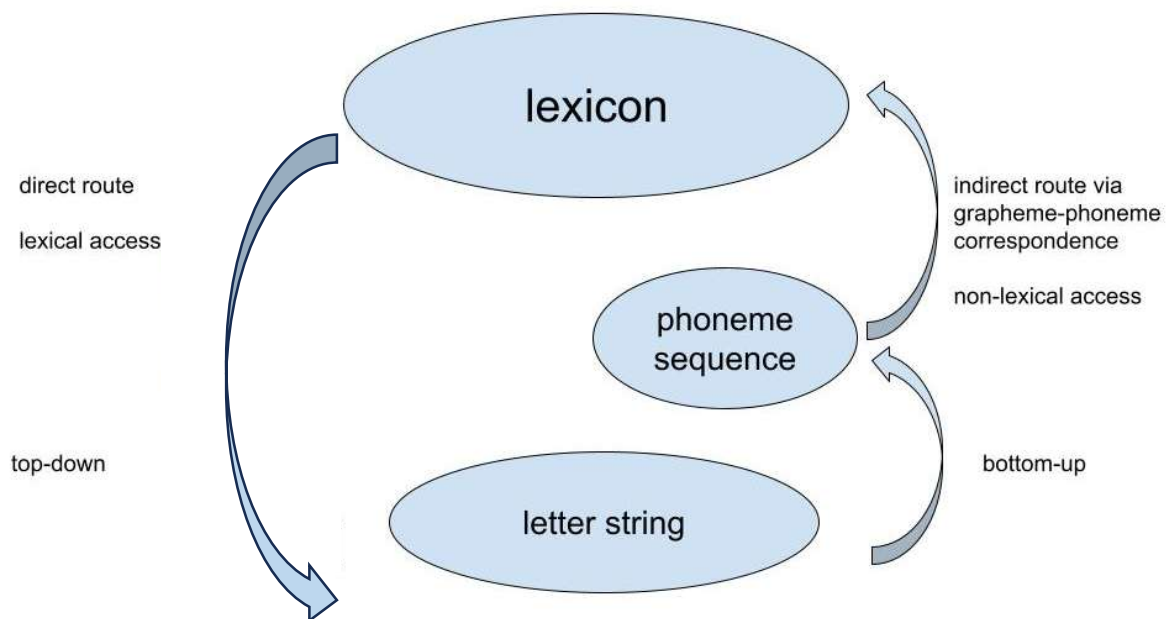


Figure 3: Basic model of the Dual-Route approach (cf. Coltheart 1978)

While in the bottom-up process (non-lexical route), visual stimuli are processed step by step until a cognitive representation of the text is achieved, top-down processes (lexical route) can be used whenever a more complex knowledge structure already exists. In principle, bottom-up and top-down processes work together.

In terms of the projected hypothesis, it can be noted that the influence of the orthographic (direct) path to the mental lexicon increases the worse the grapheme-to-phoneme relationship is (Zwitserlood & Boelte 2008: 484).

The dual-route model is probably the best-known theory of visual word recognition and plays a fundamental role for the research questions proposed here. The theoretical framework of the dual route approach to successful decoding allows us to make distinctions about how reading processes work and how words are recognized. In simplistic terms the model postulates two different ways in which written language is processed and entries in the mental lexicon are successfully activated. The eye tracking experiment conducted in this work aims, on the one hand, at word frequency effects and phonological differences with respect to grapheme-phoneme correspondences using anglicisms as counterpart stimuli to German words with regular GPCs. In terms of thinking of the two routes described with this approach, it could say something about the relation and interaction of both processes by analyzing the receptive conditions in connection with the top-down processes identifying known anglicisms in the mental lexicon of children.

Orthographically irregular means that the word do not obey the language system-specific grapheme to phoneme correspondence (GPC). Pseudowords or unfamiliar words however are thought to be processed by the non-lexical or indirect route as this route works by decoding a word syllable by syllable with its language specific GPC. Two crucial premises are that each known word has a representation in the mental lexicon and that the phonological representation are stored likewise.

Coltheart further assumes that both routes (phonological and orthographic) of word recognition are initiated simultaneously and run in parallel until one of the two routes achieves to a result and a word is recognized ('Horse-Race', Coltheart 1978). His assumption was verified for children in the studies of Grainger and Ziegler (2011) and Blythe et al. (2015) as they were able to experimentally show that, depending on the task (whether a familiar word or an unfamiliar word is read), both approaches to the lexicon always proceed in parallel until one route is successful. The theory also applies to adults, though it was noted that the reliance in adults is stronger on orthographic visual features

than on phonological information where for children this is the opposite (Tiffin-Richards & Schroeder 2015a).

This view is supported by findings from neurology. For example, patients for whom only the direct path is possible due to brain-organic damage have great difficulty with pseudowords. If the phonological, indirect path is disturbed, regular words and pseudowords cannot be read (Ehlers 1998: 27). This model conception seems particularly suitable as a theoretical basis for the present work, since anglicisms behave like irregular words.

A crucial difference between the connectionist network models and the dual-route model is that the latter assumes that all semantic, phonological and orthographic elements of the vocabulary are stored in an "inner lexicon".

The further development of the Dual Route Model is the *Dual Route Cascaded (DRC)* Model (Coltheart et al. 2001). It allows a computer-aided modeling of the reading process. The model was developed as a response to Seidenberg and McClelland's 1989 PDP model (Coltheart 2005: 11) as a computer-based model which adopted important elements of the PDP model. The idea of the activation threshold was taken over, however, the component 'cascaded' of the model literally reveals that not all processes are equal, but that activation is continuous from one level of the system to the other. It thus implements simultaneous processes in a parallel system. Like its predecessor, it includes two routes to lexical access. The individual levels and processes were linked together whereby the lexical and the non-lexical route again run simultaneously.

First, the visual properties of the word are analyzed. The result of this analysis is an abstract letter representation. After that, word recognition proceeds in two ways. In the non-lexical path, the graphemes are converted into phonemes. In the direct lexical path, the abstract letter representation activates a letter sequence in the "orthographic" lexicon. A suitable meaning and a pronunciation can be found in the interaction with the semantic and the phonological system. In the process, the system may be run through several times, as many times as necessary, until a stable optimum is found (Coltheart 2005: 14). Before the word can be read aloud, both paths meet in the phonemic system, where the correct pronunciation is assigned. Reading literacy thus refers to written texts,

but a strict separation between written and oral language cannot be proclaimed as the orthographic input lexicon and the phonological output lexicon must correspond with each other.

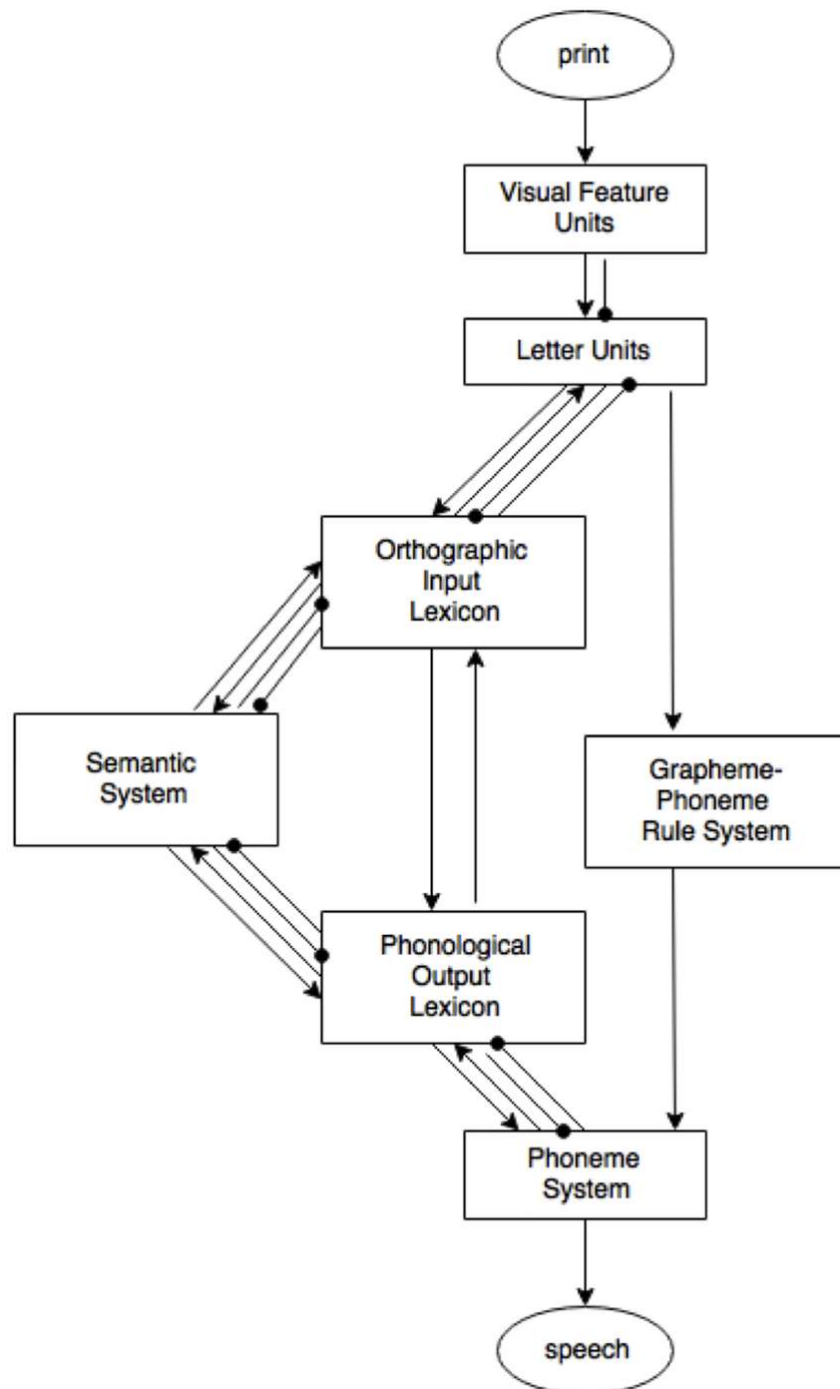


Figure 4 The Dual Route Cascaded Model (DRC) (Coltheart 2005: 12)

As shown in Figure 4 the individual processing levels are either in excitatory connection or in inhibitory connection. Precisely around this question of the balance between the two forces have scientific arguments been raging since the foundation of the model itself. Especially with the focus on the reading process in children, scientists try to operationalize individual features with concrete stimuli. Since “[w]hat is less generally agreed upon, on the other hand, is the nature of the processing involved in accessing such whole-word orthographic representations, and how the beginning reader might develop such representations. “(Grainger et al. 2012).

In the context of the work presented here, it is important to note that the DRC model was transferred to the German language and was able to prove its validity in the German language (Ziegler, Perry & Coltheart 2000). For the implementation of the model for the German language, Ziegler, Perry and Coltheart (2000) investigated loanwords from the English language to evaluate the validity and quality of the model. For their study, Ziegler et al. examined children in second grade at a single measurement point and identified the phonological component as an important foundation for successful reading development. The DRC model basically models on the assumption that it distinguishes between reading irregular and regular words. In transparent languages such as German, only about 5% of words do not correspond to the relevant GPC (*ibid.*); accordingly, only this small proportion would not be processed lexically. Nevertheless, Ziegler et al. were able to show that the DRC predicts very well for German. Therefore, effects for word frequencies, word length, or even neighborhood size must rather be brought to the fore when it comes to the principal logic of dual processing and access via the whole-word strategy (*ibid.*: 414).

4.3. Summary

In this chapter, the theoretical considerations of the word recognition process were discussed. The successful accomplishment of this sub-process of reading is essential at the very beginning of reading acquisition and has to be learned in contrast to components such as the mental lexicon or the phonological input and semantic output lexicon which are already developed in children. Thus, in reading acquisition, the

connections between the units of an orthographic input lexicon and the phonological output lexicon must be established in order to successfully deal with irregular words (Costard 2007: 13). Likewise, connections between the orthographic input lexicon and the mental lexicon, i.e., the semantic representations of the visual input, must also be established. Coltheart's dual-route model has been described in more detail in this chapter because the assumption of a phonologically structured lexicon is mandatory for predicting reading difficulties when encountering irregular words due to their GPC. In addition, it is important to note that all models explaining word recognition processes correspond in their emphasis of two key cognitive processes: on the one hand the ability to recode words by the translation of a word's spelling into sound and then map onto its meaning and on the other hand the ability to directly access meaning without having to translate spelling to phonology (Castles et al. 2018: 17). The importance of this process can be summarized as follows:

“Readers who fail to read words accurately fail to comprehend. Thus, word-level problems are potentially the most important in creating reading failures because they lead both to word reading problems themselves and to derivative comprehension problems.” (Perfetti 2001: 128)

This chapter presented theories that have become established in reading research over the course of time and consider the involved stages of the reading process. There is widespread agreement that the reading process is distinguished by running through different levels with different modeling in regard to hierarchical viewpoints. The two modular perspectives, data-driven vs. concept-driven, are ultimately not seen in isolation, but in an interactive context. The level of word recognition was emphasized since the methodological connection to the eye tracking experiment is located here. Connectionist models and dual-route approaches lay the ground for the elaboration of the meaning of phonetic features that were also discussed for the theories on learning to read. The aim was to identify the role of phonology in both areas and, as in the context of the present study, to draw conclusions on the relevance of the GPC, as anglicisms are agents for the targeted investigation of their reception. The selection of presented models is motivated by still open research desiderata that concern different reading strategies especially for beginning readers (Grainger & Ziegler 2011). This involves examining

how the individual units interact with each other. In principle, it can be said that the two predominant types of models are used to model how an optimized mapping of print to meaning takes place (ibid.) and which developmental stages are passed through in the process (see also Rau et al. 2013). To sum up, the models presented here have in common that they emphasize two key processes within the reading process. That is that word recognition either involves translating a word's orthography into its corresponding sound and then accessing its meaning or accessing meaning directly from the spelling without an effortful recoding via phonology. This later path was long considered to be the sophisticated way of skilled reading. However, newer research involving experiments with children show, that also beginning readers as young as seven years old are capable of using the direct lexical access to a large extent (cf. Blythe et al. 2014 for a review). As Castles et al. (2018) point out:

“[t]hat these two broad mechanisms should emerge in readers of alphabetic orthographies makes perfect sense: Together, they allow optimal processing of words across the full spectrum from being new and unfamiliar to a reader, where alphabetic decoding is critical, to highly familiar, where direct access to meaning is more efficient (p. 17).”

There have been efforts investigating pseudo homophones, and due to misspellings, it could be proven that this has an effect on eye movements (Blythe et al. 2014, Blythe et al. 2015).

Activation-based models (e.g., the PDP of Seidenberg & McClelland 1989) postulate that elementary lexical units are activated when visual information is received. A word is recognized when the activation level for a letter or letter sequence surpasses a certain threshold. This threshold is lower for frequent words than for rare words, which is why frequent words are recognized faster. For the identification of new and unfamiliar words, in addition to the direct visual (or orthographic) access, readers have another access via the phonological system. Here, the graphemic structure of a word is translated into a phonetic structure using grapheme-phoneme correspondence rules (Coltheart 1978, Coltheart et al. 2001). Such models are therefore also called two-way models. They postulate the phonological path for rare and unfamiliar words (provided they are pronounced regularly) and the visual path for familiar and frequent words as well as for

words with irregular grapheme-phoneme correspondence. These ideas of how the reading process is modelled build the starting point for the research conducted here.

The current assumption is that word recognition is not based on the serial processing of individual letters, but that the basis for the visual identification process is formed by abstract letter units that are processed in parallel (Rayner & Pollatsek, 1989). According to the so-called word frequency effect, frequent words are recognized more quickly than rare words for the reasons mentioned above. In this sense, all the theories and models apply the dual-route concept to some extent. But as Carreiras et al. (2014) put it:

“In fact, one of the oldest debates in visual word recognition concerns the demarcation between bottom-up and top-down processing, asking whether or not the visual stimulus feeds into the lexical level in a predominantly hierarchical manner, wherein orthographic representations feed into higher-level linguistic representations, or whether higher-level linguistic information such as phonological and morphological structure exerts a top-down influence on visual orthographic processing relatively early.” (p. 90)

This theoretical chapter forms the foundation on which the hypotheses and thus the methodological approach is based. In this sense, the selection of anglicisms as stimuli is explained and the mechanisms and influencing parameters underlying the reading process have been discussed. At this point, it should be mentioned that the theories and models presented here, as well as related studies, have been established for the most part in the Anglophone world. In this respect, the research presented here can fill a gap.

There are only few studies that have investigated the influence of phonology using regular vs. irregular words in terms of their phonological characteristics or nonwords to examine the word recognition process in developing readers (Rau et al. 2014, Rau et al. 2016, Grainger et al. 2012, Tiffin-Richards & Schroeder 2018). This focus on the phonological component is associated with the developmental stages and their involvement in the reading process. From all that is known from previous studies, anglicisms cannot be read by the indirect route via decoding syllables using German GPC. However, beginning readers are already able to access words holistically (Grainger et al. 2012). In the present study, eye movements of a sample of second and

fourth graders are measured. The stimuli within the reading material are anglicisms and German words matches for length and word frequencies. A direct comparison is possible by investigating the reading process of beginning readers using anglicisms and matched German words. Controlled sentence frames were used with the embedded target words. Further, age-appropriate reading word frequencies for children were selected. The design of the experiment allowed us to directly test the effects of interaction of word frequency, length and modality (anglicism vs. German word).

The eye tracking study presented here intends to take advantage of previous findings such as frequency effects showing that low frequency words will lead to longer fixation times (Tiffin-Richards & Schroeder 2015, Rau et al. 2015). Further, it has been proven, that word length effects occur and differ in effect size due to a word's regularity in terms of its phonology, in concrete terms, length effects were greater for low than high frequency words (Rau et al. 2014). As although there is quite an outstanding number of studies regarding anglicisms, those analyses are mostly based on the statistical computing of occurrence of anglicisms in a specific corpus (cf. section 5.3).

With the increasing interest of linguistic research in multilingualism, the interest in language contacts as phenomena that can be observed in the context of multilingualism has also increased in recent years. This study may open a new field regarding the investigation of language change analyzing contemporary data with the help of eye tracking and operationalizing psycholinguistic approaches and modelling.

5. Anglicisms

Today's language contact research covers a wide range of topics, from diglossia and domains of language behavior to individual and performance-related aspects of language contact (language acquisition, bilingualism, code-switching) to the issues of language contact in the context of language policy, language ideologies, and language conflict (for an overview see Thomason 2001).

When two languages meet, they interact. The study of language contact investigates how languages influence each other. In concrete terms, if there are (linguistic) transfers of

one language to another. Either language contact causes synchronic variation or diachronic change (Thomason 2020: 34). From a diachronic perspective, researchers have analyzed ways in which language contact has influenced lexical respectively structural developments over time. From a synchronic perspective, the ways of contact are analyzed, for instance if it is face-to-face contact or exchange of written media. Especially nowadays comprising the possibilities of modern media, this is an important aspect. The dynamics of linguistic systems and change processes are therefore as well socio- and psycholinguistic issues. If a transfer of words occurs, i.e. the adoption of words from one language into another, we speak of foreign words or loan words.

The development of European languages were accompanied by constant language and cultural contact and their mutual influence. For this reason, many words in German were adopted from other languages. In the course of history, there were particularly close contacts with some cultures and their languages, which is why they had an especially great influence. In the course of history, there have been particularly close contacts with some cultures and their languages. A first phase of contact already existed between the Roman Empire and the Germanic peoples. Through the contact with the Roman culture, German adopted words from Latin. (Riehl 2013: 200). By the 14th century, the language was influenced by French culture (Riehl: 205) and later, in the 19th century, it intensified due to the Industrial Revolution and the beginning of democratization. Especially in the field of transport and the press, there were many new achievements and thus words that were adopted into German (cf. Riehl 2013: 213-214). Nowadays, foreign language influences in German originate mainly from English.

5.1. The term *anglicism*

Onysko (2007) defines anglicisms as “any instance of an English lexical, structural, and phonological element in German that can be formally related to English” (Onysko 2007: 90). Analogous to similar borrowing processes and generalizations, Eisenberg (2018) describes loan words as words that are German, even if they are taken wholly or in part from other languages (Eisenberg 2018: 2). He further specifies, that a loan word from English is called an anglicism, expressing that it is not a word of English, but one that

comes wholly or in part from English (ibid.). These broad definitions were extended by Carstensen (1963) with respect to the phonetic, sentence, and text levels.

Busse's (1993) analysis of anglicisms in the German dictionary *Duden* includes all words that are etymologically identified as English, American, Scottish, Irish, Australian - that is, all Anglophone - keywords. Also included in his consideration are proper names and English words that have entered German via a third language. In addition, he includes all words that exhibit phonetic characteristics of English, i.e. have an English pronunciation (cf. Adler 2004: 47). A distinction between influences from American or British English or other Anglophone regions like Australia, South Africa, Canada, New Zealand is not intended in this work. From a linguistic point of view, this is impracticable and irrelevant to the question at hand (Carstensen 1963, 1965, Yang 1990: 9, Götzeler 2008: 145).

Götzeler (2008) refers to all borrowings that originate from the English language area as anglicisms (Götzeler 2008: 144). She argues that a distinction is not practicable from the linguistic perspective and supports this perspective with evidence that British English is also influenced by American English, a fact that is equally argued by Carstensen and Busse (cf. Götzeler 2008: 146). According to Yang (1990), Götzeler (2008) and also Burmasova (2010), the working definition of anglicisms in this paper includes all variants of direct English loans, regardless of their origin (e.g., Canada, Scotland, Australia). A distinction between Britishisms and Americanisms is not made since an exact separation is neither etymologically possible nor conducive to the formulated goals of this work.

Efforts to provide a comprehensive discussion of this topic and the usefulness of differentiation for linguistic research is available (cf. Yang 1990: 7).

From the above definition it becomes clear that the term anglicism does not only refer to one-to-one adoptions from the English language, but rather includes all expressions and phrases of the German vocabulary that have their origin in an Anglophone environment or a reference to English. In summary, it can be said that there are differences between the individual approaches and that the terminology is not always clear and thus a predefined perspective must be adopted according to the respective research approach

and research question (Burmasova 2010: 35). The term anglicism is associated with a multitude of different terms. In principle, an anglicism is a term adapted from the English language, although different categories have established themselves in the scientific discussion regarding the external and internal form in terms of syntax, morphology, phonology, lexicology or idiomatic use. The term anglicism is often used as a generic name to describe the occurrence of English or American language elements (e.g., word, word composition, changed word meaning) in other languages (here: the German language). A closer look at the term, however, reveals that there are unclear boundaries between linguistic and socio-cultural influences, as well as between changes that affect the language from outside and those that come from within (Onysko, 2007). In addition to the production side, which examines what types of anglicisms are used for what motives and how frequently (Duckworth 1945, Yang 1990, Adler 2004, Kuke 2006), there is also the reception side, which deals with the acceptance of anglicisms (Barbe 2004, Eisenberg 2018). For this work, however, a typology from a purely linguistic perspective is of interest because in the intended study, anglicisms are selected on the basis of their phonological properties. For this reason, attempts to classify anglicisms according to their characteristics of adaptation and modification at morphological, syntactic, and phonological levels are introduced. Based on the definitions that use the term *anglicism* as a generic term for all borrowings from the Anglophone language area, the classification attempts are presented hereafter.

5.2. Classification of anglicisms

There are numerous different perspectives dealing with research concerning language contact. While Betz (1949) and Haugen (1950) examine borrowing processes from a formal linguistic perspective, sociolinguistic approaches also attempt to describe and develop a terminology for the various borrowing processes (Yang 1990). In the theoretical examination of borrowing phenomena, the foreign word inevitably becomes the focus of research. All linguistic elements that are adapted from a donor language initially appear foreign in their own linguistic system. Thus, the foreign word is an umbrella term for all anglicisms, latinisms, grecisms, italianisms or gallicisms, whereby

this list represents a continuum, since even the contact with other cultures in a world shaped by globalization is henceforth developed further and new contacts are constantly emerging.

First attempts to define and categorize lexical loan processes took place at the end of the 19th and beginning of the 20th century, for example by Paul (1886), Seiler (1907-13) and Kaufmann (1939) (cf. Winford 2003: 42). Today's understanding of the typology of anglicisms is fundamentally based on the basic models for borrowing phenomena according to Betz (1949) and Haugen (1950).

Frequently, linguistic disputes on loanwords refer to the classification of Betz (1949). In his classification, Betz first distinguishes between direct and indirect borrowings. The direct borrowings are loanwords that are subcategorized as foreign or assimilated loanwords. Examples of a direct borrowing are *e-mail*, *cool* or *ticket*, where no changes are made during integration into the German language system. An assimilated loanword would be *einloggen*, *gepiercte* or *coole* (Onysko 2007: 14). Here, the English loanwords are morphologically adapted. On the other hand, in Betz' system the indirect loanwords are called loan imprints; as a subcategory he lists loan meanings and loan formations. The latter are further subdivided into loan translations, loan transfers and loan creations.

Haugen (1950), on the other hand, breaks down the classification of loan phenomena into three categories, which he bases on their morphological constitution. Two processes are decisive for him: importation and substitution. He distinguishes between three types of borrowing (Haugen 1950: 214-215):

- 1) the loanwords are morphologically completely adopted (morphemic importation without substitution),
- 2) loan blends with morphemic importation with substitution, so-called hybrids,
- 3) complete exchange (loan shifts), only the meaning is taken over in the foreign language form (morphemic substitution without importation), also loan translation.

The comparison of the positions shows that either two (Betz) or three (Haugen) basic types of borrowings are distinguished. The two-part distinction of Betz for only two main types of borrowings and thus two main strategies of dealing with linguistic foreignness has established itself as a robust classification, which can still be repeatedly found.

Carstensen (1979) categorizes in a similar way to Betz, but here he mentions synonymously evident loans (English origin obviously recognizable from the outer appearance) and latent loans (hidden, the English origin is difficult to recognize). An anglicism is considered to be evident if its English origin is immediately recognized. Also, pseudo borrowings and pseudo anglicisms fall in this category as Carstensen bases the class of evident loans on the phonetic recognition as a foreign phonetic element. On the other hand, anglicisms are of a latent nature if they do not contain any word components that have been directly taken from the English language, which also cover hidden influences of English on German such as loan translations and loan transfers (Carstensen 1979: 90-94).

Yang (1990) undertakes a comprehensive classification especially of anglicisms in the media field, whereby he also fundamentally distinguishes between internal and external borrowing forms and integrates Betz' terminology and typology. Yang further categorizes three categories from a sociolinguistic perspective, based on the frequency patterns of anglicisms. First, he distinguishes conventionalized anglicisms, which encompass the generally known terms and are integrated into the German language although these anglicisms do not conform to German conventions in their articulation and/or orthography, such as *computers, managers, keks, jeans*. Then he determines the anglicisms in the process of conventionalization, which are perceived as foreign by many Germans, yet are used in the SPIEGEL, which represents Yang's corpus of investigation. Examples are *factory, gay, underdog*. He assumes that this type will either be conventionalized or disappear completely from the German language. Yang's last category includes all quoted words, proper names and related words, examples are *high school, US Army, western*. The origin of these anglicisms can be referred to because of their specific relation to a nation or specific situations (Yang 1990: 9).

In the model of Götzeler (2008) English borrowings are divided into three categories. On one boundary of the borrowing spectrum there are outer loans where both form and content are adopted, there is no change of the outer form of the word. On the other boundary of the spectrum, she defines inner loans where existing vocabulary elements are changed in composition or meaning according to the English model. In between, there are hybrids, these consist of a combination of an English or English-influenced part and a non-English part.

The overview of Götzeler's categorization of anglicisms is graphically presented in Figure 5.

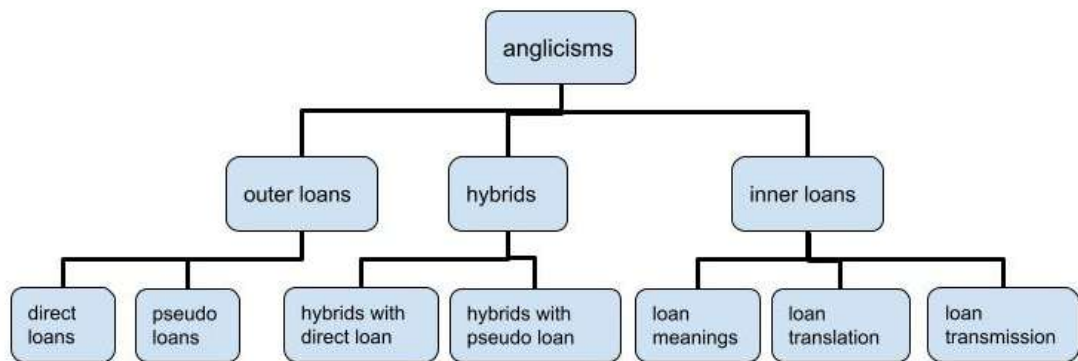


Figure 5: Graphic overview of the categorization of anglicisms as established by Götzeler 2008: 163

The existing typologies of anglicisms are methodologically based on the model of Betz and have been modified, supplemented or expanded over time (Haugen 1950, Yang 1990, Onysko 2007, Götzeler 2008), although this is an ongoing discourse.

To sum up, no matter how fine-grained the differentiation of categorical accounts and investigations of loan words from English may be in the individual papers, two approaches will always emerge. Betz' initial distinction of 'direct' and 'indirect' loans is still valid for numerous other researchers as well. Carstensen calls them 'evident' and 'latent' loans, Onysko refers to Betz' typology of 'direct' and 'indirect' loan influences, Yang and Götzeler name them 'outer' and 'inner' loans.

With reference to the theories presented in the theory chapters on the reading process and reading acquisition, the external loanwords, and here in particular those that do not

correspond to the German GPC in their phonology, are of importance for the present work. They can be operationalized in such a way that they can provide information about the phonological component of the reading process.

5.3. Anglicisms from a linguistic perspective

The empirical description of written and spoken language, based on qualitative or quantitative corpus analyses, has now established itself as a central paradigm within linguistics. Corpus-based, deductive (i.e., an approach that seeks verification of stated hypotheses using quantitative evidence), but also inductive studies (open-ended analyses that look for patterns for example within a certain specialized text type) include this approach. In this section, an overview of previous research work on corpus linguistic investigation of anglicisms and reception studies using eye tracking within the fields of empirical linguistics is presented.

As corpus linguistics is about observing and describing phenomena within language, linguists have compiled and analyzed specific corpora to describe loan words and borrowing processes within the German language. Due to the importance of English in the global language community, the description of the language contact phenomenon anglicism has played a role in many studies.

In previous research on anglicisms within this field, anglicisms are generally described and studied with a focus on the following aspects: frequency, semantics, word formation as well as their integration in the RL system. There is no shortage of publications on anglicisms in the context of their use in the German-speaking world. However, the field of research seems to be restricted to the scope of their usage and occurrence as well as the morphological, syntactic, and semantic behavior of anglicisms. With regards to corpus linguistics the published papers so far include occurrence of anglicisms (frequencies), their acceptance as well as their integration on the morphological level (linguistic features) and in the socio-linguistic dimension. In most cases, the linguistic approaches investigating anglicisms or loanwords cover the fields of fashion, technology, economics, radio, and television media.

Probably the most comprehensive work of linguistic discussion of anglicisms was the *Anglizismen-Wörterbuch* by Carstensen and Busse (1993). It lists about 3,500 examples of anglicisms as they occur in contemporary German and describes them in terms of their origin, usage and integration.

For corpus linguistic studies concerning anglicisms, research mainly considered static corpora in specific areas such as media, press, sport, fashion (Yang 1990, Onysko 2007, Burmasova 2009, Kinigadner 2012, Eisenberg 2018, Kuke 2016) or in relation to issues in the intercultural field in comparative studies (Adler 2004, Götzeler 2008). The research work has in common that "written adult language" formed the database for the investigations. Generally, issues such as morphological and syntactic integration or the investigation of acceptance and statistical distribution have been described quite extensively in these studies. Seldom has the frequency of use in the studied print media been the exclusive object of investigation. Nevertheless, research on the frequency of anglicisms in the German language seems important because many researchers deduce their integration into German from the use of English lexemes (Burmasova 2010: 11). Studies have been collected here that examine Anglicisms in terms of their occurrence and integration into German. The selection cannot claim to be exhaustive, but nevertheless reflects the prevailing methodology for describing the phenomenon *anglicism* within the current linguistic research landscape. The following is a brief outline of linguistic discussions of Anglicisms by prominent and repeatedly cited studies. In the following these studies and their main findings are presented.

An early important work on anglicisms was published by Carstensen (1965). The author examines German magazines, especially *Der Spiegel*, in the period between 1961 and 1964. This work differentiates for the first time between different types of borrowings and also examines stylistic functions. Carstensen points out that the press has a major impact on the adoption and propagation of English elements. Carstensen concludes that the influence is predominantly on the vocabulary, while grammar is less affected by foreign language elements (Carstensen 1965: 5).

The corpus-based chronological analysis of anglicisms in the 20th and early 21st centuries by Eisenberg (2018) provides information of their frequency and usage in a corpus compiled from popular, scientific, journalistic, and literary texts published during

the periods 1905-1914, 1948-1957, and 1995-2004. This study attempts to encounter structures and regularities in the process of integration into the German vocabulary. The core result is that the number of anglicisms in the German standard language has increased between the two outer periods analyzed, the period of 1905 to 1914 and 1995 to 2004, both at the level of words and at the level of frequency of use. Eisenberg concludes that anglicisms within the contemporary German vocabulary are under considerable pressure to integrate the core grammar, since the structural influence of anglicisms is marginal. The most important external reason for the high number of anglicisms in contemporary German is to be sought in the equally broad and intensive contact of German with English, with its consequences for a corresponding need for naming (Eisenberg 2018: 115).

Yang (1990) investigated a corpus consisting of issues of the German magazine *Der Spiegel* in the a period from 1950 to 1980. He performed a diachronic study of 24 issues of the news magazine by examining a total page count of 3,350 from six issues each from 1950, 1960, 1970 and 1980 for anglicisms according to the following aspects: frequency of use, word class, stylistic function (anglicisms in journalism), characteristics of word formation and the degree of integration which he refers to as the “degree of conventionalization in society” (Yang 1990: 4). Yang's aim was to provide evidence of the developmental trends in the frequency of use of anglicisms in *Der Spiegel*. Yang based his statistics on two main points. First, the determination of the absolute number of anglicisms and second, the relative number (borrowings per page) of borrowings. Methodologically, Yang resorted to the type-token relation. Each anglicism (type) is related to the total frequency (tokens) within the respective year. Thus, for the year 1950, the calculation is: 633 tokens divided by 325 types = 1.5 (rounded). Each anglicism appeared 1.5 times in 1950. Yang compared the factors and concluded that the frequency of use has steadily increased since 1950 (Yang 1990: 26). In his conclusion, Yang confirms the strong role of *Der Spiegel* in the use and integration of anglicisms. He counted 10,700 anglicisms, on average about three anglicisms per page. Except for 1960, Yang showed a steady increase in the use of anglicisms. As another result it can be noted that in semantic terms, it was found that a connotative component can be identified for anglicisms for which a German alternative word is available (Yang 1990:

168). Also, trends in the use and distribution of connotative features were identified: anglicisms without a German alternative word were rendered with awkward paraphrases. A tendency to build composita was attested as well as meaning extension of individual anglicisms (e.g., swimmingpool). Some anglicisms were not used in German in the actual sphere of use of English, a transfer of casual into the political context was observed. Regarding stylistics or motives for the use of anglicisms, it was found that local color, brevity, variation of expression, euphemistic expression, and the pedagogical aspect play an important role (ibid.).

In a large-scale corpus analysis Onysko (2007) found that anglicisms are largely resistant to orthographic integration into German. The investigation of the corpus generated from the popular German magazine *Der Spiegel* revealed that anglicisms had the small share of 1.11 % and 71 % of which only occurred once. Again, the terminological disunity when defining loans and borrowings of English is highlighted within this work. Onysko makes an intensive contribution to the description of linguistic structural peculiarities in the integration and adoption of anglicisms by lexical and syntactical means. In a related survey by Burmasova (2009), it was found that the frequency of anglicisms (nouns and verbs) in two samples within a corpus compiled of the German magazine *Die Welt* (1994, 2004) doubled; the density however is almost the same as in Onysko's research. For her research, Burmasova calculated, as a quantitative description of anglicisms, the mean values of the relative frequencies of anglicisms for each part of speech, taking into account the individual sections of the magazine. A finding from her research was that adjectives became more frequent and more varied in the course of time, whereas nouns doubled in frequency but remained stable in variance. The same observation was made for verbs. Numerically speaking the increase was between 1.56 and 1.74 for the categories noun (1.74), verb (1.69), adjectives (1.56). Overall, the study shows that the use of already borrowed anglicisms increases more than the use of new borrowings. In reference to her observations, Burmasova derives an indication for integration into language use and ties this to a process of sociolinguistic integration that takes place as anglicisms become more regular in usage (Burmasova, 2010: 225).

In the comparative work of Adler (2004), which examines the distribution of anglicisms in German and Swedish mass media as well the orthographic, phonological, and grammatical integration of English borrowings, the proportion of anglicisms measured is 1.07% for German media and 0.94% for Swedish media. Adler compared number of tokens for each defined category of anglicism for newspapers, TV, radio and internet. She defined seven categories: foreign words, loanwords, exotisms, blended loans, loan derivations, loan composita, and mixed composita (Adler 2004: 48) which she considered suitable for her research.¹³ For the share in the German investigated corpus this results match those of Onysko (2007) and Burmasova (2009). Regarding the distribution, it can be stated that subject-related anglicisms are most represented in each of the categories such as media, entertainment and music, computer, social, politics, economy, and sports (in terms of corpora). Adler also noticed, that the anglicisms appeared in both languages. However, differences in the type of borrowing are noticeable. In Swedish, reproduction in the form of loan coinage can be observed more frequently, while in German direct borrowings predominate while also being less frequently adapted to the language system of the recipient language. Regarding the socio-linguistic aspect, it is assumed that mass media influences the spread of anglicisms and thus has a major impact on language change in general (Adler 2004: 120).

Götzeler (2008) uses a comparatist intra-German approach by examining press texts for an East German and a West German print medium. She compiled her corpus from the *Ostsee-Zeitung* (Greifswald) and the *Badische Zeitung* (Freiburg im Breisgau) from 10,000 lines each within October months of the years of 1991, 2001, and 2004 to build a corpus for her analysis. With this longitudinal study, she aimed to analyze how anglicism use has developed in an East German and a West German newspaper, respectively, in the period between 1991 and 2004. For her analyses, she took types and tokens into account. She focused on the differences and similarities in the use of anglicisms in West and East German newspapers. She also verified the numerical results of other investigations, namely that the overall share of anglicism is below 2 %

¹³ As described in chapter 5.1, an all comprising system categorizing anglicisms is lacking and classification approaches are defined by the authors according to their research questions and following existing classification systems.

(Götzeler 2008: 190). On the qualitative evaluation side, Götzeler also deals intensively with the integration of anglicisms and reflects that after the adoption of loans, they emerge as new German words however graphemically, with regards to inflection or phonetic change (Götzeler 2008: 152). She concludes that social change means linguistic change and that anglicisms are the expression of current linguistic changes that result from a new form of entertainment and youth culture (Götzeler 2008: 244).

The first approach known to the author that investigates anglicisms in literature or texts that children are exposed to is the work by Kuke (2016). The main purpose of Kuke's work was to investigate whether the number of anglicisms in geography textbooks published by the German publishing company Westermann for the secondary level I has increased from 1945 to the present. By selecting the textbook variety, Kuke wanted to investigate texts in a new target group, noting that "product and factor of social processes" (Wiater 2003: 12 cited in Kuke 2016: 11) as well as "repository of the respective knowledge of cultures, [which] is passed to the following generation through textbooks" (Teistler 2003: 199 cited in Kuke 2016: 11). She thus emphasizes the importance of textbooks for society. Kuke descriptively evaluates absolute usage frequencies as well as relative to page count and by-word class. Both absolute and relative increases can be observed. The findings from the diachronic investigation of geography textbooks showed an increase of anglicisms per page from 0.09 in 1948 to 0.7 in 2015. Also, the frequency per anglicism is taken into account as she calculates – like Yang (1990) – the type-token-ratio. The higher the type-token-ratio of a geography textbook, the more varieties of anglicisms occur therein. On average an anglicism occurs 2.4 times. The type-token ratio does not increase continuously but is volatile, starting with a high value in 1948 (2.5) then decreasing with lows in 1960 and 1962 (1.0) and a further increase to a high value (3.1) in 2008 (ibid: 15). She points out that the frequency of use in geography textbooks is only slightly lower than that of press products (2.76 - 2.96 in comparative studies). One explanation Kuke gives for this is that the target reader group of the news magazine *Der Spiegel* consists mainly (two-thirds of all readers of *Der Spiegel*) of adults aged between 20- and 49-years old with a higher level of education than the population average, which is equated with a better knowledge of English (Kuke 2016: 14). The largest target group of the textbooks studied are young

people in grades 5 or 6 who have not yet graduated from high school (ibid.). In terms of grammatical parts of speech, nouns make up the largest group with 96.93% (Kuke 2016: 22).

There is only one study investigating the reception of anglicisms by school children known to the author (Gäbler 2013). Within the study, data was collected by means of checkbox questionnaires with a subsequent statistical analysis. The work's focus is on determining the level of knowledge and awareness of the use of anglicisms by children of grade 2 and 3 of elementary school. It therefore is the attempt to use empirical data to gain insights into the extent to which anglicisms already have an impact on children's everyday language. By interviewing a sample of 322 primary school children aged 7 to 10 years coming from the same school district, information about the level of knowledge of English vocabulary that is already part of elementary school-aged children is obtained. Another focus is laid on whether there is indeed a conscious differentiation of English and German lexemes within the target group.

As a result, it could be shown that anglicisms are integrated to a high degree in the daily language use of young children. On average, the participants knew 66.5 % of the presented anglicisms. The most frequently known were the anglicisms from the linguistic field of technology (79.8%). With only little distance an equally pronounced level of knowledge of anglicisms from the everyday linguistic area could be proven (75.3%). With relatively large distance English terms from the economic range (44.3%) were recognized most rarely. In this study it could also be proven that a linguistic influence of older siblings on the younger ones exists with regard to an increased knowledge of anglicisms.

The studies presented here are based on an evaluation mainly of corpora. The active language use of children is only considered to some extent in the study by Gäbler. This is where the present study comes in by operationalizing anglicisms and examining their use and comprehension by novice readers from a cognitive science perspective. This method provides ecologically valid stimuli containing anglicisms that children come into contact within everyday language use. In this way, a new perspective can also be established in the field of language contact research.

5.4. Anglicisms from the perspective of empirical cognitive science

It should not go unmentioned that anglicisms have been operationalized for reception effects in the context of reading research before. For the implementation of the DRC model of Coltheart et al. (2001) for German, a loan word effect has also been investigated to test regularities within the model. As argued by Ziegler et al. (2000): “Given that many loan words are irregular, the loan word effect is the German equivalent of the regularity effect. The regularity effect reflects the finding that low-frequency words with regular GPCs are named faster than those with irregular GPCs” (p. 423).

Following this logic, the distinction between words that conform to the rules of English grapheme-to-phoneme correspondence (regular words and nonwords) versus those that do not conform (irregular or exception words) has been the main inspiration for the influential dual-route model of skilled word reading (Coltheart 2005: 7). In concrete terms, based on the Dual Route Model, for anglicisms within this research this means that the indirect or sub-lexical route is switched off, since the GPC, the phonological form of the word is activated only post-lexically. The Dual Route Model was introduced by Coltheart (1978) and describes this dual access path. The first way to read a word is the indirect way via the letter-to-word correspondence (GPC), which explains the relationship between writing and the phonetic form of language. This access also allows the reading of unknown words. The direct way is by retrieving already known words from the inner mental lexicon (Marx 2007: 19). With regard to the writing system, orthographically irregular words can be decoded according to this model exclusively via the direct route, since a successive construction of the word on the basis of the regularities of word spelling is not possible here.

For the extension of the DRC Model to German, it was tested how loan words are recognized. The words investigated are defined as irregular words for the DRC and its ability to capture this effect. As in a previous study conducted by Scheerer (cited in Ziegler et al. 2000) the categories described below have been tested:

“To test for the existence of regularity effects in German, Scheerer (1987) selected three groups of loan words: (1) regular loan words that did not contain

any violation of German orthography (e.g., FILM, TEST); (2) regular loan words that violated German orthography; they contained at least one bigram that does not occur among native words (e.g., SKAT, TYP); (3) loan words with irregular GPCs (e.g., CHEF, TEAM). As shown in Table 2, Scheerer (1987) found that regular loan words (group 1) were not significantly different from native German words. However, regular loan words with orthographic violations (group 2) produced significantly longer latencies than native words. Finally, loan words with irregular GPCs (group 3) produced longer latencies and more naming errors (19.5 per cent) than any of the other groups.” (Ziegler et al. 2000: 423)

The summary of results as presented in Figure 6 illustrates that there is a non-negligible effect for loan words of the category *irregular GPCs* for both human data from Scherer’s experiment and data of the DRC model. In addition, it highlights the importance of the phonological component within any word recognition model.

<i>Word classes</i>	<i>Human data</i>		<i>DRC</i>	
	<i>RTs</i>	<i>Errors</i>	<i>Cycles</i>	<i>Errors</i>
Native words	573	0.3	80.3	0.0
Loan words				
Reg GPC/Reg Orth (<i>Test, Film</i>)	566	0.9	81.3	0.0
Reg GPC/Irreg Orth (<i>Skat, Typ</i>)	591	1.6	85.6	0.0
Irreg GPCs (<i>Team, Chef</i>)	634	19.5	96.4	24.2

Reg = Regular; Irreg = Irregular; Orth = Orthography.

Figure 6: Summary table for loan word effect in German (Ziegler et al. 2000: 424)

This reveals the research gap that the study with school children aims to shed light on. By using anglicisms compared to German words, ecologically valid stimuli can be used to specifically investigate the phonological components of reading acquisition and the reading process.

Previous studies using the method of eye tracking were able to confirm effects for the influencing variables’ frequency, familiarity and word length. The influence of word

frequency was characterized in children in particular by the fact that longer fixation times and more fixations were recorded for less frequent words (Joseph et al. 2013, Rau et al. 2014, Tiffin-Richards & Schroeder 2015, Dirix & Duyck 2017). Word length is also an established factor in the context of eye tracking experiments, as it addresses parafoveal processing. Results show that word length is a relevant influencing factor, especially for children, and should therefore be controlled if it is not the tested variable (Blythe et al. 2010, Joseph et al. 2009).

Few studies have examined the effect of phonology by using eye tracking and if so, the stimuli have been pseudo words or pseudo homophones (cf. Blythe et al. 2014). These findings emphasize the selection of anglicisms that will serve as agents in this study and other well controlled variables. The selection to investigate cognitive processes of reception and lexical access among children of grade 2 and 4 will be explained in detail in the following section.

5.5. The role of anglicisms in this study

As this study uses anglicisms as an agent to investigate reading processes via their cognitive-linguistic reception the outer form of anglicisms is a relevant indicator for the selection of stimuli. The phonological properties (GPCs that are considered irregular in German) are therefore important. The category of outer loans is therefore most suitable for the experiment.

In the experimental design of this work, the participants (children of grade 2 and 4) were asked to read sentences that have been manipulated with either an anglicism or a German word that was linguistically controlled for in terms of word length and frequency according to age-appropriate norms for children (norms are taken from the database ChildLex). The concept of anglicisms, which is probably the most relevant for this research topic, includes "[...] the dominant language level for borrowing processes, lexis and semantics, i.e., the most obvious and quantitatively significant forms of English influence." (Götzeler 2008: 145). Therefore, to find out which lexical routes or reading strategies the children use when encountering the stimulus, anglicisms, which

clearly differ from German words with regard to their GPC, are most suitable for the assumed effects. This assumption is tied to the idea of irregular words within the Dual Route Model of Coltheart (1978) as described in section 4.2. Hence, this study considers the category **direct loans** (Betz, Onysko), **evident** (Carstensen) or **outer** (Yang, Götzeler) and applies these anglicisms to the empirical investigation. Likewise, the probably most comprehensive work that systematically deals with borrowing products and influences from English into the German language, the three-volume *Anglizismen-Wörterbuch* (Carstensen & Busse 1993) fundamentally categorizes by these two main directions. Busse refers to the partly confusing nomenclature of English borrowings, but also emphasizes that, in principle, there are two main differences and that all approaches to classification have in common that they distinguish between external resp. evident and internal resp. latent borrowings (Busse 2001: 135). The focus here will be on direct/evident/outer loans, i.e., the direct adoption of words from English for the eye tracking analysis because of their grapheme-phonetic relationship that does not match the German pronunciation and therefore is assumed to lead to different behavior in the reception of these words. The theoretical basis for this assumption was laid in the theoretical foundation in chapter 4.

For the present study, only apparent anglicisms will be considered since they are perceived as foreign words in the reading process with regard to their phonological properties. This study aims to map differences in the reading process regarding different reading strategies. Thus, anglicisms that are morphologically and phonologically not integrated into the German language system offer the highest possible significance for the research questions. A similar approach was chosen by Gäbler (2013) who analyzed the reception of anglicisms by children of grade 2 and 3 in a qualitative study.

Götzeler's overview describes the diversity inherent in the term. Because the term *anglicism* covers very different linguistic units and there is no uniform terminology in linguistic literature, the attempt to define the term anglicism is problematic (Burasova 2010). For intended operationalization of anglicisms in terms of their phonological properties, the usage of outer loans as defined by Götzeler (2008) as shown in Figure 5

fits best for this study. The selected stimuli bear this characteristic, the majority are direct loans, only one is a pseudo anglicism.¹⁴

5.6. Summary

The purpose of the previous chapter was to give an overview of the current state of the art in research on anglicisms. First, it was outlined how anglicisms and borrowing processes are approached within the field of linguistic research. A presentation of agreed-upon classifications of anglicisms showed that there are several approaches, thus the category of anglicisms that are of interest for the here presented study was highlighted. Second, the current findings within the field of empirical linguistics were presented. In this section, corpus linguistic approaches were discussed as anglicisms have attracted the interest of linguists predominantly for investigating their appearance and integration behavior into the German language system so far. Additionally, studies from the field of cognitive-psychological reading research and their main findings were presented in relation to the research question formulated here. A comprehensive overview of the influencing variables that contribute to effects within those studies was presented. On the basis of the exploitation of these linguistic studies, their associated classifications of anglicisms and the findings of reading research investigating eye movements, it is possible to first point out which category of anglicisms can be operationalized for this study and second, to develop an appropriate methodology.

The studies presented here, which address the definition, classification, occurrence, distribution, and integration of anglicisms, already provide an overview of the amount and type of corpora that have been investigated. Except for Gäbler's study, written text

¹⁴ The pseudo-anglicism *handy* was included in the stimuli material. This has two reasons. First, as the predefined aim was to use evident loans with clearly non-matching GPCs to the German phonetic system, *handy* meets the criteria. Second, as the design calls for a differentiation of stimuli in short and long words and low and high frequency words according to the words available in the ChildLex corpus, the number of suitable anglicisms is very small.

corpora have been investigated that are primarily read by adults. Further, this kind of text does not represent children's everyday language.

Carstensen (1979) points out several problems concerning linguistic research in the fields of anglicisms, such as definition of anglicism, temporal delimitation of the object of study, internal loan material in quantitative analyses of English. He concludes that it is both pointless and impossible to account for all anglicisms in German, especially since a complete overview in all kinds of register and branches has not yet been conducted and is unlikely ever to be achieved with absolute reliability (1979: 322). However, the *Anglizismen Wörterbuch* by Carstensen and Busse (2001) comes closest to this endeavor.

The realization that a complete recording of anglicisms in the German language does not seem possible, since so many anglicisms have already been integrated into the German language, but also the fact that so far only sporadic systematic work has been done on the recording of anglicisms in German, calls for frequency analyses in as many and diverse corpora as possible, as well as for written and active language use, in order to come closer to at least as comprehensive an overview as possible of the anglicisms in German (Viereck 1981: 361).

Carstensen (1963) argues that newspapers have taken over the former function of poetry (34), so this medium is predestined for linguistic investigations. His argument may have been the foundation for the so far commonly used approach to investigate corpora that are compiled of textbooks, newspapers and other print media.

As described in section 5.4, the attempt to use anglicisms as agents for a cognitive linguistic investigation of reading strategies may also reveal how well or not anglicisms are integrated within everyday language usage of children. In this sense, a new approach is followed in this study. By means of evaluating the reading ability of children regarding anglicisms, conclusions may be drawn on how well integrated anglicisms are in daily language use.

Results of corpus linguistic studies show that anglicisms are an integral part of our language and that children have already integrated technical anglicisms in particular into their everyday language. Sociographic factors also seem to have an influence on the

knowledge of anglicisms. For the research question and the experimental design set up here, the following framework results from the review of the existing literature:

- use of evident anglicisms (cf. Dual-Route approach),
- use of age-appropriate stimuli norms (frequencies from the ChildLex database),
- control for word frequency and word length of the stimuli,
- no use of semantic collocations that favor predictability of the stimulus,
- at least 15 to 25 children per grade,
- survey of metadata such as older siblings, technology use and reading behavior.

On the methodological side, in the fields of reading research, the following desiderata have not yet been sufficiently addressed: the further investigation of silent reading, the use of authentic sentence material and the use of age-appropriate stimuli instead of single word reading to address word recognition processes. Also, the influence of external constraints and world knowledge (Blythe & Joseph 2011 as a review) such as the sociocultural environment and active language use in everyday life. The proven spatial and temporal processing limitations of young children have to be included in the research questions (cf. Blythe & Joseph, 2011 for a review) e. g. by controlling the word length of the stimuli. The specific findings for the reading behavior of beginning readers, such as the demonstrated reliance on sub-lexical units, lead to the hypothesis that children rely more on the serial processing mode in early phases of reading development, yet the exact limitations and interactions are not yet well researched enough. Recently the focus on phonology and how this component is represented within models of the reading process have become research issues addressed in eye movement research (Milledge & Blythe 2019, Leininger 2014, Grainger et al. 2012). There are still open questions when investigating the interaction of serial and parallel word processing especially for beginning readers and recently with a special focus on the time course and function of recoding when reading silently. By manipulating the frequency and other features of the stimuli, reading strategies are modulated leading to currently predictable but hence not sufficiently described effects in viewing times and eye movements. It was proved that phonology remains a distinctive component in facilitating lexical access for

all stages from beginning to skilled reading. However, as Milledge and Blythe (2019) point out,

“further research is needed to understand the nature and time course of the transition from phonological decoding to recoding, by examining moment-to-moment cognitive processing during reading in beginning readers.” (p. 11)

How is the correct identification of anglicisms representing irregular words in terms of GPC related to the development of the orthographic lexicon of children? Using the designed reading task, it may be detected at which time stage of word identification and lexical processing orthographic knowledge influences the accuracy of the word identification process. Likewise, the influence of phonology may be described regarding the timeline of lexical processing. Previous studies using Lexical Decision Tasks (LDT) addressed the question of whether or not phonological codes are used in lexical access. The idea of LDT is, that a person must identify a word and either tell the examiner “yes” or “no”. LDTs examining real words, non-words and pseudo-homophones to investigate whether phonological codes are involved in lexical access result in longer latencies and more errors for pseudo-homophones than non-homophonic non-words (Tiffin-Richards & Schroeder 2018, Leinenger 2014). From their findings it has become clear, that phonological codes are somewhat involved in lexical access.

The advantage and novum of the approach to directly compare anglicisms to German words is that the phonological code may lead to errors or distortion, yet they are not non-words. It is possible to separately investigate the two routes of lexical access separately and how they interact.

Furthermore, conclusions on the integration of anglicisms would be feasible as it may be assumed that the quality of the entries in the orthographic lexicon and possibly in coherence with phonological components may drive the accuracy of word identification.

6. Hypotheses

The aim of the present work is to analyze, on the basis of eye movements of elementary students, their gaze behavior when reading sentence material manipulated with anglicisms. Finally, a direct comparison between the anglicisms and German words matched by length and word frequency will provide information about the differences in reading words that are phonetically either regular or irregular.

The previous chapters presented reading learning processes, the theoretical modeling of skilled reading processes with the levels involved, and word recognition. Reception studies with beginning readers (children) and skilled readers (adults or young adults) have shown that reading strategies are registered on the basis of different gaze behaviors.

Table 1 summarizes the results of eye movement measures of recent eye tracking studies that address the influencing factors presented within this chapter on children's eye movements, with similar purposes and hypothesis as this study. In general, studies are moving from examining single isolated factors to multi-factorial analyses in order to draw conclusions about reading strategies and to verify, modify, or further develop the already established models of cognitive processing in reading (e.g., E-Z Reader by Reichle et al. 1998).

Table 1: Eye movement studies exploring effects on children's reading behavior

Study	subject	sample size*	FF	SF	GD	TT
Joseph et al. 2013	frequency	22	n.s.	NA	++	++
Blythe et al. 2014	reading strategy a)	18	n.s.	n.s.	++	NA
Rau et al. 2014	frequency*length	45	NA	NA	++	NA
Tiffin-Richards & Schroeder 2015	frequency*length	75	n.s.	n.s.	++	++
Dirix & Duyck 2017	AoA	14	NA	++	++	++
	word length		NA	++	++	++
	frequency		NA	++	++	++
	AoA*frequency		NA	n.s.	n.s.	++
* number of children, + p=0.1, ++p=0.05, n.s.=not statistically significant, NA=not assessed						
a) controlled items for frequency, length and AoA, target=pseudo-homophones and spelling control being of orthographic similarity						

As can also be seen from the table, a general comparability of the studies is difficult. The studies with children always include the question of the longitudinal development of reading ability and reading strategies. In this respect, ideas for one's own study can be derived from the presented studies and still open questions or new, not yet investigated interactions can be identified. In addition, these studies provide a good overview of eye tracking measures to be investigated and how they may be interpreted related to the research questions proposed in this study. Therefore, the dependent variables within this study are FF, GD, TT, and probability of revisit (RV).

As the word frequency is an established valid characteristic influencing eye movements in reading (see Rayner 1995, 2009) with respect to the work presented here, it is also assumed that this effect will appear when controlling the frequency of anglicisms in the here proposed experiment. Basically, it is expected that the amount of time that the

participants look at words varies as a function of the word frequency. The word frequency effect was also proven in experiments with children (Joseph et al. 2013, Rau et al. 2014, Tiffin-Richards & Schroeder 2015).

As discussed in the chapters that laid out the theoretical foundations, words can be recognized either indirectly by reading syllable-by-syllable and matching it with a representation in the lexicon, or directly by recognizing the word as a whole (cf. dual-route model by Coltheart et al. 2001). In order to be able to use this direct route of word recognition, the theoretical foundations of reading acquisition as described in the theories of Ehri and Share play a decisive role (cf. section 2.1). As postulated in Ehri's sight word theory, children are capable of accessing a mental representation of a word very quickly if the word is familiar and has been decoded several times before. A corresponding explanation underlies Share's self-teaching paradigm, that similarly proposes that the fact that a word has been read alphabetically several times, creates multiple entries and links to orthography, semantics and phonology. This allows the usage of the fast, direct route of word reading.

Therefore, the first hypothesis to be tested is:

It is assumed that the frequency patterns of anglicisms have an influence on the reading competence of early readers when reading anglicisms.

This expected effect is to be related to other variables. It is interesting to investigate whether anglicisms and German words, which do not differ in their linguistic properties regarding length and word frequency, elicit different gaze behavior due to the different phonological GPs and how large these effects are, especially if differences over time can be noticed (i.e., in the longitudinal course of the biological age of the participants).

A second related assumption takes a variable into account that has been considered for not too long, but the influence of which has been confirmed. Basically, the core statement is linked to theories of the self-learning hypothesis (Share 1995) and considerations of repetition effects (Raney & Rayner 1995, Kamienkowski et al. 2018) and thus, the related building of the mental lexicon as it can be argued that the more widespread anglicisms are in active language use, the easier it is to integrate them into the reading ability of children. This variable is difficult to grasp, in contrast to the more

technical approach of drawing word frequencies from existing and available corpora (such as the ChildLex corpus in this case). To address this issue, studies analyzing the gaze behavior of children during the reading process recently started to consider the Age of Acquisition of the stimuli (Dirix & Duyck 2017., Joseph et al. 2014) and found that this variable considerably influences the gaze measures. Therefore, a second hypothesis is:

It is assumed that the Age of Acquisition and the active language use of anglicisms have an influence on the reading competence of early readers when reading anglicisms.

The developmental aspects of eye movements in reading is considered as the basic component in a growing body of studies. The established findings have been reviewed comprehensively by Blythe and Joseph (2011). Although the basic mechanisms of eye movement control in beginning readers and skilled readers are quite similar, children read slower and make more fixations whereas their saccades are shorter (Rayner 1998). Further, findings from previous studies showed that the oculomotor processes are developed such as those of adults and children in grade 6 (Schroeder et al. 2015, Blythe & Joseph 2011). Therefore, the third hypothesis of this experimental investigation is:

The age of the children plays a role, an increase in reading literacy of anglicisms with biological age is expected.

In addition to linguistic features and influencing variables that may have an effect on the reading behavior of children reading anglicisms, this work also includes socio-environmental factors. In her 2013 study, Gäbler found, that children who grow up around older siblings know more anglicisms than those who have no siblings or younger ones. Gäbler (2013) does not substantiate her approach, however, the issue of sibling influence on reading literacy is described in the literature. Schmid (2015) argues that older siblings care for, guide, and explain everyday matters to their younger siblings; younger siblings observe the older ones, imitate them, and ask questions. However, the extent to which the existence of an older sibling gives younger siblings a systematic learning advantage over children without an older sibling is debatable. Such a learning advantage, which could be expressed in a higher reading competence of the younger

siblings compared to other sibling (younger or older) would be expected especially if sibling relationships or older siblings as tutors would show special qualities conducive to learning (ibid.: 592). The learning theory approach for this thesis is the so-called tutor effect. Against this background, a large sample (n= 34.451) was examined to determine whether a head start in reading competence could be observed in relation to older siblings. Overall, the results from Schmid's study interpreted as a positive indication the existence of the tutor effect. It is likely that children with older siblings are exposed to anglicisms and in general more vocabulary in general. Therefore, the variable *older siblings* was included in the analysis with the corresponding hypothesis:

Children who grow up around older siblings know more anglicisms.

Another socio-graphic factor that is likely to impact the reading behavior when reading anglicisms concerns the familiarity of the children with technical devices. As discussed in section 5.3, from a linguistic point of view, anglicisms are evidentially more dominant in print media concerning specific fields such as technology. In Gäbler's study, most frequently known by children were the anglicisms from the linguistic field of technology with a share of 79.8% (Gäbler 2013: 82). Barbe (2004) argues that "computer and Internet related terminology is English-based because of the overwhelming role the US has played in the development of computer technology" (p. 27). Yang, on the other hand, has documented that anglicisms within the corpus of *Der Spiegel* in the category *science and technology* have the smallest share compared to categories such as *politics, economy and finance, sports, culture and education or marketing* (Yang 1990: 36). However, his investigations include a corpus ending in the 1980s, so it is likely that the disruptive development of computer technology is not covered by his analysis. As Onysko (2012) argues, the overall share of anglicism in *Der Spiegel* noticeably increased in the period between 1980 and 2000, which he also strongly associates with the new importations in the fields of computer and communication technology (p. 147). The following hypotheses emerges from the preliminary theoretical considerations and inputs from the existing literature:

Children who actively use digital devices know more anglicisms than children who do not have access to digital devices.

The overall reading behavior was assessed in the interview questionnaire as described in section 8.5.

Previous experiments found repetition effects to influence eye movement behavior (Rayner & Raney 1995). Not only for this but also for the formulated theory of Share's self-learning hypothesis, it can be assumed that children that read on a regular basis are more likely to also recognize anglicisms better than those who do not exhibit a vivid reading behavior. Another hypothesis therefore is:

Children who read on a regular basis know more anglicisms than children who are not avid readers or only read for educational purposes.

The investigation of the above formulated hypothesis might contribute to advancing the understanding of the process of learning to read and here, precisely how the intertwining of the different assumed stages is pronounced. In similar studies, pseudo-homophones or non-words have been used to try to draw conclusions about reading strategies. The advantage of looking at anglicisms is that although they can be described as phonetically irregular, they are nevertheless assigned a correct semantic concept.

Further, it might contribute as a methodical-systematic insight to the ongoing debate on anglicism research through an innovative approach of using an online-method (eye tracking) involving children.

7. Empirical Methodology

In the following sections, the methodological principles of the eye tracking study are presented.

7.1. Eye-tracking

In recent years, eye-tracking has been increasingly used in combination with other methods for psycholinguistic research questions, but also in other disciplines¹⁵ (Radach et al. 2012: 185). Eye-tracking investigates the human visual interface, the eye, and has become a well proven and tested instrument to record eye movements and thus draw conclusions about cognitive processes using theories about their relations. The first step is a purely descriptive recording of the chronological sequence and intensity with which the recipient fixates on a visual stimulus. In a further step the recorded gaze patterns are interpreted quantitatively and qualitatively. The underlying assumption is of a strong relation between cognitive processes and visual attention represented by the eyes' fixation on an object or as in this case words (Joos et al. 2003, Rayner 1977). This section gives an overview of the use of eye-tracking in psycholinguistics. This concerns especially reading research.

7.1.1. Physiological principals

The human eye is a highly complex apparatus consisting of various muscles, fluids and skin layers. The collaboration of the individual components enables the perception of visual stimuli. The optical system essentially consists of the cornea, the lens, the vitreous body and the retina. The retina lines the posterior inner surface of the eye and has a small cavity, the fovea centralis. Within this area of less than 2° of the visual field, full acuity is possible. Visual stimuli penetrate the interior of the eye as light rays through the lens where an inverted image is projected through the basic principle of a "camera obscura", as a reduced image of reality rotated by 180° onto the retina (Holmqvist et al. 2015: 21). The retina transmits the projection via the optic nerve to the brain, where the

¹⁵ Eye-tracking can be used as a diagnostic interface for observational studies in the fields of psychology, psychophysics, advertising and marketing or for ergonomic questions in order to obtain objective, quantitative information on human behavioral structures. But also, in branches of engineering, for example in the automotive industry or entertainment industry (video games) eye-tracking is used as an interactive input instrument (Duchowski 2007: 205).

information is processed. This is done via the receptor layer, which consists of rods and cones, although their distribution is not uniform. There are two different types of sensory cells. Cones have different maxima in sensitivity to different wavelengths of light and thus enable color vision. The retina's network of downstream neurons receives signals from the sensory cells and transmits them to the optic nerve. For every total of 120 million rods, there are only 7 million cones (Duchowski 2007). The density of cones increases steadily from the periphery of the retina to the *fovea centralis* (the point of sharpest vision or full acuity), until there are only cones left in the fovea, and they are particularly densely packed. While the density of cones in the fovea centralis is 147 000/mm², it decreases steadily towards the periphery and from about ten degrees of visual angle drastically to less than 20 000/mm² (Duchowski 2007). This explains the gradual decrease of visual acuity with increasing distance to the fovea. To be able to see an object clearly and sharply, the eyeball must be moved so that the projection falls on an approximately 1.5 mm large spot of the fovea on the back wall of the eyeball. During reading the eye movements need to stabilize the direction to a word in this area so that it is imaged in the area of the fovea and also held there. This sharpest vision is only possible in the area of about 1° around the fixed object (Joos et al. 2003). In the area of parafoveal vision with up to 5° around the fovea centralis the resolution decreases continuously (Radach 1996). The area directly around the fovea with a deviation of up to 5° is called the parafovea because the density of the rods increases. Due to this distribution of rods and cones, visual acuity is highest in the area of the fovea and decreases towards the periphery. This means that objects or words in the peripheral area of the fovea are perceived, but are blurry. The regions of the visual field are shown in Figure 7 with the highest acuity at the fixation location, continuously decreasing to the parafoveal region and periphery.

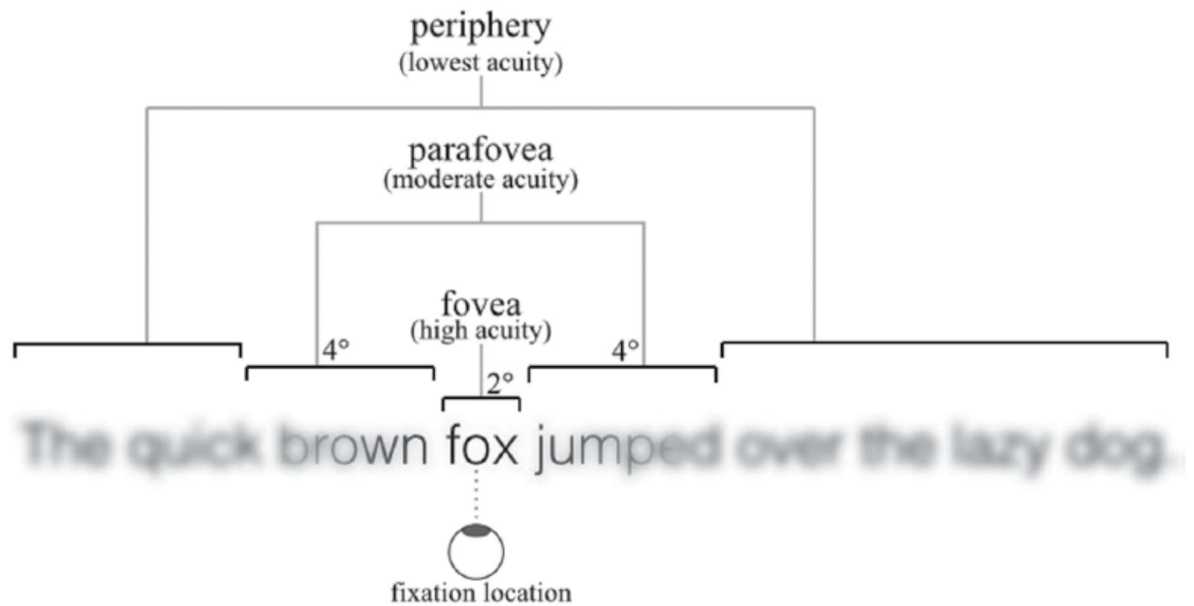


Figure 7: Visual acuity decrease as a function of distance from the fixation location (Rayner, Schotter et al. 2016)

The photoreceptors of the retina transmit the visual stimuli to the brain via the optic nerve. This is followed by a complex process of information processing, which is not discussed in detail here. The models for processing information during reading that are relevant to the research question are presented in chapter 3.

7.1.2. Technical principals and a brief history

The developments from the first eye movement measurements up to the highly sensitive devices, which are available on the market today, progresses - like all technological innovation - ever faster. Whereas the first eye movement devices were still very intransitive because ceramic adhesive shells were applied to the participant's eyes (Huey 1920), contactless systems are available today.

Rayner (1998) gives an overview of the history of eye-tracking and the development of technical devices. He distinguishes three stages of eye movement research and declares the beginning of the first era, with Javal's initial observations, to have started as early as 1879 lasting until 1920. Basic knowledge about saccadic suppression where no information is processed during a saccade, a ballistic eye movement, saccade latency

which represents the time required to initiate an eye movement and the size of the perceptual span being the region of effective vision was elaborated. The second stage described by Rayner covers the years from 1920 until the 1970s. During this period, efforts were made to improve the hardware with a focus on user-friendly devices and to establish eye-tracking for the investigation of application-oriented issues such as reading (Tinker 1946) and scene perception (Buswell 1935). Yarbus (1967) shows in his experiments the connection between the motivation of the test persons and their eye movements. The instructions given to the test persons before viewing an image influenced the scan paths and this was the first proof for a connection between cognitive processes and visual attention. The subsequent third phase lasted until the end of the 20th century and was mainly characterized by the further development of technical equipment resulting in better recording data and simpler handling. Due to the progress in computer technology in general during that time, larger amounts of data could also be processed and evaluated in eye-tracking. Following the course sketched by Rayner, the time since the turn of the millennium is referred to as the fourth era (Duchowski 2002). This newer time of eye-tracking is characterized by the deepened knowledge of methods harvesting deeper insights into the human mind. The two key areas of eye-tracking activity since the year 2000 are diagnostic use and interactive applications.

The newer eye-tracking devices can be either stationary or mobile (e.g., portable laptops with infrared unit and eye-tracking glasses). Most eye-tracking systems are video-based with the cornea reflex method. In this method, the eyes of the test person are illuminated via an infrared unit. The resulting infrared reflex on the cornea makes the pupils appear very bright and the software of the eye-tracking system can use this to determine the measure of the direction of gaze. Infrared light is invisible to humans and does not cause any physical impairment of the visual system. The eye-tracking camera is no ordinary camera for image recording. It does not react to visible light, but only to infrared light from the built-in infrared light source. The human eyes and pupils function as a mirror for infrared rays. If infrared light falls on the otherwise black pupil, it appears bright.

This cornea reflex is the first Purkinje image¹⁶ and appears to be about 3.5 mm behind the surface of the eye. In relation to the rotation point of the eye, a movement of the eye by the angle σ results in a displacement of the corneal reflex (cf. Figure 8). These relative displacements are recorded by the camera of the eye tracker and describe where the person looked, in what order, and for how long.

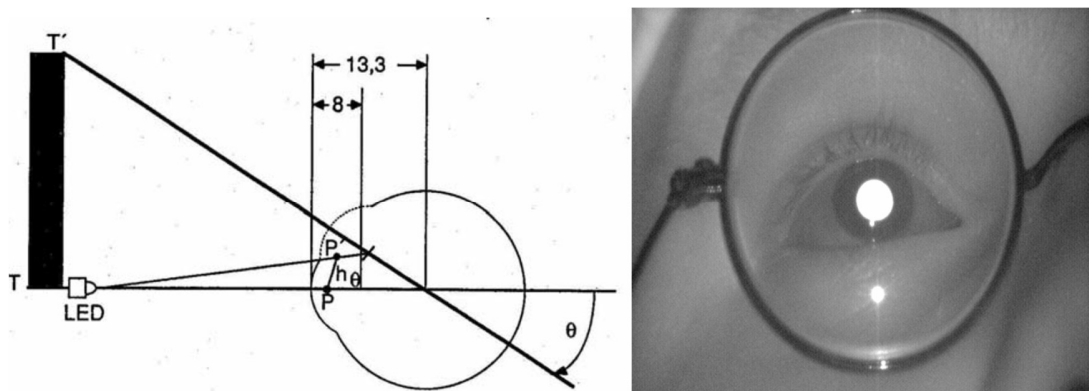


Figure 8: Emergence of the corneal reflex (first Purkinje image) and shift on rotation of the eye and the corneal reflex (both from Joos et al. 2003: 13/12).

The newer generation of eye trackers is contactless, i.e., the gaze course of the test person is recorded non-invasively and without active participation of the test person. This authentic reading situation and the online recording of eye movements provide a method that is characterized by its ecological validity, because it is possible to record unbiased and authentic behavior that is directly related to internally occurring cognitive processes (Radach 1996, Radach et al. 2012: 186). However, without the assumptions, hypotheses, and models underlying the analysis of the data, the data obtained from the eye-tracking recording are not meaningful. Only when these are brought into the context of already established observations and attempts of model building, can conclusions be drawn. Additional methods such as interviews, ratings, or as foreseen within this study, a vocabulary check, a corpus-linguistic matching of the stimuli used within the reading task and metadata collection, help to evaluate the results holistically and place them in a larger context.

¹⁶ Purkinje images are the reflections of incoming light by the cornea of the eye (Duchowski 2007: 55)

7.1.3. Eye movements during reading

Contrary to the impression that the eyes run continuously and smoothly over the lines of a text while reading, eye movements are anything but continuous. They are abrupt forward and backward movements, the saccades and moments of standstill, the fixations.

Saccades

Saccades are the fastest movements that can be performed by the human body. The speed and duration of a saccade depend on the jump distance (Joos et al. 2003). The saccades repeatedly bring an object into the area of highest resolution vision (fovea centralis). This is a ballistic movement with initial accelerations of up to 30,000 degrees/second² (Radach 1996). There are two types of saccades. Progressive saccades, which run from left to right and account for about 80 to 90 percent in adult readers, and regressive saccades, which run in the opposite direction and account for 10 to 20 percent. During saccades information is not gathered. Normally, the saccades run with the reading flow, i.e. in the reading direction. These saccades are called progressive saccades and, depending on individual reading performance and the difficulty of the text, the proportion of these forward saccades is 75 - 95% (Radach et al. 2012). However, saccades also occur in the opposite direction of reading. These saccades are called regressions and lead back to words or text passages that have already been read. The functions of these regressions are the correction of reading errors or re-analysis of difficult text passages. Saccades and regressions can also occur within a word and are accordingly called intra-word saccades or intra-word regressions (ibid.). Thinking of the analysis of eye movements, regressions are an important measure with respect to understanding reading because they constitute a deviation of the reader's eye movements from the normal progression of the text and are made to correct failures in comprehension (Rayner et al. 2006, Rayner et al. 2013: 558).

Fixations

Between the saccades, however, there are phases of relative stability during which the eye is aligned with the visual object, the fixations. Within this phase of stability in the optical axis, information is captured and thus processed.

The required minimum duration of a fixation for information acquisition is 80 ms to 100 ms (Joos et al. 2003, Radach 1996). Again, the literature is not entirely congruent, as masking pattern experiments showed that 50 to 60 ms seconds are sufficient to extract enough information for further processing (Rayner et al. 2001: 46). Average fixation durations are reported to last 225 ms (Joos et al. 2003) or 250 ms (Rayner 2016). Results are by no means stable: in many cases, there seems to be a correlation between fixation duration and task parameters (task severity, required accuracy, among others). Also, the assignment to sub-processes and drawing of boundaries between single stages of processing and individual factors such as motivation and expectation is still an ongoing debate as discussed by Radach (1996) but not conclusively resolved.

The constant adjustment of eye movements is object-related and has the function of keeping the object – or when reading a word - in the area of sharpest vision. The entire field of view corresponds to a cone with an angle of about 100°. However, as described in section 7.1.1, visual acuity is only possible in the area of the fovea centralis, since the density of the light-sensitive receptors is highest here. The range of sharp vision defined by the anatomy of the eye was extended as it was realized that information can also be captured within the periphery. In reading research, this is referred to as the *perceptual span* (Rayner et al. 2001: 46). This range comprises 3 to 4 letters to the left and 7 to 8 letters to the right side of fixation, i.e., the point located in the middle of the fovea centralis. It can happen that short, very familiar words, which are easily processed because of their familiarity, are skipped if they are still in the perceptual span and can be processed parafoveally which means that also within this area information is processed (Radach et al. 2012). It is known that these eye movements allow conclusions to be drawn about the cognitive processes during the reading process (Just & Carpenter 1976, Rayner 1978, Radach 1996, Joos et al. 2003, Kliegl et al. 2006). To further investigate the area of attention during the reading process, methods such as the moving window paradigm or boundary method have been applied. If letters and words around the

fixation position are masked while reading (moving window paradigm), it is possible to measure quite accurately the area in which it is possible to 'read' during fixation. During fixation, the eyes take three to four letters to the left of the fixation position and about 14-15 letters to the right of the fixation position but usually not words from other lines (Pollatsek et al. 1993). If the area of current fixation is masked, reading becomes impossible (Rayner et al. 1981). If the fixated words are masked after 50-60 ms, the text can still be read, but if the next word is masked at the same time, reading is severely disturbed (Rayner et al. 2006). With this method, the size of the perceptual span can be determined. The perceptual span is the area in which parafoveal visual input can also be processed. Obstruction of parafoveal availability by masking leads to increased fixation durations in the foveal area (Radach 1996: 21). Through these methods, we examine how visuospatial and cognitive factors interact (Radach et al. 2012).

Basically, eye-tracking is based on the eye-mind-hypothesis. The eye-mind-hypothesis describes how eye movements and cognitive processes are related. This hypothesis was established in 1980 by Just and Carpenter when investigating the reading behavior of students while reading scientific articles. They assumed that the time a word is fixated within the process of reading is closely related to cognitive processing. The **eye-mind-hypothesis** defines that objects remain in the visual focus of humans only if the information or in the case of reading a word, is processed. Another expanding hypothesis of Just and Carpenter's work is the **immediacy-assumption**. According to this hypothesis the processing of visual stimuli in the brain is not delayed but occurs immediately after reading the corresponding word. Further it postulates that a new saccade will be started only when the processing of the current word is finished. By combining the two hypotheses Just and Carpenter concluded that viewing times are a direct indicator of cognitive processing and therefore the observation of eye movements of persons can provide information about cognitive processes related to their reading behavior. They developed a reading model that allowed interpretations to be made about viewing and gaze duration times and fixations of words. The basic structure that underlies the model are considerations that correspond to general reading models involving serial process levels as developed by Christmann and Groeben (1999), Gough

and Tunmer (1984) and Perfetti (1989), see section 3.2. Within Just and Carpenter's serial model they claim that:

“Reading can be construed as the coordinated execution of a number of processing stages such as word encoding, lexical access, assigning semantic roles, and relating the information in a given sentence to previous sentences and previous knowledge.” (Just & Carpenter 1980: 331).

The approach or reduction to the above hypotheses have been criticized for many reasons. On the one hand, the eye-mind-hypothesis does not include the case of parafoveal processing. Up to 60% of all (especially short) function words are skipped during reading, and also up to 20% of content words. Nevertheless, these are recorded and also processed in the parafoveal area (Radach 1996). On the other hand, also the unrestricted validity of the immediacy assumption is questionable. As Vitu and McConkie (2000) point out, refixations within a sentence occur, among other things, because lexical access processes of the preceding word have not yet been completed. This contradicts the assumption that a new saccade is initiated only when the complete processing of the word has taken place.

Nevertheless, the assumptions are still the basis for cognitive science to draw conclusions about features of visual information processing by recording eye movement patterns. As the initial idea of the eye-mind-hypothesis is that fixations and information processing in the brain are closely connected, the conclusion will be for example, that long fixation periods may indicate prolonged processing and thus comprehensibility problems. In reading research, information processing processes are investigated through the targeted presentation and manipulation of visual stimuli due to presumed effects.

Interplay of fixations and saccades-scanpaths

For the investigation of cognitive science questions, the interaction of saccades and fixations, the scanpath, is relevant. The decision when to end the current fixation and start the next one is strongly influenced by word processing. This approach is supported by numerous studies (Just & Carpenter 1976), which manifest an agreement between visual fixation location and cognitive attentional attachment. The analysis of eye movements allows a very authentic investigation of these processes in real time. The

four most important parameters in the evaluation of eye movement measurement for the reading process are saccade amplitude and saccade direction as well as fixation number and fixation duration. The quantitative distance between two fixations is the saccade amplitude and averages six to eight letters for a normal good reader (Radach 2004). The fixation time is a parameter that is often examined in the analysis of eye movements. It describes the time span between two successive saccades and, like the latter, depends on reading intention such as exact or skimming reading (Kaakinen & Hyönä 2010) and the difficulty of the text or individual words. Furthermore, the number of fixations also increases with the complexity of a text and the accuracy of reading, since smaller saccade amplitudes require more fixations by nature. However, there are differences of opinion as to whether words can only be processed individually, i.e. strictly one after the other, or whether several words can be processed in parallel. There is agreement, however, that on average the direction and amplitude of saccades correspond well with the subject and the sequence of visual and linguistic information processing (Radach et al. 2012: 187).

The above explained eye movement may give insight into cognitive processing during reading. Throughout the course of already existing experimental research using eye tracking, the following measured values have been established for being an index. First Fixation Duration (FF) and Gaze Duration (GD) are considered to indicate early processing stages. As Rayer (1998) argues, FF is a measure for lexical access and GD reflects a further integration process. This may relate to visual word recognition, where low-level processing factors such as word length, word frequency and familiarity have an influence. The FF is the first fixation on a word, which determines the further course of reception. If the next fixation on the following word is initiated directly after a fixation, it is assumed that there are no problems with processing. The Probability of Revisit (RV) can be used to determine whether a word is returned to after the first reading pass and thus provide an indication of comprehension problems. If the measured value for the RV is 0, the word has only been fixated once. If the measured value is 1 or higher, the word has been fixated repeatedly. If there is a return to the word after the first fixation, this may be an indicator of a processing difficulty, which may be due either to the word length, the word frequency or the presentation of the word. The sum of all

fixations during the entire first reading of a word (before attention leaves the AOI¹⁷) is represented by the GD measure.

On the other hand, Total Reading Time (TT) is more indicative of processes that occur later in the processing of reading material, such as syntactic-semantic integration. The TT is the total reading time and includes all fixations as well as all regressions (times of the revisit).

For children, differences in the before mentioned parameters were found in eye movement measurements. Beginning readers fixate every word, because they mostly recode them serially, furthermore their saccades are shorter, they include only 3 letters and also the average fixations are longer with 300 ms to 400 ms (Rayner et al. 2001: 46). Further, up to 50% of their total eye movements are regressions and their perceptual span is also smaller. It was also found that children show more variability in their eye movement indices (Rayner 1998). For this reason, reading beginners of grade 2 and more experienced readers of grade 4 were tested in order to be able to identify any development-related differences.

7.1.4. Models from eye movement research

The decision about when to end the current fixation and start the next one is strongly influenced by word processing. Opinions vary as to how close this so-called eye-mind hypothesis is (Radach 2012). In the field of eye movement research, models have been developed that have two different opinions. One view is that each saccade is triggered by the processing of the current word reaching a certain level. Subsequent to this condition is also the more advanced assumption that words can only be processed one at a time, strictly sequentially. A second direction assumes that oculomotor control is rather autonomous but strongly influenced by linguistic processing, e.g., by processing several words in parallel within the current gaze span. For these models, basal visual

¹⁷ An AOI is the *Area of Interest* and describes the area that was selected to obtain the measured variables. In the present case, this AOI is drawn around the anglicism or the German word.

mechanisms will be combined with a connectionist word processing model. Here, two main competing models exist for describing eye movements during reading following the two branches. The E-Z Reader by Reichle et al. (1998) and SWIFT developed by Engbert et al. (2005). They differ in the assumption of serial (E-Z Reader) vs. parallel (SWIFT) word processing and can both predict eye movements well in the normal reading process but make different assumptions in process structure and lexicon. The models tie in with the question of the relationships between gaze parameters and the cognitive processes involved in language and text processing during the reading process. An early serial model was already presented by Just & Carpenter in 1980. As described in the previous chapter, it assumes that only after encoding of the visual input, can subsequent lexical access, syntactic and semantic analysis with final text coherence formation, the shift of attention to the next word occur.

Within the research applying eye-tracking to understand and describe the reading process, models have been developed to interpret the data gained by eye movement recording and to draw conclusions about cognitive processes. Again, just like the models for word recognition, two major conventionalist branches have been established and are described in the following.

E-Z Reader

The E-Z Reader model is, in the end, an extension of the serial model of Just and Carpenter (1980). The serial reader model was first presented in 1998. For the first time it allowed a complete computer-based simulation of eye movements. Extended versions have since become available (cf. Rayner & Reichle 2010), but common to all versions is that early lexical processing is the driving force for the execution of eye movements. Attention is serially directed to only one word n and moves to word $n+1$ when lexical processing of n has been completed. There are two stages. In the *familiarity check* (L1) a preliminary lexical processing of the word is initiated. Here, for example, it is determined whether n is a familiar word. In addition, the following eye movement is already planned and programmed in this phase. The second stage is completion of lexical access (L2) and gives the signal to shift attention to the next word. The word n is finally lexically processed in this stage. The shift from L1 to L2 can be triggered by various causes: Orthography, phonology, or semantic meaning of the word. Ambiguous

words, such as mouse, can be accessed through orthography, but lexical access is only revealed by further information from the text (animal vs. computer input device). The additional assumptions of the model relate to programming and saccade execution. The saccade to $n+1$ can also be programmed in two stages. The first stage *labile stage* (M_1) can be cancelled by a well-timed initiation of a subsequent saccade programming (M_2). This would be the case, for example, if $n+1$ can be predicted. The second stage *non-labile stage* (M_2) cannot be cancelled and leads to the final movement of the eye. Figure 9 shows the schematic idea of the decision process and maps the described basic assumptions.

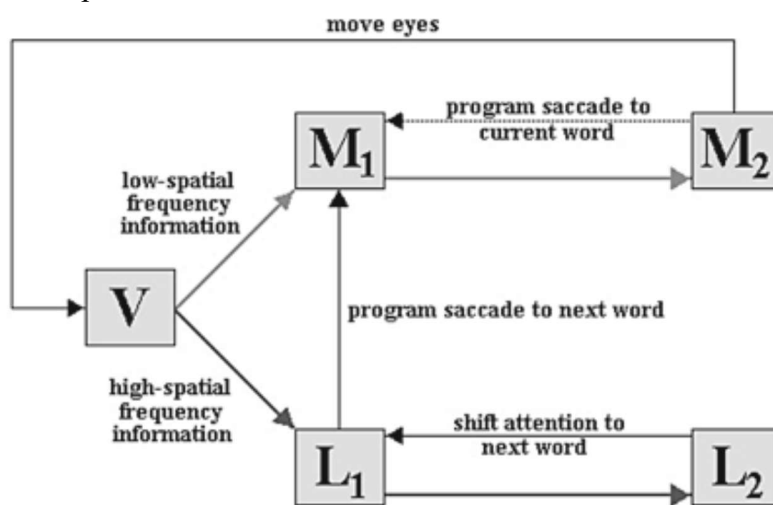


Figure 9: Schematic diagram of the E-Z reader (Reichle et al. 2009)

The latest version of the E-Z Reader 10 (Reichle et al. 2009) has been extended by additional features. Attention (A) is considered to capture the time required to switch attention from n to $n+1$. Here, the requirement that attention shifts from word n to word $n+1$ was taken into account and this was also proven experimentally. Another new feature is a post-lexical integration stage (I). This stage is supposed to reflect all required integration efforts and starts already during the identification of n (e.g. classification into higher process stages like syntactic structure analysis, context matching and coherence formation). Figure 10 schematically shows the E-Z Reader 10.

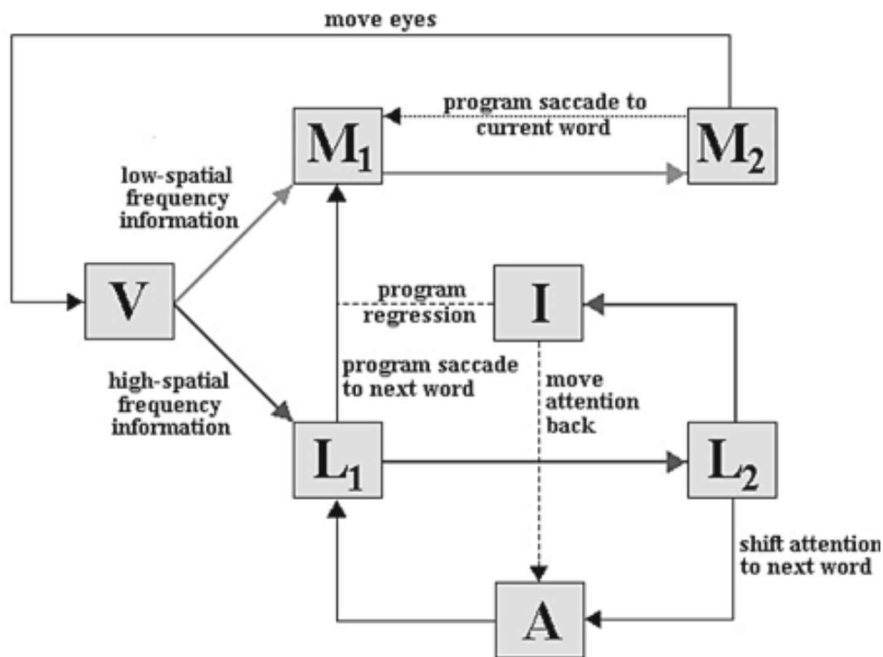


Figure 10: Schematic diagram of E-Z Reader 10 (Reichle et al. 2009)

Within the new model there are two different kinds of relations depicted by thick arrows, indicating how information flows between the model's components as obligatory transitions, and thin dotted arrows indicating probabilistic transitions. Reichle et al. (2009) acknowledge that the goal of implementing a post-lexical integration stage is to “to provide a tentative account of how—within the framework of the E-Z Reader model—post-lexical variables might affect readers’ eye movements” (ibid.: 6).

SWIFT

The abbreviation *SWIFT* stands for *Saccade-Generation With Inhibition by Foveal Targets* (Engbert et al. 2005)¹⁸ and, in contrast to the E-Z Reader, basically assumes parallel lexical processing of several words. The core principles of cognitive processing underlying the mathematical model are a set of spatially distributed activation fields that are word-based and control the selection of saccade targets. Further, separate pathways

¹⁸ The SWIFT model was first introduced by Engbert et al. (2002), however most literature references refer to the substantially extended version of Engbert et al. (2005), now known as SWIFT II.

for the timing and directing of saccades are implemented. These two factors of ‘when’ and ‘where’ saccades are placed are a crucial concept of the model.

Principally, word recognition progress is spatially distributed, lexical activation fields monitor the actual state of word processing and control the timing and saccade target selection. The random timer is autonomous and initiates saccade programs at random time intervals. The lexical decision circuit may influence saccade timing by foveal inhibition but with a time delay τ . Saccade programming is a two-stage process. After a saccade program is started, the labile stage is entered. Within this stage, initiation of another saccade program can occur and the labile stage is canceled. The non-labile stage starts after termination of the labile stage. The shift between these two stages triggers the target selection process.

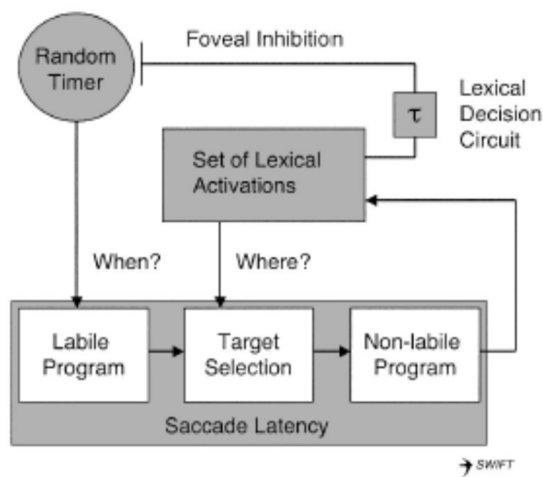


Figure 11: SWIFT - model overview (Engbert et al. 2005)

The way SWIFT works is best illustrated by a reading example. Figure 12 shows a read recording and the corresponding processes according to the model. The progressive time is plotted on the ordinate and the letter positions on the abscissa. The fixations and their durations are shown with vertical bold lines. The gray areas represent the lexical activation fields of the words.

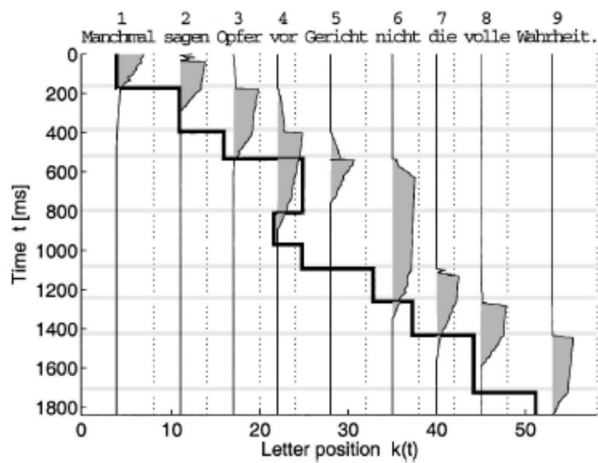


Figure 12: Example of simulation of SWIFT-model in sentence reading (Engbert et al. 2005)

It can be clearly seen in the course that the lexical activation occurs in parallel, words that are skipped first-pass are nonetheless activated (as in Figure 12 ‘vor’). Within the long fixation that occurs between the words ‘vor’ and ‘Gericht’, these two words as well as ‘nicht’ are activated.

Differences

A major difference besides serial and parallel lexical processing in both models, is saccade initiation. While the saccade is generated at the end of L1 in the E-Z Reader, in SWIFT there is a random timer that causes the eye to move forward subsequently at random intervals. Both models can adhere to benchmark data (universally proven parameters, such as minimum durations for fixations and minimum sizes for saccades, correlations between individual eye movement parameters, proven proportion of word skipping, and regressions) and are therefore valid to use (Rayner 2009).

The two prominent models have been included for the sake of completeness. They attempt to represent an architecture for the reading models described in chapter 4, e.g. the E-Z Reader as a serial processing model describes two phases. Elementary specifications for eye movements are defined here: Frequent words are fixated shorter as are words that are predictable in the sentence context. In terms of the reading models, there is already enough information on orthography and phonology in the lexicon. The

question of the role of phonology can also be asked in these models and examined with operationalized anglicisms.

7.1.5. Influencing parameters

Words are recognized most quickly when they are fixed centrally in the middle of the word. This effect is called Optimal Viewing Position Effect (OVP) in the literature and is due to the fact that, in this case, most letters fall into the area of the fovea and thus the highest resolution (Radach 1996). Landing positions within words are focused on in several studies (Radach & McConkie 1998, Engbert & Nuthmann 2008) and are influenced by word length, saccade launch distance and prior fixation duration. Nevertheless, as within the study presented here, the investigated AOI is limited to the target *anglicism/German word* and thus eye movement parameters are analyzed in direct comparison neglecting the eye movements recorded for the remaining sentence. Additionally, sentence frames for the comparison are identical and the landing position is not considered for the analysis here. As Holmqvist (2017) explains: “the AOI you draw are *part of your hypothesis*, because they decide which areas in space dwell and transition data should be calculated against” (190).

Variations in eye movement behavior are caused by such things as the text properties (e.g., contrast and presentation mode, additional or removed spaces between words), linguistic difficulty (e.g., word frequency, ambiguity of meanings, predictability), properties of the reader (e.g., age or reading competence), and goals of the reading task (e.g., leisure reading, proofreading, skimming) (Rayner et al. 2016).

The decision whether to read silently or aloud in the eye-tracking experiment was accompanied by the following considerations. In principle, there are different, partly diametrically opposed opinions in the scientific discourse about how the reading mode affects cognitive processing when reading. Some scientists found that readers understood more when they read a text quietly and justified their observations with the fact that reading aloud ties up capacities for phonological decoding, which are then not (fully) available for comprehension. An opposing theory is held by other researchers

who argue that especially weaker readers benefit from oral reading because of the feedback provided by what they hear (for a review, see Hale et al. 2007).

The advantage of reading aloud for the eye-tracking experiment is direct feedback for the study instructor whether everything has been read and whether difficulties are evident especially with the stimuli. However, it has been shown for children that the reading mode of reading aloud does not provide reliable feedback on the level of comprehension nor was there proof that reading aloud hinders comprehension due to capacity issues (Hale et al. 2007: 18).

A still open research desideratum in previous eye-tracking studies, especially investigating children's reading behavior, is the further investigation of the reading mode of reading silently (Huestegge 2010, Tiffin-Richards & Schroeder 2015).

For the present study, the reading silent mode was therefore applied. This decision is justified, in addition to the still open demand for more in-depth material from reading silently investigations from the scientific community, by the fact that very young readers participated here. The study took place in the first quarter of grade 2 and 4, so that especially the children from the second grades are classified as reading beginners and a relaxed study environment should be prepared for them. In grade 4, the children were also expected to complete the reading tasks as authentically and unbiasedly as possible. By reading silently, a more relaxed situation could be created in which the children could read without fear as in an examining situation.

7.1.6. Summary

Eye-tracking has become established in the field of reading research as an investigative tool in recent years, and extensive evidence exists between eye movements and measured parameters (see Rayner 1977, 1995, Rayner & Pollatsek 2013, Radach 1996, Radach et al. 2012). Thanks to the technical advancement of the devices, a very good ecological validity can be achieved with the method, since an uninfluenced, authentic reading situation is produced using non-invasive devices. Here, the experiment could be carried out in a natural environment since it took place in rooms familiar to the children

at their school. In conjunction with the appropriate study design (complementary survey methods), it is possible to obtain far-reaching insights into reading behavior and multivariate issues.

For many cases – as within this study – the researcher is interested in how often and how long the participant looks at a manipulated target word or the item the research question is focused on. Thus, it is possible to set Areas of Interest (AOI) that cover the stimulus and the software records the gaze and provides detailed information on how the participant interacts with the AOI (Carter & Luke 2020). In most cases, for application-specific questions, the device comes with software that converts the collected data into eye movement parameters, which are usually used to describe the reading process (see Rayner 2009).

The assumptions and findings from reading research as described in this chapter assign different interpretive possibilities to certain gaze behaviors. Initial measures such as First Fixation Duration (FF) and Gaze Duration (GD) are located at the beginning in the temporal sequence of the processing process and are associated with processing stages that have a low depth and are mainly due to visual influences (such as word length, word frequency). The Total Reading Time (TT) or the Probability of Revisit (RV), on the other hand, represent later processing stages and are supposed to provide information about syntactic-semantic reception and coherence formation.

It can be criticized that for the interpretation of eye movement data, it is assumed that they are serial, as an "operational simplification" (Duchowski 2007: 137) of the underlying non-linear but interactionist natural processes. Children have been shown to use different encoding strategies simultaneously (Rau et al. 2014, Grainger et al. 2012). This is also reflected in modeling eye movements. Opinions vary as to how close this so-called eye-mind hypothesis is (Radach 2012). One view is that each saccade is triggered by the processing of the current word reaching a certain level. Due to this assumption, words can only be processed one at a time, strictly sequentially. A second direction assumes that oculomotor control is rather autonomous but strongly influenced by linguistic processing, e.g., by processing several words in parallel within the current gaze span. For these models, basal visual mechanisms will be combined with a connectionist word processing model. Here, two main competing models exist for

describing eye movements during reading following the two branches. The E-Z Reader by Reichle et al. (1998) and SWIFT developed by Engbert et al. (2005). They differ in the assumption of serial (E-Z Reader) vs. a parallel (SWIFT) word processing and can both predict eye movements well in the normal reading process but make different assumptions in process structure and lexicon. The models tie in with the question of the relationships between gaze parameters and the cognitive processes involved in language and text processing during the reading process. Both models can adhere to benchmark data (universally proven parameters, such as minimum durations for fixations and minimum sizes for saccades, correlations between individual eye movement parameters, proven proportion of word skipping, and regressions) and are therefore valid to use (Rayner 2009). Thinking back to the theories of word recognition described in chapter 4 (connectionist and dual-route), these two paradigms can also be found here.

7.2. Eye tracking research and children

For the past 30 to 40 years eye movement measurement has contributed greatly to the study and understanding of processes involved in reception and cognitive processing during reading (see Rayner 1998, 2009, Radach & Kennedy 2013 for reviews). This has resulted in models that represent well the reading process with its visual, oculomotor, and attentional aspects (Reichle et al. 1998, Engbert et al. 2005). Among other things, these models make it possible to further understand the complex interplay of the individual levels and sub-processes such as lexical processing, visual reception, and integration processes. Thus, a broad base is available regarding the reading process in the proficient reader, but the development of this skill, i.e., the path from beginning reader to professional reader, is much less investigated (cf. Blythe & Joseph 2011, Radach & Kennedy 2013 for a reviews). The process of learning to read has been well investigated, but few eye tracking studies with children have been conducted so far, especially in non-English speaking contexts.

This section presents the state of the art of cognitive linguistic research done in the fields of reception studies investigating reading processes and with a focus on children's eye movement during reading. The focus lies on newer studies that use eye tracking to

investigate children's eye movement behavior, but also reception studies that are used as sources of knowledge in terms of content but methodologically implement other approaches such as Lexical Decision Task (LDT) and the measurement of Reaction Times (RT). Here, previous findings concerning the development of reading skills will be presented, discussed, and research desiderata that are still open will be identified. In addition, the already knowledge about reading times must be implemented for the objectives of the approach to the research questions of this thesis and the study design.

Although there is some history in conducting eye tracking studies with children, these eye tracking studies still represent a small fraction of the research that is available in this area compared to those with adults. Special requirements and hints for the implementation, which can be derived from the newer studies with children, are therefore even more valuable as there is no 'guideline' for setting up an eye tracking experiment for linguistic purposes.

It can be stated that eye tracking experiments investigating children's reading behavior have experienced an upswing in the past five to ten years, which is also due to more user-friendly technical apparatuses that enable a relatively authentic environment under empirical conditions (Blythe et al. 2013). Until then, the literature and research activity in this area had been very sparse (cf. Blythe & Joseph 2011 for a review). Yet it must be acknowledged that within the past five to ten years there have been very interesting studies carried out on this topic with promising results and findings that will serve for the proposed experimental design here. As in eye tracking research with adult readers, effects of word length and frequency were also found to have high priority within the research of children's reading behavior.

Early studies focusing on global parameters such as average fixation duration, related number of fixations made and overall regression rate (Rayner 1986, McConkie et al. 1991) were able to describe qualitatively for the first time that with increasing age and reading experience, fixation durations generally decrease, and also fewer fixations are found overall. Since publication of these groundbreaking studies, the research questions have become differentiated and more and more effects have been considered (e.g., reading mode: silent/aloud, systematic manipulation of the sentences and stimuli material).

Newer reception studies quantitatively analyze viewing times as they are assigned to different stages and time courses of word processing and comprehension. Basically, there are three temporal components which allow conclusions to be drawn about cognitive processing that apply for all participants regardless of literal experience (cf. Vorstius et al. 2014):

- 1) Initial fixation duration, reflecting early orthographic and lexical processing,
- 2) Refixation times, indicating full lexical access,
- 3) Rereading times, representing the time spent on integration of the word meaning into representations within the sentence and text level (global coherence).

The three main measures commonly used to describe the stages are: first fixation duration, gaze duration and total reading time (Raney & Rayner 1995: 152). First fixation duration (FF) is the duration of the first fixation on an item, no matter how many refixations are made afterwards. It is considered to be an index of early lexical processing (Juhasz & Sheridan 2020). Gaze duration (GD) is the sum of all fixations (except for regressions) made on an item within the reading task. Total reading time (TT) is the sum of all time spent on the item (including regressions). It is an index of late processing that already incorporates integrative processes when the words from the text are embedded in a greater context and global coherence building (ibid.).

Contemporary research work conducted in cognitive linguistics that methodologically fits the here proposed hypothesis and is relevant regarding their scope, focus on the following issues: effects of stimuli frequency, word length, Age of Acquisition, and reading mode (silent vs. aloud), the role of phonology in early literacy and reading strategies (Joseph et al. 2013, Blythe et al. 2014, Vorstius et al. 2014, Rau et al. 2014, Rau et al. 2016, Grainger et al. 2012, Tiffin-Richards & Schroeder 2015). When investigating children's eye movements these variables are modulated and systematically manipulated to learn about the different stages of the reading process and their interaction. In the following, the variables and the contemporary approaches are discussed.

7.2.1. Frequency

Whether a word is familiar to the reader, this word is encountered regularly, or whether it is a rather rare or even unknown word makes a difference for the required cognitive processing effort and thus exhibits a difference in eye movements when comparing familiar to unfamiliar words within a study setting. The repetition of orthographic features makes them easier to recognize and to map orthography to semantics (Ehri 1997) or map phonology to semantics (Share 1995). Within eye movement research the familiarity is described by an item's frequency that can be attained from linguistic databases such as CELEX, dLexDB, the DWDS corpus or ChildLex. For research on the reading behavior of children, Tiffin-Richards & Schroeder (2015) emphasize the importance of utilizing age-appropriate stimuli and text material and thus implementing word frequencies that are generated from child literature and not using adult word frequencies as this may cause inconsistent and non-reliable results. To illustrate the differences, the frequencies of the DWDS corpus for anglicisms used here have been listed with those from the ChildLex corpus in Table 2. In part, there are non-negligible differences and confirm the requirement to rely on age-appropriate norms.

Table 2: Comparison of frequencies of the DWDS Kernkorpus and ChildLex corpus for anglicisms used as stimuli

anglicism	frequencies	frequencies	difference
	DWDS Kernkorpus 20 types-norm	ChildLex corpora types-norm	
Handy	0.499	72.843	-72.344
Computer	12.819	49.126	-36.307
Baby	8.11	41.88	-33.77
Teddy	2.305	25.222	-22.917
T-Shirt	0.654	23.34	-22.686
Chef	59.498	22.493	37.005
Jeans	1.709	22.493	-20.784
Trainer	1.831	17.222	-15.391

Jeep	1.202	6.588	-5.386
Container	0.67	6.494	-5.824
Skateboard	0.033	6.305	-6.272
Laptop	0.196	6.023	-5.827
Pool	0.695	5.694	-4.999
Toast	2.42	5.647	-3.227
Cowboy	0.425	5.553	-5.128
E-Mail	0.662	4.894	-4.232
Couch	2.616	4.706	-2.09
Sheriff	0.482	4.706	-4.224
Cornflakes	0.065	4.329	-4.264
Ketchup	0.237	3.67	-3.433
Puzzle	0.164	3.388	-3.224
Shorts	0.572	3.106	-2.534
Outfit	0.172	2.823	-2.651
Surfer	0.335	2.823	-2.488
Mountainbike	0.238	2.823	-2.585
Steak	0.352	2.635	-2.283
Muffin	0.016	2.447	-2.431
Shampoo	0.114	2.259	-2.145
Truck	0.065	1.976	-1.911
Sandwich	0.237	1.882	-1.645
Scanner	1.022	1.788	-0.766
Butler	2.706	1.694	1.012
Safe	0.491	1.412	-0.921
Notebook	0.531	1.223	-0.692
Spray	0.049	0.847	-0.798
Keyboard	0.401	0.753	-0.352
Webcam	0	0.659	-0.659
Jogger	0.025	0.659	-0.634
Cocktail	0.695	0.376	0.319

Volleyball	0.139	0.376	-0.237
Camping	0.376	0.282	0.094
Flyer	0.065	0.188	-0.123
Cartoon	0.041	0.188	-0.147
Tablet	0.049	0	0.049
Beamer	0.008	0	0.008
Player	0.392	0	0.392
E-Book	0.008	0	0.008
Skater	0.033	0	0.033
Smoothie	0	0	0
Oldtimer	0	0	0
Snowboard	0.025	0	0.025
Controller	0.392	0	0.392

To access the effect of frequency with eye tracking, fixation times during natural reading are analyzed. In general, high frequency words are read faster resulting in shorter fixation times. Quite a few investigations so far could determine values for the frequency effect under controlled conditions showing differences between low and high frequency words of 36 ms to 87 ms (Kliegl et al. 2004: 279, Raney & Rayner 1995: 152). These values were measured for adults; studies investigating the frequency effect in children showed greater mean differences depending also on the study setting and choice of stimuli.

The interest to investigate frequency effects in children's eye movements has so far produced a still small but steadily growing number of publications. The results show that frequency effects are more pronounced in children than in adults (Rau et al. 2014, Tiffin-Richards & Schroeder 2015). For children the frequency effects were found in all measures, whereas for adults only in early measures such as FF and single (SF). For SF, which means that the item is only fixated once, it is assumed that the reader is likely to have already identified the item quickly and has easy lexical access since a word receives only one fixation and it is assumed that this one fixation is sufficient for full lexical access. As frequency effects are gradually intertwined with length effects when

modelling eye movement behavior, results show significant interaction for GD and TT for children however not for FF and SF which is interpreted to prove the effectiveness of the lexical route (Tiffin-Richards & Schroeder 2015). Rau et al. (2014) reported increasing length effects from high frequency to low frequency words of 410 ms and 780 ms for GD from children of grade 3 to adults. Only for children of grade 2 the length effect for high frequency words was not found and they argued that beginning readers still rely on serial decoding for all words. They applied correctly spelled familiar words as high frequency, low frequency words and nonwords (as spelling controls). In a direct comparison of low and high frequency words with the focus on reading mode (silent vs. aloud). Vorstius et al. (2014) found within a large sample of readers of grades 1 to 5 ($n = 632$), that the frequency effect on average was comparably small with 20,8 ms for silent reading and 8,8 ms for the aloud mode. Tiffin-Richards and Schroeder (2015) are in line with previous results and show differences on average of 21 ms (short words) to 44 ms (long words) for FF and 113 ms (short words) to 714 ms (long words) for GD.

The mean occurrence for low frequency words in the study of Rau et al. (2014) was 2.6/million and 140/million for high frequency words. Tiffin-Richards et al. (2015) also distinguished between low and high frequencies for their investigation. They applied logarithmic frequencies of the given lemma where the target words with high frequency were defined as $>1.2 \log_{10}$ lemma frequency in the German childLex corpus of Schroeder et al. (2014) and low frequency were defined as $<0.1 \log_{10}$ lemma frequency.

7.2.2. Word length

Longer words generally have longer fixation times and are prone to be refixated compared to short words (Just & Carpenter 1980, Kliegl et al. 2004). This effect is also observed in children's eye movements (Blythe & Joseph 2011, Tiffin-Richards & Schroeder 2015). An interaction with the frequency effect appears and is stronger for low frequency words (Rau et al. 2014, Rau et al. 2015, Tiffin-Richards & Schroeder 2015). This is argued to be a consequence of sub-lexical processing, which is serial and sensitive to word length which then results in larger length effects for infrequent words

(Tiffin-Richards & Schroeder 2015: 40). Compared to skilled adult reader the word length effect is stronger for children. The word length effect is stronger for German than for English (Treutlein et al. 2017). For children of grade 2 Rau et al. (2014) report that they did not show differences for the length effect along with varying frequency. They argue that they used serial decoding as a default strategy as they are beginning readers.

7.2.3. Age of Acquisition (AoA)

Only recently has Age of Acquisition (AoA) also been systematically considered in eye tracking studies. The AoA of an item influences the reading time, earlier AoA lead to shorter fixations (Dirix & Duyck 2017: 1916). This is due to the semantic hypothesis, which refers to the organization of semantic representations and states that when a new word is learned, relationships to pre-existing concepts are established. The earlier a word is learned, the more central it is in the semantic network and the faster it can be accessed (Brysbaert et al. 2000) Increasingly, this effect is also being studied in sentence reading tasks (Dirix & Duyck 2017., Joseph et al. 2014). It has also been proved that AoA interacts with word frequency, for example, the effect of AoA was larger for low frequency words (Dirix & Duyck 2017: 1918).

7.2.4. Reading mode

The condition of reading mode in combination with word frequency was investigated by Vorstius et al. (2014) analyzing the reading behavior of readers of grade 1 to 5 in a longitudinal study design. They showed experimental sentences in two conditions. Half of the items were low frequency and the other half high frequency. Participants were asked to either read silent or aloud. General findings of the study concerned the description of eye tracking parameters for children in their large-scale experiment (N=632). The viewing time measures (initial fixation time, re-fixation time, re-reading time, proportion of re-fixation, fixation probability) decreased as assumed by the authors with increasing reading ability. It is argued that reading aloud requires a great portion of the reader's cognitive resources for pronunciation, intonation and emphasis on words

and it is argued that much capacity is tied up in phonological recoding, which can hinder lexical access (cf. Hale et al. 2007). While the study by Hale et al. (2007) found that comprehension was higher under the reading aloud condition, it also highlights that it may be related to the fact that in this study design (silent vs. reading aloud followed by comprehension questions), only the reading aloud condition ensured that children read everything. So, the not understanding could also be related to the fact that they quite simply did not read everything. This can be circumvented with the eye tracking method in so far as the recordings are visually reviewed to be able to determine with the help of the eye movement whether the children have fixated everything or whether there are abnormalities in the reading. Already during the experiment with the help of online tracking, the examiner can intervene if the eye movements are not normal. Hale et al. (2007) also state that the correlation between reading quietly and reading aloud with regard to comprehension is relatively low with 14.38 % - 27.66 % (as variance explanation in silent reading mode) depending on the age group. In principle, it can be stated that the reading mode has an influence on the gaze parameters (FF, SF, GD, TT) and must therefore be taken into account.

7.3. Reading strategies

Individual effects, as has been demonstrated and modeled to date, cannot be considered entirely in isolation; in some cases, they interact with each other in a highly significant manner. For the change from a serial sub-lexical reading characteristic for beginning readers to a parallel lexical processing as investigated by Rau et al. (2014) the assumptions underlying the study were that the word length effect depends on familiarity, consequently it depends on the frequency of the items. Several research papers confirmed that the word length effect interacts with frequency and that the effect is larger for non-words and low frequency words than for high frequency words. This effect suggests, especially for beginning readers, that the identification of less familiar words requires more phonological recoding (Rau et al. 2014: 225, Share 1995) which requires even more processing time for longer words. The results of the investigations of these individual variables now lead to an attempt to explain the sub-processes of reading

and thus to identify reading strategies. In 2013 Radach and Kennedy attested, that “(a)t present there are no studies directly addressing the issue of serial versus parallel word processing in younger readers”. In addition, this was and still is one major research interest in this kind of reception study.

In their study, Rau et al. (2014) focused on the change from a serial sub-lexical reading characteristic for beginning readers to parallel lexical processing. To prove this effect within a natural reading context, high frequency words, low frequency words and non-words were presented within whole sentences using eye tracking to record GD as a measure of processing time. Half of the items were short (3 to 6 letters), half were long (7 to 10 letters). Participants were children of grade 2, 3 and 4 as well as a control group of adults to reflect the development as reading ability progresses. The length effect, measured as gaze duration in [ms], was employed as an indicator of serial sub-lexical decoding. Their analysis showed that the length effect was comparable across frequencies (high frequency and low frequency as well as nonwords) for beginning readers, but for experienced readers (adults and children of grade 4), the length effect increased with decreasing familiarity (from high-frequency to low-frequency to non-words). Here, for non-words all groups showed a strong length effect. Further, as a result, it was reported that the progress of the two possible reading strategies, i.e., serial recoding and direct lexical access, develop in parallel and not exclusively as serial recoding first, to which in addition, direct lexical access is possible in a later or more advanced stage. Assuming that the proportion of sub-lexically processed words is highest at the beginning of reading development, this result also supports the hypothesis that children process words holistically more often as their reading experience increases. Eye movement studies confirm that in languages in which the GPCs can be consistently applied, the influence of word length on word processing times decreases over the course of reading acquisition, arguing for a transition from sub-lexical to lexical word processing (Rau et al. 2014).

This is where this study can come in, since for evidential anglicisms, especially in beginning readers, it must be assumed that only direct lexical access leads to successful decoding, provided that decoding ability develops from serial to lexical access.

One study specifically contrasts the different GPC of English and German and investigates eye fixation characteristics on the premise that German has a more consistent orthography than English (Rau et al. 2016). In this context, consistency is referred to in terms of contrasting language:

“German is an alphabetic orthography with consistent grapheme–phoneme correspondences; that is, one and the same grapheme typically receives the same pronunciation in different words (e.g., the vowel “a” is always pronounced in the same way in the German words Karte, Fabel, Hand, Ball, Magier). English, on the contrary, is an alphabetic orthography with much less consistent grapheme–phoneme correspondences; that is, one and the same grapheme can be pronounced differently in different words (e.g., the vowel “a” is pronounced differently in the English words card, fable, hand, ball, magician).” (Rau et al. 2016: 1)

The consistency defined above is not the core of the present investigation, where the focus is rather laid on the fact that the GPC between German and English are fundamentally different in terms of pronunciation. Nevertheless, the study provides important input of the compared phonetics and on the resulting different reading strategies. Students were matched pairwise, always with an English-German tandem (25 English-German pairs). In total, 16 English-German adult tandems serve as control group. The reading material consisted of sentences operationalizing German-English cognates as stimuli (e.g., *Onkel Thomas hat eine Kuh und drei Hennen. - Uncle Thomas has a cow and three hens*). An effect was assumed for differences in consistencies in local word and global sentence processing. For German readers, a more small-unit processing was expected and vice-versa a more large-unit processing for English readers. The main finding of their investigation was that the overall processing outcomes comparing the almost identical reading material was almost indistinguishable. But the underlying reading strategies differed which was particularly evident for children. In concrete terms that means that there were no significant differences in mean fixation duration, total sentence reading time, or the total number of fixations. However, differences could be observed in the realization of the reading task. First-pass reading of words and sentences was longer for German children and rereading was seldom

necessary, whereas initial reading for English children was faster, but they made more regressions. The effect was not as pronounced among adult readers, but it was still present. German readers made more fixations and refixations in first-pass reading, whereas English adults showed a higher skipping-probability and a higher regression percentage. The conclusion that can be drawn from this is that orthographic consistency has a major influence on the size of sub-lexical units on which initial reading is based (Rau et al. 2016: 14).

The basic mechanisms of the dual-route model were tested using two effects, the pseudo-homophone effect and the transposed-letter effect, in an eye tracking study analyzing reaction times by Grainger et al. (2012). One hypothesis operating on the pseudo-homophone effect (as a marker for phonological processing) and the transposed-letter effect (as a marker for the orthographic processing) was to verify that within the development in learning to read, both routes are predisposed but that the direct orthographic route lags behind that of phonological recoding (cf. Share 1995, Ehri 2005). The aim was to identify longitudinal development (readers from grade 1 to 5 and a control group of adults were examined). The assumed effects were a large pseudo-homophone effect in beginning readers, which should steadily decrease towards experienced readers, and vice-versa a small transposed-letter effect in beginning readers, which should steadily increase in experienced readers. These two predictions are based on the assumption that phonological recoding plays the most important role for beginning readers, i.e., they perceive pseudo-homophones as real words. With increasing reading proficiency, however, the initial predominance of the indirect route decreases towards a more holistic orthographic reading, so it was hypothesized that transposed letters would then lead to these manipulated words being mistakenly seen as real words by experienced readers whereas this is not yet possible for beginning readers. The study revealed that for the pseudo-homophone effect, the assumption was in line with the observations: for the transposed-letter effect an initial increase in size was observed for readers of grade 1 and 2, then the effect was stable and diminished for adults. The investigation illustrated that with increasing reading experience, phonological influences becomes less important, however as the transposed-letter effect shows, it does not completely disappear. This is an interesting component, because the fact that

phonological recoding is also present in skilled readers as a necessary strategy to recognize unfamiliar words (in the context of mapping orthography to semantics and mapping orthography to phonology) can be operationalized, for example, to determine which anglicisms are already integrated in active language use and which are unknown to readers participating in this study.

It has also already been investigated whether and when children use the strategy of serial reading or orthographic grain size reading of larger units and whether it is possible to switch flexibly here (Treutlein et al. 2017). As an important result, it could be shown that children have orthographic units at their disposal, even in a language characterized by consistency as German.

It could also be shown that the individual parameters can usually not be considered in isolation but influence each other. For this reason, the obtained data from eye tracking experiments are also transferred into linear mixed models besides the fact that the amount of data collected by computational eye trackers is not suitable for analysis without running computational models.

A comparison of German- and English-speaking children showed that the children basically use different reading strategies. German children read in smaller units (phoneme-oriented), while English children try to read lexically, content-oriented, already in an earlier state (Rau et al. 2016, Treutlein et al. 2017). A theory that focusses on this differentiation of sub-lexical and lexical access is the psycholinguistic grain size theory (Ziegler & Goswami 2005). It suggests that readers of orthographies that are very consistent in their GPC use small grain sizes (e.g., graphemes) as they can rely on this mapping, while readers of orthographies that are more inconsistent in their GPC (e.g., English) rely on greater and flexible grain sizes (e.g., graphemes, onsets, and rimes) to help resolve inconsistency in the mapping.

This is also reflected in the implementation of the DRC model of Coltheart et al. (2001) for German. Here it could be shown that the model runs stably in German with far less learned GPC for the German than for the English version. For the German only 48 units of multilettered-rules (GPC) were implemented, for the English 146 were required (Ziegler et al. 2000: 419).

7.4. Using eye tracking to investigate the role of phonology in early literacy

Eye tracking studies involving children often lay their focus on the investigation of phonological influence, as it is assumed that beginning readers are particularly sensitive to phonological aspects in learning to read due to the development from recoding single letters and graphemes to holistic access to their lexicon. Furthermore, the description of this developmental process is valuable for the examination of interfaces and the interaction of individual stages in the reading process. In all languages, phonology is one part of the writing system. The background is the theories of learning to read as described in section 2.2. Phonological recoding processes assign a phonetic (phonological) representation to a grapheme sequence. These processes play a crucial role especially in early stages of learning to read when using alphabetic strategy e. g. matching graphemes to phonemes (Frith 1986, Ehri 1995) and in the recognition of rare words. The here presented study on the reception of anglicisms as they are irregular words in terms of their GPCs, may contribute to the already existing experimental literature on phonology in beginning readers as the investigation may shed light on the how and when phonology influences word recognition.

In an experiment using a list of words descending in frequency, it was shown that children read words correctly up to the point where the words were low frequency and from this level on, the children obviously began sounding the syllables of the words out. This resulted in delays and reading errors (Adams & Huggings 1985 cited in Milledge & Blythe 2019). In addition, it was shown that children benefited from regularity with respect to GPC, i.e., when pronunciation conformed to GPC, and had difficulty with nonconforming pronunciation, but only with low frequency words (Schmalz et al. 2013 cited in Milledge & Blythe 2019). The reason was

"that children were using phonological decoding for words that they encountered less frequently because the output for irregular words from phonological decoding conflicts with the correct entry in the mental lexicon" (Milledge & Blythe 2019: 3).

The core of this observation forms the ground for choosing anglicisms as stimuli within the experiment as by them, it may be possible to check what happens when phonological decoding in German leads to no result. According to the review of the literature, phonological decoding should be switched "off" in this case. The children either recognize an anglicism as a whole word or they cannot read it. The supplemental aid of phonology for decoding is not available (Milledge & Blythe 2019). Findings about phonological processing show that children relying on phonological decoding have difficulties when unfamiliar words are encountered (Milledge & Blythe 2019: 3).

Studies on reading behavior in recent years have shown evidence for a shift in the role of phonology in the course of learning to read and becoming a proficient reader (Tiffin-Richards & Schroeder 2015a). When comparing parafoveal processes for German adults and children it was observed that whilst the adults clearly benefitted more from orthographic than phonological information in the parafovea, this only applied for children under certain conditions. The beneficial effect only occurred when the previewed nouns were capitalized, and the effect solely occurred when the word was individually fixated. Juxtaposed to adults' behavior, children showed clear advantages when the parafoveal stimuli were pseudo-homophones. Tiffin-Richards and Schroeder (2015a) draw the conclusion that phonology is a more decisive element in word identification than orthography for German children. However, for adults the relation of phonology and orthography for lexical access is the other way round: here orthography dominates over phonology in terms of supporting lexical access. As they formulate: "Our results do suggest differences in the use of phonological information which we predicted based on developmental models of reading acquisition." (Tiffin-Richards & Schroeder 2015a). Following these findings, the eye tracking experiment within this research work may contribute to further verification, as anglicisms clearly do not adhere to German GPC.

The studies of Grainger et al. (2012) and Tiffin-Richards and Schroeder (2015a) examine this phonological influence, e.g., pseudo-homophones are recognized as real words in early reading development, but are later identified as false words. This outcome shows how children develop and change their reading strategy as literacy becomes more and more proficient and a direct access to the lexicon becomes more and more reliable.

A study by Blythe et al. (2014) discusses the different stages assumed for children's progress in reading. They emphasize that all theories thereby assume the occurrence of a stage of phonological decoding. In their experiment, they operationalize pseudo-homophones to prove the transition of phonological recoding and its apparent function also for skilled readers. Words with an AoA of below six years were embedded in sentences in three conditions: being real, misspelled homophone and spelling control (e.g. water, worta, wecho). For both, adults and children, they showed that GD was significantly longer for the spelling control whereas the differences between word and pseudo-homophone were small. This showed that a letter string that is spelled incorrently, but sounds right, could be more easily accessed than a similar word both spelled wrong and sounding wrong. The results show that phonological recoding is definitely a core element in word recognition, as assumed in models of word recognition by Coltheart et al. (2001) and Seidenberg and McClelland (1989).

Comparative studies show that phonology plays a greater role in German-speaking children than in English-speaking children (Milledge & Blythe 2019, Rau et al. 2016). Based on these research findings, Milledge and Blythe (2019) formulate that:

"[...] the developmental transition from overt, effortful phonological decoding to covert, rapid phonological recoding that appears to occur in English, [...], may not be applicable to other languages" (Milledge & Blythe 2019: 8).

These considerations and findings lead to Hypothesis 1 and 2 formulated in chapter 6, which state that it is assumed that word frequency as well as the AoA has an influence on children's reading behavior when reading anglicisms.

Concerning the present study, these findings are to be considered when evaluating the data from the eye tracking experiment as the experimental literature might contribute to theoretical models of learning to read and models of word recognition for the German language system respectively if the findings of the investigations that have been observed within the anglophone context are to be transferred to German.

7.5. Summary

The anglicisms used in this experiment can be clearly identified as irregular words due to their phonetic properties which do not match German GPC. Further, the approach brings anglicisms to another field of empirical linguistics, namely eye movement research associated with cognitive linguistics. Within this field, eye-tracking helps to shape linguistic theories about reading processes.

On the way to becoming a proficient reader, word recognition is a *sine qua non* to successfully conquering a reading task (Perfetti 1985, Gough & Tunmer 1984) and the initial step of the comprehension of written text in hierarchical modelling (Christmann & Groeben 1999, Gough 1972).

In addition, following the logic of the dual-route approach of word recognition and lexical access (Coltheart et al. 2001) and also models that refer to connectionist approaches (Seidenberg 2007, Seidenberg & McClelland 1989), phonology is an indispensable component to transferring written text into meaning. Considering these theoretical prerequisites, the major focus within this study lies on anglicisms as *agents* to investigate reading processes. As described in the previous sections, the role of phonology is still a contemporary research topic as it is assumed to highlight evidence of word recognition processes with regards to reading strategies.

Here the study tries to contribute to already existing reception studies by gathering and analyzing data about eye movement behavior using the eye tracking method to describe the various linguistic phenomena during the reading process for beginning readers.

8. Empirical data acquisition

This chapter aims to present the research method underlying this study as well as to describe the data material used. The experimental study design is composed of the eye tracking reading experiment, an interview questionnaire to obtain metadata and explore the participants sociographic attributes, as well as a vocabulary check of the stimuli used within the eye tracking experiment. In the following, the interaction of these study

elements and the methodology will be described in detail. The core element is the reading experiment; the data of the eye tracking experiment will be used as dependent variables in a later statistical analysis. The compilation of the reading material and the systematic manipulation with anglicisms and matched German words will be described before the two further research elements, the interview questionnaire and the vocabulary check, are discussed. Finally, the test set-up and realization are described.

8.1. Reasons for the research strategy and data selection

To explain the research method chosen here - an eye tracking study flanked by corpus linguistic data and socio-biographical data - methodological as well as substantive arguments can be used, which will be outlined below. Previous research on gaze behavior in beginning readers' reading has found that word-specific features such as frequency and length have a significant impact on gaze durations (Blythe & Joseph 2011, Radach & Kennedy 2013, Tiffin-Richards & Schroeder 2015). In addition, findings from reading research support the assumption that the spread of words and concepts in productive vocabulary also have an influence on lexical processing and word recognition (Share 1995, Ehri 2005, Dirix & Duyck 2017). In addition, there are studies in which biographical interviews were conducted that show that life circumstances also have an influence on the extent of vocabulary with regard to anglicisms (cf. Gäbler 2013). Following the state of research, this dissertation examines anglicisms as irregular words in terms of word recognition strategies. The largely objective data from eye movement measurement are suitable for examining anglicisms with regard to the question of whether there are differences in reading strategies in direct comparison to words corresponding to regular GPC.

8.2. Participants

Homogeneous framework conditions of geographic limitation and age structure were established as only children of one elementary school were recruited from grades 2 and 4 and as the experiments took place within three weeks without breaks. Having the

examinations all within a short period of time ensures that the children are at a comparable level. The determination to recruit children of grades 2 and 4 comes from previously conducted eye tracking and reading experiments. The choice to study children of grade 2 is based on very practical considerations, because in this state the children already have a certain reading proficiency because they have already received the basic GPC through phonics instruction, which is a prerequisite to participate in a reading experiment. Since the aim is to investigate how reading behavior develops over time with increasing reading proficiency, children of grade 4 were also selected. Similar procedures can also be found in the studies of Scharke (2018), Rau et al. (2016), Tiffin-Richards and Schroeder (2015), Rau et al. (2014), and Vorstius et al. (2014). It was planned to also include children of grade 6t as a control group, since it is known that reading ability at this age is already nearly equivalent to that of adults (Blythe & Joseph 2011, Radach et al. 2012). The difference in perceptual span, for example, has already been shown to disappear for children of grade 4, i.e., oculomotor development in children of grade 4 is already equivalent to that of adults (Blythe et al. 2009). In general, the difference in eye movement behavior is considered to have more importance on the lexical processing component than on the development of ocular-motor skills (Blythe & Joseph 2011, Tiffin-Richards & Schroder 2015a).

Subsequently, it was necessary to find cooperating schools, clarify organizational matters (permits, information letters to all involved, exact number of participating classes and students) and make further arrangements with the school management. The parent information with the response form was distributed by the relevant class teachers. The parent information included a description of the experiment, its scientific background, and the procedure, as well as a note on the possibility of withdrawal without giving any reason and the privacy policy (the parent information is attached in the Appendix). Since this was a purely voluntary experiment, out of about 100 parent information leaflets, 40 signed consent forms from the children's legal guardians returned. A total of 36 children participated in the experiment as 4 children did not participate due to illness or absence (17 female, mean age = 8.67). The biodata is presented in Table 3. The children were informed that they could withdraw from the experiment at any moment and without giving any reason for their withdrawal. The

participants did not receive monetary compensation for their participation in the experiment which took place in the afternoon as part of all-day schooling. Six participants were excluded from the final analysis because the eye tracking data was non-evaluable due to very thick glasses (one participant) or because the experiment had to be terminated before completion due to concentration difficulties (two participants), unsuccessful calibration (one participant) or due to massive reading difficulties (two participants).

Table 3: Biodata of the participants

Grade	Gender	Mean age
2	7 female, 8 male	7.47 (7 - 8)
4	7 female, 8 male	9.33 (9 - 11)

Note: Range in parentheses

Like in other studies, considerations were made to completely filter out the migration background parameter (cf. Gäbler 2013: 23). On the one hand, for pragmatic reasons, this limiting requirement could not be met, as it was per se difficult to recruit children for participation due to the temporary pandemic-related school closures and alternating classes during the implementation of the experiment, as well as the strict hygiene measures that had to be observed. On the other hand, it must be clearly stated that the exclusion of children with a coeducational background means that the locally existing structure is not represented. According to the participating elementary school, the proportion of children with a migration background is 30 to 40 percent. This information matches the data published by the micro census 2020 of about 38 percent of students in general education and vocational schools and about 40 percent of children with a migration background in early childhood education institutions.¹⁹ The share of children that answered the question of mother tongue, respectively the language be spoken at home being another than German was 36% (13 children). The aim was to recruit

¹⁹ <https://mediendienst-integration.de/integration/bildung.html> last accessed on 11/16/2021.

participants from grades 2 and 4 with a number of at least 35 children per grade level to participate in the experiment. The target number of test persons results from findings of previous reading studies with children (Tiffin-Richards & Schroeder 2015, Blythe & Joseph 2011) and aims at ensuring ecological validity and taking into account data loss. However, by the time the experiment was ready to run, the Covid-19 pandemic situation had presented itself, so ultimately only 40 children in total participated in the study (20 per grade level). Similar studies investigating children's reading behavior by means of eye movement measurement vary in their number of participants, sometimes considerably. The range here is between about a dozen to 20 children per age group (Blythe et al. 2009, Joseph et al. 2008, Rau et al. 2014, Rau et al. 2016) and at least 30 to even over a hundred children (Gragner et al. 2012, Vorstius et al. 2014, Tiffin-Richards & Schroeder 2015, Tiffin-Richards & Schroeder 2018). Keating and Jegerski (2015: 27) state that

“[t]he ideal number of participants needed for a sentence processing study is a function of the number of conditions in the experimental items. [...] The tendency in the monolingual processing literature is to aim for a minimum of 12 participants per condition after attrition.”

As all participants read a list containing all conditions and in sufficient quantity (cf. section 8.3.1), it can be concluded that the study includes a sufficient number of subjects.

8.3. Reading material

There were 104 sentences (items) in total. In the context of the research question, 52 doublets were created containing either an anglicism as stimuli and or a German word matched for word length and frequency. As these parameters (frequency and word length) have experimentally confirmed influence on the reading behavior regarding eye movements (as discussed in sections 7.2.1, 7.2.2, 0 and 7.2.4), the parameters were controlled. There is evidence due to several investigations that the word frequencies have a significant influence on adults' but also on children's reading behavior (Blythe et

al. 2009). Another considerable influence for word identification processes is word length (Tiffin-Richards & Schroeder 2015, Rau et al. 2014, Keating & Jegerski 2015: 7). The average frequency per word was slightly higher for anglicisms (7.04 vs. 6.87), $t(102) = 0.07$, $p > 0.95$. In turn, the average number of letters per word was slightly higher for German words (6.62 vs. 6.58), $t(102) = -0.11$, $p > 0.92$. Thus, there is no statistically significant difference between the average frequency and letters per word between the two conditions. Care was taken to place the stimuli in the middle of the sentence, if possible, and in no case be the first or the last word of the sentence (cf. Conklin et al. 2018: 36). The sentences had on average 7.88 words (44.98 characters) with a SE of 1.46 word (8.11 characters). Each participant of grade 2 read 36 sentences and each participant of grade 4 read 52 sentences. This increase in the amount of material to be read was intended to account for the development of reading ability and accounts for younger children having limited concentration spans (Joseph et al. 2013). Similar designs have proven successful in similar research paradigms (Scharke 2018). The average total reading times (see section 7.3) support this approach.

In fact, there were 52 doublets which were lexically matched and the only difference between the two sentences is a noun either being an anglicism or the German word (matched for frequency and length). An example is given for a sentence frame in both versions:

Papa legt das Handy auf den Tisch neben die Vase.

(Dad puts the phone on the table next to the vase)

Papa legt die Karte auf den Tisch neben die Vase.

(Dad puts the map on the table next to the vase)

To avoid repetition effects (cf. Keating & Jegerski 2015: 9) when participants read both versions of the same item, the different versions were divided into two different presentation lists for each grade. The lists contained the equal number of sentences of version a (anglicism) and b (German word). The number of different conditions (see section 8.3.1) were also balanced for both versions and in both presentation lists. The lists were then automatically randomized by the presentation software of the eye tracker (SMI Experiment Center 3.7).

Another influential factor that must be considered when composing sentence material is the predictability of target words from prior text as predictability or semantic relations to preceding words also influence gaze behavior (cf. Castelhana & Rayner 2007, Kliegl et al 2004, Rayner 1998). Rayner et al. (2011) showed in an eye tracking experiment examining stimuli that were either predictable from the context or not, that word predictability had a strong effect on skipping and fixation time. They also investigated the interplay with word length and concluded that the predictability effect on target words was independent of the length of the target word. Therefore, the sentences were formulated in such a way that unambiguous semantic relations were avoided.

8.3.1. Selection of stimuli

There is no standard work on how to design *the* perfect eye tracking experiment comprising detailed norms and layouts on texts appropriate for reading questions. Therefore, the attempt for this study was to get as close as possible to this perfect setup. Findings of previous experiments and principles manifested to date were applied (cf. section 7.2). A good starting point for determining the experimental design is to formulate one or more hypotheses (Duchowski 2007: 157). Thinking of the postulated hypotheses in chapter 6, item-related features such as frequency and word length must be controlled on the one hand and information of sociographic characteristics of the subjects are to be taken into account on the other hand. The main hypothesis to be investigated here is the influence of word frequency on reading behavior and whether there is a difference between anglicisms and matched German words.

“Factors known to have a robust effect on adults’ eye movements during reading, such as the length or frequency of a word, need to be carefully considered before being incorporated into experimental designs with children. For example, there are many words which are low frequency for adult readers but high frequency for children (e.g., dragon). “(Blythe & Joseph 2011: 646)

Blythe and Joseph found that there are non-negligible differences when investigating the reading behavior of children compared to adults in terms of the frequencies of the

chosen stimuli. To meet their request for the consideration of age-appropriate stimuli created by a suitable corpus analysis, frequencies of the ChildLex corpus (Schroeder et al. 2015) were applied for this study as to meet the requirements proposed by Blythe and Joseph (2011) and also emphasized by Schroeder et al. (2015) as they claim that “these (other) databases may not adequately reflect children’s language.” The 52 anglicisms have a mean frequency of 7.04 (SD = 13.54) and the 52 reference words have a mean frequency of 6.87 (SD = 12.73), the correlation between the two versions is 0.998 showing that the matches are almost identical concerning their frequencies. All pairs were also of the same length in terms of their number of characters.

Following existing studies by Rau et al. (2014) and Tiffin-Richards et al. (2015), which distinguish between low and higher frequency words the stimuli were equally selected for lower frequency (mean occurrence of 0.79/million) and higher frequency (mean occurrence of 13.61/million). Admittedly, there is no scientific motivation for the chosen categorization, only the adherence to existing research and the available reading material. In the analysis, therefore, the continuous frequency of the stimuli was also examined.

Only concrete nouns were used as target words²⁰. Unfortunately, there is no comprehensive compendium of annotated corpus data available for identifying anglicisms. Therefore, the *Anglizismen Wörterbuch* (Carstenten & Busse 1993) was searched for the anglicism types defined in section 5.2. This list was cross-checked with the existing entries in the ChildLex corpus. A total of 54 anglicisms with the criteria - evident loan, concrete noun - could be found. The selection resulted in 52 anglicisms for

²⁰ To exclude a further noise factor, only concrete nouns were used. This is because it is known that there are fundamental differences in the processing of concrete and abstract terms. The so-called *concreteness effect* manifests itself in the fact that concrete concepts (such as tree) are processed faster and more accurately than abstract concepts (e.g., moment or smell) in experimental comparison (see Holcomb et al. 1999). A very recent eye-tracking study by Griffiths et al. (2021) confirms the qualitative differences between abstract and concrete words. A significant difference in the number of fixations as well as fixation durations was found between concrete and abstract concepts, further confirming the restriction of selection to concrete nouns in this study.

which there was a matching German equivalent - also available in the ChildLex corpus (cf. list in the appendix). This equivalent was not a cognate, because this was not suitable due to the mandatory specifications (word length and frequency).

The number of target words met the generally valid quality criteria as “[p]sycholinguists usually create enough items for participants to read 8 – 12 items per condition, the goal being to have data for at least 6 – 10 items per condition after accounting for data loss.” (Keating & Jegerski 2015: 9). The number of items available for the two version of doublets each (anglicism and German word) in reference to the controlled parameters word length and word frequency resulting in four conditions is shown in Table 4.

Table 4: Number of test items and distribution according to control variables

	high frequency	low frequency	Σ
Short words (4-6 characters)	16	14	30
Long words (7-12 characters)	9	13	22
Σ	25	27	

Studies with children who are still in the process of learning to read are often a great challenge, since they are less enduring and have a limited concentration span compared to skilled adult readers. This is particularly the case for eye movement measurements, as participants must sit still for a longer period of time (see Blythe & Joseph 2011). This circumstance must be considered by ensuring that the amount of reading material matches the reading performance, and that noisy data does not occur due to overtiredness and poor concentration. Therefore, within the two age groups (children of grade 2 and 4) the children were divided in two groups reading half of the total stimuli provided each. The participants of grade 2 read 36 sentences, and participants of grade 4 read 52 sentences. Similar approaches are recommended and have already been tested in other studies (Scharke 2018, Blythe & Joseph 2011, for a review).

8.3.2. Querying Age of Acquisition for the stimuli

One variable that must be considered in the hypothesis is the effect of the Age of Acquisition hypothesis (Schröder et al. 2003, Dirix & Duyck 2017), which claims that earlier-learned words are recognized, read, spoken, and responded to faster than words learned later in life. Regarding reading times, it was possible to show that the ages at which individual words were learned indeed influenced reading times (Brysbaert et al. 2000, Birchenough et al. 2017). Particularly for the research question raised here the AoA may have a significant effect. Birchenough et al. 2017 report that inter-language studies identified larger AoA effects for words in English with inconsistent GPC compared to languages where letter-to-sound mappings are more consistent, but also mention that the results vary depending on the language studied. Overall, however, it can be concluded that the semantic component influences the AoA effects and the AoA needs to be considered in order to explain variance in performance (486).

Unfortunately, there is no comprehensive database offering values for AoA values for German concrete nouns, i.e., for all stimuli used within this study. After a review of the existing research, the largest collection for AoA for German found is the database from Julia Birchenough (2017). The database comprises 3,259 items, 33 of them are also used in this study (of a total of 104 stimuli). However, it should be borne in mind that the norms for anglicisms, especially from the technical field may be problematic to adopt for investigation here, as the ratings from Birchenough for cell phone (AoA=10.17 years), computer (AoA=9.19 years), webcam (AoA=15.25 years) no longer reflect reality²¹. With the ongoing digitization push, especially for children during the pandemic year of 2020, accompanied with increasing media use as for homeschooling purposes, the present values no longer seem relevant. This is especially true because Birchenough's instruction to raters is based on adults' own AoA and thus reflects data from about 30 years ago.

²¹ It was proven to be true that especially technology terms are learned and used at a very early age due to the rating, e.g., the AoA for computer is 3.35 years and that for webcam is 6.94 years which are indeed much lower values than those of Birchenough's database.

A recently performed Swedish study (Barrow et al. 2019) examined the validity and reliability of rating AoA scores and found that preschool and primary school teachers represent appropriate groups of individuals "[...]individuals with high familiarity with preschool-aged children provide more valid and reliable ratings, compared to individuals who do not work with or have children of their own." (ibid.: 1)

For this reason, the survey did not ask the participants to rate their own AoA for a word among a group of university students. Instead, preschool educators and elementary school teachers were asked to participate in the survey. The instruction for the rating was:

"Try to estimate as accurately as possible the age at which a child learns each of the following words, together with their meaning, and uses them himself or herself for the first time in the spoken form. It does not matter whether the word is used completely without error at the time of acquisition. Please mark the age range (e.g., in the period 5 to 6 years of age) that you think best corresponds to the productive age of acquisition."

For the rating a 7-point Likert scale was used representing time periods. The coding is presented in Table 5 as it is also used by Schröder et al. (2003).

For the evaluation of the results, the mean value was calculated for each item using the scale 1 to 7. For a better presentation and comparability of the results with already existing AoA data, the mean values were converted into monthly values ($[(\text{Rated AoA}_{\text{Likert}} \times 24) - 12]$) (corresponding to Schröder et al. 2004:122).

Table 5: Likert-scale - age correspondance for AoA rating

likert-point	age-range
1	1 , 2 years
2	3, 4 years
3	5 , 6 years
4	7 , 8 years
5	9 , 10 years
6	11 , 12 years
7	13 + years

Three kindergartens in southern Palatinate (Klingenmünster, Pleisweiler-Oberhofen and Rohrbach) participated in the AoA rating survey. In the context of a training seminar held in the kindergartens, a total of 20 preschool teachers took part in the rating that was designed as an online form. In addition, a local union of three small elementary schools (Gleiszellen-Gleishorbach, Dörrenbach and Klingenmünster) participated with another 14 raters. The elementary school teachers were invited to participate in the online survey by a principal during a staff meeting. The mean age of the raters was 35 years (SD = 9.24). All participants completed the survey completely resulting in 34 entries for each item. On average, within Birchenough's research there are 19.57 individual ratings per item on average (Birchenough et al. 2017: 489) with a range of 7 to 27 ratings per entry of the database. This reference implies a stable statistical basis for the rating. A table with the results of the rated AoA is attached in the Appendix to this work.

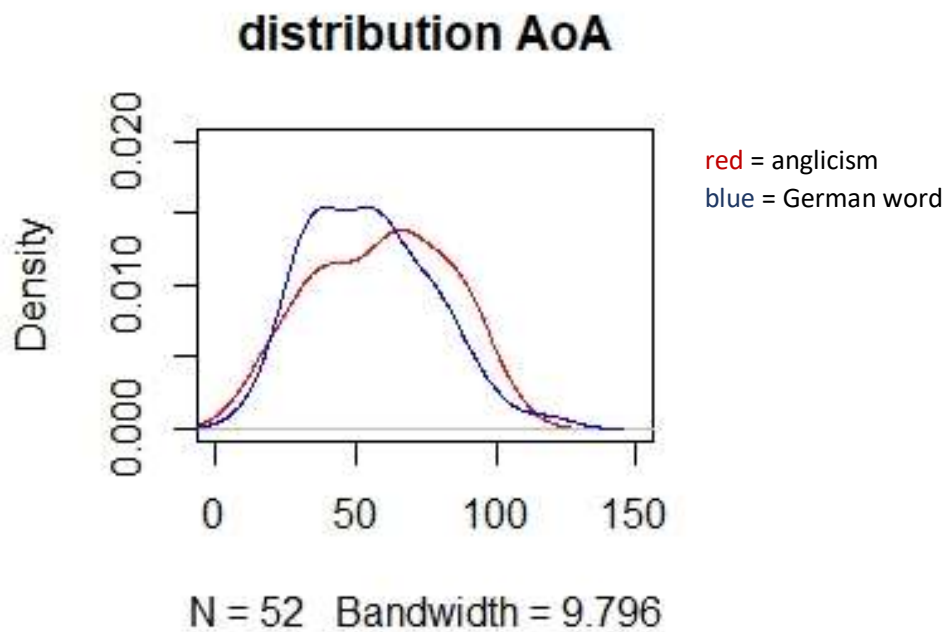


Figure 13: Distribution of the AoA for the stimuli used in the study

Figure 13 shows the distribution of the rated AoA for anglicisms (red line, mean = 59.25 months) and the German words (blue line, mean = 55.11 months). A t-test revealed that there is no statistically significant difference between the samples, $t(101) = 0.91$, p-value = 0.363.

8.3.3. Critical reflection on the reading material

In practice, it is rarely possible to completely cover all study-relevant parameters and variables at the same time. In this experiment, an attempt was made to control for all known influencing variables while still examining a realistic reading task. Although sentence characteristics were controlled for length, avoidance of semantic constraints and stimuli position, the pre-target and post-target words were not controlled. This was due to practical reasons and since a direct comparison between anglicism and German word was possible due to being embedded within the same sentence frame. This

approach of creating one sentence that appears in separate conditions is a basic principle to study a linguistic phenomenon in order “to rule out the possibility that factors other than those studied by the researcher are responsible for the obtained results” (Keating & Jegerski 2015: 5).

8.4. Vocabulary check

The experimental design also included a vocabulary check of the stimuli, which was conducted as an interview situation. Semantic concepts for the terms used as stimuli are queried (34 terms for grade 2 and 52 terms for grade 4). The audio recordings are used exclusively for writing, the statements are made anonymously. As there were two lists for each age group it was ensured that the participants were not asked about a word that already appeared within their reading experiment. If for example they read *skateboard* as part of the eye-tracking experiment, the matched German word *Kürbisbrot* (‘pumpkinseed bread’) was queried in the vocabulary check. The conceptual content is checked by demanding definitions (cf. Haß 2016: 103).

The purpose of the vocabulary check was to see if the reading times and other parameters matched the results from the task set here. Thus, the data should be verified in the sense of a triangulation. Indices were formed for the vocabulary check, where the coding was 1 = yes, a semantic concept is present and 0 = no, a semantic concept is not known. The indices were formed per word and grade level. The correlation with the AoA shown in Figure 14.

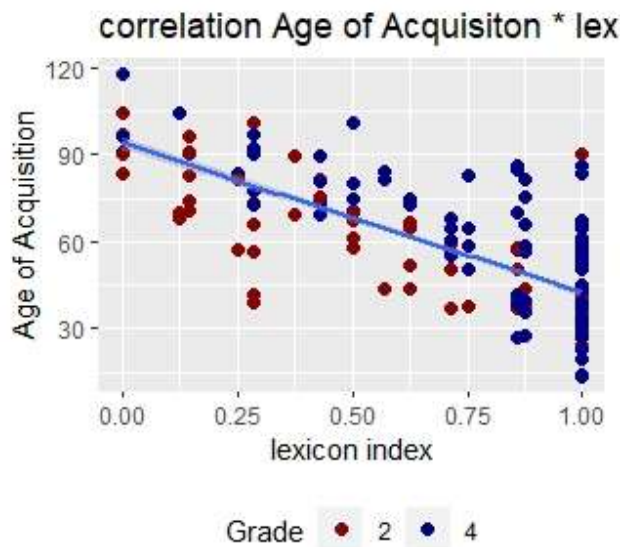


Figure 14: Correlation of AoA and lexicon index

Using Pearson's correlation measuring the strength of a linear association between two variables, it can be shown that there is a strong negative correlation (-0.72), being statistically significant ($p < 0.001$). Explicitly, this means that the indices retrieved and formed from the vocabulary check are confirmed by the AoA. Words learned early are generally also more often present as semantic concepts and have a representation in the mental lexicon of the children.

8.5. Interview questionnaire

Hurrelmann (2009) and several large-scaled studies (PISA, BiKS, IGLU) point out that the learning goal of reading essentially depends on the stimuli children receive in their families and highlight that the socio-cultural environment influences reading ability. To evaluate the socio-graphic attributes of the participants and to gather information about their reading and leisure behavior, a questionnaire was designed for the purpose of this study (see Appendix for the questionnaire). In order to operationalize the collected characteristics a standardized interview questionnaire collected quantitative data. In the case of quantitative data collection methods, the degree of structuring is very high and fully standardized instruments are used (Döring & Bortz 2016: 322), i.e., all answers

were formulated (except for the questions about the age and parents' occupation, which were not included in the statistical analysis).

The questionnaire included questions about personal information such as age, grade and whether older siblings are living in the same household. This question was added as Gäbler (2013) found that this was an influencing factor on the usage of anglicisms in elementary school children. Information of mother tongue and languages present within the children's home were also queried.

Individual reading behavior also plays a decisive role in determining the size of children's vocabulary in general and thus also for anglicisms. However, the act of reading undergoes changes in a more and more digitalizing world. Three developments and changes at the same time can be identified (Feierabend 2013: 21):

- *medium*: reading was previously tied primarily to print products such as books, but also newspapers and magazines. Now these are being expanded to e-books, e-mails, Facebook and X, but also text messages on cell phones. As PISA 2018 (2019) states: "Digitalisation has resulted in the mergence and availability of new forms of text [...] (text messages; annotated search-engine results)".

- *purpose* of reading: the classic functions of reading - education, entertainment, and information - have been expanded. Communication (Facebook) or networking (Xing, LinkedIn) become increasingly popular to exchange ideas on a digital basis. People also read to engage in (electronic) commerce and to make purchases. Also playing computer games alone or online together with others reinforces this trend.

- *content* of reading, in the case of traditional reading media (books, newspapers, magazines) this content is produced by authors (literary content) or journalists (prepared content from politics, society, celebrities). The content is produced according to certain (journalistic) standards or rules. With SMS, Facebook or X, the situation is completely different in the way that not only content is created by everyone, but all possible areas of life are being targeted. This content is also not subject to "control" or quality checks. It is produced without any standards or rules.

To take these influences into account, the questionnaire included questions on reading behavior in general, but also collected data on the use of cell phones, computers and digital networks. Behavior regarding digital gaming via consoles or apps was also surveyed. Here the children had to evaluate temporal exposure to print, digital texts and media in general. A scale with four possible answers (every day/several times a week/several times a month/never) was provided. Another question on reading behavior concerned to the number of books read in summer holidays (more than 6/3 to 6/1 to 3/0) as this was presumed to give insight into behavior of leisure reading ('reading for fun'). It was also assessed if parents or another person reads aloud (every day/several times a week/several times a month/never).

The behavior and handling of technology was assessed as the children gave information on which kind of device they use and how often they use them.

From the answers of the interview questionnaire, a value between 0 and 3 was mapped for the level for each respondent via index formation (cf. Döring & Bortz 2016: 278). Three indices were built that entered the statistical analysis as independent variables (fixed effect). In the following, the indices *reading behavior*, *reading to children*, and *technologies* are explained.

Reading behavior

The index to describe the characteristics of one's own reading behavior was elaborated by evaluating three questions. The individual values result from the weighted sum of the following point coding as shown in Table 6:

Table 6: Coding for index formation reading behavior

Reading behavior											
Do you read outside of school in books or magazines/newspapers for fun (not for homework)?				Do you also read online media like Facebook, Twitter, electronic articles (Wikipedia)?				How many books did you read during summer vacation?			
every day	several times a week	several times a month	never	every day	several times a week	several times a month	never	more than 6	4 to 6	1 to 3	none
3	2	1	0	3	2	1	0	3	2	1	0

The result for reading behavior is weighted $\frac{3}{4}$ * regular reading (question 1) + $\frac{1}{8}$ * electronic reading (question 2) + $\frac{1}{8}$ * reading during summer vacation (question 3). The weighting was chosen because the extent of leisure reading activities plays a crucial role in promoting reading literacy in children (e.g., Cipielewski & Stanovich, 1992; Cunningham & Stanovich, 1997; Mol & Bus, 2011) and thus has a $\frac{3}{4}$ weighting. For example, Mol & Bus (2011) showed in their meta-analysis that leisure reading contributes to vocabulary expansion, better reading comprehension, and improved reading and writing skills. However, reading in online media should also be considered (Question 2). The third question (reading during summer vacations) was included following a survey of the lifelongreaders.org project initiated by the EU Commission as well as a press release of Stiftung Lesen²² to also capture whether there are long periods of reading abstinence (during summer vacations). Motivation could also play a role here

²² (<https://www.stiftunglesen.de/presseservice/pressemitteilungen/1071/>) last accessed

and its positive influence on reading literacy is supported by research findings (Guthrie et al., 1999; McElvany et al. 2008; Pfof, Dörfler & Artelt, 2010). The weighting results in indices for each participant range from 0 (= “no reading activity besides in school”) to 3 (=” participant virtually reads all the time”). The mean value for the index representing the reading behavior was 1.44 (SE 0.73) overall. Related to grades it was 1.39 (SE 0.76) for children of grade 2 and 1.49 (SE 0.73) for those of grade 4.

The importance of phonics in learning to read is indisputable as all models describing the reading process include a phonetic unit. Especially in beginning readers phonology seems to play a crucial role (Ehri 1992, Share 1995). The exposure to storybooks that are read to children therefore directly influences the processes in beginning readers to become a proficient reader. Numerous studies indicate that the benefit for oral language skills and vocabulary is due to linguistic diversity provided by reading to children (Grolig et al. 2019). In this study, Grolig et al. (2019) were able to further enhance the results of previous studies that have found a positive relation between the home literature environment and vocabulary. The German *Stiftung Lesen* published a report enhancing that the findings on early childhood language and reading socialization indicate that the more frequently and regularly parents offer reading to their children in several ways. The frequency effected the effectiveness of reading aloud, storytelling and accompanying communication. The more often children and adolescents have been read to by their parents, the better their opinion about reading books, which leads them to read more themselves (Ehmig 2013). If the vocabulary of children who are regularly read to is demonstrably larger and more varied, it is expected that they will also tend to achieve better results in the recognition of anglicisms. To consider this effect, a question on this issue was included in the questionnaire. As can be seen in Table 7, the children answered in a range from *never* (coded “0”) to *every day* (coded “3”). The mean value for the index representing the reading to children was 1.07 (SE 1.28) overall. Related to grades it was 0.80 (SE 1.21) for children of grade 2 and 1.33 (SE 1.35) for those of grade 4.

Table 7: Coding for reading to children index formation

Reading to children			
How often are you read to?			
every day	several times a week	several times a month	never
3	2	1	0

The use of technology supposedly influences the number of anglicisms within the children’s vocabulary. For the use of technologies, this means that it is assumed that the influence of reading using electronic media has the same effect as the use of devices for games. Here exhaustive studies have not been found but the tendency that usage has an influence on knowledge of anglicisms is reported in the study of Gäbler (2013). Table 8 shows the coding for the formation of the technology index. The technologies factor is equally weighted with the two questions resulting in an index ranging from “0” (= no use of electronic devices at all”) to “3” (= regularly use of at least one or more devices”). The mean value for the index representing the use of technologies was 1.42 (SE 0.60) overall. Related to grades it was 1.40 (SE 0.74) for children of grade 2 and 1.43 (SE 0.46) for those of grade 4.

Table 8: Coding for technologies index formation

Technologies							
Do you read stories or articles using any of the following technologies?				Do you use a PC/laptop at home, a tablet or smartphone, or a game console?			
Computer	Tablet/ipad	Handy/Smartphone	none	every day	several times a week	several times a month	never
1	1	1	0	3	2	1	0

The described indices were calculated for all participants and implemented in the data frame for the statistical analysis using R.

Table 9: Variable from the metadata survey entering the statistical analysis

variable	variable type and range	underlying assumption
older_siblings	chr yes, no	children with older siblings know more anglicisms
reading_behavior_index	num. range: 0 – 3	children who read regularly know more anglicisms and less frequent words
read_aloud_index	num. range: 0 – 3	children who are read to by their parents/grandparents etc. are better readers
technology_index	num. range: 0 – 3	children who use technical devices on a regularly basis know more anglicisms

Table 9 summarizes the variables that emerge from the interview questionnaire via index formation or direct adoption for statistical analysis.

8.6. Triangulation

As cognitive processes elude direct observation, empirical studies in cognitive linguistics work with methods that are both process-oriented (peri-actional) and product-oriented (post-actional) (Burzan 2016, Krings 2005: 348). The methodology, which has become established to investigate the reading process allows recording of the cognitive processes and subprocesses with a so-called online method in order to then triangulate these insights with reading comprehension with the aid of various offline methods such as rating procedures. The methodology is also to be applied to the research question at hand. The online method applied here is eye tracking which has become the preferred method for the investigation of sentence processing or the investigation of reading tasks in general since it delivers “fine-grained information about moment-by-moment sentence comprehension” (Keating & Jegerski 2015: 2). Though, as “eye movement data [...] may appear to be informative, however, without further analysis, raw data are for the most part meaningless” (Duchowski 2007: 137). With this statement, Duchowski first refers to the pure raw data of eye movement measurements, which have to be converted into the known parameters such as fixation durations, regressions, etc. in order to draw conclusions about reading behavior. But ultimately this statement can also be extended to influencing factors of these eye movement parameters, through the correlation of which it becomes possible to discover or describe causal relationships (cf. Rayner 1995, 1998, 2009, Radach 2012) such as word frequency and word length. Without further contextualization, therefore, few specific insights can be gained from the processes of reception, processing and effect associated with visual perception.

For this purpose, data are triangulated and each eye tracking study needs to develop a research design that fits the hypotheses and includes methods to gather the relevant information. In this thesis, different sources of data are combined in order to shed light on a linguistic question, or in concrete terms here, the reception of anglicisms. The data gathered is triangulated to broaden the understanding of the data-driven quantitative analysis.

Triangulation in terms of research means that several sources of data, methodological approaches, analyzing tactics, researchers or theoretical bases serve the superordinate goal to eliminate the weaknesses of the individual sources and benefit from the criteria in total (Flick 2011: 11-17)

Four types of triangulations are distinguished: data triangulation, investigator triangulation, within method, and between method (Flick 2011, Thurmond 2001). Method triangulation (within and between) is also referred to as a mixed-methods approach (Bortz & Döring 2016: 184, Thurmond 2001). In this study, different quantitative data are collected in a combination of methods design in order to gain additional perspectives on the research object under investigation. In this sense, it is a within method, since different quantitative data collection methods are applied in the same study (Thurmond 2001: 254). However, data triangulation also comes into play because corpus-relevant data (frequencies) and other linguistic norms (AoA) are included in the analysis. Krings (2005: 352) refers to data triangulation as the processing of the same questions with different methods. The methodology applied here is thus located under the umbrella of triangulation. The advantage of this approach of triangulating data is that bias effects of the individual methods can be reduced and minimized by taking different perspectives (Flick 2011: 17, Krings 2005: 352, Thurmond 2001).

With this guiding idea of triangulation, the gathered data and information investigating the proposed hypotheses of this thesis are related to each other, and the point here is not that one method or one type of data fully explains the other. As Flick (2011) indicates, following the suggestion of Lamnek (1988), one should operationalize congruence and confirmation of findings through the strategy of triangulation not in the sense of congruence but of complementarity. This means that findings must fit to each other, complement each other, be on the same level, but they do not have to be congruent. In other words, they are related to and around the phenomenon under investigation. However, Flick also points out that in order to be able to assess the complementarity of findings, a much higher - theoretical - effort is required than, for example, to determine a congruence by correlation - computationally (Flick 2011: 19). Therefore, the collected

data and information will ultimately be implemented in statistical models for analysis using the statistical programming language R.

In Figure 15 the concept of data triangulation coming from different methodological approaches for the study design of this thesis is illustrated.

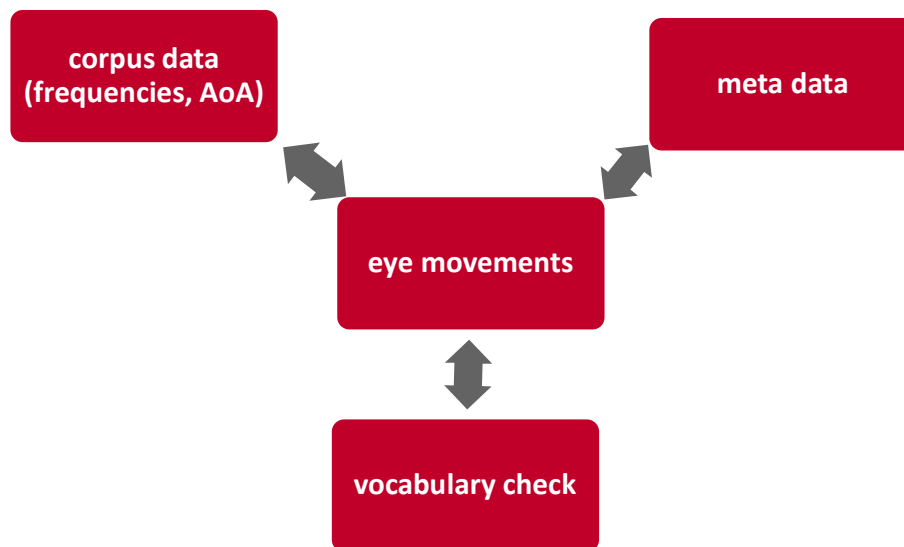


Figure 15: Triangulation of data for the investigation of the reception of anglicisms

The core of the experimental part is the measurement of eye movements, eye tracking, as it is an established method in reading research to investigate questions that deal with the cognitive processes during reading. Since these are not directly accessible, the methodology of eye movement measurement in turn makes use of the fact that there is a correlation between eye movements and cognitive processes (Just & Carpenter 1980). The underlying premise is that the completion or execution of certain cognitive processes during reading leads to certain eye movements, which are mainly described in saccades and fixations and conclude in general assumptions to be drawn about the distribution, depth and ranking of cognitive processing power, since there are strong interdependencies between eye movement and the overall visual information processing (for an overview see Radach 1996: 9 ff and chapter 7.1.3 of this thesis).

The experimental design also included a vocabulary check of the stimuli applied in the eye tracking experiment. It was conducted within an interview situation as one of three tasks of the empirical data acquisition. The data is reviewed to potentially back up the eye movement data as the information represents the productive vocabulary of the participants. The procedure and findings are described in section 8.3.

As further components, corpus linguistic norms (word frequencies, AoA) and semiotic characteristics (word length) were included in the methodological compilation of the stimuli as well as in the statistical analysis. The compiling of the reading material is described in section 8.3 of this chapter.

Variables related to sociodemographic characteristics and identified from previous studies as influencing the reception of anglicisms (Gäbler 2013) were collected using a standardized interview questionnaire. The procedure as well as the conversion method of these qualitative data collection elements into quantitative data on the basis of previously defined evaluation criteria and categories is described in section 8.5.

Quite simply put, a great deal of data focusing on or relating to the phenomenon of the linguistic reception of anglicisms by school children was collected and pooled for statistical analysis. All data was gathered via quantitative methods resulting in numerical or factorial variables for the analysis. In this sense, a combination of methods (quantitative - quantitative) is applied here, which results in a triangulation of the data, which should lead to a picture of the research object that is as holistic as possible and to validate results of one strand of methods (Kuckartz 2014: 58).

8.7. Test set-up and realization

The experiment consisted of three parts: the eye tracking experiment, the interview questionnaire and the vocabulary check. Therefore, three stations were set up. At the first station, as presented in Figure 17, the eye tracking experiment was conducted. At the second station the two other components were executed as presented in Figure 18. The survey could be conducted in the same room. By shading the windows with blinds and the use of artificial light, it was possible to realize consistently comparable lighting

conditions for the registration of eye movements. The SMI RED 250 Mobile eye tracker provided by the TRACO Laboratory was used, which is mobile and can be used with a sampling rate of 250 Hertz with a 23-inch monitor, on the lower edge of which the infrared unit is mounted. It is an infrared based video-eyetracker, which works contactless. The SMI Experiment Center is used for programming and execution of the experiment. The test persons' statements during the metadata query and vocabulary check were recorded with a dictation machine and were then available as mp3 files. A notification to conduct a scientific investigation in schools was submitted to the competent authority and approved.

A time frame of approximately 30 to 45 minutes per participant was estimated for the complete experiment. This should consider the fact that the participants are children, and it was assumed that the concentration capacity cannot be maintained longer than a normal school hour lasting 45 minutes. A further aspect in limiting the time frame to this was the acceptance for implementation in the cooperating schools since the experiment had to take place during school hours and the children should not be impaired in their learning process. The time frame and the technical set-up was tested ahead of time. Therefore, a short piloting preceded the actual experiment. Three participants (1 female, mean age 7.66 and SD 1.82) went through all three stations of the experiment. The following sequence in the experiment was followed per participant (Figure 16). A detailed script in list form was created to guarantee the identical sequence. This schedule can be found in the Appendix.



Figure 16: Schematic representation of the test procedure for each participant

A schedule was also created for the technical setup in the form of a check-up in order to routinize and standardize the technical part as well (see Appendix). This included setting up the technical equipment and setting up the three stations.

Depending on class level and reading skills, the three tasks of the eye tracking experiment, the metadata query and the vocabulary check took 25 to 35 minutes. Since participants had to be accompanied from and to their respective classes, the time frame worked out. On the way to the room where the experiment was set up, the participants were familiarized with the procedure and the individual tests were explained. It was not revealed that the subject of the experiment was the investigation of anglicisms in order to ensure an unbiased reading attitude. After entering the room, due to the prevailing COVID pandemic, the hands were first washed at the hand basin and the windows opened for ventilation were closed.²³ The children took a seat at the equipped eye tracking station and the chin rest and chair were adjusted to the appropriate size to ensure a comfortable sitting position. The chin rest guaranteed a constant distance of the children's eyes to the monitor of 57 cm to 61 cm. The children could now remove their face mask.

²³ A hygiene plan for the implementation of the experiment was developed and submitted to the competent authority together with the notification for implementation at schools. The hygiene plan is based on the introduced *Hygieneplan-Corona* for schools in Rhineland-Palatinate and was developed to ensure compliance with the Infection Protection Act during the experiment. The hygiene plan is part of the Appendix.



Figure 17: Station 1: Eye tracking, experimenter (left image) and participant (right image)

The eye tracking experiment was started with a calibration followed by a validation in order to equalize the individual anatomy of the human eye as well as situational influences of external parameters (light conditions, sitting position, distance to the infrared light source). The target value for the calibration was 0.5° (Conklin et al. 2018: 76, Holmqvist et al. 2012: 46). The calibration and validation was repeated after each sixteen sentences. The children were asked to read the sentences which were displayed on a single line of text silently²⁴ for comprehension at their own pace. Beforehand, a ‘code word’ was agreed upon with each participant, which the children said after

²⁴ As discussed in section 7.2.4, the reading mode aloud or silent is not neglectable when considering the observed gaze time measures. Here, the argument of Joseph et al. (2013) is followed and it was chosen to ask the children to read silently. Within their paper they argue that reading silently is the more natural behavior and allows children to feel more comfortable in the experimental situation. They also point out an important aspect: reading aloud is argued to be an offline method because it reports the end point of a cognitive process, namely the product. As eye-tracking is an online method, recording the cognitive processes underlying reading it only seems logical to apply silent reading.

finishing each sentence, so that the examiner could press the continue-button. The sentences appeared in Arial font (font size 36) as black against light grey background. The experimental sentences were split in two lists (a and b). Half the children read list a (containing all conditions) and the other half read list b. The purpose of this was to ensure that all children read all conditions but did not read any sentence frame twice to prevent repetition effects. The sentences within the lists were randomized.



Figure 18: Station 2: Interview questionnaire and vocabulary check

A standardized interview survey followed the eye-tracking experiment in order to gather metadata such as a biographical and reading behavior information. The last task was a vocabulary check where the children were asked to give short definitions of the concrete nouns being the target words within the eye tracking experiment (here the children answered the other half of stimuli they had not seen within the eye tracking experiment).

8.8. Summary

The purpose of this chapter was to show how eye-tracking in combination with other quantitative methods can be used to describe the reception behavior of school children when they read anglicisms in the sense of a triangulation of data (sections 4.2 to 4.5). Section 8.7 gave an overview of the realization of the experimental design on-site. Considerations about the participants and the description of the composition of the population were assessed within section 4.1.

Essentially, eye tracking in combination with other methods can shed light on research questions concerning cognitive processes and here provide authentic quantitative data for the description of the reception of anglicisms directly compared to matched German words. In terms of ecological validity, research conditions that are as close as possible to those of natural everyday life should be aimed for (Döring & Bortz 2016: 106). Here, this was considered by using a mobile eye tracker device in the sense of a field experiment - albeit with some limitations - because not every child could be examined in the child's home, but nevertheless in an environment that was well known to them. The feedback of the test persons from the pilot project and the experiment itself was positive. Some children reported that they enjoyed the experiment a lot and would like to participate again. This feedback was very important as it showed that the material and the duration of the experiment did not overstrain the children and that their motivation was high.

9. Analysis

In the following chapter, the data description and data preparation are described, and the statistical research methods are presented. The measurement variables and their influence for the analysis are explained to provide a concise overview of the actual analysis. The statistical analysis using linear mixed effect models concludes the chapter.

9.1. Data description and data preparation

The eye tracking recordings were transferred from the SMI Experiment Center (version 3.7) to SMI's neighboring BeGaze analysis software (version 3.7). Since the evaluation of eye movement times and parameters aimed at a direct comparison of anglicism and German word, all relevant stimuli were first assigned AOIs and coded according to the study design to be able to unambiguously assign the AOIs to the stimuli at any later time. In a second step, data sets were reviewed where AOIs had no hits. The AOIs were either adjusted if, for example, in general the line of gazes ran above or below the sentence. In this case, often other sentences of this participant showed the same above or below gaze lines within a certain period and this could be explained by the unfortunately not completely controllable lighting conditions in the classroom. It was not possible to entirely prevent sunlight incidence by the classroom's shading; pure laboratory conditions could not be established. To take this into account a manual review of the material helped to correct and center the gaze line if necessary.

Word-level eye movement parameters were computed from the eye tracking data. The dependent variables for the statistical analyses are: First Fixation Duration (FF) being the duration in [ms] of the initial fixation of the AOI. First Pass Gaze Duration (GD) being the duration of all fixations within the AOI during first pass reading in [ms] before the eye leaves in either direction. Total Fixation Time (TT) in [ms] being the sum of all fixations made on the AOI and the Probability of Revisit (RV) which is a two-level variable for all observations (0 if the AOI receives no revisit and 1 if there are one or more revisits to the AOI). All required descriptive characteristics (e. g. participant, recording, AOI name, AOI group) were imported into Excel using a CSV file. Records from 16.6% of the participants had to be excluded immediately. In these cases, the experiment was terminated before completion (four participants) because they were extremely slow readers, or the raw data could not be used due to poor data quality. For one participant the calibration was impossible, and recording was not possible for another participant due to very thick lenses of the glasses. After cleaning the data, 1245 observations entered the analysis. Children of grade 2 took an average of 8:11 minutes to read 36 sentences (SD = 0.11), and children of grade 4 took an average of 5:58 minutes (SD = 0.08) to read 52 sentences.

The means and standard errors of the measured target eye movements are summarized in Table 10.

Table 10: Descriptive statistics for target measures; fixation times in [ms], probability percentage/100

	Measure	Word length	Frequency	Stimulus Type			
				Anglicism		German word	
				M	SE	M	SE
Grade 2	First Fixation Duration (FF)	Long	High	1373	241	1763	317
			Low	1533	207	1158	166
		Short	High	1161	160	1262	166
			Low	1458	139	1307	193
	First Pass Gaze Duration (GD)	Long	High	2345	339	2076	316
			Low	2450	291	1991	238
		Short	High	1731	189	1574	183
			Low	1982	179	2159	215
	Total Fixation Time (TT)	Long	High	3459	303	2750	309
			Low	3929	285	2621	204
		Short	High	2587	225	1988	169
			Low	2771	166	2711	213
	Probability of Revisit (RV)	Long	High	0.49	0.08	0.43	0.08
			Low	0.56	0.07	0.44	0.07
Short		High	0.43	0.06	0.41	0.06	
		Low	0.44	0.06	0.42	0.06	
Grade 4	First Fixation Duration (FF)	Long	High	739	111	594	59
			Low	460	48	624	56
		Short	High	557	46	449	30
			Low	615	53	705	72
	First Pass Gaze Duration (GD)	Long	High	1103	161	885	78
			Low	875	82	923	71
		Short	High	714	67	496	35
			Low	814	67	926	95
	Total Fixation Time (TT)	Long	High	1472	157	1164	94
			Low	1588	115	1407	100

Probability of Revisit (RV)	Short	High	1174	95	734	46
		Low	1408	97	1371	102
	Long	High	0.43	0.06	0.36	0.06
		Low	0.51	0.05	0.44	0.05
	Short	High	0.56	0.05	0.40	0.04
		Low	0.55	0.05	0.53	0.05

The overview of the descriptive summary reveals the expected developmental differences. The measured gaze times were consistently larger on average for children of grade 2 ($p < 0.01$). The dispersion in terms of SE was also greater among young beginning readers. This observation is consistent with existing observations (Radach et al. 2012) in that the wider spread reflects broader individual word recognition problems, which diminish over time in advanced readers. Likewise, from the descriptive perspective, the influence of the word type (anglicism vs. German word) on the mean gaze times has a greater impact for children of grade 2 ($p < 0.01$) than for children of grade 4 ($p < 0.05$). Therefore the data of the gaze time samples were analyzed in pairs using a t-test. Figure 19 shows, that the impact of the word type itself (in general, including both participant groups) only had an effect on the probability of revisit, when the words are controlled for length and frequency.

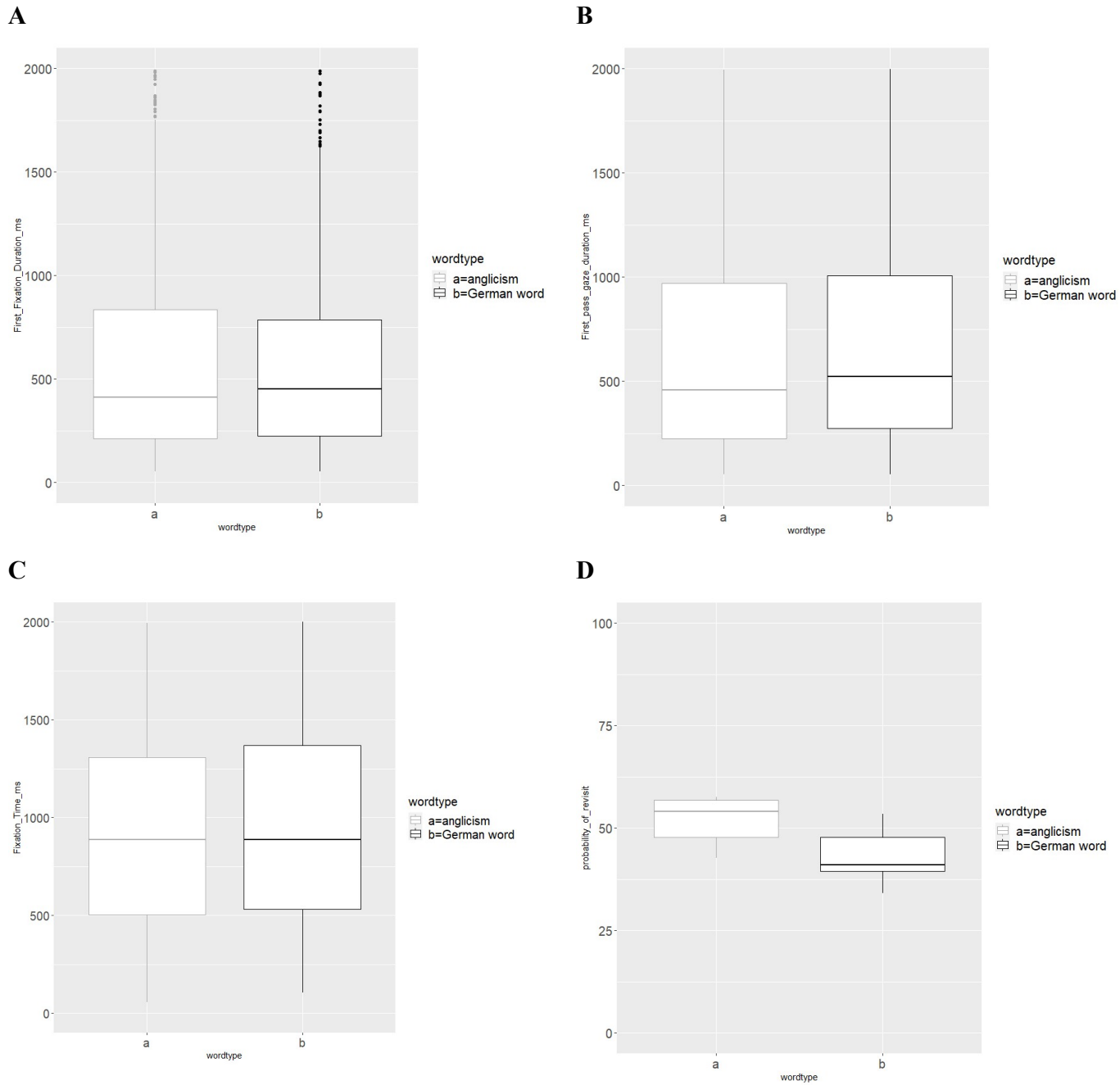


Figure 19: Visualization of the descriptive statistics, comparison of reading time measures for (a) FF, (b) GD, (c) TT and (d) RV

Values for probability of revisit were also consistently greater for anglicisms ($p < 0.01$). Also, for probability of revisit, both children of grade 2 ($p < 0.1$) and children of grade 4 ($p < 0.05$) showed a smaller percentage in German words throughout all conditions. Here, as well, the developmental advantage has an obvious impact.

The rating data of the AoA entered the analysis and were formed of mean values as described in section 8.3.2. The indices describing the lexicon of the children, the reading behavior and familiarity with technologies were built as described in section 8.4 and section 8.5 and were implemented as numerical variables in a data frame for the analysis.

9.2. Statistical analysis

Multiple regression analyses in the form of linear mixed effects models (LMEs) have demonstrated to be a powerful tool to describe the relations and dependencies of experimentally measured data in psycholinguistics. The aim of a psycholinguistic experiment using eye tracking is to explain the measured dependent variable (FF, GD, TT and RV) by means of its variance due to independent variables, which may be fixed or random effects. For reading experiments, LMEs have great advantages as they make it possible to consider the multiple correlations of several independent variables with the dependent variable at the same time (Balling 2008: 177). Further, in addition to the fixed effects being the coefficients (intercept, slope), random effects also representing the variances of the intercepts or slopes across groups are implemented within a model. This allows inclusion of random variation, typically for participants and items, so that the model considers the individual differences e.g., in overall reading speed of a participant.

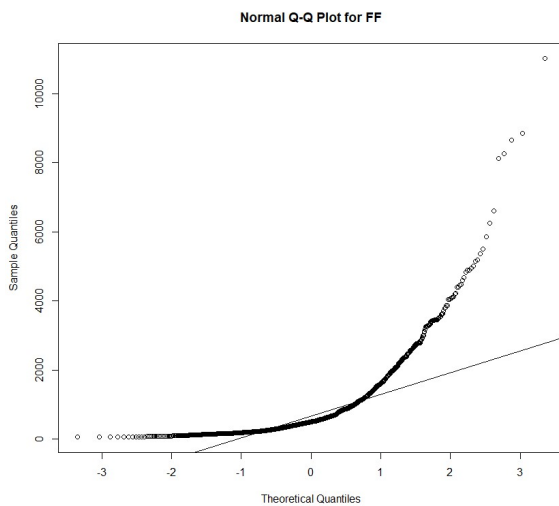
All statistical analyses were calculated using R (R core team 2021). R is a programming language and environment for statistical analyses and their graphical representation. The associated user interface is RStudio. Models were computed using the package `lme4` (Bates et al. 2015) and their graphical representations were created using `effects`-packages (Fox & Hong 2009) and `jsPlot` (Lüdecke 2021). The graphs for description were created with the `ggplot2`-package (Wickham 2016). In addition, the packages `lmerTest` (Kuznetsova et al. 2017) were used to evaluate the LMEs in terms of their effect sizes, variances, standard errors, and for significance testing, `MuMIn` (Bartón 2020) for the coefficient of determination R^2 describing the goodness of model fit, moments (Komsta & Novomestky 2015) for considering the residuals of individual models, and `emmeans` (Lenth 2021) for contrasting models. For the evaluation of

descriptive statistical values and testing of homogeneities and variance differences, the packages psych (Revelle 2020) and car (Fox & Weisberg 2019) were used. To describe effect size the package lsr (Navarro 2015) was used.

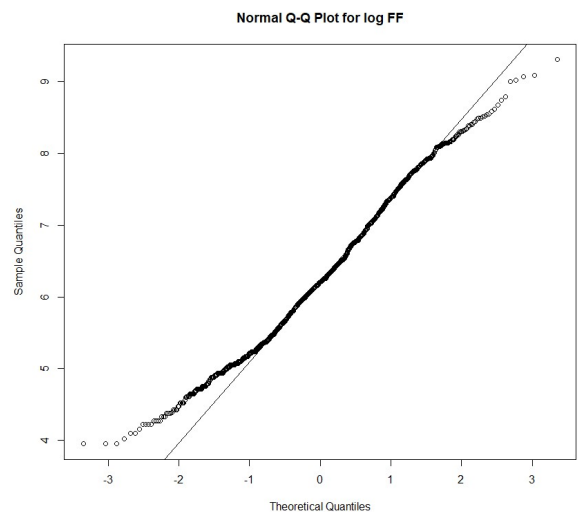
The reading time measures were skewed and consequently log transformed. The test for normal distribution of fixation times was performed with the command qqnorm and qqline from the ggplot2-package showing that log transformation is required (see Figure 20).

Besides excluding incomplete trials and obviously unusable trials as described in section 9.1, for FF, GD and TT reading times $>|2.5|$ SD were removed for each participant before entering the models using a R command. As a result, for FF 1 % ($n = 12$), for GD 3 % ($n = 36$) and for TT 2 % ($n = 24$) trials were removed. For each reading time measure (being the dependent variable) a linear mixed effect model was built. In all models, participant and item were entered into the model as random factor with varying intercepts and random slopes in order to account for variance between subjects and between items for the fixed effects (and interactions) within the respective model.

Q-Q Plot for dependent measures



Q-Q Plot for dependent measures log-transformed



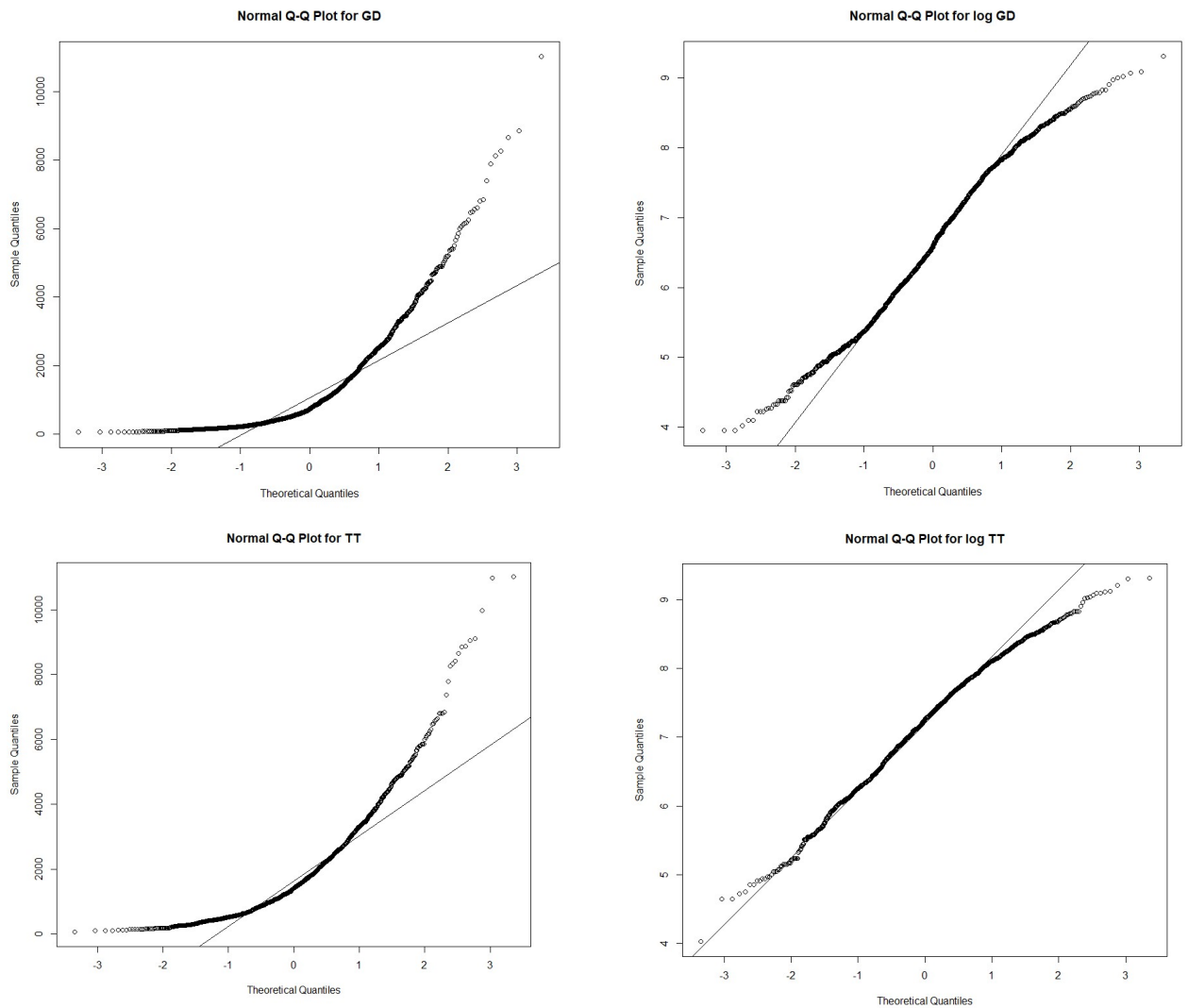


Figure 20: Q-Q Plots of the dependent measures FF, GD and TT (left) and log-transformed (right)

Since a large number of values and input data were obtained from the data collection, which can now be included in the model as variables in the form of covariates, fixed effects and random effects, the model selection must be carried out carefully. It has become standard to create a maximum model, including the maximum structure of random effects justified by the design ('maximal model'; Barr et al. 2013). However, this may be too conservative if the maximum structure is not present in the data. A compromise can be found in performing an iterative reduction in complexity as suggested by Bates et al. (2015). Likewise, within this analysis, the attempt was not to create 'maximal' models here, but rather with selected variables depending on the hypothesis.

Basically, lmes are used to express the relationships in the given experimental data in terms of a function and their effect sizes. For all models in the analysis the word type (“anglicism”) is a fixed effect. As the main interest of the study is the relationship of the word type, the basic model looks like this:

Dependent variable (FF, GD, TT, RV) \sim wordtype + ϵ

In addition, there is another fixed effect, the word frequency which was experimentally controlled for. Therefore, the formula looks like this:

Dependent variable (FF, GD, TT, RV) \sim wordtype + frequency + ϵ

ϵ represents the “error term” and accounts for the variations from the predictions due to “random” factors that cannot be controlled for experimentally. In linguistic studies the random factors are usually “item” and “participant”. Due to the study’s design, the dataset contains multiple entries for reading times by the same person for both word types (anglicism and German word). It would be wrong to regard multiple responses from one person independent from each other. Therefore, a random effect for “participant” is added to the equation as it can be assumed that each participant has his or her own baseline dealing with irregular phonetic words. The formula expanded by the random effects basically looks like this:

Dependent variable (FF, GD, TT, RV) \sim wordtype + frequency + (1|participant) + ϵ

Furthermore, it has become established in the linguistic context to also expect by-item variation. This is for example a variation for certain stimuli, as there might be something special about the word “Abakus” which will lead to an overall longer viewing time regardless of the word’s frequency. In that case if this applies for (almost) all of the participants, the responses cannot be regarded as independent when multiple viewing times by different participants if there is a similar effect. Therefore, by-item variability is added to the model:

Dependent variable (FF, GD, TT, RV) \sim wordtype + frequency + (1|participant) + (1|item)

Within this format the influence of differences between individuals in the direction and size of an effect is not yet considered. In order to not only account for individual

differences in the mean across all conditions (via random intercepts, included in the model by the notation $1|participant$), but also for individual differences in the effect (size and direction of the experimental effect), it has become usual to include random slopes that may differ across individuals (using the notation $1 + wordtype|participant$). As Oberauer (2022) suggests, the analysis should be started by testing the support for random slopes within the experimental data. In case this cannot be proven, the structure can be removed from the models. The design justifies random slopes for participants because the children reading the material may differ in their personal reading times, some may have difficulties reading less frequent words and others may not. However by-item random slopes are considered not to be justified for the fact, that each word has an unique level of frequency and is only read by the participant in one condition with regards to the predictor of interest (word type). Due to this consideration regarding the study's design, the random effect's structure ($1+wordtype*frequency|participant$) + ($1|item$) was applied for the lme-model analysis. By this, all random slopes that are justified by the experiment's design are included in the models (cf. Barr et al. 2013). It is expected that the participants differ in the way they react to the experiment's manipulation. By including random slopes for the manipulation that the experiment aims at, the "+ ϵ " rate (error rate) should be minimized.

Before running the analysis, the random effects structure was accounted for. In order to properly address the effect of word type, representing the difference between the two experimental conditions, 'word type' and 'frequency' were included as within-participant factors. Using an anova, it was tested separately for each dependent variable which random effect's structure fits a null model best to consider stochastic variability in the data set. This way the effect of the individual reading time measures was accounted for that were moderated by the variables word type and word frequency. The pre-tested random effect structure was applied for the rest of the analysis for each dependent variable.

Separate LMEs were constructed for the dependent variables (FF, GD, TT and RV). The initial measures First Fixation duration (FF) and Gaze Duration (GD) are at the beginning in the temporal sequence of the cognitive processing process and indicate low level processing like visual word recognition and are particularly sensitive to parameters

like word length and word frequency. Total Time (TT) is a measure that plays a role much later in the processing process and is indicative of greater depth of processing. TT is used in conjunction with syntactic-semantic reception and the recognition of cohesive structures. Another dependent variable examined was the Probability of Revisit (RV), i.e., whether a word was refixed after the first fixation. If the next fixation on the following word is initiated directly after a fixation, it is assumed that there are no problems with processing. However, if several fixations follow the same word, this may indicate that there are comprehension problems.

First, for all measured dependent variables (FF, GD, TT and RV) a full model was created where all fixed effects (control variables) were included. These were: word type (anglicism vs. German word), word length, word frequency, Age of Acquisition and grade. Findings from the metadata analysis regarding the participants, such as older siblings, their reading behavior, technology knowledge, and the effect of reading aloud to children also found entrance into the models, as indices were built (except for older siblings which is a two-dimensional variable) as described in section 8.4 and 8.5. The models then were simplified by removing fixed factors that were near-perfectly correlated (such as the frequency of the stimuli and their AoA) with others as long as the model fit was not reduced. To check for collinearity of the fixed effects the variance inflation factors (VIF) were calculated.²⁵

For all final models, the residuals were inspected using diagnostic visual plots (qq-plots) to confirm no major deviations from homoscedasticity or normality.

Interaction models were built as reported in Table 11 to check the interaction effects presumed by the hypotheses, based on the reduced model. Finally, after testing the individual variables, a 3-way model was calculated in order to statistically correlate the

²⁵ As Zuur et al. (2010) illustrate, collinearity or the correlation between fixed effects can lead to confusing statistical analysis because it may happen, that no covariate is significant, however when dropping one covariate, others may become significant. This is due to the mathematical expression representing the variance of the covariate. By removing highly correlating covariates from a model, the p-values of the remaining fixed effect drops, and a real effect can be revealed.

affiliation to an age group (children of grade 2 versus children of grade 4) with the frequency effects and the anglicisms for each gaze time measure.

Table 11: Lmes for analysis

Dependent variable	Name of the model	Interaction
FF	FFfull	no interaction, full model
	FFred	no interaction, reduced model
	FFint_type_freq	wordtype*frequency
	FFint_type_AoA	wordtype*AoA
	FFint_type_oldersib	wordtype*older siblings
	FFint_type_technology	wordtype*technology_index
	FFint_type_readingbeh	wordtype*reading_behavior_index
	FFint_type_readaloud	wordtype*read_aloud_index
	FF_3way	wordtype*frequency*age
GD	GDfull	no interaction, full model
	GDred	no interaction, reduced model
	GDint_type_freq	wordtype*frequency
	GDint_type_AoA	wordtype*AoA
	GDint_type_oldersib	wordtype*older siblings
	GDint_type_technology	wordtype*technology_index
	GDint_type_readingbeh	wordtype*reading_behavior_index
	GDint_type_readaloud	wordtype*read_aloud_index
	GD_3way	wordtype*frequency*age
TT	TTfull	no interaction, full model
	TTred	no interaction, reduced model
	TTint_type_freq	wordtype*frequency
	TTint_type_AoA	wordtype*AoA
	TTint_type_oldersib	wordtype*older siblings
	TTint_type_technology	wordtype*technology_index
	TTint_type_readingbeh	wordtype*reading_behavior_index
	TTint_type_readaloud	wordtype*read_aloud_index
	TT_3way	wordtype*frequency*age
RV	RVfull	no interaction, full model
	RVred	no interaction, reduced model
	RVint_type_freq	wordtype*frequency
	RVint_type_AoA	wordtype*AoA
	RVint_type_oldersib	wordtype*older siblings
	RVint_type_technology	wordtype*technology_index
	RVint_type_readingbeh	wordtype*reading_behavior_index

	RVint_type_readaloud	wordtype*read_aloud_index
	RV_3way	wordtype*frequency*age

9.3. First Fixation

The experimental paradigm for the investigation of the reception of anglicisms in the context of this study is based on the conceptual assumptions of dual-route cognitive models. These state that word recognition in reading occurs via either the direct route or the lexical route, namely by conversion of the orthographic form of a word into its corresponding phonological word form together with retrieval of its semantic representation in memory. This is based on the assumption that irregular and phonetically regular words are read in the same way, since the lexical route retrieves the pronunciations of the words in their entirety from the memory.

By contrast, the indirect route operates with the conversion of GPC rules. This process is more small-scale and first decomposes a word into its graphemic equivalents which are then translated into a phonemic construct by applying the GPC rules. Only then, and after successful assembly and translation, can the semantic representation be accessed.

The assumption investigated when analyzing the reception and gaze times of reading anglicisms in beginning readers is that the indirect route naturally fails and the semantic representation of an anglicism can only be accessed by the direct, lexical route.

Therefore, it is assumed that the word length effect is larger for regular pronounced German words than for the matched anglicisms. The development from the sub-lexical analytical rule-based transformation of GPCs within beginning readers to the application of the lexical route has been proven (e. g. Rau et al. 2014). By the investigation of the reception of anglicisms it can also be shown that especially long anglicisms may be decoded faster than long matched German words as they are “long enough for lexical access to be faster than full serial decoding” as argued by Rau et al. (2014: 231). They also suggested as a result of their study that “the transition from predominant use of this sublexical reading strategy to predominant use of lexical word recognition are likely to develop in parallel” (ibid.: 232). For this, a focus within the analysis is set on the interaction of the variables age, the frequency of the target words and the word type.

According to the postulated hypothesis, assumed effects were tested using linear mixed effects models. The zipf scale introduced by van Heuven et al. (2014) for the normalization of frequencies was used for better comparability of the data²⁶.

For each dependent variable FF, GD, TT and RV a three-way interaction of grade, word type and frequency were run. Further, the word length's influence was investigated by running an analysis where the categorized stimuli entered.

Further, the assumed influences of the socio-demographic aspects entered the analysis as random factors (1 + socio-demographic aspects | Participant).

First, the visual representation of the descriptive statistic shows that there is little difference in terms of gaze durations for FF with respect to word type within an age group. A t-test confirms this observation for both, children of grade 2 ($t = 0.129$, $p =$

²⁶ As van Heuven et al. state, the dependence of word frequencies on the size of the respective corpus is a major problem because absolute numbers are difficult to interpret. Therefore the following conversion has been applied: $\log_{10}((\text{raw data}/8.000.000)/1.000.000)+3$

0.896) and children of grade 4 ($t = 0.777$, $p = 0.437$). The gaze times for the older children were shorter, as expected, and in addition, there was less variation.

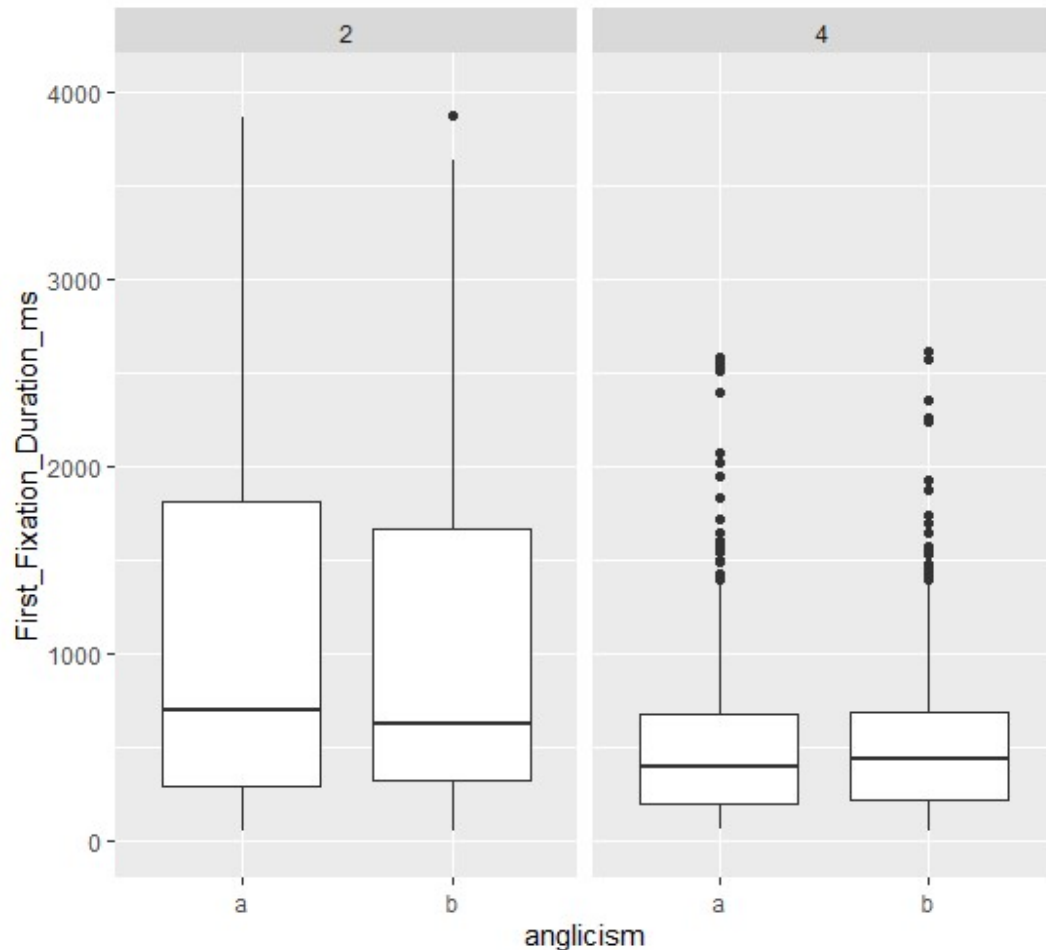


Figure 21: Visualization of the descriptive statistics of FF for anglicisms (a) and German words (b) for children of grade 2 (left) and children of grade 4 (right)

As stated in section 7.2 the information of recording eye movements can be interpreted in different ways based on the assumptions and findings from reading research and the associated gaze behavior. In general, it can be said that longer fixation times indicate complex structures or difficulties in decoding (Radach et al. 2012, Joos et al. 2003). The dependent variables recorded in this experiment differ with regard to the time of measurement and can be attributed to a specific processing stage in the reception process. They can thus provide information about difficulties. Initial measured variables such as FF and GD are located at the beginning of the processing process and are

accordingly attributed to low-level processing such as visual word recognition. Influencing factors at this stage are mainly word length and word frequency. Later in the processing stage are the total reading time (TT), which is attributed more to coherence formation and syntactic reception.

9.3.1. Full model for FF

The initial model included the random structure as motivated in section 9.2 as well as all controlled variables and fixed effects. The model investigates the effects of the fixed effects and covariates on FF. As shown, only grade and the AoA were significant for FF.

As argued in section 9.2, the random effects structure including random slopes for participant was included considering the individual effects of word type and the words' frequency.

A full model was run to test main effects that looks like this:

```
FFfull <-lmer(log(First_Fixation_Duration_ms) ~ word type + Grade +  
AgeofAcquisition + frequency + older_siblings + wordlength + reading_behavior_index  
+ technology_index + read_aloud_index + (1 +anglicism*Childlex_F| Participant) + (1 |  
item), data = EOFF)
```

Table 12: Results of FFfull for FF

fixed effect	β	SE	df	t	p	sig
word type	0.031	0.056	59	0.540	0.591	
grade	-0.640	0.152	24	-4.202	0.000	***
AoA	0.003	0.001	94	2.531	0.013	*
word frequency	-0.002	0.002	33	-0.877	0.387	
older siblings	0.075	0.155	24	0.490	0.629	
word length	-0.006	0.059	92	-0.105	0.916	
reading behavior index	-0.137	0.122	24	-1.125	0.272	
technology index	-0.113	0.127	25	-0.890	0.382	
read aloud index	0.035	0.070	23	0.503	0.620	

As this model is overparametrized, it was reduced, removing non-significant covariates while keeping the control variables word length and word type as basis for the further interaction models. The R^2 values for both models were similar (0.29 for the full model, 0.28 for the reduced model), in an anova there was no significant difference in performance and also AIC were almost the same (3170 vs. 3172). As is also evident from Figure 22, word frequency had the predicted effect for FF: the higher the frequency is, the shorter was the mean gaze time for FF.

With regard to the main research question of the influence of frequency, a statistical significance was not found. On graphical means, as Figure 22 shows, the frequency effect for the FF is small - respectively non evident.

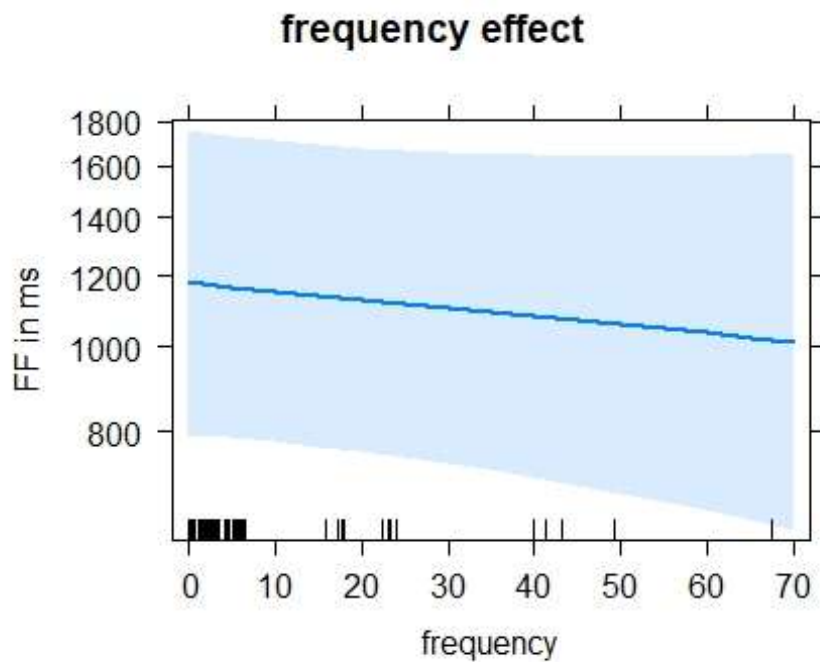


Figure 22: Frequency effect on FF

The reduced, optimized model structure for FF is applied for the following interaction model and looks like this:

```
FF <-lmer(log(First_Fixation_Duration_ms) ~ word type + Grade + frequency +
wordlength + wordtype* variableofinterest + (1 +wordtype*frequency| Participant) + (1
| item), data = EOFF)
```

9.3.2. Interaction of word type and frequency for FF

Within this model of FF, no significant effect for the interaction exists that would suggest an influence of phonological structure on reading strategy ($\beta = -0.00$, $SE = 0.00$, $df = 59$, $t = -0.32$, $p = 0.751$). As Figure 23 shows, the frequency patterns of the target words (anglicisms and German word) influence the gaze times of FF, however no significant difference appeared between the word type. There is no difference for FF either children encountered an anglicism or a German word.

interaction wordtype and frequency

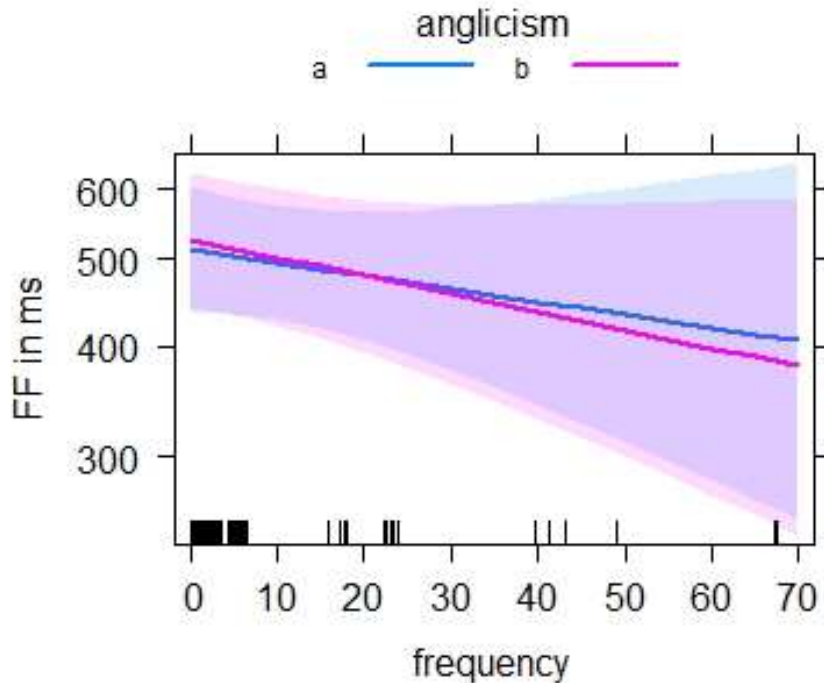


Figure 23: Two-way interaction of word type and word frequency for FF

9.3.3. Interaction of word type and AoA for FF

Analogous to the previous model, the interaction effect of word type and the AoA was investigated. Note here that two separate lmes were built, as frequency and AoA correlate (which was proved by running a Pearson's correlation test with $p < 0.001$). The effect of the AoA with regards to the word type was not significant either ($\beta = -0.00$, $SE = 0.00$, $df = 98$, $t = 1.10$, $p = 0.276$). However, as Figure 24 shows, an overall effect of AoA is visually and statistically present in terms of a smaller – yet not significant p-value - resulting in shorter gaze times for FF for earlier learned words. This effect – although not significant – is more pronounced for German words than for anglicisms.

interaction wordtype and AoA

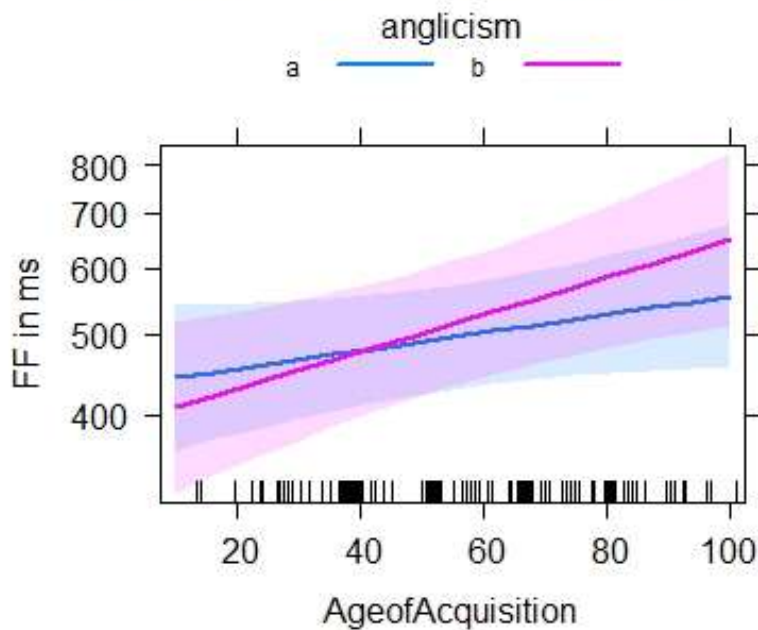


Figure 24: Interaction effect of wordtype*AoA

9.3.4. Interaction of word type and older siblings for FF

To test the further hypotheses, interaction models with the respective effects to be examined were tested for the reading behavior of anglicisms.

The following observations were made: the presence of older siblings (H4) correlates positively, which means that the expected effect does not occur here, but that children with older siblings do not have any advantages in reading anglicisms and that higher gaze times are observed for German words ($\beta = 0.12$, $SE = 0.10$, $df = 122$, $t = 1.16$, $p = 0.247$).

interaction wordtype and older siblings

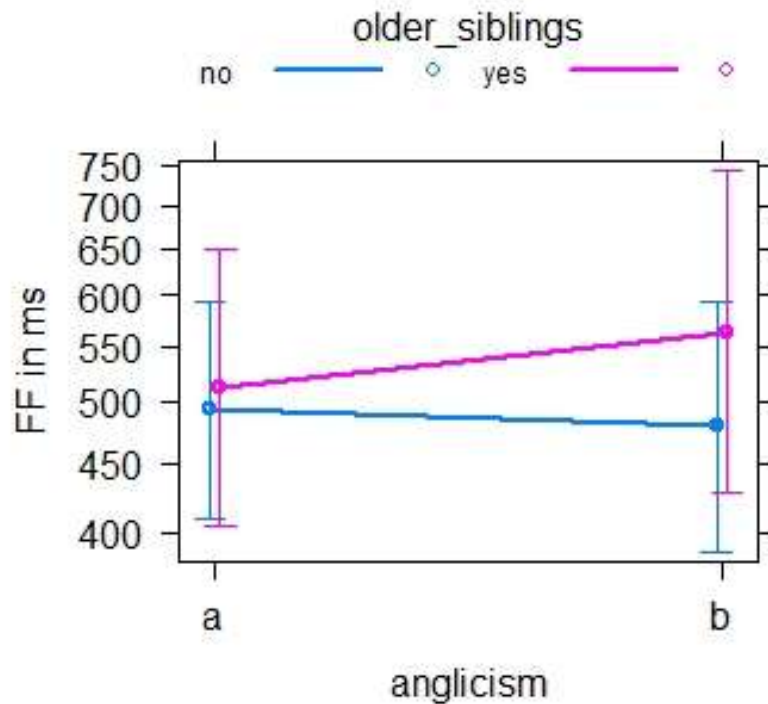


Figure 25: Interaction of word type*older siblings

9.3.5. Interaction of word type and technology use for FF

Likewise, no effects with regards to the reading proficiency of anglicisms due to the use of technology devices (H5) was revealed by the distinctive interaction model ($\beta = -0.01$, $SE = 0.09$, $df = 103$, $t = -0.13$, $p = 0.900$). As Figure 26 shows, there is almost the same effect for anglicisms and the German words with regards to the use of technology for FF.

interaction wordtype and technology

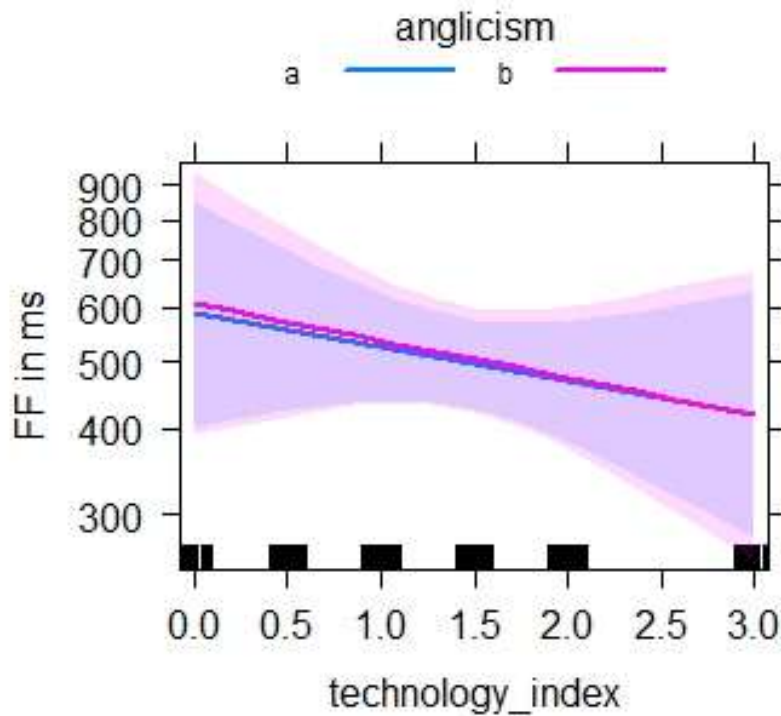


Figure 26: Interaction effect of wordtype*technology_index

9.3.6. Interaction of word type and reading behavior for FF

Likewise, no effect was encountered for the overall reading behavior of children that would lead to shorter viewing time in favor of anglicisms ($\beta = -0.07$, $SE = 0.07$, $df = 100$, $t = -0.95$, $p = 0.342$) as illustrated in Figure 27.

interaction wordtype and reading

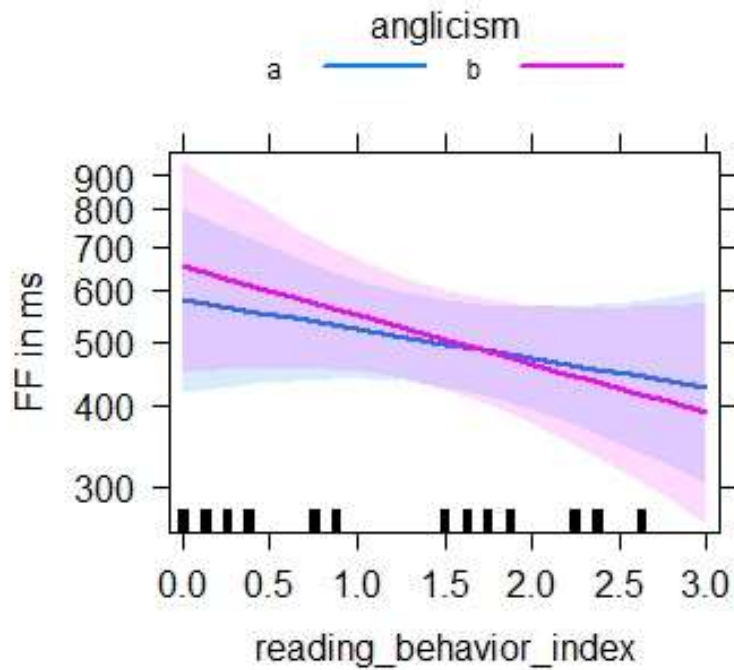


Figure 27: Interaction effect of wordtype*reading behavior for FF

9.3.7. Interaction of word type and reading aloud to children for FF

The influence of the children's exposure to phonological input by having persons reading to them (H6) was equally neglectable ($\beta = -0.03$, $SE = 0.04$, $df = 100$, $t = -0.68$, $p = 0.497$).

interaction wordtype and r.aloud

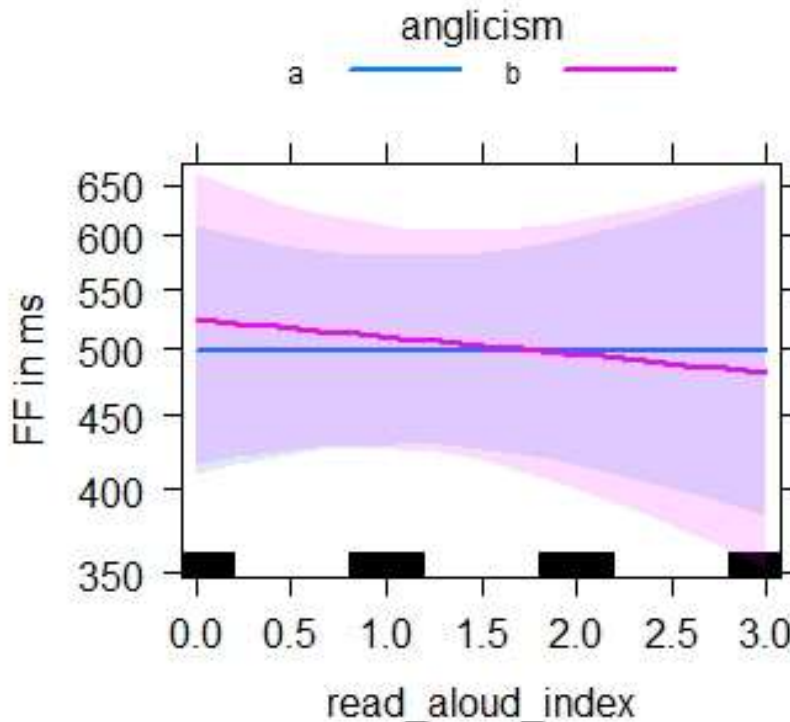


Figure 28: Interaction effect of wordtype*read aloud for FF

9.3.8. Summary

Significant results regarding the influence of different phonological features in reading anglicisms for FF are consistently found only for the developmental aspect.

In relation to the formulated hypotheses, it can be said that for the early processing stage in the reading process represented by the independent measure FF no significant findings for the word frequencies can be found (H1). Likewise, AoA does not significantly influence the reading behavior of anglicisms (H2). The only variable that is significant throughout with $p < 0.001$ is grade representing the developmental component supporting H3. The early eye movement measure FF is associated with low-level processing features of the reading process. Mainly, word recognition is attributed to this stage (Rayner 1998, Radach 1996). As there is no significant difference for the word type, the question is, if only the orthographic representation is activated or if

phonological and semantic features of the lexicon are already accessed in this early stage.

The data further showed no significance for the 3-way interactions of word type, frequency and grade or wordtype, AoA and grade. A stronger effect was assumed here, as it is a “benchmark phenomenon” in the literature that the effect of frequency is greater for irregular words (here: anglicisms) (Rayner & Reichle 2011). This was not confirmed with the data set here.

9.4. Gaze Duration

Again, a visual representation of the descriptive statistic was first created, showing that also for gaze durations for GD no significant difference with respect to word type can be observed. For both grade levels, gaze time on anglicisms are similar overall. An obvious effect of age is clearly detectable (Figure 29). A t-test for the word type showed no statistical significance neither for children of grade 2 ($t = 0.311$, $p = 0.755$) nor for children of grade 4 ($t = 0.729$, $p\text{-value} = 0.466$) for GD.

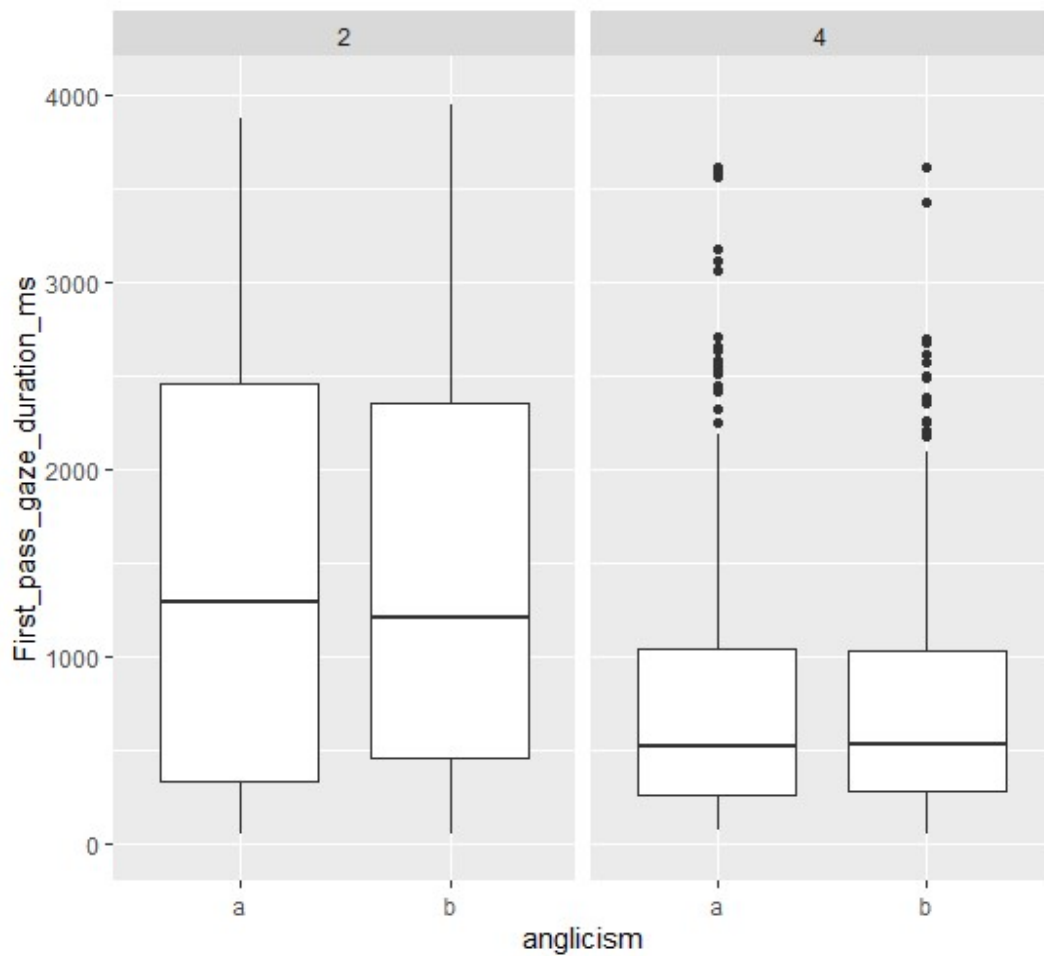


Figure 29: Visualization of the descriptive statistics of GD for anglicisms (a) and German words (b) for children of grade 2 (left) and children of grade 4 (right)

As within the model of FF, the random effects structure was accounted for. Using an anova, it was tested which random effect's structure best fits a null model. As a result, a structure concerning random intercepts and slopes for each participant with regards to word type and the word's frequency as well as the interaction between these effects turned out to be the best fit model. This random effect structure was applied for the rest of the analysis.

9.4.1. Full model for GD

Again, a full model with all variables was built and collinearity between the covariates was checked by VIFs. The results of the full model are reported in Table 13.

Table 13: Results of the full lme GDfull for GD

fixed effect	β	SE	df	t	p	sig
word type	0.023	0.061	29	0.381	0.706	
grade	-0.863	0.167	24	-5.120	0.000	***
AoA	0.007	0.001	96	5.096	0.000	***
older siblings	0.187	0.171	24	1.097	0.284	
word length	0.149	0.056	89	2.662	0.009	**
word frequency	-0.006	0.002	39	-2.321	0.026	*
reading behavior	-0.197	0.134	24	-1.468	0.155	
technology index	-0.085	0.140	24	-0.608	0.549	
read aloud index	0.102	0.778	23	1.313	0.202	

The word frequency was significant as illustrated in Figure 30 confirming H1.

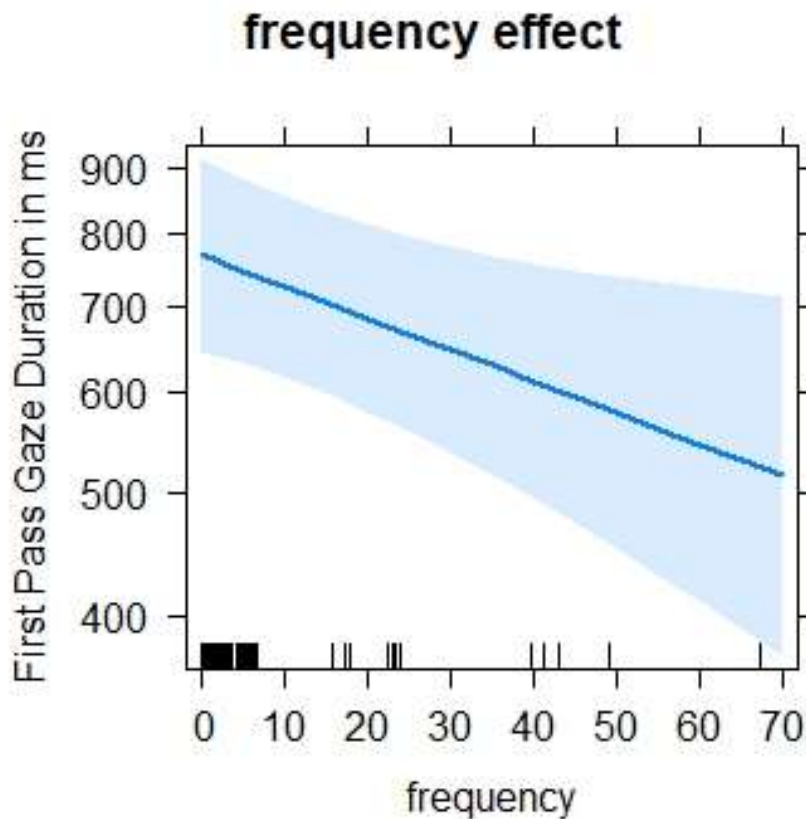


Figure 30: Frequency effect for GD

The notation of the full model is:

```
GDfull <-lmer(log(First_pass_gaze_duration_ms) ~ wordtype + Grade +
AgeofAcquisition +older_siblings + wordlength + frequency + reading_behavior_index
+ technology_index + read_aloud_index + (1 +wordtype* frequency | Participant) + (1 |
item), data = EOGD)
```

Again, the model was reduced, removing non-significant covariates and while keeping the control variables word length and word type as basis for the further interaction models. The Rc^2 values for both models were similar (0.36 for the full model, 0.34 for the reduced model), in an anova a χ^2 test revealed a significant difference in performance ($p < 0.001$) and also AIC were almost the same (3306 vs. 3325). The reduced model was adjusted and the AoA was added as a fixed factor, resulting in a base model for the further interaction models ($Rc^2 = 0.35$).

As is also evident from Figure 22, word frequency had the predicted effect for GD, the higher the frequency is, the shorter was the mean gaze time for GD.

With regard to the main research question of the influence of frequency, there is neither statistical significance, on graphical means, as Figure 30 shows, the frequency effect for the GD is small.

The notation of the reduced model that is applied for the further testing is:

```
GD <-lmer(log(First_pass_gaze_duration_ms) ~ Grade + AgeofAcquisition +  
wordlength + wordtype* variableofinterest + (1 + wordtype*frequency| Participant) + (1  
| item), data = EOGD)
```

9.4.2. Interaction of word type and frequency for GD

The interaction effect of word type and word frequency is shown in Figure 31. From this figure significant correlation between the word type and the frequency can be seen. According to the figure, the frequency effect is not as pronounced for anglicisms resulting in a significant interaction effect of word frequency and word type ($\beta = 0.01$, $SE = 0.00$, $df = 45$, $t = -2.21$, $p < 0.05$).

interaction wordtype*frequency

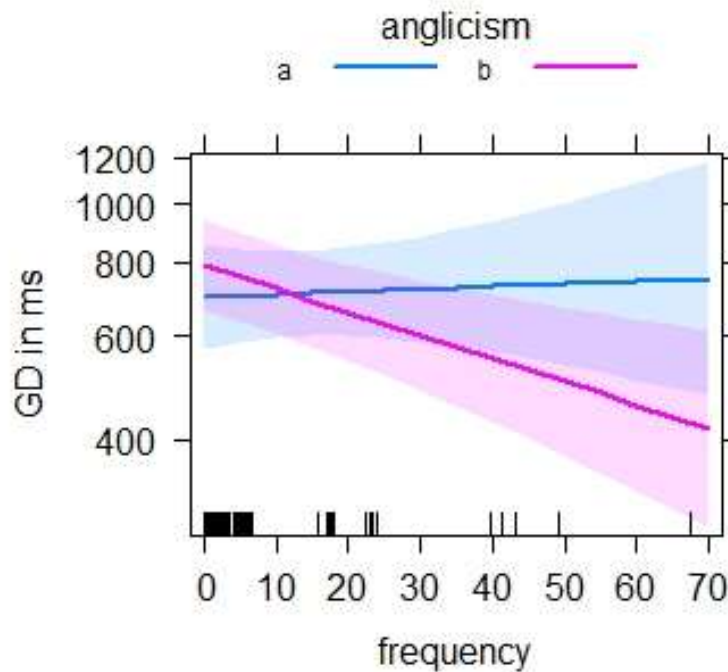


Figure 31: Interaction wordtype*frequency for GD

9.4.3. Interaction of word type and AoA for GD

Subsequently, a second interaction model was elaborated, including the interaction effect of wordtype*AoA. In this model, the interaction effect was significant ($\beta = 0.01$, $SE = 0.00$, $df = 99$, $t = 2.43$, $p < 0.05$). Figure 32 shows that the slope for the German words is steeper than the slope for anglicisms indicating that the influence of the AoA on GD is more pronounced for German words.

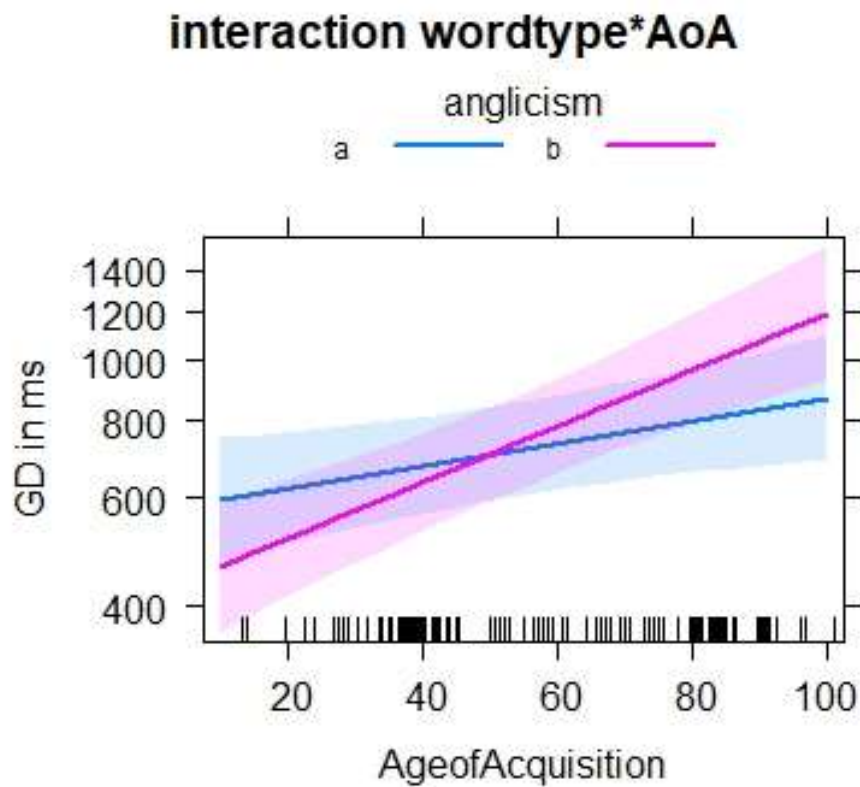


Figure 32: Interaction effect of wordtype*AoA for GD

9.4.4. Interaction of word type and older siblings for GD

The presence of older siblings (H4) correlates positively, which means that the expected effect does not occur here, but that children with older siblings do not have any advantages in reading anglicisms and that higher gaze times are observed for German words ($\beta = 0.07$, $SE = 0.11$, $df = 38$, $t = 0.62$, $p = 0.542$).

interaction wordtype*older siblings

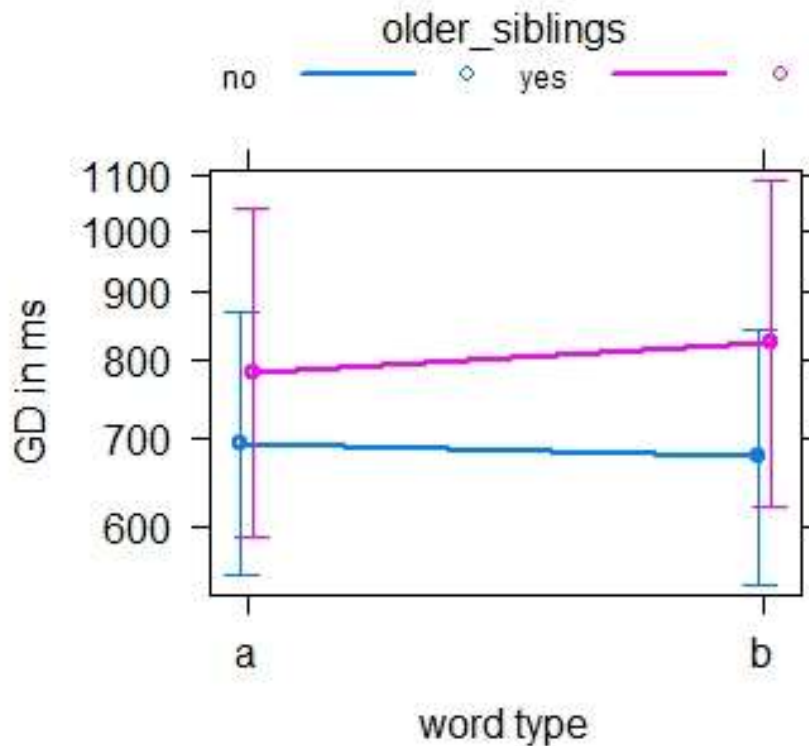


Figure 33: Interaction of wordtype*older siblings for GD

9.4.5. Interaction of word type and technology use for GD

Again, no interaction effects for children using technological devices on a regular basis ($\beta = -0.14$, $SE = 0.10$, $df = 90$, $t = -1.42$, $p = 0.159$) were observed. Figure 34 shows that there is no difference in the slope for children with higher scores on the technology_index implying that they are very familiar with the use of technical devices.

anglicism*technology_index effect plot

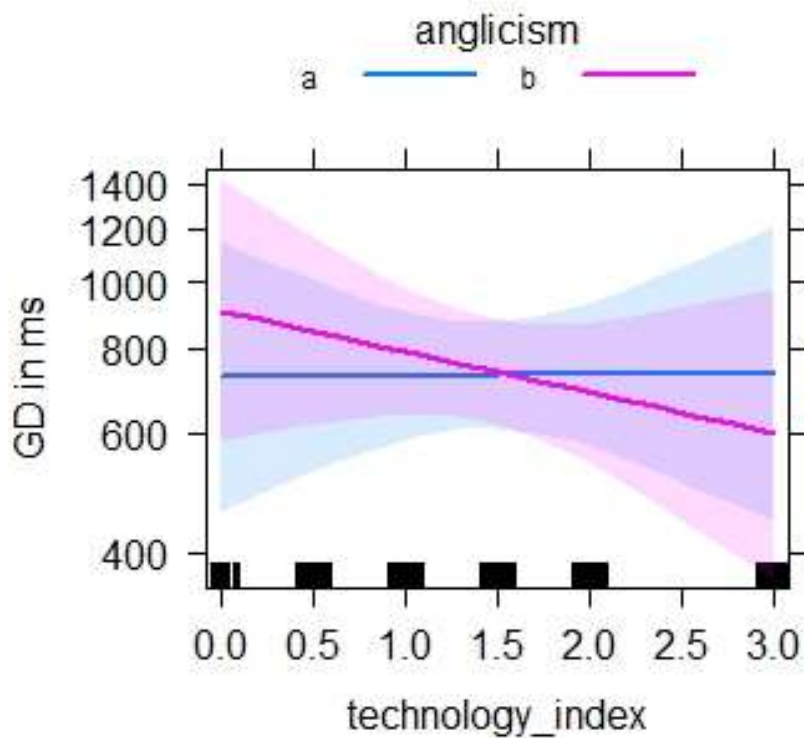


Figure 34: Interaction of wordtype*technology_index for GD

9.4.6. Interaction of word type and reading behavior for GD

Children with a high index of reading behavior meaning that they read a lot (H6) showed differences in their reading behavior of anglicisms ($\beta = -0.17$, $SE = 0.08$, $df = 96$, $t = -2.01$, $p = <0.05$). The effect is shown in Figure 35. As illustrated, there is an advantage in reading times for GD regarding the German words, for anglicisms the reading behavior seems to have no impact.

interaction wordtype*reading behavior

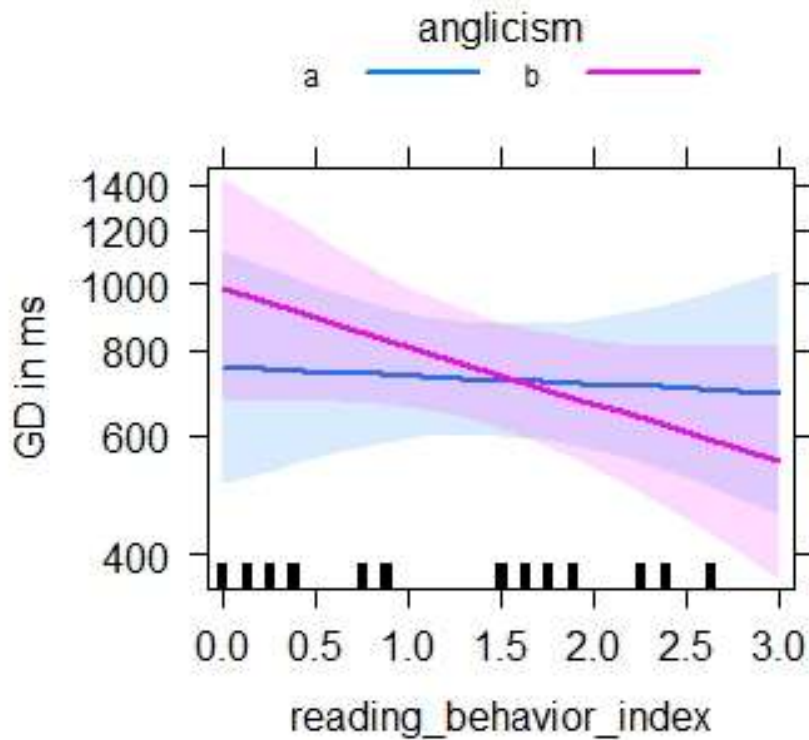


Figure 35: Interaction of word type*reading behavior for GD

9.4.7. Interaction of word type and reading aloud for GD

The influence of the children's exposure to phonological input by having persons read to them was equally neglectable ($\beta = -0.06$, $SE = 0.04$, $df = 87$, $t = -1.13$, $p = 0.198$) as shown in Figure 36.

interaction wordtype*reading aloud

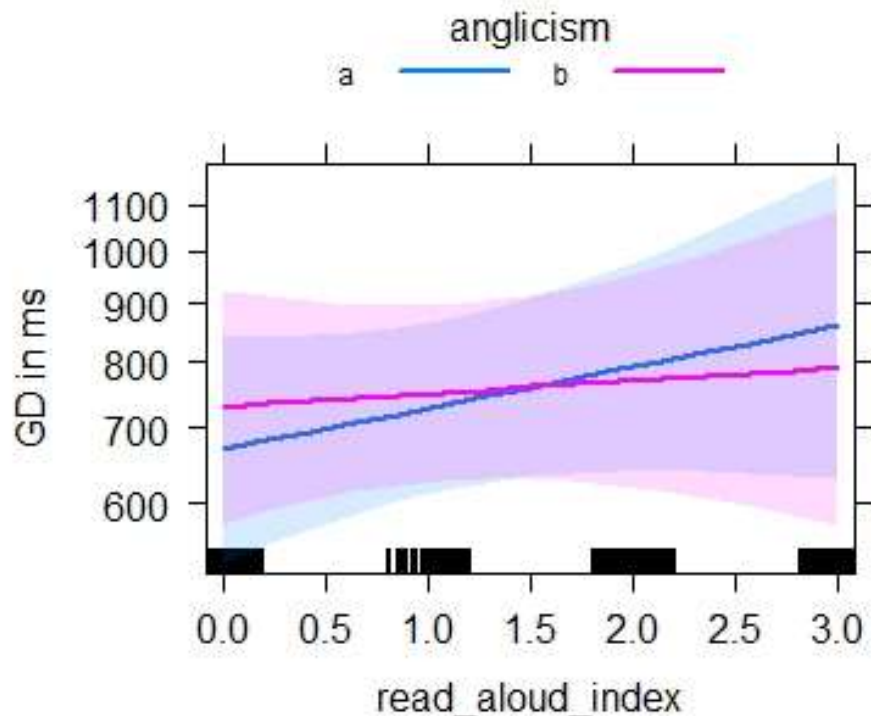


Figure 36: Interaction of word type*reading aloud to children for GD

9.4.8. Summary

The AoA showed to have a significant effect on GD overall with $p > 0.005$, and likewise the word frequency's effect was significant with $p > 0.05$. Significant differences between the word type anglicism and German word with regards to the gaze time measure GD were found for the AoA ($p > 0.05$), as well as for the interaction with the target words' frequency ($p < 0.05$). There was no statistically detectable effect of older siblings, technology use or reading aloud to children. Instead, it proved that the children who had a high reading behavior index benefitted with regards to the word type, but significantly stronger for German words, which means that there was a clear decline in reading time spent for GD on German words, whereas almost no difference existed for anglicisms. For anglicisms the influence of reading behavior apparently had a smaller

influence, the reading time measures remained nearly stable regardless of the reading behavior.

With regards to the proposed effect of word length as an indicator for the reading strategy (Rau et. Al 2014), no significant effect was found indicating differences in reading strategies between anglicisms and German words for GD.

Although GD is an early measure in the processing process in terms of temporal sequence, it can be a first indicator of successful lexical access. The evaluation shows that German words have a significant advantage in reading time GD compared to anglicisms.

9.5. Total Time

The visual representation of the descriptive statistic shows that differences in terms of gaze durations for TT with respect to word type differ more for younger readers than for the more proficient beginning readers. The gaze times for the older children were shorter, as expected, and in addition, there was less variation. The differences showed no statistical significance for children of grade 2 ($t = 1.421, p = 0.155$) but for children of grade 4 ($t = 2.507, p < 0.05$).

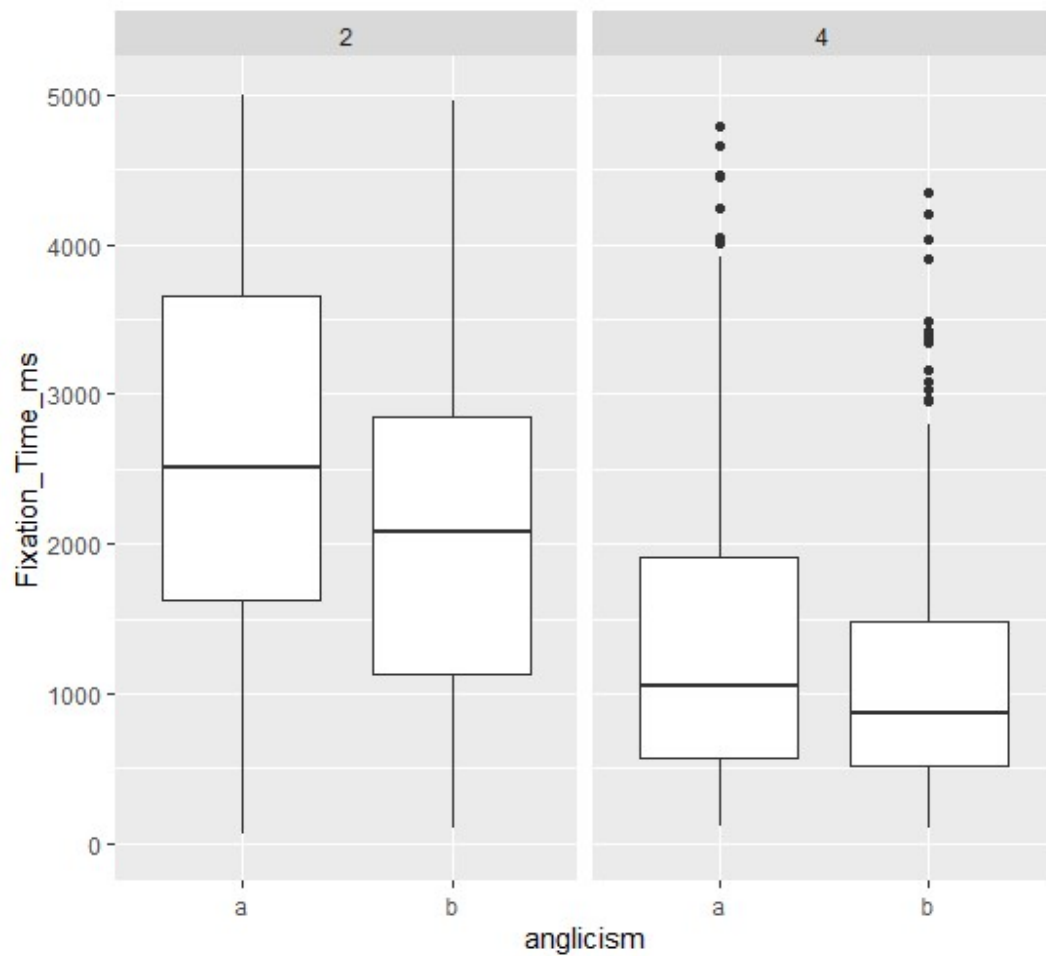


Figure 37: Visualization of the descriptive statistics of TT for anglicisms (a) and German words (b) for children of grade 2 (left) and children of grade 4 (right)

9.5.1. Full model for TT

As before, in a first step, the random effects structure was accounted for. Using an anova, it was tested which random effect's structure best fits a null model. As a result, a structure concerning random intercepts and slopes for each participant with regards to word type turned out to be the best fit model. This random effect structure was applied for the rest of the analysis.

A full model was run to test main effects that looks like this:

TTfull <-lmer(log(Total_Time_ms) ~ word type + Grade + AgeofAcquisition + frequency + older_siblings + wordlength + reading_behavior_index + technology_index + read_aloud_index + (1 +frequency*wordtype| Participant) + (1 | item), data = EOTT)

Table 14: Results of the full model for TT

fixed effect	β	SE	df	t	p	sig
word type	-0.142	0.052	90	-2.719	0.008	.
grade	-0.864	0.142	23	-6.065	0.000	***
AoA	0.006	0.001	96	4.811	0.000	***
older siblings	0.345	0.145	23	2.378	0.026	*
word length	0.210	0.051	94	4.088	0.000	***
word frequency	-0.009	0.002	63	-3.803	0.000	***
reading behavior	-0.283	0.114	23	-2.482	0.021	*
technology index	-0.002	0.118	23	-0.018	0.985	
read aloud index	0.127	0.066	23	1.921	0.067	.

The results of the full model for TT, as shown in Table 14, show several significant effects. First, the word type itself – anglicism vs. German word – implying that for the late processing measure of TT the difference for this reading time measure is not neglectable. Again, as with all other dependent variables, the developmental component of grade is highly significant, supporting the hypothesis that reading proficiency improves over time. AoA and the word frequency are both significant for TT as well as word length. In contrast to the previously reported reading measures concerning earlier stages in the reading process, effects of older siblings, the overall reading behavior and the influence of reading to children were found. Basically, there was a strong frequency

effect (Figure 38) implying that high-frequency words had shorter viewing times. As Figure 39 illustrates, there were shorter overall fixation times for short words, whereas long words received longer fixation times. As is evident from Figure 40, children that read a lot in their leisure time resulting in a high reading_behavior_index benefit in terms of shorter total reading times. Surprisingly, the expected effect of older siblings was the other way round. Here, children with older siblings showed longer viewing times (Figure 41).

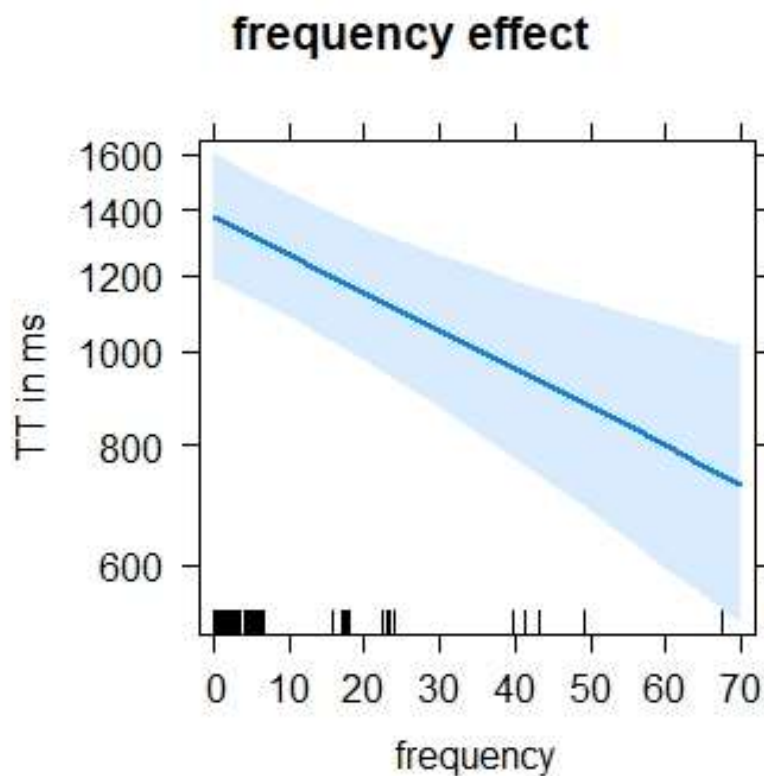


Figure 38: Frequency effect for TT

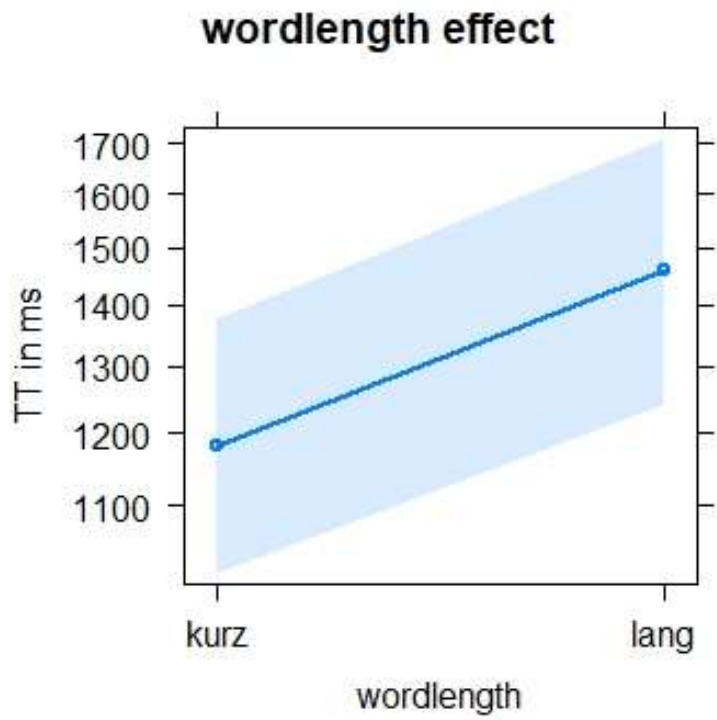


Figure 39: Wordlength effect for TT

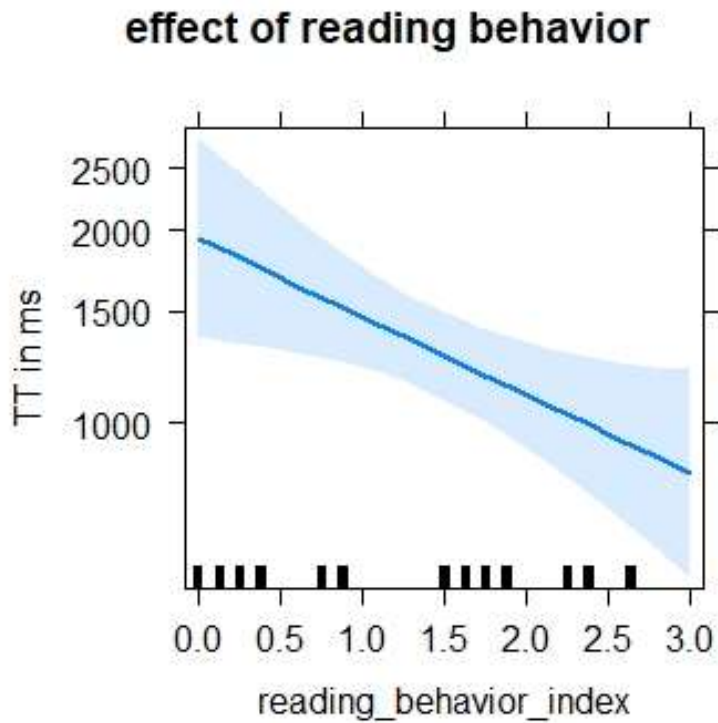


Figure 40: Effect of reading behavior for TT

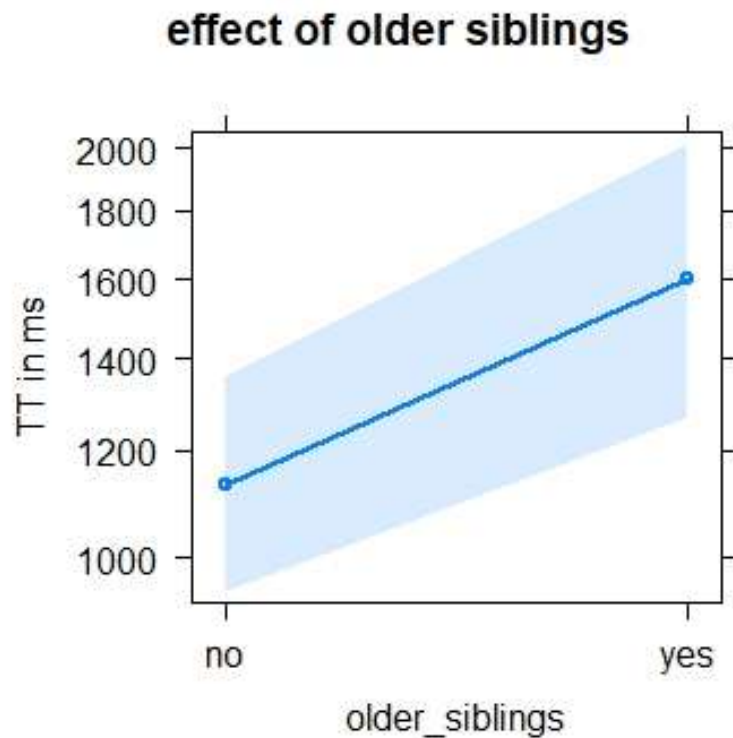


Figure 41: Effect of older siblings for TT

Again, the full model was reduced by removing the non-significant variables, testing for correlation with the VIFs and under the premise of not having to accept a loss of performance. This was verified by calculating the R^2 in addition with contrasting the models by anovas resulting in χ^2 testing.

The reduced model notation looks like this:

```
TT <-lmer(log(Fixation_Time_ms) ~ Grade + reading_behavior_index + older_siblings
+ frequency +wordlength + wordtype*variableofinterest + (1 +wordtype| Participant) +
(1 | item), data = EOTT)
```

9.5.2. Interaction of word type and frequency for TT

The interaction of wordtype*frequency was not significant ($\beta = -0.00$, $SE = 0.00$, $df = 82$ $t = -1.04$, $p = 0.30$) as shown Figure 42. A very similar picture can be seen for both types of words with slopes almost being parallel, only varying in their intercepts.

interaction wordtype*frequency

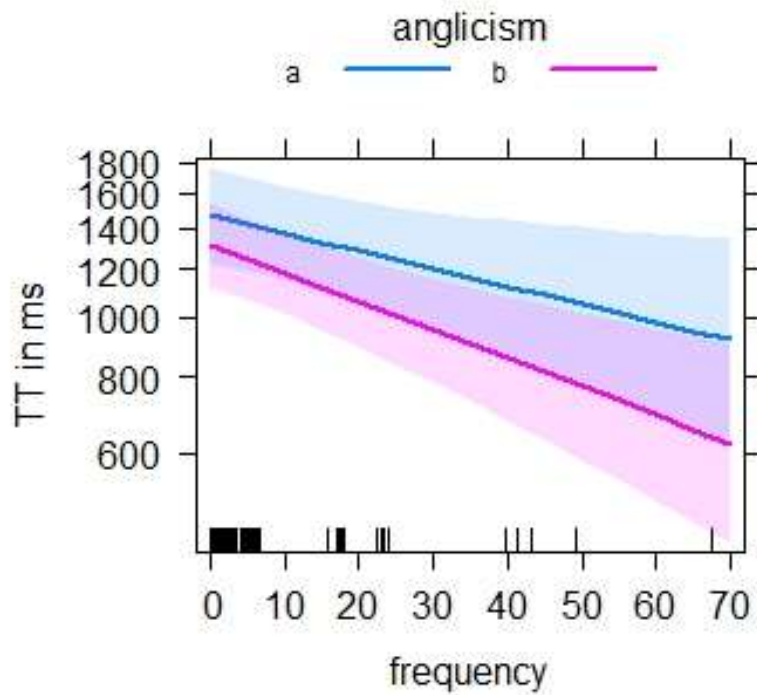


Figure 42: Interaction of wordtype*frequency for TT

9.5.3. Interaction of word type and AoA for TT

The interaction effect of word type and AoA for TT (Figure 43) suggests that there is no significant interaction effect as the slopes are almost parallel and close ($\beta = 0.00$, $SE = 0.00$, $df = 96$, $t = 0.81$, $p = 0.421$).

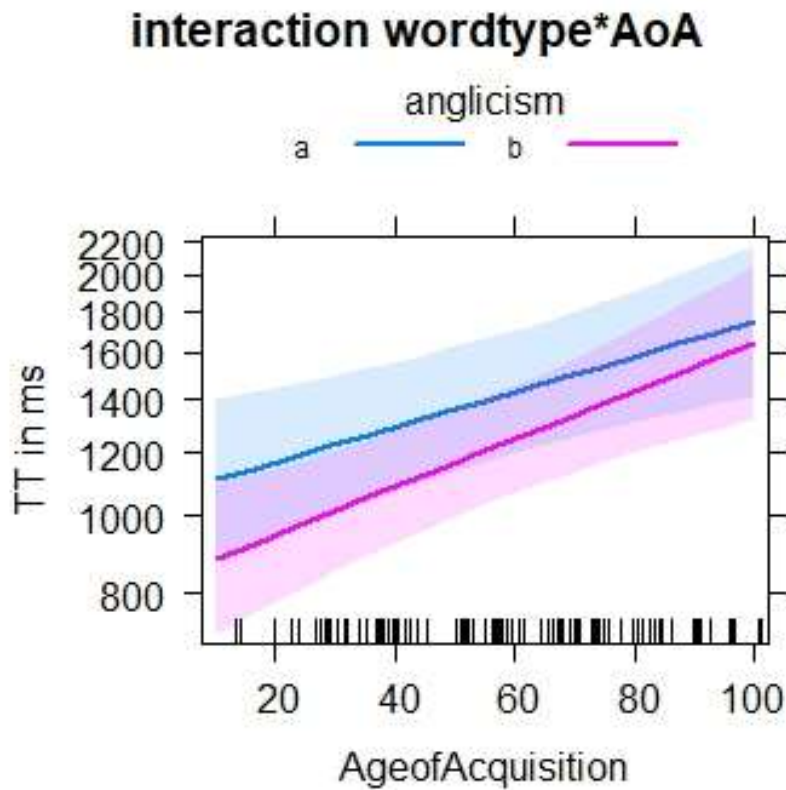


Figure 43: Interaction effect of word type**AoA* for *TT*

9.5.4. Interaction of word type and older siblings for *TT*

When readers had older siblings, this meant that in general the *TT* on the target words (anglicism and German word) was slightly shorter. Yet, it was not supported that children having older siblings find it easier to read anglicisms ($\beta = 0.10$, $SE = 0.07$, $df = 92$ $t = 1.27$, $p = 0.205$).

anglicism*older_siblings effect plot

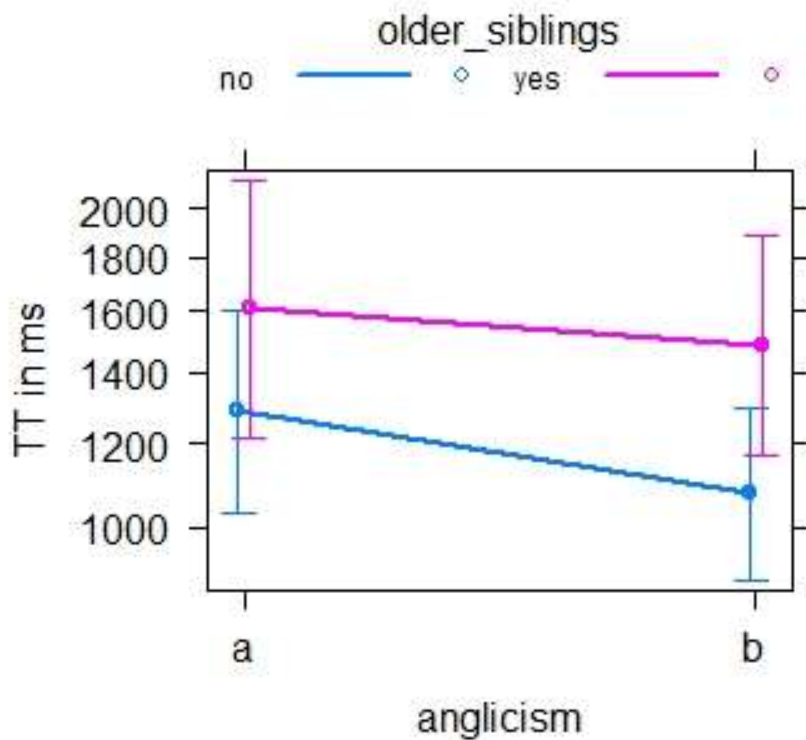


Figure 44: Effect of interaction for word type*older siblings

9.5.5. Interaction of word type and technology use for TT

No significant effect for the interaction of word type and the use of technology was verified ($\beta = 0.06$, $SE = 0.06$, $df = 103$, $t = 0.87$, $p = 0.388$),

Effect of interaction wordtype*technology_index

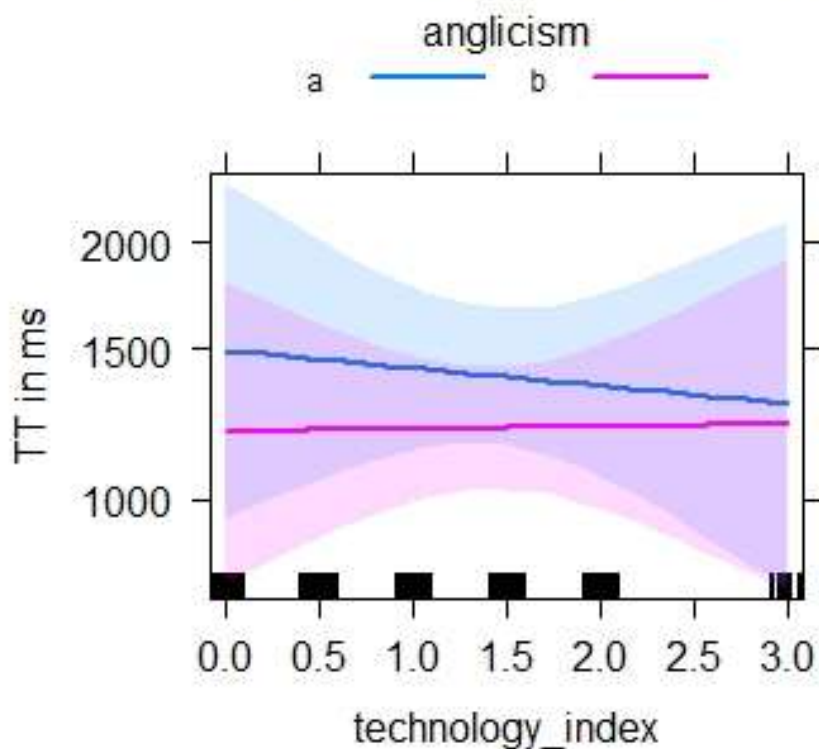


Figure 45: Effect of interaction word type*technology index for TT

9.5.6. Interaction of word type and reading behavior for TT

Likewise, no significant effect for the interaction of word type and the reading behavior of children was found ($\beta = -0.05$, $SE = 0.05$, $df = 93$, $t = -1.07$, $p = 0.288$). Figure 46 shows, that in general, children with a high reading behavior index had shorter overall reading times on the target words. From the figure, it becomes clear that anglicisms received longer TT, yet as stated above, the difference was not statistically significant.

interaction wordtype*reading behavior

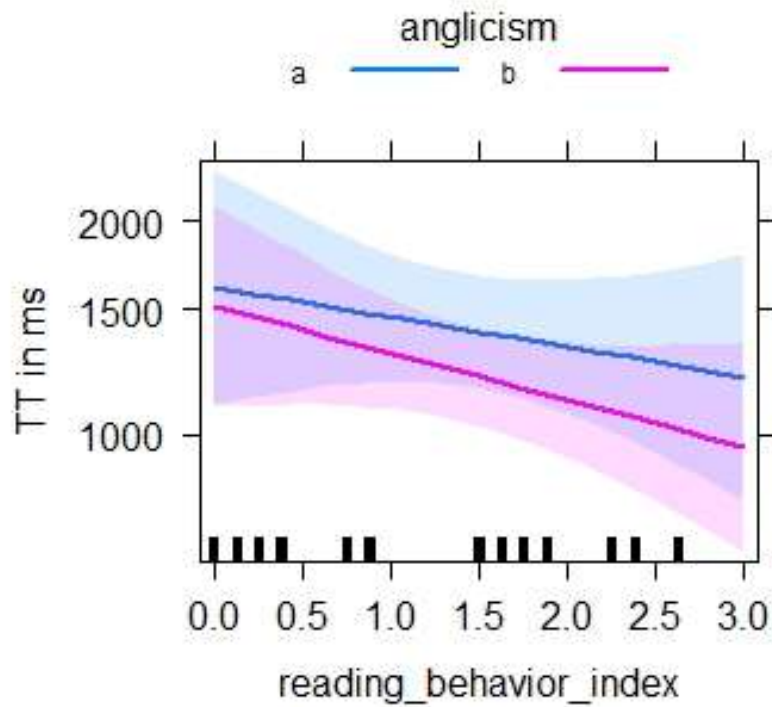


Figure 46: Interaction of word type and reading behavior for TT

9.5.7. Interaction of word type and reading aloud to children for TT

Contrary to expectations, the effect of reading aloud (H7) was positively correlated with TT and became slightly significant in the interaction with word type ($\beta = -0.05$, $SE = 0.03$, $df = 290$, $t = -1.71$, $p < 0.1$), implying that children who are regularly read to actually demonstrated longer reading times for anglicisms.

interaction wordtype*reading aloud

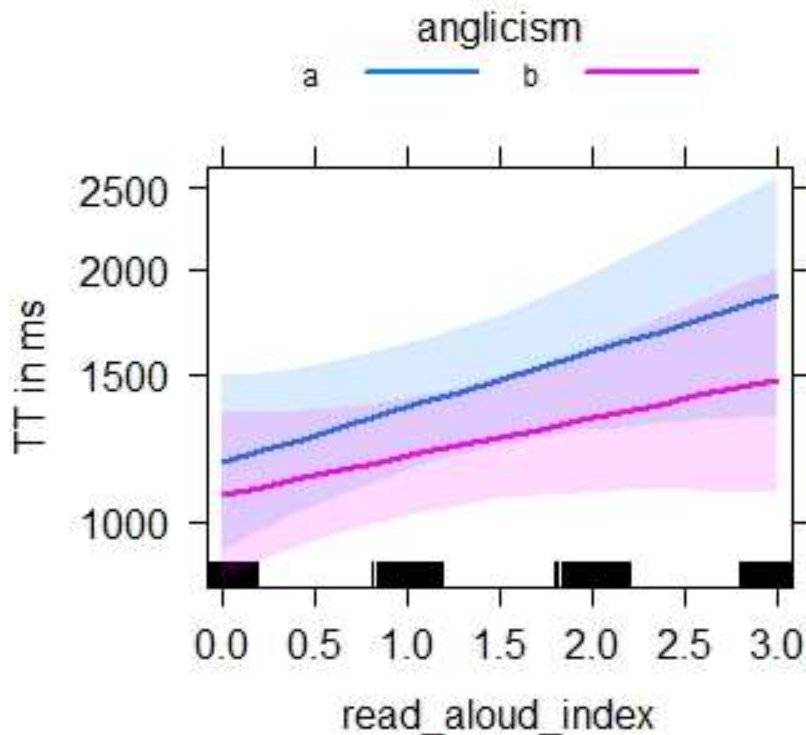


Figure 47: Interaction of word type and reading aloud for TT

9.5.8. Summary

To summarize, for TT, significant individual effects were found for word frequency ($p < 0.001$), AoA ($p < 0.001$), age ($p < 0.001$), older siblings ($p < 0.05$), and reading behavior ($p < 0.05$) regardless of word type. However, there were no significant interaction effects with word type, leading to the conclusion, that it made no difference whether the children encountered an anglicism or a German word. With regards to the proposed effect of word length as an indicator for the reading strategy (Rau et. Al 2014), only a slight effect ($p < 0.1$) was found and within this context, indicating problems in reading respectively decoding anglicisms. As children of grade 2 showed proportionally longer reading time of long words that were anglicisms it can be assumed, that the indirect-lexical route was applied with more and longer effort to decode the word.

9.6. Probability of Revisit (RV)

To discuss the eye movement measure for the Probability of Revisit (the probability that the reader will revisit the target word), generalized linear mixed-effects models are used to analyze the data. If a target word was only glanced at once, this equals “0”, if it was revisited for another or more glances, a “1” enters the binomial model. The visual representation of the descriptive statistic clearly shows differences for the RV. For both cases, children of grade 2 and 4, anglicisms had more revisits, however, this fact is more pronounced for the older beginning readers and they were more likely to revisit the target word (Figure 48). A t-test revealed the statistically significant differences for the RV of word type for both, children of grade 2 ($t = 15.204, p < 0.001$) and grade 4 ($t = 3.906, p < 0.001$).

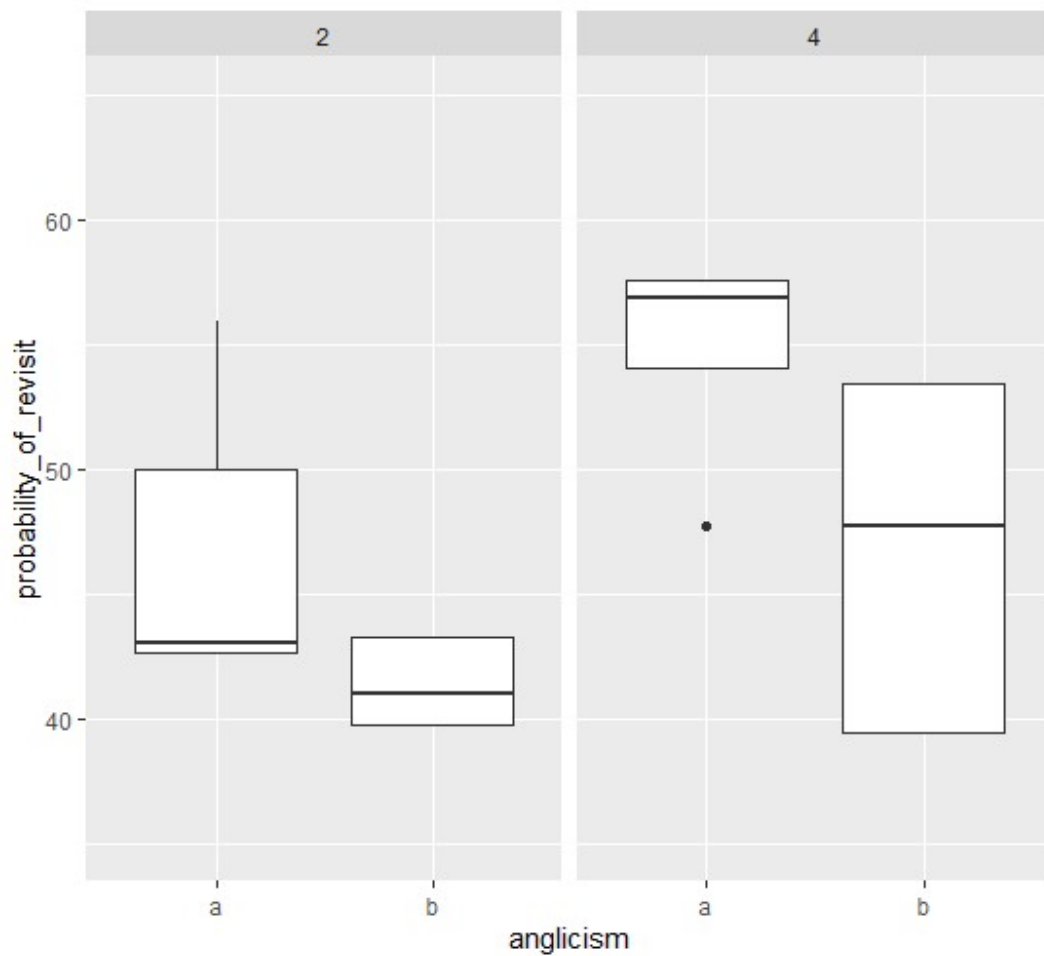


Figure 48: Visualization of the descriptive statistics of RV for anglicisms (a) and German words (b) for children of grade 2 (left) and grade 4 (right)

For the dependent variable RV, the random effects structure was tested and as a result, a structure concerning random intercepts and slopes for each participant with regards to word type turned out to be the best fit model. This random effect structure was applied for the rest of the analysis.

9.6.1. Full model for RV

When running the full model, only the age of the participants and the word type became significant. In a further step, the model was reduced with the results shown in Table 15.

Table 15: Results of the full model for RV

fixed effect	β	SE	z-Value	sig
word type	-0.314	0.121	0.009	**
grade	0.078	0.195	0.688	
AoA	-0.001	0.003	0.0.823	
older siblings	0.339	0.201	0.091	
word length	-0.091	0.122	0.456	
word frequency	-0.008	0.005	0.111	
reading behavior	-0.132	0.156	0.395	
technology index	-0.069	0.163	0.674	
read aloud index	0.088	0.090	0.328	

From the overall model only the wordtype showed a significant effect. In concrete terms, words being less frequent are refixed significantly more often than the high-frequent words regardless of the word type (H1).

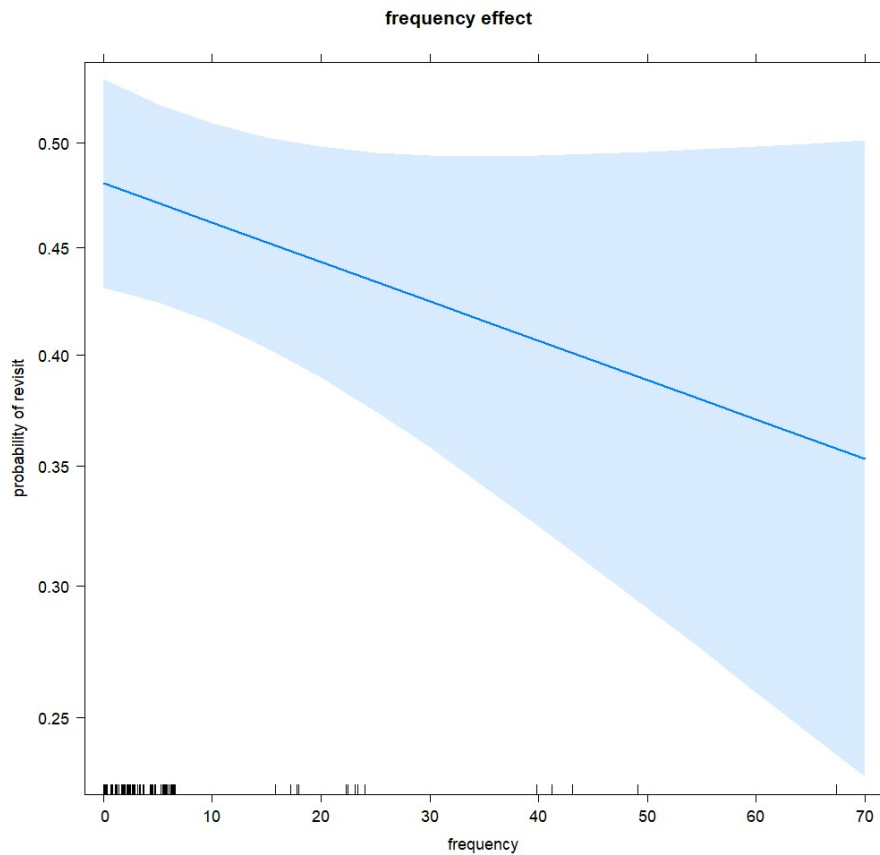


Figure 49: Frequency effect for RV

As with the other models, the full model was reduced for all non-significant fixed effects as long as the model fit was not impaired. The R^2 value for the full and the reduced model for RV was the same 0.81, implying that 81% of the variance in the models is explained by random and fixed effects. The reduced model as a basis for the interaction model comprised the word type, grade, word length and the word frequency.

9.6.2. Interaction effect of word type and word frequency for RV

The effect of the interaction between word type and frequency was not significant ($\beta = -0.00$, $SE = 0.01$, $p = 0.865$). As Figure 50 illustrates, there is no significant difference for anglicisms.

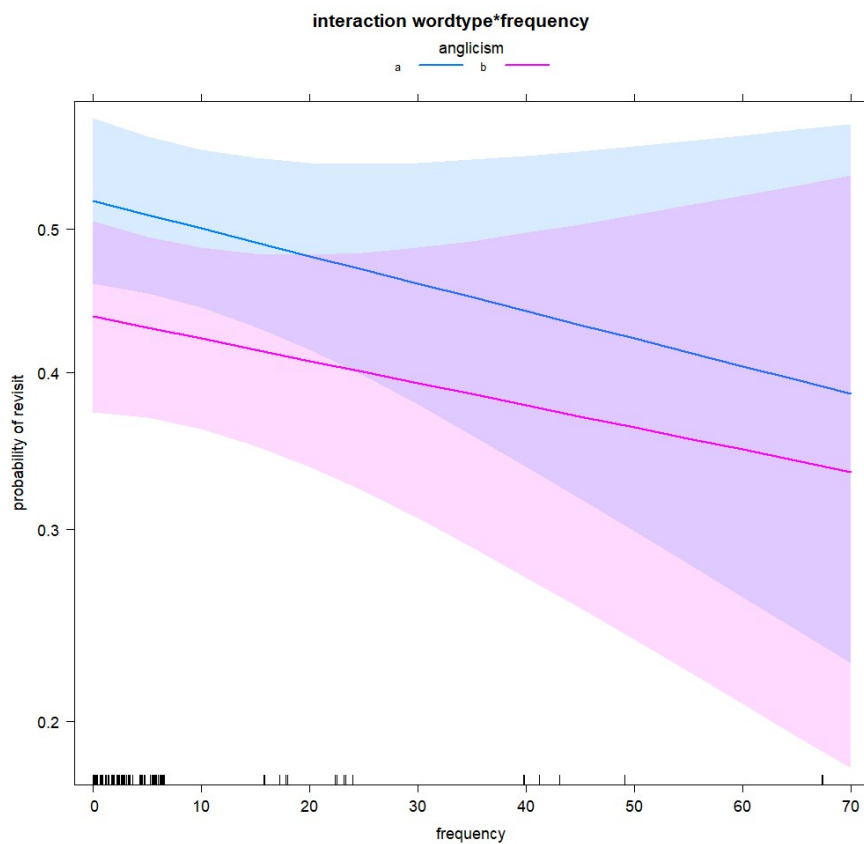


Figure 50: Effect of interaction wordtype*frequency for RV

9.6.3. Interaction effect of word type and AoA for RV

Analogous to word frequency, no significance was found in the interaction of the AoA and the word type ($\beta = -0.00$, $SE = 0.01$, $p = 0.180$), however, through the visualization (Figure 51) it becomes clear that anglicisms were re-fixated more often than German words.

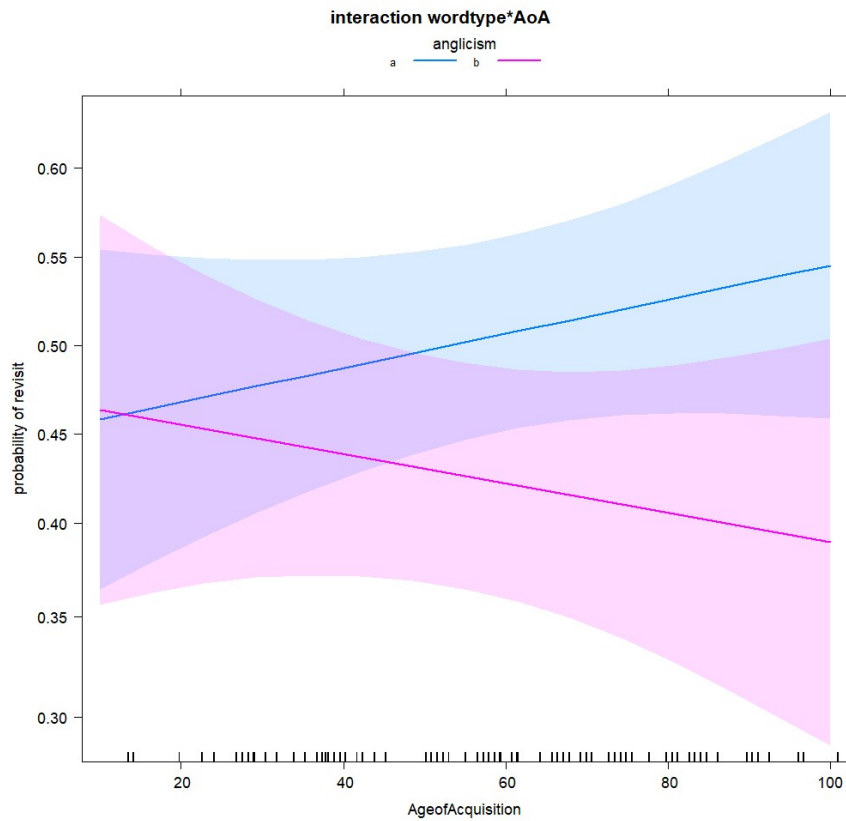


Figure 51: Interaction of word type and AoA for RV

9.6.4. Interaction effect of word type and older siblings for RV

As Figure 52 reveals, the difference of wordtype was significant ($p < 0.001$), however, an effect of interaction of word type and older siblings is virtually not apparent ($\beta = 0.24$, $SE = 0.24$, $p = 0.315$).

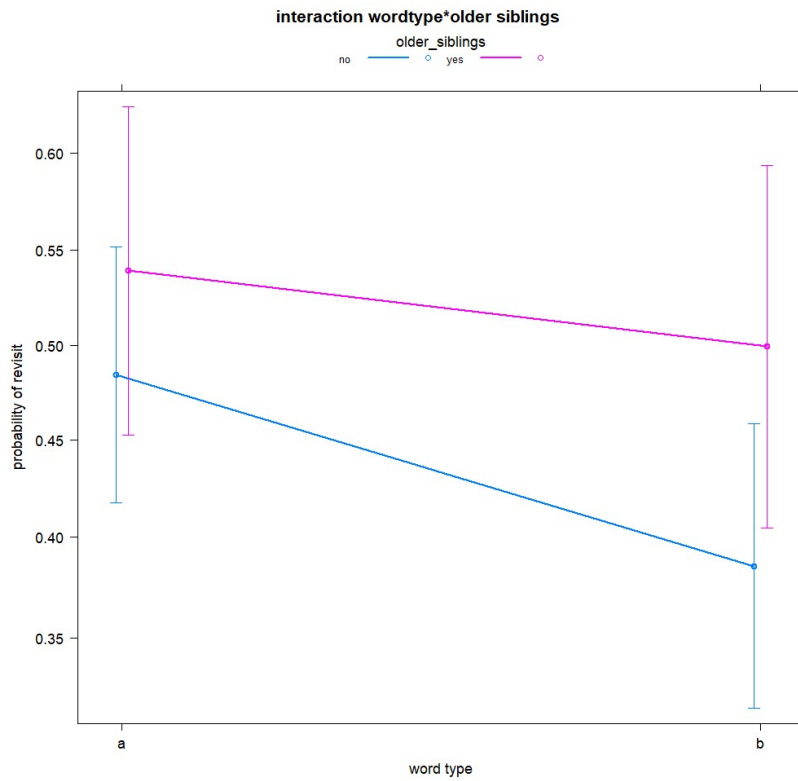


Figure 52: Effect of interaction wordtype*older siblings for RV

9.6.5. Interaction effect of word type and technology use for RV

There was obviously (Figure 53) no effect of technology use for the behavior of refixations neither for anglicisms nor for German words ($\beta = -0.07$, $SE = 0.21$, $p = 0.720$).

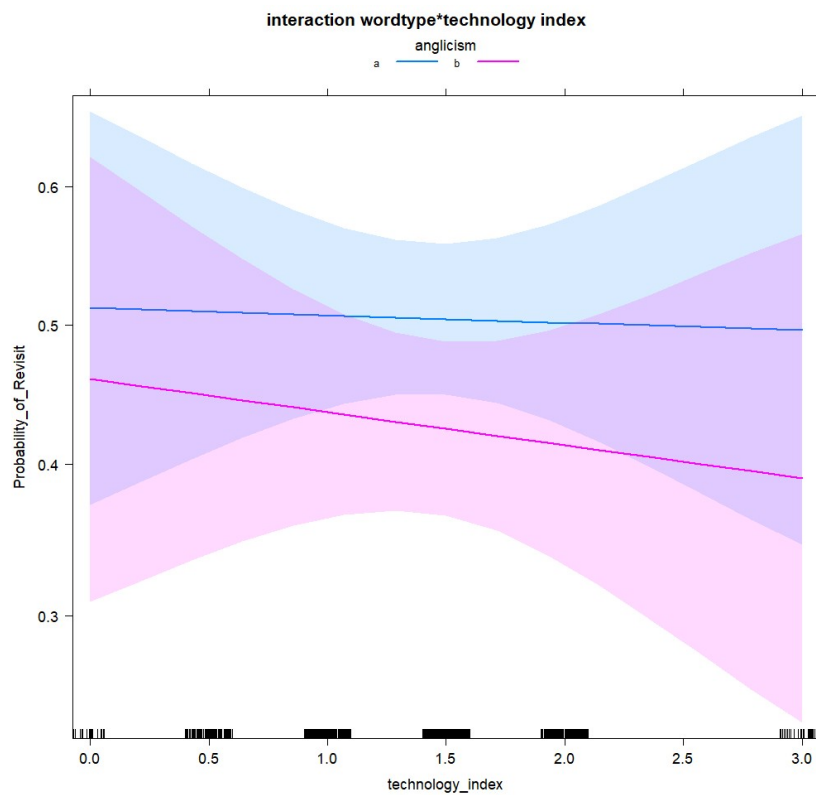


Figure 53: Effect of interaction wordtype*technology_index for RV

9.6.6. Interaction effect of word type and reading behavior for RV

Again, there was no effect on the overall reading behavior for the share of revisits made on the target word ($\beta = 0.06$, $SE = 0.17$, $p = 0.696$). Figure 54 shows, that overall, anglicisms are more often re-fixated than German words, however this effect does not interact with the reading behavior.

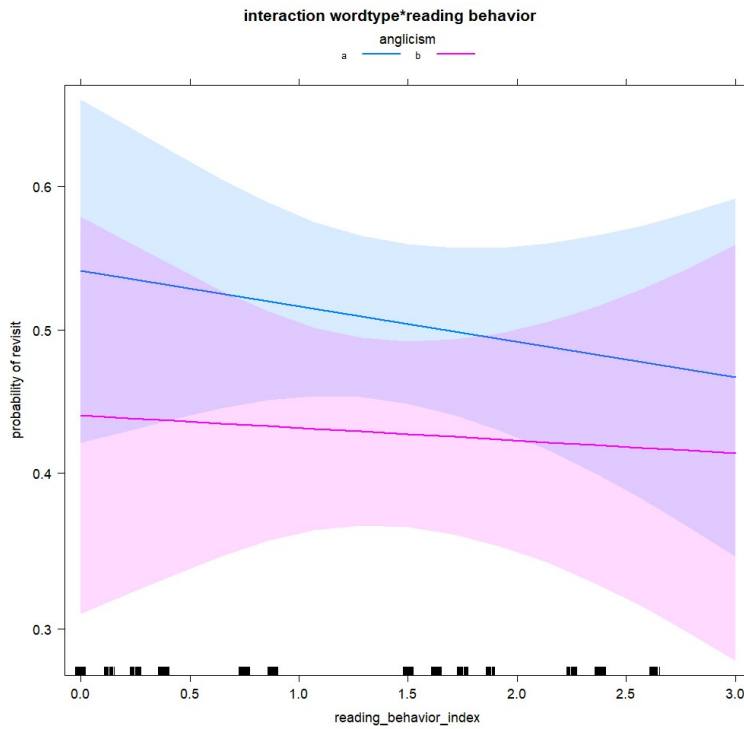


Figure 54: Effect of interaction wordtype*reading behavior for RV

9.6.7. Interaction effect of word type and reading aloud for RV

Figure 55 clearly illustrates again that anglicisms receive more refixations than German words ($p < 0.05$). Further, a significant effect for the interaction of reading aloud to children with the reading ability of anglicisms was not found ($\beta = 0.03$, $SE = 0.09$, $p = 0.756$).

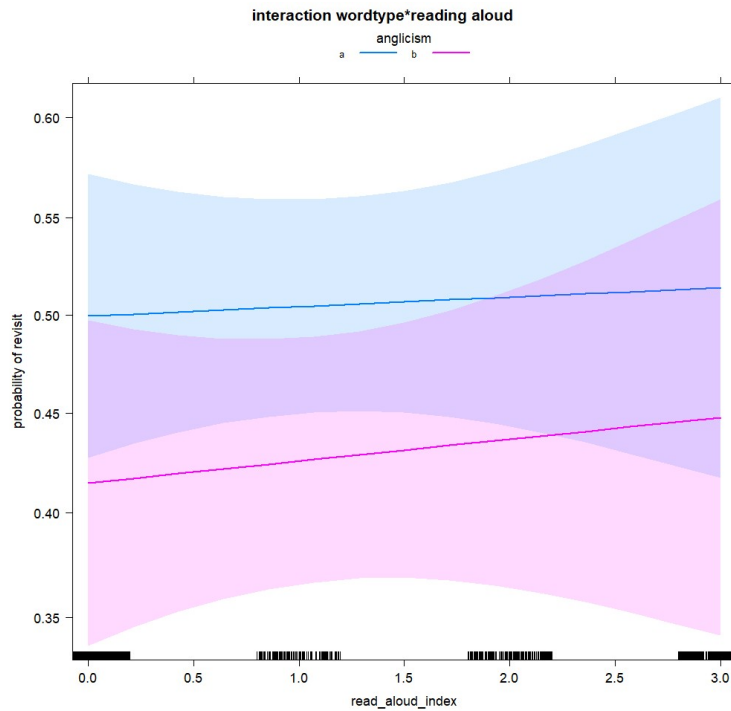


Figure 55: Effect of interaction wordtype*reading aloud for RV

9.6.8. Summary

A revisit count of 0 indicates that the AOI is not refocused in all edits after the first reading. This can indicate either a successful observation or an unconscious observation (in the case of a direct interpretation). Difficulties in word recognition are thus operationalized here by revisit numbers with 1.00. The AoA was not significant for RV (H2). Again, the hypothesis that age (H3) of a strongly influencing variable was confirmed ($p < 0.001$). Whether older siblings (H4) were present in the household of the participants had no influence with regard to the reading behavior of anglicisms ($\beta = 0.339$, $SE = 0.201$, $p = 0.091$). There was again no effect of regular contact with technical devices (H5) for the reading ability of anglicisms ($\beta = -0.069$, $SE = 0.163$, $p = 0.674$) and neither was it the case for the overall reading behavior of the participants (H6) ($\beta = -0.132$, $SE = 0.156$, $p = 0.395$). Likewise, children that are read to by parents or other persons (H7) did not show beneficial effects for anglicisms ($\beta = 0.088$, $SE = 0.090$, $p = 0.328$).

9.7. 3-way interactions

Overall, for the research questions posed here, a 3-way interaction that takes into account the biological age by inserting the variable grade to address the proposed hypothesis that the developmental factor in the process of learning to read into the model. Therefore, linear mixed models with the interaction wordtype*frequency/AoA*grade were calculated for the respective dependent variables of eye movement times according to the main research question or hypothesis.

The first models reveals the differences for the wordtype and frequency with regard to the developmental effect of the children as shown in Figure 56 for the FF, Figure 57 for GD and Figure 58 for TT.

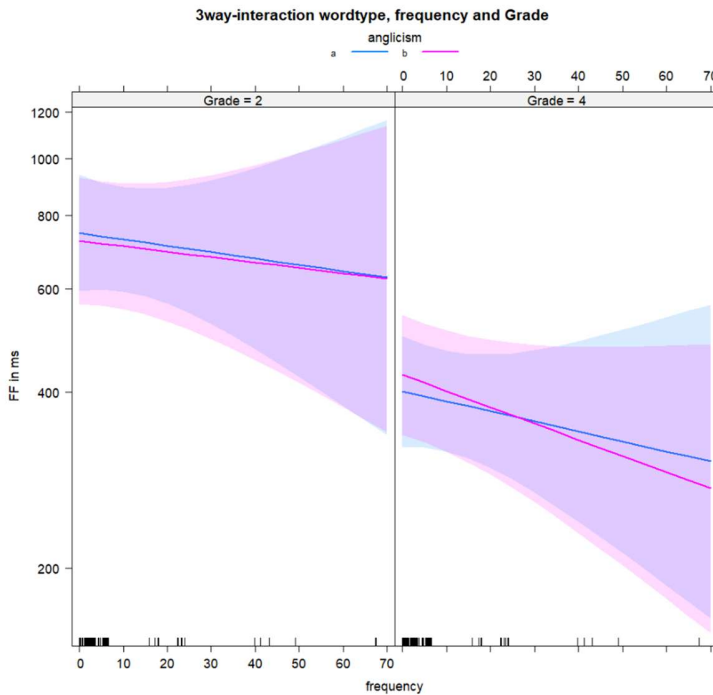


Figure 56: 3-way interaction of wordtype*grade*frequency for FF

The 3-way interaction for FF proved not to have a significant effect ($\beta = -0.00$, $SE = 0.00$, $df = 85$, $p = 0.73$).

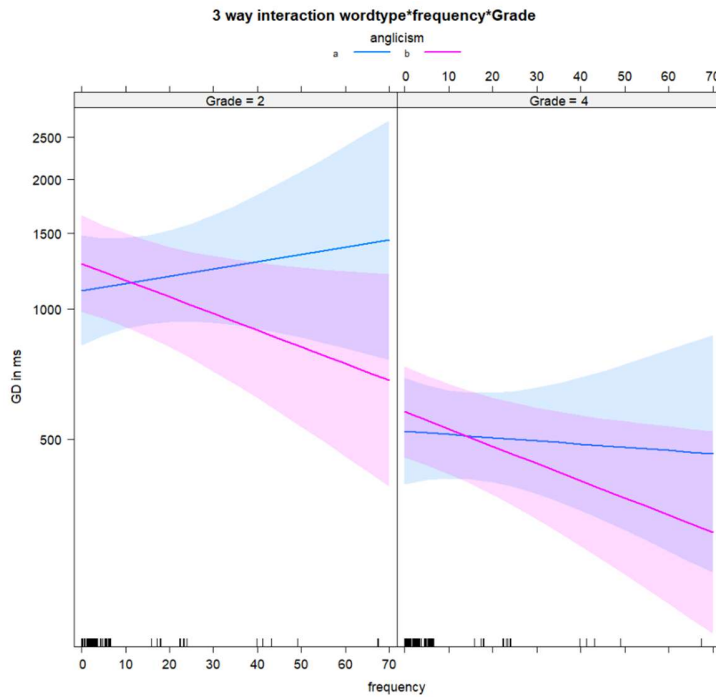


Figure 57: 3-way interaction of wordtype*grade*frequency for GD

The tested model for GD ($\beta = 0.00$, $SE = 0.01$, $df = 25$, $p = 0.40$) did not show a significant effect either.

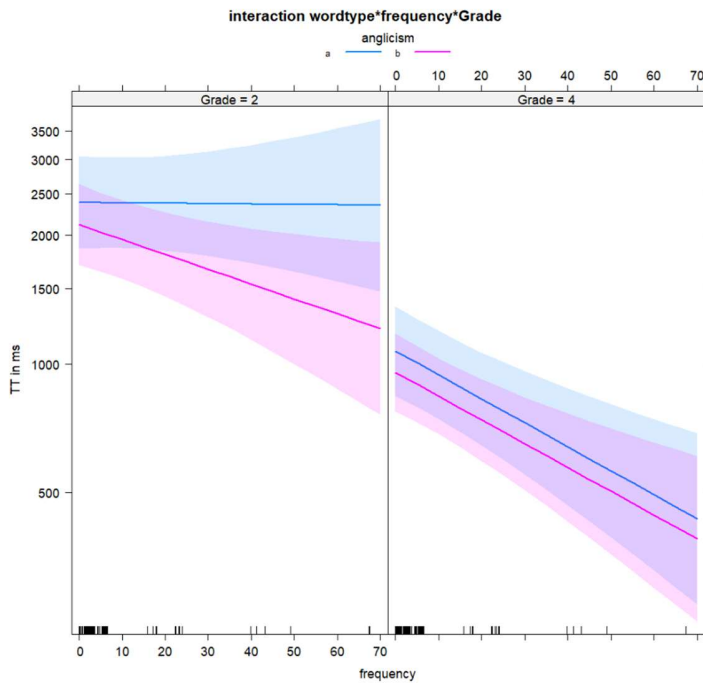


Figure 58: 3-way interaction of wordtype*grade*frequency for TT

Also the last 3-way interaction for TT did not have any significance ($\beta = -0.00$, $SE = 0.00$, $df = 1,141$, $p = 0.11$).

The data show no significance for the 3-way interaction. A stronger effect was assumed here, as it is a “benchmark phenomenon” in the literature that the effect of frequency is greater for irregular words (here: anglicisms) (Rayner & Reichle 2011). This was not confirmed with the data set here.

The same procedure was applied for the AoA and is shown in the figure below:

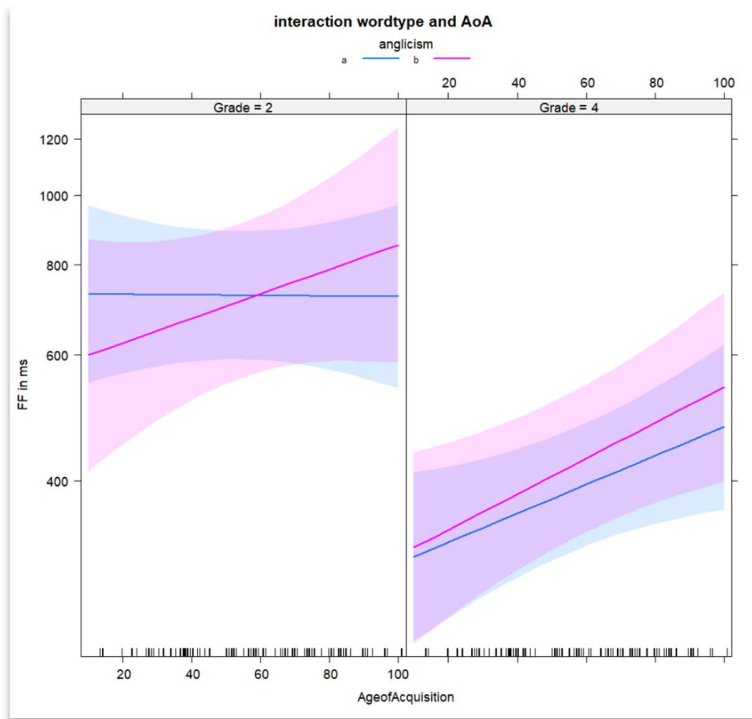


Figure 59: 3-way interaction of wordtype*Grade*AoA for FF

Again, as seen for the variable frequency, the model for FF was not significant for the 3-way interaction ($\beta = -0.00$, $SE = 0.00$, $df = 86$, $p = 0.539$).

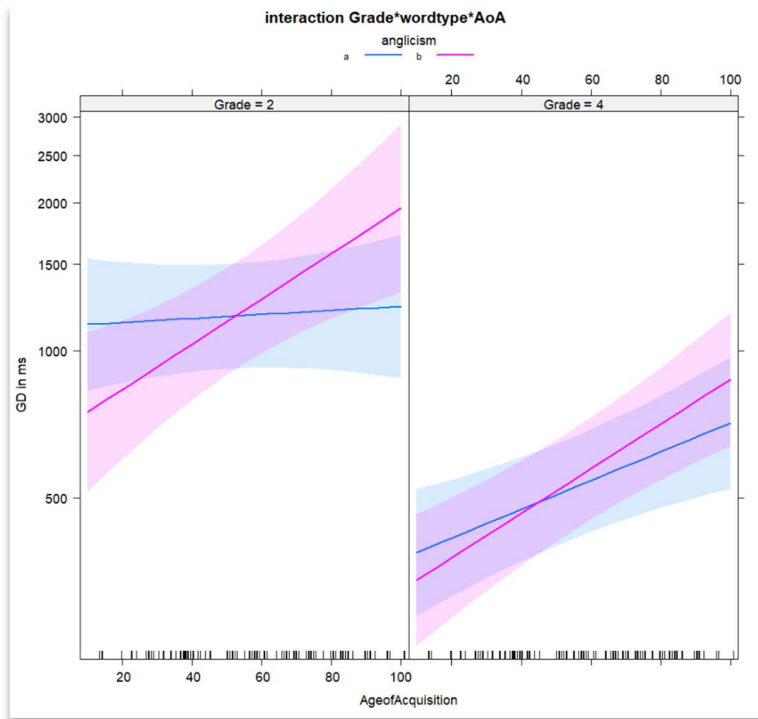


Figure 60: 3-way interaction of wordtype*Grade*Age of Acquisition for GD

Analyzing the measure GD, the 3-way interaction proved not to be significant ($\beta = -0.01$, $SE = 0.01$, $df = 81$, $p = 0.243$), yet the visualization of Figure 60 assumes that especially for the reading beginners of grade 2, the wordtype has an impact on the reading behavior, as reading times increase with higher AoAs. This effect seems to vanish for the more experienced readers grade 4.

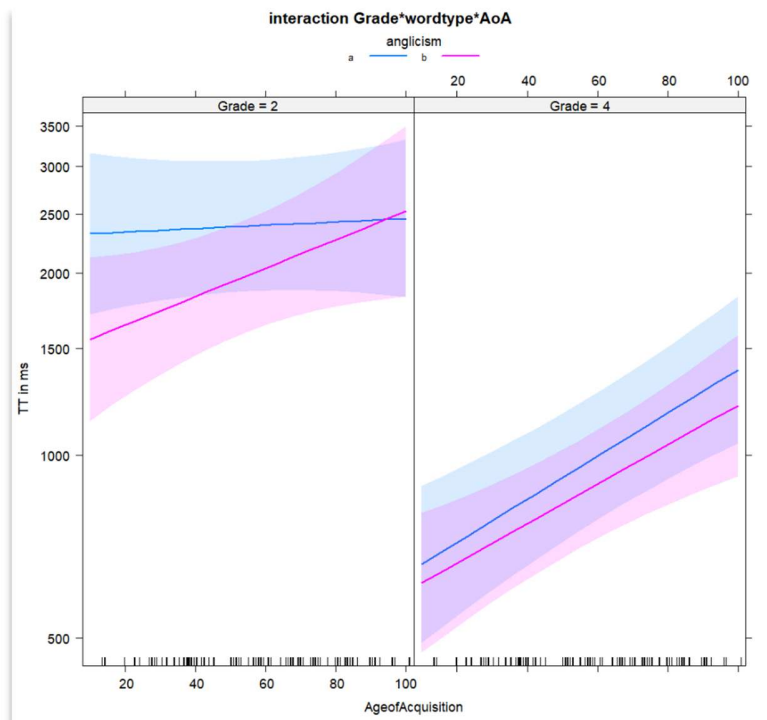


Figure 61: 3-way interaction of wordtype*Grade*AoA for TT

The model representing the 3-way interaction for the variable TT was also not significant ($\beta = -0.01$, $SE = 0.00$, $df = 118$, $p = 0.104$).

9.8. Discussion and theoretical placement

The present study tested whether beginning readers show differences in gaze behavior during the reading process when encountering anglicisms in direct comparison with German words that were matched for word length and word frequency. Differences were expected due to assumptions derived from a dual-route view and findings from reading acquisition research (Coltheart et al. 2001, Ehri 1995, 1997, 2005, Share 1995, Perfetti et al. 1995, Grainger et al. 2012).

Basically, the experiment addresses the role of phonology in the word recognition process. Following the theory of the dual-route approach of reading aloud there are two routes by which print is transformed to sound (Coltheart et al. 2001). The initial model has undergone several specializations and adaptations over time (e.g., Grainger et al.

2012, Houghton & Zorzi 2003), but fundamentally it distinguishes between a lexical direct route and a non-lexical route. There is also general agreement that both routes run in parallel resulting in one of the two leading to successful access to the lexicon, whereby both routes can also interact. With the direct lexical route, words are recognized holistically orthographically and assigned to a representation in the lexicon, while on the non-lexical route words that are not known to the reader as a whole, if no orthographic representation is stored in the lexicon, can be decoded using known GPC. Generally, irregular words, non-words, and pseudo homophones were used as agents to verify the existence of the two routes and to better understand their mechanisms within lexical decision tasks (Grainger et al. 2012, Tiffin-Richards & Schroeder 2018).

Likewise, there is fundamental agreement in the literature that there is a development from initial letter-to-sound decoding via the non-lexical route to direct orthographic-semantic links via the lexical route (cf. Milledge & Blythe 2019). Following the logic of Ehri (2005), children increasingly identify words by sight which means in concrete terms that they establish a direct link from orthography to semantics.

The anglicisms used here can be seen in this way as irregular words that can eventually only be read via the direct route (cf. Grainger & Ziegler 2011). Properties of the anglicisms such as frequency, the AoA, and word length were predicted to influence reading behavior. For example, there is scientific evidence that children read words correctly - without having to overtly decode them via the non-direct route - for example, via reading word lists until these words become unfamiliar, such as low-frequency words (cf. Milledge & Blythe 2019). Dirix and Duyck (2017) describe an AoA effect, if words learned earlier are more centrally positioned and better linked in the lexicon, making them much easier to access. In their study, they found strong effects in eye tracking patterns attributable to the AoA.

Following the logic of the self-teaching hypothesis (Share 1995, Share 1999) the repeated phonological decoding of a word results in a reliable entry in the orthographic lexicon. The more often a word and its orthographic presentation is encountered in written texts and thus fixated within the lexicon of a reader due to multiple repetitions of decoding, the more easily, efficiently and correctly it can be matched using the lexical route. Again, it can be assumed that anglicisms that are frequently heard or actively used

by children are more easily and rapidly recognized via the direct route. Thus, the serial, indirect route via decoding has proved to be sensitive to word length and word frequency (Blythe et al. 2011, Tiffin-Richards & Schroeder 2015).

Greater word length effects are interpreted as representing the readers' greater reliance on serial processing (Tiffin-Richards & Schroeder 2015). An inverted effect for anglicisms as revealed for FF may indicate that anglicisms are read via the lexical route. When relating this effect to AoA, it can be shown, that there is no significant difference for German reference targets: either the long words have a low AoA or a high AoA. This observation may indicate that all long German words are read via the sub-lexical route and the reading strategy relies on decoding. For long anglicisms the AoA has a greater impact, as earlier learned words receive longer FF.

As a descriptive study, the purpose here was to show where effects due to the manipulation and the fixed control variables were evident in the dependent variables (target eye measures) during the reading process. In particular, as it is assumed that the non-lexical route is disabled because decoding via known GPC is not possible it is of course interesting to see which factors have an influence on successful reading and comprehension.

For later reading time measures TT and RV, the word type as individual effect became significant ($p < 0.1$ for TT and $p < 0.001$ for RV) implying that the integration processes of the anglicism took more time than for the German word. Interestingly, the probability of revisit was higher for children of grade 4. In general, younger readers make more refixations because the degree of automation of word recognition is still developing (Radach et al. 2012) however, with increasing reading proficiency, RV should decrease (ibid.).

Also contrasting reading time measures with the index representing whether children are read to regularly showed no effects with regard to shorter fixation times for anglicisms.

Overall, hypothesis 1 was supported as an overall frequency effect was apparent for all four dependent variables (FF, GD, TT, RV). This observation matches previous findings verifying frequency effects in the reading behavior of children especially if age-appropriate reading material is used (Radach et al. 2012, Blythe & Joseph 2012, Tiffin-

Richards & Schroeder 2015). Likewise, hypothesis 2 was verified as developmental changes were found throughout all gaze measures and those were significant in all models and consistent with the existing research (Blythe et al. 2011, Joseph et al. 2009, Tiffin-Richards & Schroeder 2015, Rayner 1986).

The main aim of this study was to investigate differences in children's eye movements for a direct comparison of anglicisms and German words matched for word length and word frequency. First, the frequency effect was more pronounced for German words than for anglicisms for the reading time measures FF and GD. This difference disappeared in the later processing stages represented by TT and RV. However, AoA seems to have a greater impact on reading behavior than word frequencies. Statistical significance was present for the three measures FF, GD, and TT for the AoA; for RV alone, word frequency became significant.

The same effect is seen for AoA. Again, the effect was more pronounced for FF and GD for the German words, for TT and RV the effect size was the same for both word types.

Given the observation that word frequency or familiarity (AoA) has larger effects on German words than on anglicisms for early reading time measures, whereas in the later course of the reading process the effect between the word type is equalled out, it must be that reading times on the target word reflect difficulty in word recognition for anglicisms due to phonological decoding.

This result can be interpreted to indicate that children must initially invest more effort and time in word recognition as they attempt to decode the word. This initially takes longer with anglicisms, since the GPC do not fit ad hoc and have to be re-adjusted. German words that are highly frequent can be recognized more quickly and directly. Once the word is decoded, however, there are no more restrictions for further processing; the anglicism simply had to turn an extra phonological loop. In Figure 62, a schematic time course is illustrated as a tentative description of the overall observations of this study.

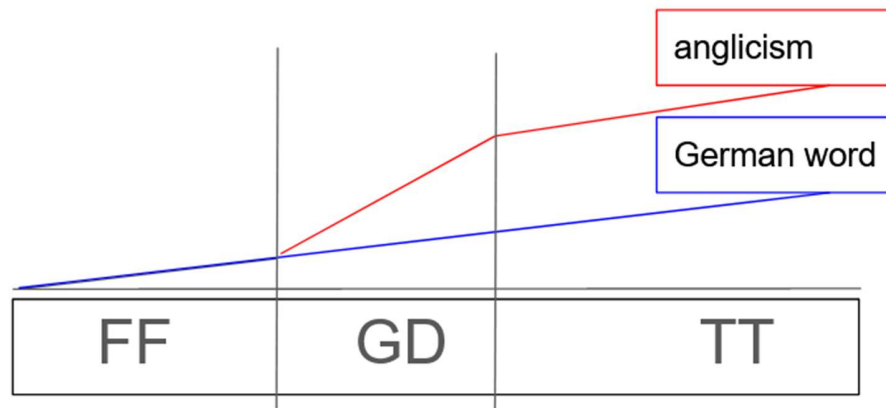


Figure 62: Schematic time course anglicism vs. German word

As the reading behavior measures of the later processing stages are more likely to be influenced by the word type, this may indicate that visual word identification of anglicisms was more resource-demanding as “[f]ixation durations reflect the mental workload associated with linguistic processing in reading” (Vorstius et al 2014: 20). Interestingly, this coincides with the early results of Raney & Rayner (1995: 152), who found an analogous effect for GD for low vs. high frequency words.

The influence of the children’s reading behavior was analogous to that of word frequency and AoA. For FF times there was almost no difference, for GD there was a strong influence for the German words, namely that children with a high index for reading behavior showed significantly lower fixation times with regard to GD. For anglicisms, on the other hand, an effect was almost undetectable, which means that there were hardly any changes in fixation times for GD depending on the reading behavior index. The overall effect of reading behavior on TT was significant ($p < 0.05$), an interaction with the word type did not appear, meaning that the effect was the same for anglicisms and for German words resulting in shorter TT for children that had a higher index for reading behavior.

The proposed influence of older siblings was not verified. Overall gaze time measures were longer for those children who had older siblings. As Figure 63 illustrates using the

descriptive raw data, for children of grade 2 there was apparently no influence of having older siblings, whereas children of grade 4 with older siblings had longer TT on the target words regardless of the word type.

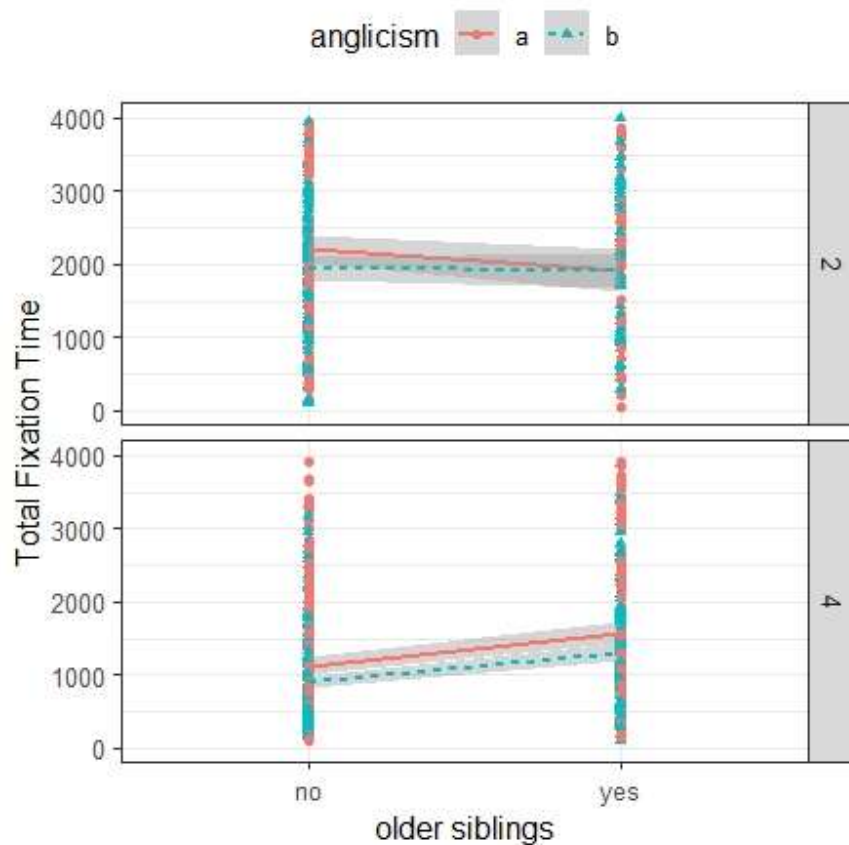


Figure 63: Visualization of TT depending on older siblings

Therefore, the postulated H_4 : *Children who grow up around older siblings know more anglicisms* is not verified and an alternative hypothesis was demonstrated within the dataset of this study:

Older siblings do not enhance the knowledge of anglicisms.

Likewise, the hypothesis stating that children who actively use digital devices know more anglicisms than children who do not have access to digital devices was not proven to have statistically significant effects on the fixation times. In Figure 64 the visualization

of the descriptive raw data implies, that there is a change between the age groups. For students of grade 2 the influence of the use of technological devices apparently has no influence on the reading times. For older student of grade 4, there may be a tendency that technology use marginally favors the knowledge of anglicisms.

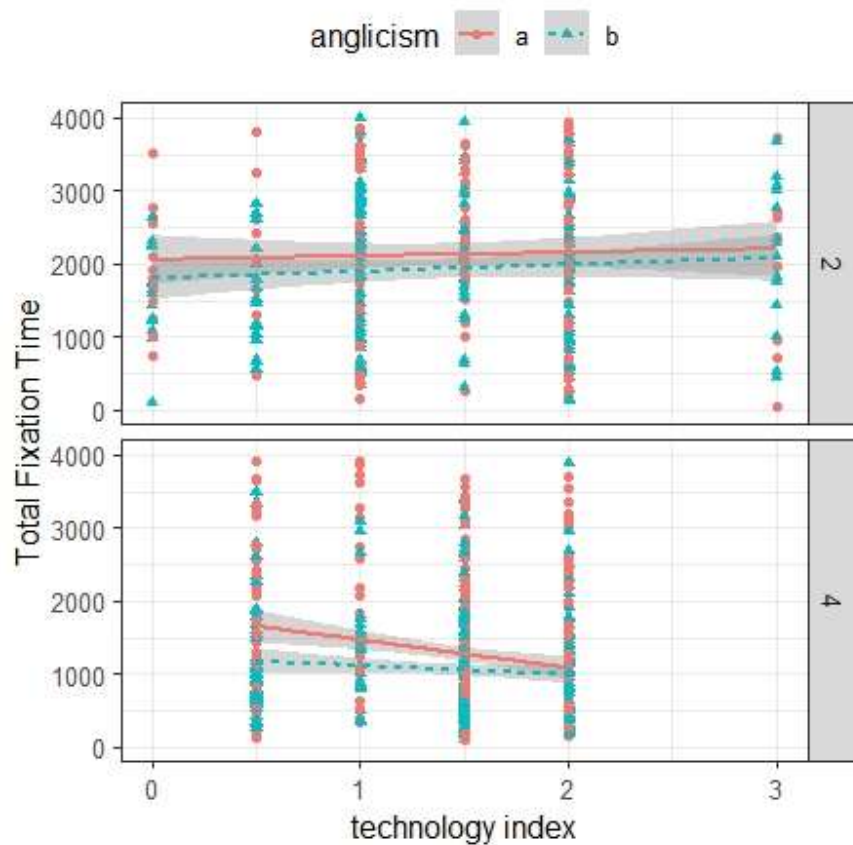


Figure 64: Visualization of TT depending on technology index

Therefore, the postulated ***H₅: Children who actively use digital devices know more anglicisms than children who do not have access to digital devices***, was not proved to be statistically significant, yet a tendency for older children can be assumed.

With increasing age, the use of technological devices may influence the knowledge of anglicisms.

Throughout all reading time measures, age was a significant variable. Therefore, the hypothesis *H₃: The age of the children plays a role, an increase in reading literacy of anglicisms with biological age is expected* was proved to be true.

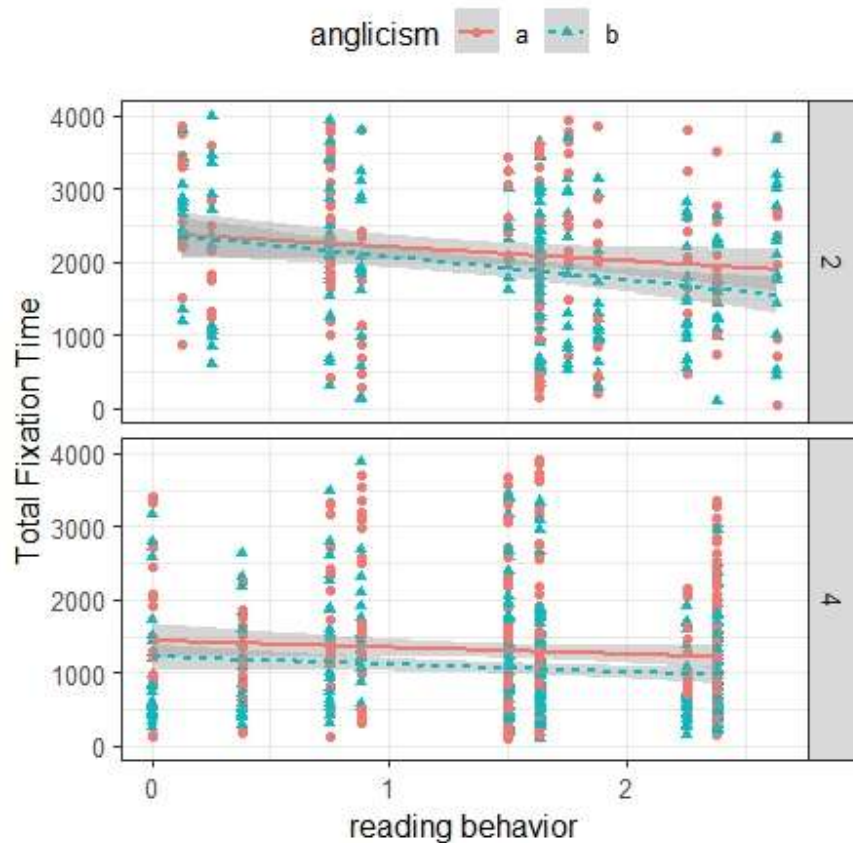


Figure 65: Visualization of TT depending on reading behavior

As discussed in the previous sections, the influence of the reading behavior was not as strong as assumed. Nonetheless, the influence of the reading behavior was significant for German words in GD. Overall, as Figure 65 illustrates from the descriptive data, the effect of the reading behavior seems to be stronger for students of grade 2 in addition to the word type of German words. Considering the observations from the dataset of this study, the postulated hypothesis *H₆: Children who read on a regular basis know more anglicisms than children who are no avid readers or only read for educational purposes*, could be reformulated as

The influence of an avid reading behavior on German words is stronger for younger children.

The ability to store word-specific orthography in the mental lexicon is highly individual. However, it is decisive for how quickly the visual word recognition processes take place. These are heavily dependent on the successful execution of phonological decoding processes. Overall, the available data showed that personal reading behavior has the strongest influence on successful word recognition and thus reading competence. Sociographic factors such as siblings or the use of technical devices have no or only a marginal influence. As postulated by both Ehri (1995) and Share (1995), repeated reading creates entries in the mental lexicon, so that words are also partially read lexically. Pronunciation, meaning and spelling of words are linked and stored in the mental lexicon.

9.8.1. Evidence for frequency effects

The formulated assumption of H₁ that the frequency patterns of anglicisms influence the gaze time measures of early readers when reading anglicisms showed to have similar effects overall, regardless of whether the target word was an anglicism or a German word as no interaction was statistically significant. The effect for FF and GD was less pronounced and increased for TT. Also for RV, the probability that a word was re-fixated was about 10 percent lower for high-frequency words than for low-frequency words. For FF, the effect of word frequency was almost identical for both word types resulting in similar fixation times. A difference in the effect of the word frequency with regard to the word type was only found in GD, where anglicisms were proven to be less sensitive to frequency. This means that German words showed a clear decrease of gaze times when frequency was high. The slope or rate of change for anglicisms remained almost stable. The same observation was made for the AoA. This effect on gaze duration may support the proposal of Grainger et al.'s (2012) model that phonology plays a non-neglectable role in visual word recognition. The model which was designed to describe the reading behavior of beginning readers distinguishes between two routes of word recognition. First, an effortful phonological coding and an automatized use of phonology

that develops according to the beginning readers' exposure to print. Within this model components of the dual-route approach and Share's self-learning hypothesis can be found. The model further distinguishes between two orthographic codes that are generated by the process of parallel letter decoding. The fine-grained route corresponds to what Coltheart et al. (2001) refer to as the indirect route, coding letter-by-letter or phoneme-by-phoneme. If the phonology created in this way encounters an entry in the semantic lexicon, the word is recognized. The coarse-grained route allows direct lexical access to semantics (e.g. direct route for Coltheart et al.'s terminology).

The findings from the frequency and familiarity (AoA) effect on GD is interpreted here as evidence that children are disrupted in lexical access if the GPC are not regular.

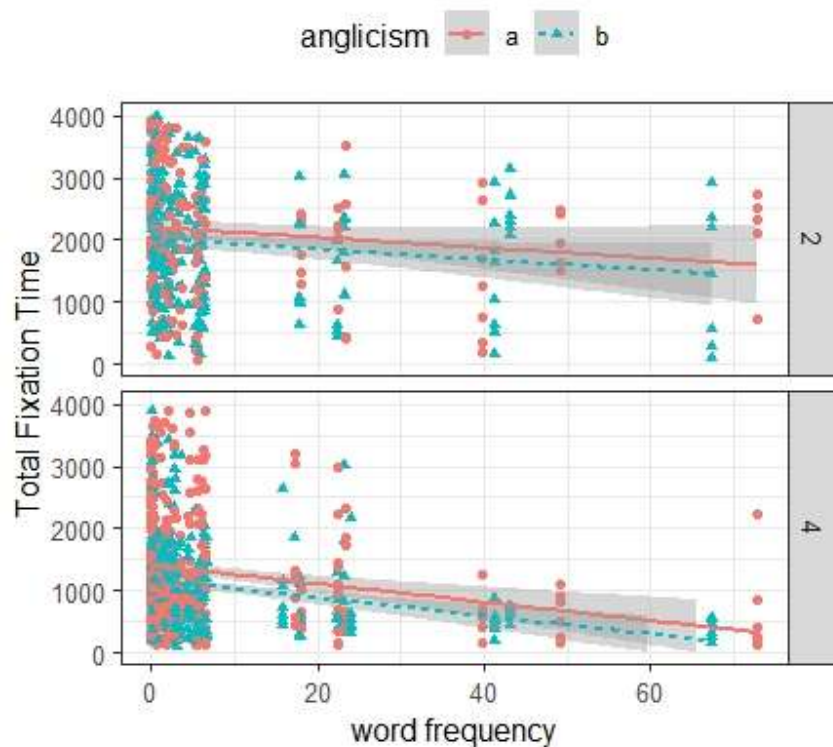


Figure 66: Visualization of TT depending on word frequency

To sum up, as illustrated in Figure 66, the TT spent on the target words is influenced by the word's frequency in a comparable effect size regardless of the word type. Likewise, it becomes evident that TT for anglicisms is longer than for German words overall.

The main hypothesis, *It is assumed that the frequency patterns of anglicisms have an influence on the reading competence of early readers when reading anglicisms*, was not proved right. The effect of the words' frequency was notable only for the German words. The 3-way interaction of the regression models showed additionally that for beginning readers, children of grade 2, the difference between anglicisms and the matched German reference words were huge. The data shows that the frequency of the words hardly played a role in the anglicisms, but a clear role in the German words. The experimental data also showed that this discrepancy decreases as the schoolchildren get older. This means that the frequency of words for children of grade 4 also has an increasing influence on reading times for anglicisms, comparable to the effect on German words.

The same observation derives from the descriptive evaluation of the data with reference to the AoA as illustrated in Figure 67.

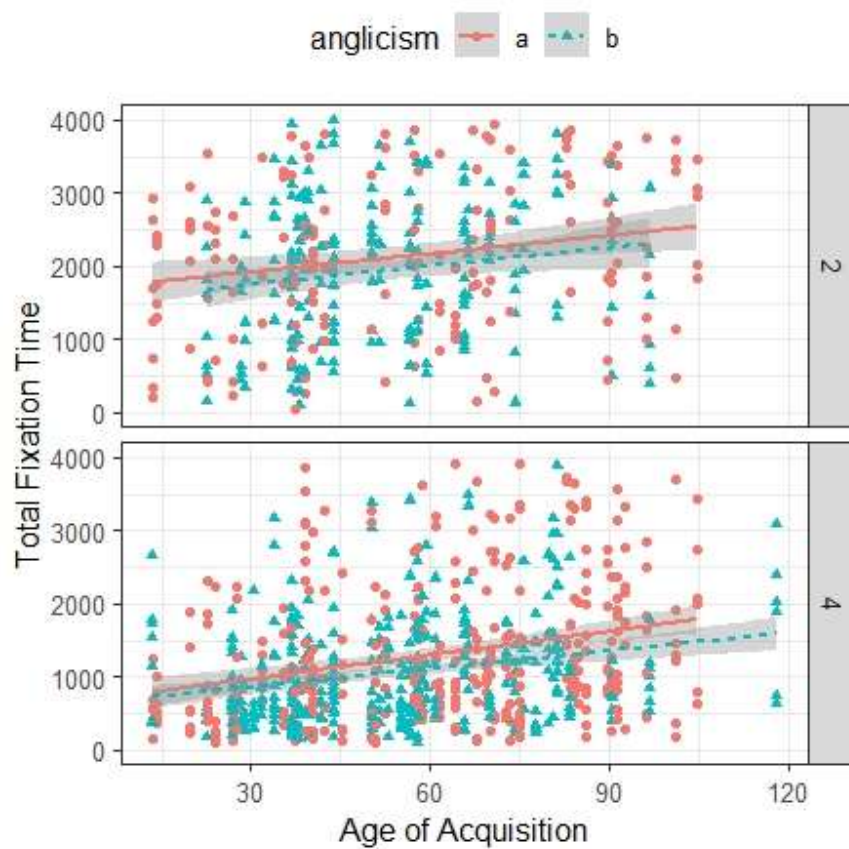


Figure 67: Visualization of TT depending on AoA

Thus, the postulated hypothesis *It is assumed that the Age of Acquisition and the active language use of anglicisms have an influence on the reading competence of early readers when reading anglicisms* is to be answered analogous to H₁. This result is not surprising, but is rather due to the fact that the AoA correlating to the frequency in particular is even more closely aligned with the empirical data at hand, as the data for the AoA was collected in a side study (section 7.2.3). In summary, this means that anglicisms are probably still read serially, especially by beginning readers. At this stage, the phonological component is still predominant and more relevant than with increasing lexicalization.

9.8.2. Evidence for reading strategies

According to Share's theory of self-learning (1995) the recognition of less familiar words requires a larger degree of phonological processing compared to the effort of recognizing familiar words. A key feature of the self-learning theory is the assumption that the "process of phonological recoding becomes increasingly 'lexicalized' in the course of reading development" (p. 156). These considerations support the observations that for children of grade 2 the frequency and AoA effects in GD for anglicisms are not found, however they are for German words. Although both word types were linguistically identical in terms of frequency and length, anglicisms required more effort to retrieve a semantic concept. Share's self-learning theory supports the frequency pattern assertion. This assumes that children know the words that they have heard often. The process of phonological self-learning is increasingly lexicalized during the development of reading ability. Two sub-processes are involved: phonology and orthography. Here GPC is used to decode unknown words. The ability to acquire and memorize word-specific orthography depends heavily on the successful execution of phonological processes. Based on the data obtained from this study and the interpretation of the results, it can be assumed that the native GPC are initially established in the lexicon and that the phonological entries are increasingly expanded. The assumed effects of the word type for beginning readers, showing that children of grade 2 would have more difficulties when encountering an anglicism than a German

word, is based on the assumption that phonological recoding plays the most important role for beginning readers (cf. Grainger et al. 2012, Rau et al. 2014). With increasing reading proficiency, the initial predominance of the indirect route is assumed to decrease towards a more holistic orthographic reading, so it was hypothesized that with increasing age, the effect of the word type will decrease. Here, the patterns of the data showed that especially for GD (which is generally considered to reflect the stage of lexical access of a word), the gaze times were longer for anglicisms than for the German control words. This is evidence that phonological processing is located at the stage of lexical access during reading. This observation is in line with other studies investigating phonology during the reading process (Blythe et al. 2014) which investigated pseudo-homophones for example.

9.8.3. A word on the anglicism debate

As mentioned in the introductory chapter and chapter 5 on anglicisms, the interest in linguistic investigation has a long tradition in corpus linguistics. Here, the amount or share of anglicisms predominantly in print media is reported to be constant, often depending on the branch (e. g. science, sports, economic, fashion). The evaluation of the lexicon index, verifying the eye movements measures, shows that there is a statistically significant difference for anglicisms and German words applied in this study by means of the familiarity with the participating children (see Table 16). The difference in means is not large, however there are high standard deviations, meaning that more German words had an entry in the children's lexicon as they were asked to give definitions in the lexicon task as part of the experiment (cf. section 8.4).

Table 16: Descriptive statistics on lexicon index

grade	word type	mean	SD	p (t-test)
2	anglicisms	0.68	0.34	0.018
	German words	0.72	0.33	
4	anglicisms	0.75	0.32	0.153
	German words	0.77	0.29	

Accordingly, fewer anglicisms are anchored in the children's lexicon than German words, despite the same frequency. This may be an indication for the assumption that, in the sense of a network model, the phonological component plays a decisive role in the establishment of lexicon entries. Or as already noted by Cunningham et al. (2002) who investigated the validity of application of the self-learning hypothesis of Share with controlled RAN²⁷ experiments including homophones "it [orthographic knowledge²⁸]does appear to be something more than print exposure" (p. 197). With regard to existing eye movements research, it was shown that phonology provides pre-lexical support at an early stages of processing as homophones facilitate lexical access (Millegde & Blythe 2019: 5). In this way, psycholinguistic research contributes to the understanding of mechanisms of contact-induced change. Based on the data collected and analyzed here, it can also be assumed that the native language will continue to dominate until there are sufficient linguistic competence in the native language and sufficient entries in the lexicon.

10. Conclusion

Part of the motivation and focus of this work was to contribute to the understanding of reading processes in the previously meager research landscape of eye tracking with children in the field of empirical reception research. In the present study, children of grade 2 and 4 read sentences with manipulated concrete nouns in two conditions (either anglicisms or German word) that were embedded as target words in the same sentence frame. The manipulation tried to assess the readers' reading strategy when encountering items that either correspond to German GPC and can supposedly be read via the indirect, non-lexical route, or did not obey standard German GPC and therefore are assumed to only be read via the direct, lexical route. The fact that the dual-route model (Coltheart et al. 2001) is typically tested with pseudowords in beginning readers was the central

²⁷ Rapid automatized naming (RAN) is a task applied to measure a person's ability to name aloud letters, objects or pictures.

²⁸ Note by the author

motivation for the work. This means that instead of using ecologically invalid comparisons of the processing of pseudowords read (or pseudo-homophones in the study by Blythe et al. 2014), real words (no pseudowords or pseudo-homophones) were used here to investigate the acquisition of reading skills, namely ecologically valid stimuli containing anglicisms that children come into contact within their everyday language use.

In summary, it can be said that reading acquisition can be influenced by a variety of factors. Naming speed, which is linked to the degree of automation of lexical recall, is proven to be a relevant predictor of reading performance. The present study was designed to investigate the effects of children's reading of anglicisms versus matched German words. The data showed that children had problems decoding anglicisms compared to German words which had been matched for length and word frequency, indicating that phonology influences the lexical access, respectively retrieving the correct lexical representation on the basis of a letter string's orthography. This observation in the eye movement data was supported by a vocabulary check of the target words used in the experiment. As the GPC of anglicisms are considered to be irregular with regard to the German phoneme inventory, effects on GD were found. Within the context of this work, this observation is interpreted as a disruption due to phonological difficulties.

With regard to the postulated hypothesis as stated in chapter 6, the following can be noticed. The answer to the first hypothesis – whether the frequency of anglicisms influences the word recognition ability – was not found. The data showed, that frequency played a decisive role for reading time measures overall. However, the frequency effect was stronger for German words than for anglicisms, especially for the reading time measure GD. For children of grade 2 the disruption detected for GD was obvious. Also the active language use respectively the Age of Acquisition showed to affect the reading behavior (hypothesis 2) again with no significant effects for the word type for all dependent variables (reading time measures), except for the GD.

Following the presented theories of learning to read in chapter 2, this observation is only logical, as the recognition of familiar items require a lower degree of phonological processing than words of low familiarity respectively low frequency (Share 1995).

The observations show that children are able to create several phonological entries for an orthographic string in the lexicon at an early age. In relation to the presented theories of learning to read, the following interesting points can be noted. The common aspects of the theories concerning phonology are decisive for this work. Basically, the theories distinguish phases that children go through during the learning process. The first phase is characterized by the fact that children establish the relationships between the orthographic properties of the written words and the words they already know from their oral vocabulary. The children then learn the alphabet with the typical GPC. This enables them to read words that they did not know before or that they are not familiar with. The ability to read words holistically then develops, with direct links between orthography and semantics. At this point, children are no longer reliant on laborious decoding through the phonological units (Blythe et al. 2015, Milledge & Blythe 2019).

Besides theoretical accounts of the AoA or familiarity effect of reading acquisition models, the results are also important for eye movement models. As described in chapter 7.1.4. the E-Z Reader model postulates two serial stages for lexical processing of words. L1 is the familiarity check, where the preliminary lexical processing of an item is initiated. After this stage, a saccade is programmed by the oculo-motor system before L2, the item identification is completed. L1, the familiarity check might be shorter for words that are easily accessible in the mental lexicon, which leads to shorter fixations. So frequency and the AoA can be determined as factors for shorter fixation times in the context of this eye movement model. The findings of lexical processing of children may be included in the existing computational models describing eye movements during reading such as the SWIFT model or the E-Z Reader.

The third hypothesis – assuming that the biological age influences the reading time measures – was also answered in the affirmative. Children of grade 2 showed longer overall fixation times than children of grade 4. The fourth hypothesis addressing the presence of older siblings favoring a better understanding and thus showing effects in the reading behavior had an interesting result. Overall, reading times were longer if there were older siblings living in the same household, yet not statistically significant. The fifth hypothesis arguing that the use of technical devices may enhance the knowledge of anglicisms could not be proved either. The influence of the general reading behavior of the children, hypothesis 6, was analyzed by the reading behavior itself (being an avid

reader vs. not reading for leisure purposes at all) and being read aloud to by others. The influence of reading by themselves was only significant for GD regarding the word type. It is therefore reasonable to assume that phonological representations are activated more slowly than orthographic representations during reading. Here, only German words experienced a positive effect if children read a lot. No evidence for the influence of reading aloud was found for the word type.

In order to embed these observations and results in the theoretical framework presented, the models of word recognition presented in chapter 4 should be briefly discussed again at this point. Both connectionist and dual-route approaches were presented. Against the background of the data available here, both approaches are probably justified. It seems that the dual-route approach is still very pronounced, especially for beginning readers, but that further, network-like approaches to the mental lexicon, similar to the connectionist models, are possible as reading competence increases. Within the concept of connectionist - or network - models, word recognition is explained as a function of the link strengths of the orthographic units stored in memory and their phonological equivalents. It can be argued, that with increasing proficiency (grade 4) also entries for not native GPCs are developing, as the data showed, that the difference of reading times of GD between anglicisms and matched German words is smaller than in the group of reading beginners (grader 2) who strongly rely on the direct route and decoding syllable-by-syllable. Therefore, the data supports the item-based approach of connectionist or network models such as the original type of these models by Seidenberg & McClelland (1989) postulating that phonological, orthographic and semantic features are elaborated during the learning process. As Milledge & Blythe (2019) explain, there is

“a change in phonological processing during reading, this is best characterized as a transition from phonological decoding to phonological recoding. Such a developmental transition is not currently accounted for in theoretical models of learning to read, which simply posit decreasing reliance on phonology as reading skill increases.” (Milledge & Blythe 2019: 8).

Repeated activation in the network reinforces the connection and activation patterns between these features. So here too, the frequency and daily usage of words plays a

decisive role in order to consolidate the phonological entries. With the available data, a certain period of time can therefore be identified in which the transition from serial GPC assignments to holistic reading takes place. For the present study of anglicisms, it can be said that within two years of reading experience, there has already been a major development towards direct lexical access.

However, the assumption that anglicisms behave in the same way when they are matched in frequency to a German word was not confirmed. For children of grade 2 in particular, it was clear that they still read the words to a large extent and that the phonological component via the indirect route in the sense of the dual-route model is the predominant strategy. Nevertheless, this difference seems to be decreasing, at least among the participants of grade 4, so that a shift towards the direct route can be seen. Therefore, the present studies (Milledge & Blythe 2019, Grainger et al. 2012) investigating the role of phonology could be enhanced by using ecologically valid material in the form of real existing words (anglicisms).

10.1. Critical reflections

In the following, selected aspects of the study are critically reflected upon in order to highlight limitations of the study. In retrospect, participant acquisition was much more difficult than expected. At this point, compromises had to be made with regard to the initially created requirement profiles. The participant pool did not consist of participants as in a clinical study, but a certain heterogeneity had to be accepted. For example, it was not ruled out that children with a migration background would participate in the experiment, although care was taken to ensure that the proportion corresponded to the actual share of the school. The time frame for conducting the experiment was also subject to restrictions resulting from the organizational procedures of the participating school. Further, the number of participants was just sufficient for the study design.

The target words in the sentence reading task were controlled for their length and frequency, as these variables have been shown to have a large effect on eye movement measures (Kliegl et al. 2004, Blythe & Joseph 2011). However, not all possible controllable factors could be considered (control of preceding and following words),

also because the sentences were supposed to be meaningful. The sentence reading task itself was externally valid in terms of creating a natural reading behavior. External validity was also well achieved by the generalizability of the data obtained due to a field study and representative sample as well as the investigation of the central research questions through multiple approaches (Döring & Bortz 2016: 95).

As described in section 8.3.2, the AoA was queried for the purpose of the experiment. When comparing the effects of AoA and those of word frequency, similar patterns appear as discussed in the analytical chapter 9. As Figure 66 and Figure 67 show, for the AoA the values are more consistent and cover a wider range. Another advantage of applying the AoA is, that it was querying within a close period of time and therefore it was possible to verify the data of the vocabulary check. As it is very important to use valid data for frequency norms for experimental purposes, for this experiment the norms were taken from the Childlex corpus (2015) and therefore were quite contemporary, as a strong correlation to the AoA could be shown.

10.2. Method reflection and outlook for future research

This study was the first in Germany to quantitatively investigate the reception of anglicisms by young school children. The study was conducted in an elementary school with children of grade 2 and 4. This reception study was flanked by an AoA rating survey with educators from kindergartens of the same region.

Of course, the method of this study - just like any other method - has its disadvantages and weaknesses. These are due on the one hand to the sample of respondents and on the other hand to the selected method. In addition, the validity of observations among participants also has its limitations. Overall, although results become directional, the sample was very heterogeneous within itself. While this certainly reflects an authentic reality in the contemporary compositions, both sociographically and ethnically, it can be considered a confounding factor in terms of a study. In this sense, the present study can be seen as an "exploratory study" (cf. Döring & Bortz 2016: 297) that provides first tentative results. For further studies investigating the reception of anglicisms, for

example, preliminary studies that have a better view of the basal reading skills of the sample may be useful. The critical reflection and description of shortcomings in the previous section provides arguments to replicate the present study with a larger number of participants. In addition, homogeneity with respect to the subject pool in terms of their basic language skills could be better controlled. However, it is always a matter of balancing internal and external validity and certainly also depends on the external circumstances (Döring & Bortz 2016: 206). As this is the first study using anglicisms as agents to investigate reading strategies in beginning readers, it has a tentative character. On the basis of these findings, that GD was most sensitive to the irregularities of GPC providing evidence that there might be some core standard GPC inventory for German. It might be worth investigating which phonemes are represented how often in German and whether a connection with eye movements can be identified here

Further research may include a larger group of children as well as a control group of adults or – as originally planned – a group of proficient readers such as children of grade 6. This would allow an even finer gradation of the influence of phonological recoding for lexical access or word recognition processes.

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12. Appendix

12.1. Reading material

ZUSAMMENFASSUNG SATZMATERIAL					
Nr	Lesesatz	Anglizismus	Referenzwort	Referenzsatz	Klassenstufe
2-1	Papa legt das Handy auf den Tisch neben die Vase.	Handy	Karte	Papa legt die Karte auf den Tisch neben die Vase.	2+4
2-2	Da vorne steht der Computer neben dem Fenster.	Computer	Schuppen	Da vorne steht der Schuppen neben dem Fenster.	2+4
2-3	Papa legt den Teddy in den großen Koffer.	Teddy	Anzug	Papa legt den Anzug in den großen Koffer.	2+4
2-4	Auf dem Foto sieht die gelbe Jeans dreckig aus.	Jeans	Küken	Auf dem Foto sieht das gelbe Küken dreckig aus.	2+4
2-5	Paul trägt ein Skateboard unter dem Arm.	Skateboard	Zeitschrift	Paul trägt eine Zeitschrift unter dem Arm.	2+4
2-6	Der hungrige Cowboy kommt näher.	Cowboy	Ferkel	Das hungrige Ferkel kommt näher.	2+4
2-7	Auf dem Tisch liegen Cornflakes und die Zeitung.	Cornflakes	Zigaretten	Auf dem Tisch liegen Zigaretten und die Zeitung.	2+4
2-8	Sie nehmen das Puzzle mit nach draußen.	Puzzle	Würfel	Sie nehmen den Würfel mit nach draußen.	2+4
2-9	Der verpackte Muffin ist nicht mehr gut.	Muffin	Spinat	Der verpackte Spinat ist nicht mehr gut.	2+4
2-10	Sie kaufen Shampoo in dem Geschäft.	Shampoo	Pfannen	Sie kaufen Pfannen in dem Geschäft.	2+4
2-11	Der freundliche Butler steht da vorne.	Butler	Herzog	Der freundliche Herzog steht da vorne.	2+4
2-12	Gestern wurde mein Notebook mit Wasser geflutet.	Notebook	Handbuch	Gestern wurde mein Handbuch mit Wasser geflutet.	2+4
2-13	Sie nimmt die Webcam mit ins Büro.	Webcam	Mangos	Sie nimmt die Mangos mit ins Büro.	2+4
2-14	Wir hatten den Volleyball in die Hecke befördert.	Volleyball	Kirschkern	Wir hatten den Kirschkern in die Hecke befördert.	2+4
2-15	Paula betrachtet das Tablet lange bevor sie sich hinsetzt.	Tablet	Zugtür	Paula betrachtet die Zugtür lange bevor sie sich hinsetzt.	2+4
2-16	Oma braucht ein bestimmtes E-Book zum Einschlafen.	E-Book	Badeöl	Oma braucht ein bestimmtes Badeöl zum Einschlafen.	2+4
2-17	Nele trug ein schweres Snowboard nach Hause.	Snowboard	Kürbisbrot	Nele trug ein schweres Kürbisbrot nach Hause.	2+4
4-1	Das kleine Baby ist erst ein paar Monate alt.	Baby	Sofa	Das kleine Sofa ist erst ein paar Monate alt.	4
4-2	Jana freut sich über das neue T-Shirt sehr.	T-Shirt	Theater	Jana freut sich über das neue Theater sehr.	4

4-3	Emma nimmt ihr Laptop überall mit hin.	Laptop	Kostüm	Emma nimmt ihr Kostüm überall mit hin.	4
4-4	Im Hof steht der Container hinter der Hecke.	Container	Mülltonne	Im Hof steht die Mülltonne hinter der Hecke.	4
4-5	Peter reinigt den Pool hinter dem Haus nicht gerne.	Pool	Steg	Peter reinigt den Steg hinter dem Haus nicht gerne.	4
4-6	Mia gibt dem Clown eine Flasche Wasser.	Clown	Maler	Mia gibt dem Maler eine Flasche Wasser.	4
4-7	Jakob kümmert sich um den Ketchup für später.	Ketchup	Besteck	Jakob kümmert sich um das Besteck für später.	4
4-8	Nils packt die Shorts in seinen Rucksack.	Shorts	Lineal	Nils packt das Lineal in seinen Rucksack.	4
4-9	Weiter vorne kann Ela den Truck schon sehen.	Truck	Tulpe	Weiter vorne kann Ela die Tulpe schon sehen.	4
4-10	Auf dem Küchentisch liegt ein Sandwich für Lias.	Sandwich	Törtchen	Auf dem Küchentisch liegt ein Törtchen für Lias.	4
4-11	Sie nimmt einen Safe mit auf Reisen.	Safe	Föhn	Sie nimmt einen Föhn mit auf Reisen.	4
4-12	Das Kind sucht das Keyboard im Haus.	Keyboard	Gitarren	Das Kind sucht die Gitarren im Haus.	4
4-13	Im Park gibt es viele Jogger am Morgen.	Jogger	Zecken	Im Park gibt es viele Zecken am Morgen.	4
4-14	Es sind Bücher zum Thema Camping in diesem Verlag erschienen.	Camping	Seelöwe	Es sind Bücher zum Thema Seelöwe in diesem Verlag erschienen.	4
4-15	Sie laufen schnell am Skater vorbei zur Schule.	Skater	Südtor	Sie laufen schnell am Südtor vorbei zur Schule.	4
4-16	Im Keller steht ein alter Beamer in einer Ecke.	Beamer	Öltank	Im Keller steht ein alter Öltank in einer Ecke.	4
4-17	Anton möchte den Smoothie nicht haben.	Smoothie	Restgeld	Anton möchte das Restgeld nicht haben.	4

12.2. Information for guardians

Elterninformation für die Teilnahme an der Eyetracking Studie zur Untersuchung der Rezeption von Anglizismen bei Schulkindern

FACHBEREICH 06

Englische Sprach-und
Übersetzungswissenschaft

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Liebe Eltern,

mit diesem Schreiben möchten wir Ihnen unser Forschungsprojekt *Eyetracking Studie zur Untersuchung der Rezeption von Anglizismen bei Schulkindern* vorstellen. Wir hoffen auf Ihre Unterstützung und möchten Sie im Folgenden über die oben genannte Studie informieren. Es handelt sich dabei um eine wissenschaftliche Studie der Johannes Gutenberg-Universität in Mainz, die die Rezeption, also die Informationsverarbeitung, von Anglizismen bei Schulkindern untersucht.

Anglizismen haben mittlerweile einen festen Platz im deutschen Sprachgebrauch und schon Kinder nutzen Anglizismen aktiv. Uns interessiert, welche Anglizismen von Schulkindern beim Lesen bereits erkannt und auch inhaltlich verarbeitet werden. Mit unserem Forschungsprojekt möchten wir ferner Erkenntnisse darüber erhalten, welche Faktoren einen Einfluss bei der Rezeption von Anglizismen bei frühen Lesern haben.

Dazu möchten wir die folgenden Untersuchungen bei Ihrem Kind durchführen:

- ein Lesetest mit Anglizismen, bei dem die Blickbewegungen aufgezeichnet werden (Dauer ca. 20 Minuten),
- eine Überprüfung des Wortschatzes (Dauer ca. 10 Minuten),
- Beantwortung eines Interview-Fragebogens, in dem wir die Kinder zu persönlichen Daten (z. B. Alter, Alltagssprache in der Familie) und ihren Lesegewohnheiten befragen, z. B. Lesezeit außerhalb der Schule (Dauer ca. 5 Minuten).

Die Durchführung der Tests wird vor Ort in der Schule Ihres Kindes durchgeführt. Mit der Schul- und Klassenleitung wird der Termin so gestaltet, dass Ihr Kind in seinem Lernprozess nicht beeinträchtigt wird. Die Tests sollen während der Schul- bzw. Betreuungszeit Ihres Kindes an einem Termin (Dauer ca. 35 Minuten) zwischen dem 2. November und 18. Dezember durchgeführt werden.

Die Blickbewegungsmessung erfolgt mit einem sogenannten Eyetracker. Die Leseaufgabe wird hierzu auf einem Bildschirm präsentiert. Der Blickverlauf der Pupillen während des Lesevorgangs wird berührungslos mittels Infrarot-Technologie aufgezeichnet. Es werden keine Videoaufnahmen von Ihrem Kind gemacht. Der Eyetracker zeichnet nur die Bewegungen der Pupillen auf. Beim Eyetracking handelt es sich um ein erprobtes Messverfahren für diese Fragestellungen und birgt keinerlei Risiko für die Probanden. Diese Messmethode wird von Ihrem Kind nicht wahrgenommen und ermöglicht eine authentische und stressfreie Untersuchungssituation.

Die Wortschatzabfrage erfolgt als Interview. Dabei fragen wir Ihr Kind, ob es einen Begriff kennt, oder kurz beschreiben kann, um was es sich bei dem Begriff handelt. Für die spätere Auswertung wird eine Tonaufnahme gemacht.

Für unsere Untersuchungen benötigen wir einige persönliche Daten von Ihnen und Ihrem Kind, beispielsweise Alter, Geschlecht und Berufe der Eltern. Mit Ihrer Unterschrift erlauben Sie uns, Sie nach diesen Informationen zu fragen. Alle Daten werden anonymisiert, daher sind Rückschlüsse auf Sie und Ihr Kind nicht möglich. Sämtliche Informationen werden vertraulich behandelt, weder die Schulleitung noch das Lehrerkollegium haben Einblick in die erhobenen Daten. Wir verwenden die Daten zum Leseverhalten Ihres Kindes, um eine deskriptive Analyse durchzuführen. Das heißt konkret, dass einzelne Lesegewohnheiten nicht bewertet oder mit denen anderer Kinder verglichen werden, sondern vielmehr eine Bestandsaufnahme unterschiedlicher Lesegewohnheiten und Lesestrategien erfolgt.

Die erhobenen Daten werden ausschließlich zu Forschungszwecken ausgewertet und gespeichert. Die Tonaufnahmen werden ausschließlich zur Verschriftlichung benutzt, die Aussagen werden dabei anonymisiert. Im Anschluss daran werden die Aufnahmen gelöscht. Dabei halten wir uns an die Richtlinien der DSGVO (Datenschutz-Grundverordnung). Die Daten werden im TRACO-Labor gespeichert und verwaltet. Das Experiment kann jederzeit abgebrochen und eine Löschung der Daten verlangt werden.

Unser Eyetracking Experiment wurde bei der ADD (Aufsichts- und Dienstleistungsdirektion) Rheinland-Pfalz in Ihrer Funktion als Schulaufsicht angezeigt und genehmigt.

Die zum Zeitpunkt der Durchführung des Experiments geltenden Corona Hygieneregeln werden umgesetzt.

Wir freuen uns, wenn Sie uns bei unseren Forschungsarbeiten unterstützen, indem Sie Ihr Kind an der Studie teilnehmen lassen. Hierzu bitten wir Sie das Formular zu Einwilligung Ihrem Kind unterschrieben wieder in die Schule mitzugeben. Verantwortlich für die Datenverarbeitung und die Durchführung der Studie ist Frau Stefanie Linsel.

Datenschutzerklärung:

Ich versichere, dass die erhobenen Daten streng vertraulich behandelt werden. Die Auswertung erfolgt ohne unmittelbaren Bezug zu personenidentifizierenden Daten. Weder Eltern noch Lehrer oder die Schulleitung erhalten Einblick in die Daten und es werden keine Anstrengungen zur Re-Identifizierung einzelner Personen unternommen.

Für Rückfragen stehe ich gerne zur Verfügung – per E-Mail (slinsel@uni-mainz.de) oder telefonisch (06343 9893902).

.....

Stefanie Linsel

12.3. Consent form

Einwilligungserklärung

- Ich bin damit einverstanden, dass mein Kind

JOHANNES GUTENBERG
UNIVERSITÄT MAINZ



.....
Name, Vorname des Kindes

an der Eyetracking Studie zur Untersuchung der Rezeption von Anglizismen bei Schulkindern teilnimmt.

- Ich wurde über die Gründe, die Methode und den Ablauf der Studie schriftlich aufgeklärt, ich fühle mich ausreichend informiert und habe verstanden, worum es geht.
- Ich habe das Recht, jederzeit meine Einwilligungserklärung ohne Angabe von Gründen zu widerrufen. Dadurch entstehen keine Nachteile weder für mich noch für mein Kind.
- Die Teilnahme meines Kindes an der Studie ist freiwillig und anonym.
- Ich habe keine Einwände, dass die anonymisierten Daten für spätere Veröffentlichungen verwendet werden.

.....
Name

.....
Vorname

.....
Ort, Datum

.....
Unterschrift

12.4. Privacy notice

Aufsichts- und Dienstleistungsdirektion (ADD)
Willy-Brandt-Platz 3
D-54290 Trier

Datenschutzerklärung

Gleiszellen,
15.09.2020

Sehr geehrte Damen und Herren,

für in der geplanten *Eyetracking Studie zur Untersuchung der Rezeption von Anglizismen bei Schulkindern* erhobenen Daten versichere ich, dass

- unbefugte Dritte keinen Einblick in die Daten erhalten,
- die Daten nur zu dem im Antrag angegebenen Zweck verwendet werden.

Die Daten werden im TRACO-Labor gespeichert und verwaltet. Dabei halten wir uns an die Richtlinien der DSGVO (Datenschutz-Grundverordnung). Die erhobenen Tonaufnahmen werden ausschließlich zur Verschriftlichung benutzt, die Aussagen werden dabei anonymisiert.

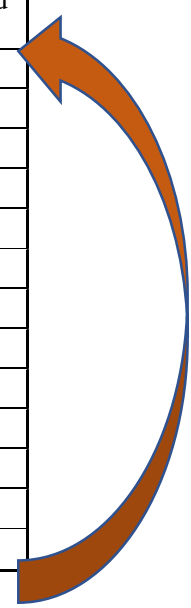
Für Rückfragen stehe ich Ihnen gerne unter der Mobilnummer 0178 33 13 967 zur Verfügung.

Mit freundlichen Grüßen

Stefanie Linsel

12.5. Experimental setup

Ablauf Experiment - Regieplan			
	Minute	Nr.	Tätigkeit
Vorbereitende Arbeiten	0	01	Raum aufschließen
	1	02	Jalousien herunterfahren
	1	03	Licht oberlichtseitig einschalten
	3	04	Stellen der Tische und Stühle
	4	05	Einrichten Station 1: Eyetracker
	10	06	Einrichten Station 2: Fragebogen und Wortschatzabfrage * Aufnahmegerät * Zurechtlegen der Fragebögen * Schreibmaterial
	12	07	Dose mit Süßigkeiten hinstellen
	13	08	Öffnen der Fenster zum Lüften
	15	09	Raum abschließen
Experiment	0	1	Abholen des Probanden vom Klassenraum auf dem Weg: Einführung, erklären, was das Kind erwartet, Smalltalk
	3	2	Raum aufschließen
	4	3	Händewaschen/Hände desinfizieren
	4	4	Fenster schließen
	5	5	Kinnstütze desinfizieren
	6	6	Kinnstütze und Stuhl einrichten
	7	7	Eyetracking Experiment
	20	8	Wechsel Station 1 zu Station 2
	21	9	Starten des Aufnahmegeräts
	21	10	Abfragen der Metadaten
	24	11	Wortschatzabfrage
	30	12	Verabschiedung
	31	13	Öffnen der Fenster zum Lüften
	33	14	Raum abschließen



12.6. Technical setup

Technisches Setup - Ablauf	
Nr.	Tätigkeit
1	Eyetrackerlaptop auspacken und aufklappen
2	Monitor auspacken und aufstellen
3	Beide Geräte positionieren
4	Kabeltrommel anstecken und positionieren
5	Stromversorgung des Eyetrackers zusammenstecken und in die Kabeltrommel stecken
6	Stromversorgung mit dem Eyetracker verbinden
7	Stromversorgung des Monitors in die Kabeltrommel stecken
8	Stromversorgung des Monitors mit dem Monitor verbinden
9	Laptop und Monitor mit VGA-Kabel verbinden
10	Dongel an die USB-Schnittstelle mit der weißen Markierung auf der linken Seite des Laptops einstecken
11	Eyetracker auspacken und an die USB-Schnittstelle mit der gelben Markierung RED einstecken
12	Befestigungsschiene am Eyetracker anbringen und den Eyetracker an den Monitor anheften
13	Maus an eine freie USB-Schnittstelle auf der rechten Seite des Laptops einstecken
14	Monitor einschalten
15	Laptop einschalten
16	iView RED starten
17	Kontrollieren, ob sich Eyetracker verbindet und rot 'leuchtet'
18	DesktopSetup auswählen
19	Experiment Center starten und Experiment öffnen
20	Kontrollieren, ob der externe Monitor der Stimulusmonitor ist
21	Kontrollieren, ob das Experiment im 'locked'-Modus ist
22	Diktiergerät auf Funktionsbereitschaft testen

12.7. AoA norms

Zeitstempel	Handy	Computer	Teddy	Jeans	Skateboard	Cowboy	Cornflakes	Puzzle	Muffin	Shampoo
2021/02/18 4:09:01 PM MEZ	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre
2021/02/18 4:14:32 PM MEZ	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
2021/02/18 8:28:50 PM MEZ	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre
2021/02/21 10:51:20 PM MEZ	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	9, 10 Jahre	3, 4 Jahre
2021/02/24 8:18:14 AM MEZ	1, 2 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre
2021/02/24 8:44:02 AM MEZ	1, 2 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/02/24 2:09:25 PM MEZ	1, 2 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/24 2:48:30 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/02/24 5:49:52 PM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/24 6:24:18 PM MEZ	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	1, 2 Jahre
2021/02/24 10:04:15 PM MEZ	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre
2021/02/25 9:05:13 AM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	1, 2 Jahre
2021/02/25 5:36:27 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
2021/02/25 7:41:28 PM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/25 7:44:39 PM MEZ	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/26 8:07:51 AM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/26 9:15:36 AM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre
2021/02/27 9:55:00 AM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre
2021/03/01 8:28:25 AM MEZ	3, 4 Jahre	5, 6 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre
2021/03/03 2:14:49 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
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2021/03/04 1:59:57 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/04 4:29:50 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre
2021/03/04 8:42:44 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre
2021/03/06 9:15:52 AM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	9, 10 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/08 9:15:27 PM MEZ	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/09 6:52:46 AM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/09 7:13:05 AM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/09 9:21:24 AM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
2021/03/10 11:31:25 PM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	13 + Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre
2021/03/13 9:52:05 AM MEZ	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre
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2021/03/17 5:41:19 PM MEZ	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre

Butler	Notebook	Webcam	Volleyball	Tablet	E-Book	Snowboard	Baby	T-Shirt	Laptop	Container	Pool
11, 12 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	7, 8 Jahre	13 + Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	9, 10 Jahre	3, 4 Jahre
5, 6 Jahre	7, 8 Jahre	9, 10 Jahre	3, 4 Jahre	1, 2 Jahre	11, 12 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	7, 8 Jahre	3, 4 Jahre	3, 4 Jahre
13 + Jahre	11, 12 Jahre	9, 10 Jahre	3, 4 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
9, 10 Jahre	13 + Jahre	9, 10 Jahre	5, 6 Jahre	13 + Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre
9, 10 Jahre	13 + Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre
7, 8 Jahre	11, 12 Jahre	9, 10 Jahre	7, 8 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre
9, 10 Jahre	13 + Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre
9, 10 Jahre	5, 6 Jahre	9, 10 Jahre	9, 10 Jahre	1, 2 Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre
7, 8 Jahre	7, 8 Jahre	7, 8 Jahre	5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre
7, 8 Jahre	5, 6 Jahre	7, 8 Jahre	9, 10 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	1, 2 Jahre
9, 10 Jahre	7, 8 Jahre	9, 10 Jahre	7, 8 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre
3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre	3, 4 Jahre
13 + Jahre	9, 10 Jahre	5, 6 Jahre	9, 10 Jahre	3, 4 Jahre	9, 10 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre
5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
9, 10 Jahre	7, 8 Jahre	7, 8 Jahre	7, 8 Jahre	5, 6 Jahre	9, 10 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre
5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre
9, 10 Jahre	5, 6 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre	13 + Jahre	11, 12 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	13 + Jahre	3, 4 Jahre
7, 8 Jahre	7, 8 Jahre	7, 8 Jahre	5, 6 Jahre	7, 8 Jahre	11, 12 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	7, 8 Jahre	9, 10 Jahre	5, 6 Jahre
7, 8 Jahre	7, 8 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	7, 8 Jahre	1, 2 Jahre
7, 8 Jahre	11, 12 Jahre	9, 10 Jahre	7, 8 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	5, 6 Jahre
7, 8 Jahre	9, 10 Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	9, 10 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	9, 10 Jahre	5, 6 Jahre
7, 8 Jahre	9, 10 Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	9, 10 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	9, 10 Jahre	5, 6 Jahre
5, 6 Jahre	3, 4 Jahre	5, 6 Jahre	7, 8 Jahre	1, 2 Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre
9, 10 Jahre	7, 8 Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre
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13 + Jahre	7, 8 Jahre	7, 8 Jahre	9, 10 Jahre	3, 4 Jahre	7, 8 Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre
9, 10 Jahre	9, 10 Jahre	7, 8 Jahre	9, 10 Jahre	3, 4 Jahre	7, 8 Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre
9, 10 Jahre	9, 10 Jahre	7, 8 Jahre	9, 10 Jahre	3, 4 Jahre	7, 8 Jahre	7, 8 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre
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13 + Jahre	13 + Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre	9, 10 Jahre	9, 10 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	7, 8 Jahre	3, 4 Jahre
13 + Jahre	5, 6 Jahre	5, 6 Jahre	9, 10 Jahre	5, 6 Jahre	13 + Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre
5, 6 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre

Brühe	Globus	Drucker	Knete (Knetmasse)	Eiskugel	Legos	Hörbuch	Abakus	Bergbach	Liederbuch	Wie alt sind Sie?
9, 10 Jahre	3, 4 Jahre	7, 8 Jahre	3, 4 Jahre	7, 8 Jahre	1, 2 Jahre	3, 4 Jahre	13 + Jahre	9, 10 Jahre	3, 4 Jahre	28
3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	3, 4 Jahre	23
5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	13 + Jahre	7, 8 Jahre	3, 4 Jahre	37
1, 2 Jahre	5, 6 Jahre	9, 10 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	13 + Jahre	5, 6 Jahre	1, 2 Jahre	29
7, 8 Jahre	9, 10 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	9, 10 Jahre	7, 8 Jahre	32
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7, 8 Jahre	9, 10 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	9, 10 Jahre	7, 8 Jahre	32
5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	7, 8 Jahre	5, 6 Jahre	28
7, 8 Jahre	5, 6 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	9, 10 Jahre	9, 10 Jahre	3, 4 Jahre	26
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7, 8 Jahre	5, 6 Jahre	7, 8 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	5, 6 Jahre	7, 8 Jahre	37
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3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	27
3, 4 Jahre	11, 12 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	9, 10 Jahre	5, 6 Jahre	3, 4 Jahre	39
7, 8 Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	5, 6 Jahre	24
5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	7, 8 Jahre	7, 8 Jahre	3, 4 Jahre	39
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7, 8 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	13 + Jahre	7, 8 Jahre	5, 6 Jahre	33
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5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	9, 10 Jahre	13 + Jahre	9, 10 Jahre	7, 8 Jahre	62
3, 4 Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	1, 2 Jahre	7, 8 Jahre	13 + Jahre	11, 12 Jahre	7, 8 Jahre	43
5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	13 + Jahre	7, 8 Jahre	3, 4 Jahre	36
5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	5, 6 Jahre	5, 6 Jahre	42
5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	5, 6 Jahre	5, 6 Jahre	42
5, 6 Jahre	7, 8 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	7, 8 Jahre	11, 12 Jahre	5, 6 Jahre	5, 6 Jahre	42
9, 10 Jahre	7, 8 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	1, 2 Jahre	13 + Jahre	9, 10 Jahre	13 + Jahre	24
5, 6 Jahre	9, 10 Jahre	3, 4 Jahre	1, 2 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	13 + Jahre	7, 8 Jahre	5, 6 Jahre	25
5, 6 Jahre	5, 6 Jahre	5, 6 Jahre	3, 4 Jahre	1, 2 Jahre	1, 2 Jahre	3, 4 Jahre	5, 6 Jahre	7, 8 Jahre	7, 8 Jahre	47
3, 4 Jahre	3, 4 Jahre	5, 6 Jahre	1, 2 Jahre	3, 4 Jahre	1, 2 Jahre	7, 8 Jahre	9, 10 Jahre	5, 6 Jahre	3, 4 Jahre	22

Sind Sie...
GrundschullehrerIn
ErzieherIn
GrundschullehrerIn
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ErzieherIn
GrundschullehrerIn
ErzieherIn

item	AoArated months	anglicism
Abakus	117,88	b
Anzug	56,47	b
Arzt	30,35	b
Baby	13,41	a
Badeöl	81,18	b
Beamer	90,35	a
Bergbach	79,76	b
Besteck	33,88	b
Block	55,06	b
Bluse	58,59	b
Brühe	60,71	b
Burger	45,18	a
Butler	100,94	a
Camping	61,41	a
Cartoon	84,00	a
Chef	50,82	a
Clown	26,82	a
Cocktail	86,12	a
Computer	40,24	a
Container	73,41	a
Controller	86,12	a
Cornflakes	39,53	a
Couch	38,82	a
Cowboy	38,82	a
Drucker	57,88	b
E-Book	104,47	a
Eiskugel	31,76	b
Ferkel	41,65	b
Flieger	26,82	b
Flyer	91,06	a
Föhn	36,71	b
Gitarren	36,71	b
Globus	72,71	b
Handbuch	96,71	b
Handy	24,00	a
Herzog	90,35	b
Hörbuch	58,59	b
Jeans	40,24	a
Jeep	74,82	a
Jogger	57,18	a
Karte	38,12	b

Ketchup	31,76	a
Keyboard	67,76	a
Kirschkern	57,88	b
Knete	26,82	b
Kostuem	39,53	b
Krug	77,65	b
Küken	28,24	b
Kürbisbrot	66,35	b
Laptop	57,88	a
Legos	13,41	b
Liederbuch	52,94	b
Lineal	57,88	b
Maler	36,71	b
Mangos	43,76	b
Mountainbike	64,24	a
Muffin	36,71	a
Mülltonne	38,82	b
Notebook	91,06	a
Oldtimer	92,47	a
Öltank	81,18	b
Pfannen	43,76	b
Player	72,71	a
Pool	37,41	a
Puzzle	19,76	a
Restgeld	75,53	b
Safe	89,65	a
Sandwich	52,24	a
Satteltasche	80,47	b
Scanner	84,71	a
Schuppen	69,88	b
Schwan	33,88	b
Seeloewe	65,65	b
Shampoo	35,29	a
Sheriff	64,24	a
Shorts	69,18	a
Skateboard	50,12	a
Skater	69,88	a
Smoothie	67,06	a
Snowboard	70,59	a
Sofa	22,59	b
Spinat	31,76	b
Spray	57,88	a
Steak	58,59	a
Steg	74,12	b

Suedtor	96,00	b
Surfer	74,82	a
Tablet	42,35	a
Teddy	14,12	a
Theater	50,12	b
Toast	27,53	a
Törtchen	56,47	b
Trainer	60,71	a
Truck	64,24	a
T-Shirt	22,59	a
Tulpe	43,76	b
Volleyball	82,59	a
Webcam	83,29	a
Werwolf	83,29	b
Wuerfel	28,94	b
Zecken	50,12	b
Zeitschrift	65,65	b
Zigaretten	51,53	b
Zugtür	59,29	b

12.8. Vocabulary check

Klassenstufe 2	Gruppe I	34 Lesesätze	34 Wortschatz Items
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Wortschatzabfrage

- Fragen: - Kannst Du mir sagen was ein/eine..... ist?
 - Was ist ein/eine.....?

Begriff	Semantisches Konzept		Begriff	Semantisches Konzept	
	Ja	Nein		Ja	Nein
Baby			Karte		
T-Shirt			Schuppen		
Laptop			Anzug		
Container			Küken		
Pool			Zeitschrift		
Clown			Ferkel		
Ketchup			Zigaretten		
Shorts			Herzog		
Truck			Würfel		
Sandwich			Spinat		
Safe			Pfannen		
Keyboard			Handbuch		
Jogger			Mangos		
Camping			Kirschkern		
Skater			Zugtür		
Beamer			Badeöl		
Smoothie			Kürbisbrot		

Klassenstufe 2	Gruppe II	34 Lesesätze	34 Wortschatz Items
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Proband Nummer		Datum	
----------------	--	-------	--

Wortschatzabfrage

- Fragen: - Kannst Du mir sagen was ein/eine..... ist?
 - Was ist ein/eine.....?

Begriff	Semantisches Konzept		Begriff	Semantisches Konzept	
	Ja	Nein		Ja	Nein
Handy			Sofa	Sofa	
Computer			Theater		
Teddy			Kostüm		
Jeans			Mülltonne		
Skateboard			Steg		
Cowboy			Maler		
Cornflakes			Besteck		
Butler			Lineal		
Puzzle			Tulpe		
Muffin			Törtchen		
Shampoo			Föhn		
Notebook			Gitarren		
Webcam			Zecken		
Volleyball			Seelöwe		
Tablet			Südtor		
E-Book			Öltank		
Snowboard			Restgeld		

Klassenstufe 4	Gruppe I	34 Lesesätze	34 Wortschatz Items
----------------	----------	--------------	---------------------

Proband Nummer		Datum	
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Wortschatzabfrage

- Fragen: - Kannst Du mir sagen was ein/eine..... ist?
 - Was ist ein/eine.....?

Begriff	Semantisches Konzept		Begriff	Semantisches Konzept	
	Ja	Nein		Ja	Nein
Baby			Karte		
T-Shirt			Schuppen		
Laptop			Anzug		
Container			Küken		
Pool			Zeitschrift		
Clown			Ferkel		
Ketchup			Zigaretten		
Shorts			Herzog		
Truck			Würfel		
Sandwich			Spinat		
Safe			Pfannen		
Keyboard			Handbuch		
Jogger			Mangos		
Camping			Kirschkern		
Skater			Zugtür		
Beamer			Badeöl		
Smoothie			Kürbisbrot		

Klassenstufe 4	Gruppe II	34 Lesesätze	34 Wortschatz Items
----------------	-----------	--------------	---------------------

Proband Nummer		Datum	
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Wortschatzabfrage

- Fragen: - Kannst Du mir sagen was ein/eine..... ist?
 - Was ist ein/eine.....?

Begriff	Semantisches Konzept		Begriff	Semantisches Konzept	
	Ja	Nein		Ja	Nein
Handy			Sofa	Sofa	
Computer			Theater		
Teddy			Kostüm		
Jeans			Mülltonne		
Skateboard			Steg		
Cowboy			Maler		
Cornflakes			Besteck		
Butler			Lineal		
Puzzle			Tulpe		
Muffin			Törtchen		
Shampoo			Föhn		
Notebook			Gitarren		
Webcam			Zecken		
Volleyball			Seelöwe		
Tablet			Südtor		
E-Book			Öltank		
Snowboard			Restgeld		

12.9. Metadata questionnaire

Fragebogen/Interviewbogen

**Eyetracking Studie zur Untersuchung
der Rezeption von Anglizismen bei Schulkindern**

Metadaten Probandengruppe

Datum: _____

Proband: _____

Wie alt bist du? _____

Sehhilfe: keine Brille Kontaktlinsen

W/M: Weiblich Männlich

Klassenstufe: 2 4 6

Welche Sprache wird bei dir zuhause gesprochen? _____

FACHBEREICH 06
Englische Sprach-und
Übersetzungswissenschaft

Universitätsprofessorin
Dr. Silvia Hansen-Schirra

JGU Mainz
An der Hochschule 2
D-76726 Germersheim

Studienleitung:
Stefanie Linsel
slinsel@uni-mainz.de

Muttersprache: _____

Als was arbeiten deine Eltern?

Vater: _____

Mutter: _____

Wohnen ältere Geschwister bei dir zuhause?

ja, im Alter: _____ nein

Liest du außerhalb der Schule in Büchern/Ebooks oder Magazinen/Zeitungen zum Spaß (nicht als Hausaufgabe)?

jeden Tag mehrmals pro Woche mehrmals im Monat nie

Liest du auch in Online-Medien wie Facebook, Twitter, elektronische Artikel (wikipedia)?

jeden Tag mehrmals pro Woche mehrmals im Monat nie

Wie viele Bücher hast du während der Sommerferien gelesen?

mehr als 6 3 bis 6 1 bis 3 keine

Wer liest dir zuhause Geschichten vor:

Mutter/Vater Bruder/Schwester eine andere erwachsene Person niemand

Wie oft wird dir vorgelesen?

täglich mehrmals pro Woche mehrmals im Monat nie

Liest du Geschichten oder Artikel mit einer der folgenden Technologien?

Computer Tablet (Ipad) Handy/Smartphone Internet nein

Nutzt du Zuhause einen PC/Laptop, ein Tablet oder Smartphone oder eine Spielekonsole?

jeden Tag mehrmals pro Woche einmal pro Woche nie

Hast du schon Englischunterricht und seit wann?

Kindergarten Grundschule weiterführende Schule noch keine Kenntnisse

12.10. Approval of the school supervisory authority

From: ADD, Schulumfragen (ADD) <Schulumfragen@add.rlp.de>
Sent: Thursday, September 17, 2020 7:01 AM
To: Linsel, Stefanie Sarah <slinsel@uni-mainz.de>
Subject: 273-20 AW: Anzeige einer wissenschaftlichen Untersuchung in Schulen

Sehr geehrte Frau Linsel,

vielen Dank für die Anzeige Ihrer geplanten wissenschaftlichen Untersuchung an Schulen.

Gerne genehmige ich Ihnen hiermit Ihr Vorhaben.

Für Ihre Forschungsarbeit wünsche ich Ihnen viel Erfolg.

Mit freundlichen Grüßen

Im Auftrag

Thomas Rendenbach

Abteilung 3 - Schulen und Kultur
Referat 32 - Allgemeine Schulverwaltung, Kirchenrecht und Kulturpflege

Aufsichts- und Dienstleistungsdirektion

Willy-Brandt-Platz 3
54290 Trier
Telefon 0651 9494-174
Telefax 0651 9494-77-174
thomas.rendenbach@add.rlp.de

12.11. Covid hygiene guidelines for the implementation of the experiment

Hygieneplan für die Durchführung eines Eyetracking Experiments

In Anlehnung an des Hygieneplan-Corona für die Schulen in
Rheinland-Pfalz in der 5. überarbeiteten Fassung vom 17.08.2020

1. Vorbemerkungen

Der vorliegende Hygieneplan orientiert sich an dem eingeführten *Hygieneplan-Corona für die Schulen in Rheinland-Pfalz* und wurde erarbeitet, um die Einhaltung des Infektionsschutzes während der Durchführung des *Eyetracking Experiments zur Untersuchung der Rezeption von Anglizismen bei Schulkindern* zu gewährleisten. Mit der/dem Hygienebeauftragte/r an den teilnehmenden Schulen wird die Durchführung des Experiments und die Umsetzung des vorliegenden Hygieneplans abgestimmt. Das Setting für das Experiment sieht vor, dass ein Raum (beispielsweise die Bibliothek) seitens der Schule für den Aufbau der Testapparatur zur Verfügung gestellt wird. Der Eyetracker in Form eines Bildschirms an dessen unterem Rand der Eyetracker angebracht ist steht auf dem Tisch und eine am Tisch arretierte Kinnstütze ist der vorgesehene Platz für die Probanden. Das Kind sitzt auf einem Stuhl an diesem Tisch, der Kopf wird auf die Kinnstütze gelegt, um den Kopf zu stabilisieren und um eine gute Qualität der Daten beim Aufzeichnen der Blickbewegungen durch den Eyetracker zu gewährleisten. Weiter anwesend im Raum werden Frau Stefanie Linsel und gegebenenfalls eine weitere Mitarbeiterin des TRACO Labors sein. Diese werden während des Experiments (Eyetracking, Interview Fragebogen und Wortschatzüberprüfung) auf einem Stuhl mit erforderlichem Mindestabstand von 1,5 m platziert sein (am anderen Kopfe des Tisches). Die erforderliche Raumgröße hinsichtlich des

erforderlichen Mindestabstands zwischen den im Raum anwesenden Personen von 1,5m wird bei der Auswahl der Räumlichkeit berücksichtigt.

2. Hygienemaßnahmen

Personen, die

- mit dem Corona-Virus infiziert sind oder mit COVID-19 zu vereinbarende Symptome aufweisen,
- innerhalb der letzten 14 Tage Kontakt zu einer infizierten Person hatten oder
- einer sonstigen Quarantänemaßnahme unterliegen,

dürfen am Experiment nicht teilnehmen.

a) Persönliche Hygiene

- Es wird auf jeglichen Körperkontakt (Händeschütteln) verzichtet.
- Es erfolgt eine gründliche Händehygiene sowohl bei den Kindern als auch bei den Durchführenden des Experiments vor und nach jeder Einzeltestung (Händewaschen oder Händedesinfektion). Desinfektionsmittel wird in ausreichender Menge zur Verfügung gestellt.
- Einhalten der Husten- und Niesetikette.
- Das Tragen einer Mund-Nasen-Bedeckung für die Schulkinder bis zum Erreichen des Sitzplatzes, für die Studiendurchführende(n) für die gesamte Zeit des Experiments.

Raumhygiene

- Lüften: Eine intensive Lüftung des Raums vor und nach jeder Einzeltestung erfolgt als Stoßlüftung bzw. Querlüftung durch vollständig geöffnete Fenster, d. h. dies erfolgt spätestens nach 20 Minuten.
- Flächendesinfektion: Die Kinnstütze, der Tisch und alle weiteren Flächen, mit der die Kinder in Kontakt kommen werden nach jedem Kind desinfiziert.
- Es wird sichergestellt, dass die Türklinke nur von einer Person betätigt wird.

3. Mindestabstand

Ein Mindestabstand von 1,5 m zwischen allen sich im Raum aufhaltenden Personen wird stets gewahrt. Die Stühle und ein Tisch werden entsprechend des erforderlichen Mindestabstands aufgestellt. Es ist vorgesehen, dass die Kinder vor einem Bildschirm sitzen, die Studienleiterin wird am anderen Kopfe des Tisches vor einem Laptop sitzen. Falls der Mindestabstand von 1,5 m beispielsweise beim Einstellen der Stuhlhöhe für die Kinder kurzfristig nicht eingehalten werden kann, ist sichergestellt, dass eine Mund-Nasen-Bedeckung getragen wird.

4. Dokumentation und Nachverfolgung

Um ein erfolgreiches Kontaktmanagement durch das Gesundheitsamt zu gewährleisten, werden die Anwesenheiten im Raum dokumentiert.