EXPLICIT HISTORICAL, PHONETIC, AND PHONOLOGICAL INSTRUCTION IN SECOND LANGUAGE ACQUISITION

by

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This dissertation reflects a culmination of personal and academic interests in historical linguistics, language education, phonetics and phonology, psychology, and applied linguistics. When I began learning German at high school, I was always fascinated by the connections between English and German as a result of various historical changes that have taken place. Since then, I have always wondered how knowledge of language history could be beneficial for learners when learning a historically related language. Since 2015, I have been studying and researching language variation and change at Purdue University under the supervision of Prof. John Sundquist, and I have had several opportunities to explore the histories of Germanic languages.

In 2011, I took a language course at the University of Leipzig. In one of the classes, an applied linguist introduced the International Phonetical Alphabet to learners of German. Personally, I felt that knowledge of place and manner of articulation helped me learn to produce non-English phones in a more native-like manner. This experience with applied phonetics catalyzed my future interest in applied linguistics, which ultimately led me to explore the place of phonetics and phonology in the second language classroom as part of this dissertation.

As both a linguist and a language teacher, I have long been interested in the intersection between linguistics and language pedagogy, so for this dissertation I wanted to explore this relationship further. In particular, I wanted to explore the ways in which knowledge of historical linguistics and phonetics and phonology can be useful to second language learners.

I would like to thank my supervisor, Prof. John Sundquist, as well as my committee members (Prof. Mariko Wei, Prof. Olga Dmitrieva, Prof. Mary Niepokuj) for allowing me to pursue an interdisciplinary topic of this kind. I would also like to thank Vanessa Felton for her arduous work recording the German stimuli.

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ABSTRACT

The question of whether second languages (L2s) are best learned implicitly or explicitly has been a topic of much empirical discourse, with the majority of studies pointing to the benefits of explicit instruction when learning L2 grammar rules. However, given the focus on grammar, it is unclear how generalizable these findings are to other linguistic domains, such as L2 speech and L2 vocabulary. The previous focus on laboratory-based settings, and the language bias in the literature, also make it unclear how ecologically valid and applicable these findings are to the real world. To address these macro research questions, two experiments were carried out on English-speaking L2 learners of German.

Experiment I (ExI) investigated the effects of implicit and explicit learning on the acquisition of Final Obstruent Devoicing and Dorsal Fricative Assimilation. The effect of the two learning conditions on L2 perception was also measured using a perceptual discrimination task and a perceptual identification task. Experiment II (ExII) investigated the effects of explicit historical instruction on the learning of English-German cognates, which were compared to the effects of a non-explicit learning condition. To examine whether declarative knowledge of relevant historical changes can aid in vocabulary learning, an explicit condition received instruction on the Second Germanic Sound Shift, Ingvæonic Palatalization, and relevant historical semantic changes. Both experiments followed a pre-/post-/delayed-post-test design.

Results indicate that the two explicit conditions significantly outperformed the non-explicit conditions, suggesting that explicit learning and explicit instruction can be beneficial when learning L2 speech and L2 vocabulary. In ExI, acoustic analyses of learner speech samples indicate that the explicit condition was more successful in the learning of the two phonological rules. In ExII, the explicit condition was more successful in the identification and learning of cognates, suggesting that knowledge of language history, and instruction on applied historical linguistics, can be beneficial when learning a language that is historically related to a language that learners already speak. The results from this dissertation are discussed in the context of implicit and explicit learning and instruction, the role of attention, and the role of declarative knowledge, with concluding remarks pointing to the importance of metacognitive and metalinguistic awareness in adult or university-level language courses.

CHAPTER 1. INTRODUCTION

1.1 Background

Communicative-Based Approaches to Language Teaching (henceforth, CLT) have dominated North American L2 pedagogical practices for the best part of four decades (Lee & VanPatten, 2003; Savignon, 2005; Dörnyei, 2009; Littlewood, 2011; Thornbury, 2016).[1] As a result of CLT, and the proponents of meaning-focused or implicit learning conditions (Krashen, 1982; Reber, 1989, 1993), explicit instruction has been, to varying degrees, downplayed, de-emphasized, or in some instances, discouraged in the L2 classroom (Renou, 2001, pp. 248–249; Nassaji & Fotos, 2004, p. 126; Saalfeld, 2011, p. 144). However, there is a large body of empirical evidence to suggest that explicit instruction is superior to implicit instruction with respect to the acquisition of L2 grammar rules (Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Kang et al., 2019).

While many studies have attempted to compare the effectiveness of explicit and implicit learning conditions on varying aspects of second language acquisition (Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Kang et al., 2019), few studies have successfully compared both learning conditions objectively while simultaneously accounting for potentially confounding variables such as learner-internal factors (e.g., previous knowledge of learners) and learner-external factors (e.g., the instructor, the level of instruction, time exposure to stimuli), both of which could significantly affect the degree of learning. Given that the majority of studies have focused largely on (semi-)artificial laboratory grammars (DeKeyser, 1995; de Graaff, 1997; Rebuschat & Williams, 2012), it is unclear how applicable these findings are to the L2 classroom. Moreover, given the previous focus on the acquisition of languages such as English and Spanish (Thompson & Derwing, 2015; Levis, 2019), it is unclear how generalizable these results are to languages such as German. Furthermore, it is also unclear how amenable other linguistic domains are, such as L2 vocabulary and L2 speech, to explicit instruction given the predominant previous focus on L2 grammar rules. These empirical gaps therefore serve as a point of departure for this dissertation.

[1] Broadly defined, L2 refers to any language beyond the L1. In this dissertation, no distinction is made between language learning and language acquisition.

1.2 Research Specifics

1.2.1 L2 Pronunciation

While the acquisition of L2 grammar rules is important, learners have to "physically produce the sounds of the target language with enough accuracy to be understood" (Miller, 2012, p. 48). An impressive command of L2 grammar rules can be rendered incomprehensible in the presence of non-target-like production (Lord, 2008; Goodwin, 2014). However, accurate production and perception of L2 speech sounds alone is also insufficient without knowledge of their distribution within the L2 phonological system. Nevertheless, explicit pronunciation instruction has been largely ostracized in the L2 classroom (Saalfeld, 2011) and recasts, the most frequent type of corrective feedback for pronunciation, have been found to be the least noticed by L2 learners (Lyster & Ranta, 1997). As a result, L2 learners are often left to learn pronunciation implicitly (Gordon & Darcy, 2016, p. 61). However, Derwing & Munro (2015) point out that pedagogical decisions in the L2 classroom should be empirically tested and evaluated as opposed to relying on instructor intuitions and institutional preferences and philosophies.

North American English-speaking L2 learners of German have to learn to articulate and perceive consonants (e.g., [ç] [x]) and vowels (e.g., /y, ʏ, ø, œ/) which do not exist in the modern inventory of English. Learners also need to become acquainted with different phonological processes (e.g., Final Obstruent Devoicing and Dorsal Fricative Assimilation) which are not present in North American English. While interest in L2 pronunciation instruction is growing (Field, 2005; Chung, 2008; Derwing & Munro, 2009; Saito, 2011; Kissling, 2013; Sturm, 2013; Lee, Jang & Plonsky, 2015; Thomson & Derwing, 2015; Offerman & Olson, 2016; Bryan, 2019; Offerman, 2020; Peltekov, 2020; Wiener et al., 2020; Olson & Offerman, 2021), from an empirical standpoint it is unclear whether the relevant aspects of German L2 speech should be taught implicitly or explicitly in the L2 classroom.

1.2.2 L2 Vocabulary

In addition to acquiring the phonetic and phonological system, L2 learners also need sufficient vocabulary to become effective communicators (Nation, 2013). However, like with pronunciation instruction, explicit vocabulary instruction is often discouraged in the L2 classroom. Although the majority of L1 vocabulary is acquired incidentally (Nation, 2013; Webb & Nation, 2017),

incidental L2 vocabulary acquisition is generally thought to be less successful (Laufer, 2005; Carpenter et al., 2012). In contrast, explicit learning conditions can offer a number of advantages when learning vocabulary intentionally (Laufer, 2005; Schmitt, 2008; Elgort & Nation, 2010; Elgort, 2011; Yamamoto, 2014).

Because English and German are both Germanic languages, they share a large number of cognates. However, due to various historical changes, such as sound and semantic shifts, many of the cognates are not easily recognizable to most naïve speakers of English. Although some scholars have called for explicit historical instruction in the L2 German classroom (Smith, 1968; Horsford, 1987; Wolff, 1993; Lightfoot, 2007), to date, no empirical studies have tested the effectiveness of explicit historical instruction on the learning of L2 German vocabulary. One of the empirical questions this dissertation seeks to investigate is whether receiving explicit instruction on relevant historical sound and semantic changes can facilitate the learning and identification of English-German cognates for English-speaking L2 learners of German.

1.3 Research Agenda

In light of these unanswered research questions, this dissertation examines the effectiveness of explicit instruction on L2 speech and L2 vocabulary in the German L2 classroom. To address the question of effectiveness, two experiments were carried out, each consisting of two learning conditions: an explicit learning condition and a non-explicit learning condition. Learners in the non-explicit condition followed a traditional communicative, often task-based curriculum, which emphasized a "Focus on Meaning" (Long, 1997) and a "Focus on Form" (Long, 1991; Doughty & Williams, 1998). In contrast, learners in the explicit condition received explicit instruction which emphasized a "Focus on Forms" (Ibid). The effectiveness of implicit and explicit German pronunciation instruction was tested in the first experiment (ExI), and the effectiveness of explicit German vocabulary learning was tested in the second experiment (ExII).

In ExI, the explicit condition received explicit pronunciation instruction on the articulation of German consonants, specifically German stops and German fricatives. The explicit condition also received explicit pronunciation instruction on two phonological rules: German Final Devoicing and German Dorsal Fricative Assimilation (O'Brien & Fagan, 2016, pp. 115–117). In contrast, while the implicit learning condition was given the same amount of time to acquire these target consonants and phonological rules implicitly, they did not receive any explicit instruction.

In ExII, the explicit condition received explicit instruction on two historical sound changes, namely the Second Germanic Sound Shift (Salmons, 2012, pp. 112–118) and Ingvæonic Palatalization (Lass, 1994, p. 55). The explicit condition also received explicit instruction on semantic changes relevant to the evolution of English-German cognates, the effects of which were compared to a learning condition which did not receive explicit instruction.

The structure of this dissertation is as follows. Chapter 2 provides an overview of the relevant previous literature. Specifically, Section 2.1 provides an overview of the implicit-explicit debate, Section 2.2 discusses the role of memory, Section 2.3 reviews the formal features of German phonetics and phonology, as well as the previous studies on German L2 pronunciation instruction, and Section 2.4 reviews the historical relationship between English and German. Previous studies on explicit historical instruction in the L2 classroom are also reviewed in Section 2.4. A summary of the four sections is subsequently provided in Section 2.5, followed by the seven research questions and hypotheses in Section 2.6. The methodology of ExI is presented in Chapter 3, followed by the results in Chapter 4. The methodology of ExII is presented in Chapter 5, followed by the results in Chapter 6. A discussion of the results relative to the previous literature is provided in Chapter 7, followed by conclusive remarks in Chapter 8.

CHAPTER 2. LITERATURE REVIEW

2.1 Implicit and Explicit Debate

2.1.1 Implicit and Explicit Learning

Because this dissertation is framed within the context of implicit-explicit learning, it is useful to define these terms and situate them within the ongoing discourse. However, doing so is no simple task and has posed great difficulty for researchers in Second Language Acquisition and Cognitive Psychology. In his pioneering study, psychologist Arthur Reber (1976) stated that it is consciousness which differentiates implicit and explicit learning, the former consisting of a lack of consciousness and the latter consisting of the existence of consciousness (p. 93). However, precisely what is meant by consciousness is conceptually challenging to define. In 1934, Thorndike & Rock defined implicit learning in terms of awareness, rather than consciousness, with implicit learning defined as "learning without awareness of what is being learnt", a definition which was later taken up by scholars such as DeKeyser (2003, p. 314) and Leung & Williams (2011, p. 33). According to Second Language Acquisition researcher Nick Ellis (1994), implicit learning is "the acquisition of knowledge about the underlying structure of a complex stimulus environment by a process which takes place naturally, simply and without conscious operations" (p. 1). However, it seems that implicit learning has to involve some degree of awareness or consciousness since intake, that is, what is understood from the input (Corder, 1967; VanPatten, 2004), can only take place if learners are able to notice a rule in the input (Schmidt, 1993, p. 209; Schmidt, 1995, p. 20; N. Ellis, 2015, p. 14).

Early research in Cognitive Psychology investigated whether noticing, and subsequently learning, can take place when information is not consciously attended to (Cherry, 1953; Ingham, 1957; Moray, 1959; Treisman, 1960, 1964). In so-called "dichotic listening paradigms" where participants were asked to wear headsets through which different input was simultaneously sent to their left and right ear, participants were asked to intentionally attend to auditory input in one ear and ignore the input in the other. Participants were asked to repeat aloud the attended information, a process known as "shadowing". The results indicated that when attentional resources were diverted elsewhere, unattended information was largely unnoticed. In some cases, it was possible to change the language in the input for one ear or play participants nonsensical speech, and they

would fail to notice (Cherry, 1953; Treisman, 1964). This strand of cognitive research developed into early filter model theories which suggested that unattended information is completely filtered out (Broadbent, 1958), or, more moderately, that unattended information is attenuated (Treisman, 1964; Norman, 1986). More recent research in Cognitive Psychology suggests that the ability to notice unattended information depends on the complexity of understanding the attended information (Strayer & Johnson, 2001; Hyman et al., 2010) or whether attention is divided (Strayer et al., 2011). In the latter case, divided attention, that is dividing one's attention between several stimuli simultaneously, (e.g., operating a vehicle while talking on a cell phone), can lead to "inattentional blindness", a phenomenon whereby information is not noticed because attention is diverted elsewhere (Most et al., 2005; Hyman et al., 2010; Chabris et al., 2011; Strayer et al., 2011; Drew et al., 2013). Meanwhile, some strands of Second Language Acquisition research have proposed that the ability to notice attended information may depend on saliency (VanPatten, 1996, 2003, 2004; Schmidt, 2001), a theory supported in several studies in Cognitive Psychology and Cognitive Neuroscience (Itti & Koch, 2001; Tsuchiya & Koch, 2005).[2] In short, a major conclusion of the studies from Second Language Acquisition, Cognitive Psychology, and Cognitive Neuroscience, is human attentional resources are limited, that is, it is not possible to actively attend to too much input simultaneously (Kahneman, 1973; Robinson, 1995, 2003; Skehan, 2009; Hyman et al., 2010). In the context of Second Language Acquisition, this could potentially mean an impairment or hinderance in the acquisition of linguistic information if learners' attention is diverted elsewhere, such as a diversion to communication in a CLT classroom (Swain, 1985, 1991, 1999; VanPatten, 1996, 2003, 2004).[3]

[2] In Second Language Acquisition research, attention is often measured through "think aloud protocols" (Leow, 1997; Rosa & Leow, 2004; Bawles, 2010; Hama & Leow, 2010) and occasionally through "diary entries" (Schmidt & Frota, 1986; Warden et al., 1995). These protocols can be problematic because controlled introspection, that is, asking people what they noticed, is an indirect measure of attention which fails to account for instances of detection outside of one's conscious experience. In contrast, in Cognitive Psychology and Cognitive Neuroscience, physiological measures of attention have been used, such as ERP (Event-Related Brain Potential) and fMRI (Functional Magnetic Resonance Imaging). However, behavioral measures, such as stimulus response time and eye movement, have been used in more recent attentional research in Second Language Acquisition (cf. Godfroid, 2020).

[3] Although communicative-based approaches to language teaching are often reduced to the label "communicative language teaching" (henceforth, CLT), CLT is not a monolithic entity since it refers neither to a single nor uniform approach or methodology. Instead, the label CLT is an umbrella term for a variety of pedagogical approaches which foreground communicative competence. Because the primary focus is on meaning (i.e., FonM), a variety of instructional approaches can be classified as CLT, such as language immersion (Johnson & Swain, 1997; Lyster, 1998, 1999), content-based language learning (Ullmann, 1999; Rodgers, 2006; Cheng et al., 2010), task-based instruction (Long 1983, 1985; Skehan, 1998; Long, 2015; R. Ellis et al., 2019), the natural approach (Krashen & Terrell, 1983; Krashen, 1996), and cooperative learning (Nunan, 1988; Kagan, 1989).

The very notion of what it means to "notice" has been a topic of much discourse in Second Language Acquisition (Schmidt, 1990, 1993, 1994; Tomlin & Villa, 1994; Robinson, 1995; Truscott & Sharwood Smith, 2011). A hugely influential model is Schmidt's Noticing Hypothesis (1990, 1993, 1995). According to this hypothesis, there are three levels of awareness which are hierarchically ordered: "perception" (level 1), "noticing" (level 2) and "understanding" (level 3). Awareness at the level of perception and noticing is thought to be a "conscious registration of [an] occurrence" whereas awareness at the level of understanding is "recognition of a general principle, rule or pattern" (Schmidt, 1995, p. 29). The Noticing Hypothesis suggests that while understanding involves noticing, noticing does not necessarily involve understanding. Many studies in Second Language Acquisition have found empirical support for this hypothesis; with the finding that awareness at the level of understanding appears to correlate with a significant improvement in intake (Rosa & O'Neil, 1999; Leow, 2000; Rosa & Leow, 2004; Radwan, 2005; Mackey, 2006; Hama & Leow, 2010; Grey et al., 2014; Medina, 2015; Kerz et al., 2017). However, similarly, as Schmidt's model suggests, attempts to direct learners' attention to linguistic forms through what has come to be known as visual or textual "input enhancement" (Sharwood Smith, 1991, 1993) do not necessarily result in understanding or learning (Leow, 1997; Jourdenais, 1998, 2001; Rosa & O'Neil, 1999; Izumi, 2002; Leow et al., 2003; Lee & Huang, 2008; Winke, 2013; La Cross, 2018). In fact, studies in Educational Psychology found that the use of typographic conventions, such as highlighting and underlining as facilitative studying practices, generally have little to no significant effects on learning (Fowler & Barker, 1974; Peterson, 1991).

In line with findings on input enhancement, there is also some evidence to suggest that L2 learners are capable of acquiring rules without detectable awareness, and the conscious registration of a rule is not a sufficient requisite for learning (Williams, 2005; Mackey, 2006). After his [Schmidt's] original claim of noticing being "the necessary and sufficient condition for conversion of input to intake" (Schmidt, 1993, p. 209), Schmidt (1994) later conceded that noticing alone is not the only sufficient condition for learning and thus changed his claim to "more noticing leads to more learning" (p. 129). This more lenient stance aligns with the current *status quo* in Second Language Acquisition where adult attainment of high L2 accuracy is thought to "require(s) additional resources of consciousness and explicit learning" (N. Ellis, 2011, p. 35, see also Robinson et al., 2012). Schmidt's modified assertion also aligns with the research which suggests

that learning relies heavily on focal attention as opposed to peripheral attention (Bialystok, 1990; Cowan, 1999; see also Williams, 2009, p. 341; Baars & Gage, 2010).[4]

In contrast to Schmidt (1990, 1993, 1994), psychologist Jean Gombert (1992) distinguishes two kinds of awareness, awareness which is "epilinguistic" and awareness which is "metalinguistic" (pp. 10–14). Epilinguistic awareness is intuitive awareness of grammar rules, such as knowing intuitively that the subject of a sentence has to agree with the verb, and metalinguistic awareness is the ability to verbalize and explain grammar rules. In a broad sense, metalinguistic awareness can be defined as learners' explicit declarative knowledge of language (Alderson et al., 1997; Elder et al., 1999; R. Ellis, 2004; DeKeyser, 2009) or their explicit declarative knowledge about the phonological, morphological, lexical, syntactic, and pragmatic features of the L2 (Gombert, 1992; Hu, 2002; R. Ellis, 2004). The discussion of metalinguistic awareness is of particular relevance to the implicit-explicit debate since metalinguistic awareness has been found to correlate with L2 grammatical accuracy (Renou, 2001; Hu, 2002; White & Ranta, 2002; DeKeyser, 2003; Elder & Manwaring, 2004; Roehr, 2007; Berry, 2009). For instance, in her studies on English-speaking L2 learners of German, Roehr (2018) found that metalinguistic awareness correlates with German proficiency, with more proficient L2 learners having higher levels of metalinguistic awareness than less proficient learners. Nagy (2007) also argues that metalinguistic awareness is a correlate of a learner's reading ability and vocabulary knowledge. Thus, "metalinguistic information is likely to help learners reach their goals much quicker and much more efficiently" (Rebuschat, 2015, p. 39, citing DeKeyser, 2003).

Avoiding the terms "consciousness" and "awareness", implicit learning can be defined as an incidental process of knowledge acquisition whereas explicit learning can be defined as an intentional declarative process of knowledge acquisition (Yang & Li, 2012). In 2009, Nick Ellis re-defined his definition of implicit learning as "learning without metalinguistic awareness" and explicit learning as "learning with metalinguistic awareness" (p. 7). These re-defined definitions are the ones operationalized in this dissertation.

[4] In focal attention, full attentional resources are utilized which is different to peripheral attention, such as noticing something out of the corner of one's eye.

2.1.2 Implicit and Explicit Instruction

Equipped with a working definition of implicit and explicit learning, the next task is to define implicit and explicit instruction. In a broad sense, explicit instruction can be thought of as instruction in which the goal of the lesson (e.g., to target a specific grammatical structure) is clear to the learner, whereas in implicit instruction the goal of the lesson is not made explicitly clear to the learner (R. Ellis, 2008, p. 438). However, it should be noted that learners receiving implicit instruction can still become aware of the goal of the lesson despite an instructor's best intentions. The difference between implicit and explicit instruction is sometimes paralleled with the distinction between "Focus-on-Form" (henceforth, FonF) and "Focus-on-Forms" (henceforth, FonFS) (Doughty & Williams, 1998). FonF "overtly draws students' attention to linguistic elements as they arise incidentally in lessons whose overriding focus is on meaning or communication" (Long, 1991, pp. 45-46).[5] An example of a FonF activity is one in which learners roleplay the opening of a bank account. Through this activity, learners may inductively and thus incidentally acquire structures such as the imperative (from the basis of the input: e.g., *give me your bank card, wait here, sign here* etc). Therefore, the acquisition of the imperative arises in the context of a communicative task, and learners are not told explicitly that the imperative was the target structure, hence implicit instruction. In contrast, in FonFS, language is dissected into discrete elements, "which are then taught item by item in a linear, additive fashion" (Shintani, 2013, p. 39).

Michael Long later turned this bipartite distinction into a tripartite one with the addition of "Focus-on-Meaning" (henceforth, FonM). These three types of focus (i.e., FonFS, FonF, FonM) can be viewed as part of a continuum which differ in the degree of attention to form (Doughty & Williams 1998, p. 258). FonFS is on the explicit end, which is diametrically opposed to FonM, with FonF in the middle. More recent research in Cognitive Psychology suggests that the ability to notice unattended information depends on the complexity of understanding the attended information (Strayer & Johnson, 2001; Hyman et al., 2010) or whether attention is divided (Strayer et al., 2011). As Doughty & Williams (1998, p. 4) point out, FonFS and FonF are not polar opposites, but FonFS and FonM are. Therefore, explicit instruction can be defined in similar terms as FonFS, namely the intentional instruction of discrete linguistic forms. In contrast, implicit

[5] Note that "form" can refer to any linguistic form, be it phonological, morphological, lexical or grammatical.

instruction can be defined as falling somewhere along the FonF or FonM continuum, that is, the instruction of form as it arises incidentally in communicative or task-based lessons.

A fundamental difference between implicit and explicit instruction is the use of metalanguage (Roehr, 2018, p. 64). In explicit instruction, metalinguistic terminology can be used to describe rules formally, whereas in implicit instruction, metalinguistic terminology is typically avoided. One of the motivations for the use of metalanguage in explicit instruction is the Skill Acquisition Theory (DeKeyser, 2015). This theory postulates that learning a skill follows a developmental sequential pathway where declarative knowledge is a prerequisite to procedural and automatized knowledge. Since declarative knowledge is knowledge of how something works, this stage of high cognitive demand often makes use of metalanguage.[6] In Cognitive Psychology, the Skill Acquisition Theory is attributed to Fitts & Posner (1967) and later Anderson (1983). Although the authors use slightly different terminology, their theory of learning follows the same sequence whereby explicit declarative knowledge becomes proceduralized into implicit knowledge. In Fitts & Posner's (1967) model, the three stages are "cognitive stage", "associative stage", and "autonomous stage", which map onto the same stages as DeKeyser's (2015) "declarative knowledge", "procedural knowledge", "automatized knowledge". The work by Fitts & Posner (1967) later influenced the development of another similar model of skill acquisition, namely the Adaptive Control of Thought (Anderson, 1983), which also maintains the proceduralization and automatization of declarative knowledge. This discussion of the proceduralization of explicit knowledge is revisited in Section 2.2 with the discussion on interface positions.

Turning to the empirical research, various studies have attempted to address the question as to whether implicit or explicit instruction is most effective in second language acquisition, where effectiveness is operationalized as accuracy and speed of acquisition. The majority of studies from the last three decades have found that explicit instruction is more effective than implicit instruction for the learning of L2 grammar rules (Green & Hecht, 1992; N. Ellis, 1993; Hulstijn & de Graaff, 1994; Robinson, 1994; DeKeyser, 1995, 1997; Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Leow, 2018). Based on Reber's artificial grammar (henceforth,

[6] It should be noted, however, that the use of metalanguage in the L2 classroom does not necessarily mean that the established linguistic terminology is used. In many cases, terminology and rules are simplified for pedagogical purposes (James & Garrett, 1991, p. 7).

AG) learning paradigm (1967), DeKeyser (1995) tested the effectiveness of explicit instruction and implicit instruction on the learning of a miniature AG called *Implexan*. Subjects were divided into either the explicit-deductive instruction group (i.e., they received metalinguistic explanations) and the implicit-inductive instruction group (i.e., they did not receive metalinguistic explanations). Two types of rules were tested in this computerized experiment: "simple categorical rules" which are rules that are generalizable, such as–*s* is the orthographic plural marker in English, and "fuzzy prototypical rules" which are complex rules that cannot be reduced to an abstract rule such as *buy > bought, drive > drove*.[7] DeKeyser found that the explicit-deductive condition outperformed the implicit-inductive condition with the learning of categorical rules, but no significant difference was found between the two conditions for the learning of more complex prototypical rules.

DeKeyser's (1995) findings, echoed by others (Reber, 1989; R. Ellis, 1990), suggest that certain rules, namely simple categorical rules, are more amenable to explicit instruction. Even opponents of L2 explicit instruction concede that simple rules can be learned explicitly (Krashen, 1982 p. 97; Reber, 1993 p. 49). However, while the opponents also argue that the inverse is true, that is, complex rules are best learned implicitly (Krashen, 1982, 1994; Reber, 1989, 1993), this claim has not borne out empirically (DeKeyser, 1995; Robinson, 1994, 1996; Rosa & O'Neil, 1999). In Robinson's 1996 study on the effects of implicit and explicit learning on rule complexity in ESL, L2 learners were divided into four learning conditions: implicit, incidental, rule-search, and instructed (1996, p. 34). Two target forms were of interest: subject-verb inversion (simple rule) and pseudo-cleft structures (complex rules). Not only did the explicit learning condition outperform the other three learning conditions for the acquisition of simple rules, but they also outperformed the other conditions for the learning of complex rules. Similar results have also been found in subsequent studies (Hulstijn & de Graaff, 1994; de Graaff, 1997; Rosa & O'Neil, 1999; Wei, 2003; Housen & Pierrad, 2005; Spada & Tomita, 2010).

In their famous meta-analysis which combined the results from 49 studies, Norris & Ortega (2001) found that while both implicit and explicit L2 instruction can be beneficial, explicit instruction appears to be the most effective type of instruction for the learning of L2 grammar rules.

[7] Complexity is often operationalized and defined in different ways depending on the study. Pedagogically, rule complexity is often determined by asking teachers which rules are more difficult to acquire (Robinson, 1996) or by examining L2 errors (Spada & Tomita, 2010).

> "A major theme within second language acquisition has been the conclusion, convincingly won over the last thirty years of research building on the foundations laid by Schmidt (1990), Long (1991), and Lightbown, Spada, and White (1993) that L2 acquisition by implicit means alone is limited in success" (Ellis, 2015, p. 12).

In a more recent meta-analysis on the effects of implicit and explicit interventions on rule complexity, Spada & Tomita (2010) found that explicit learning conditions result in more learning, as measured by accuracy, for both simple and categorical rules. In the most recent meta-analysis, which included 11 studies from Norris & Ortega's original meta-analysis, as well as 23 subsequent studies published between 1999 and 2011, Goo et al. (2015) also found explicit instruction to be more effective for the learning of grammar than implicit instruction. Berges-Puyó (2018) tested the effectiveness of implicit and explicit instruction on the learning of Spanish determiners and found explicit instruction to be significantly more effective for learning Spanish determiners than implicit instruction. Thus, in short, while acquiring a language implicitly is possible, there seem to be observable age constraints with respect to the L2 (Higgs & Clifford 1982; R. Ellis et al., 2009, p. 14; N. Ellis 2011, p. 35). For instance, Bley-Vroman (2009) proposed that the implicit learning mechanisms available for L1 acquisition are no longer adequate for L2 acquisition, while others have suggested that the capacity for implicit learning attenuates with age (Janacsek et al., 2012; Long, 2017). In contrast, "explicit knowledge can be learned at any age" (Bialystok, 1994, p. 566).

However, although the majority of studies suggest that L2 grammar rules are more amenable to explicit instruction, a number of caveats and shortcomings are worth pointing out. First, many of the assessments or measures which have been used to assess the efficacy of implicit and explicit instruction are biased toward explicit testing, that is, the assessments require explicit knowledge to complete the task (Doughty, 2001, 2003; Nassaji, 2017; Kalra et al., 2019). In their meta-analysis, Norris & Ortega (2001) pointed out that around 90 percent of the assessments in the studies they compiled showed possible bias toward explicit testing.[8] Second, higher learning gains reported from L2 explicit instruction do not necessarily mean that L2 implicit instruction does not result in learning. Several studies have shown that implicit instruction can lead to learning (e.g., Williams, 2005; de la Fuente, 2006; Rebuschat & Williams, 2012; Kerz et al., 2017; Kang et al., 2019), and there is a large strand of generative work supporting the biological argument of

[8] However, it should also be noted that these assessments which require explicit knowledge mirror the types of assessments which are generally used to evaluate learners' proficiency in the L2 classroom (Mayes & de Freitas, 2007, p. 14).

implicit L2 acquisition due to the so-called "poverty of the stimulus" or "logical problem of language acquisition" (Bley-Vroman, 1989; Cook, 1991; Schwartz, 1993; Schwartz & Sprouse 1996, 2000, 2013; VanPatten & Rothman, 2015).[9] Third, regardless of whether implicit or explicit instruction is considered most effective for Second Language Acquisition, when providing learners with feedback, research suggests that the most effective instructional methods are those which use both implicit and explicit learning conditions (Kissling, 2013). Finally, one of the shortcomings with the aforementioned research is that, with the exception of Kissling (2013), they refer specifically to the learning or acquisition of L2 grammar rules, not to the linguistic domains which are tested in this dissertation. The relevant studies which address implicit and explicit pronunciation instruction are now addressed in Section 2.1.3, and the studies relevant to implicit and explicit vocabulary instruction are addressed in Section 2.1.4.

2.1.3 Implicit and Explicit Pronunciation Instruction

As previously mentioned, the large majority of studies on the effectiveness of implicit and explicit instruction have focused on the acquisition of L2 grammar rules. Because explicit pronunciation instruction is often discouraged in many communicative-based classrooms (Renou, 2001, pp. 248–249; Saalfeld, 2011, p. 144), L2 learners are often left to learn pronunciation implicitly (Arteaga, 2000; Isaacs, 2009) even though instruction of this kind has received little empirical validation. For this reason, Derwing & Munro (2015) call for a rigorous empirical comparative testing of different instructional methods. The role of L2 pronunciation should certainly not be downplayed since, with the exception of sign languages, oral speech is the vehicle through which the majority of communication takes place (Miller, 2012), and studies have found some association between between pronunciation and intelligibility (Levis, 2005; Derwing & Munro, 2009; Sturm, 2013).

However, in light of the aforementioned research on attentional resources (e.g., Broadbent, 1958; Treisman, 1964; Norman, 1986; Itti & Koch, 2001), it is reasonable to hypothesize that learning L2 pronunciation implicitly can be challenging for learners because of the simultaneous

[9] Like L1 speakers, L2 speakers have been observed to produce linguistic output which is seemingly unexplainable by their received input alone, leading to the hypothesis that they either acquired features of the language implicitly, or alternatively the same Universal Grammar faculties which are present for L1 acquisition are also present for L2 acquisition. However, this type of generative work has come under criticism over the last three decades (e.g., Cowie, 1999; Pullum & Scholz, 2002), and the large majority of research indicates that "naturalistic L2 acquisition is typically much less successful than L1 acquisition" (R. Ellis, 2015, p. 12).

focus on meaning and pronunciation. For instance, recasts, a type of corrective feedback which involves the reformulation of a student's utterance minus the error, are reported to be the most frequent type of corrective feedback, yet the least noticed by learners (Lyster & Ranta, 1997). Therefore, in many cases, learners can process the input for meaning but fail to notice the corrected pronunciation.

Swain (1985) argued that comprehensible output is just as crucial for L2 acquisition as comprehensible input. Through explicit pronunciation instruction, instructors can invite learners to "notice the gap" between their L2 pronunciation and the target pronunciation (Derwing & Munro, 2005, p. 388). Many studies have showcased the benefits of explicit pronunciation instruction on articulation (Derwing & Munro, 2009; Sturm, 2013; Lee, Jang & Plonsky, 2015; Thomson & Derwing, 2015; Wiener et al., 2020; Olson & Offerman, 2021) and some studies have also found that explicit pronunciation training can improve L2 perceptual skills (e.g., Linebaugh & Roche, 2015). There is also some evidence for the reverse trend, that is, perceptual training may also improve L2 pronunciation (Wang et al., 2003; Lee & Lyster, 2017) and speech theories, such as the Speech Learning Model (Flege 1995, 1999, 2002), support this hypothesis, with the postulation that perception precedes production. Whether acquiring L2 perceptual knowledge is a prerequisite for the development of L2 articulatory skills is not entirely clear (e.g., Scott, 2019, p. 1; Offerman, 2020), but both perceptual and articulatory knowledge are important components of L2 speech.

However, because of the age constraints associated with L2 speech, as well as the belief that L2 learners cannot attain native-like accuracy in pronunciation (R. Ellis et al., 2009, p. 14; N. Ellis, 2011, p. 35), pronunciation training is thought by many instructors to be "useless" (Sturm, 2013, p. 655). Despite this, learners seem to be highly motivated toward improving their pronunciation (Derwing, 2003; Zielinski & Yates, 2014; Levis, 2015). As Derwing & Munro (2009) point out, "in these days of learner-centered curricula, it seems ironic that some authorities advocate the opposite of what the students want" (p. 485). "Students recognize the importance of oral corrective feedback and seem less anxious about receiving it than their teachers do about providing it" (Darcy, 2018, p. 28, citing Roothooft & Breeze, 2016).

While the overwhelming majority of studies suggest that explicit pronunciation instruction is effective for improving L2 production and L2 perception (Field, 2005; Chung, 2008; Saito, 2011; Lee, Jang & Plonsky, 2015; Thomson & Derwing, 2015; Gorbani, Neissari, & Kargozari, 2016;

Offerman & Olson, 2016; Darcy, 2018; Offerman, 2020; Olson & Offerman, 2021), because of various confounding factors, it is unclear how generalizable these findings are to languages such as German, and to the L2 classroom in general. Different confounds can be found in previous literature, such as the use of different instructors for different intervention groups (e.g., McCandless & Winitz, 1986; Bryan, 2019), comparisons between different level language classes (e.g., McCandless & Winitz, 1986), and failing to control for the amount of durational exposure to specific stimuli (e.g., Sturm, 2013). Moreover, "effectiveness" has been measured in different ways depending on the study, ranging from different types of impressionistic analyses to acoustic analyses. There is also a clear language bias since historically the large majority of studies on L2 pronunciation have focused on L2 learners of English (e.g., Derwing et al., 1997; Chung, 2008; Thomson & Isaacs, 2009; Saito, 2011; Khaghaninejad & Maleki, 2015), or Spanish (e.g., Lord, 2005, 2008, 2010; Kissling, 2013; Olson, 2014; Offerman & Olson, 2016; Offerman, 2020). To provide some perspective, in Thomson & Derwing's (2015) systematic review of 75 L2 pronunciation studies, 74 percent of the studies were on English, and 13 percent were on Spanish. In a survey of dissertations on L2 pronunciation research, Levis (2019) found similar results, with English and Spanish dominating over two thirds of the languages studied. The English-German L1-L2 pairing is therefore under-represented in the literature. In light of this language bias, one of the aims of this dissertation is to examine the effectiveness of implicit and explicit learning conditions on the acquisition of German L2 speech. Of few studies which have attempted to represent German in the study of classroom-based L2 pronunciation instruction (McCandless & Winitz, 1986; Dlaska & Krekeler, 2013; Roccamo, 2015; Bryan, 2019; Peltekov, 2020), several confounding factors are present, making it challenging to arrive at a conclusion as to which learning condition is most appropriate when learning the relevant aspects of German phonetics and phonology. A detailed review of these previous studies on German pronunciation instruction are provided in Section 2.4.

2.1.4 Implicit and Explicit Vocabulary Instruction

Like pronunciation instruction, the effects of implicit and explicit instruction on vocabulary acquisition are widely understudied relative to their effects on grammar. In implicit instruction, words are presented in meaningful contexts which provide sufficient cues for learners to infer their

meaning. In contrast, in explicit instruction, explicit attention is drawn to vocabulary form, meaning, and use (Nation, 2013).

Because of the symbiotic relationship between vocabulary and reading (Nation, 2013, p. 144), a large body of L2 vocabulary research has focused on incidental vocabulary acquisition through reading (e.g., Laufer & Hulstijn, 2001; Carpenter et al., 2012; Webb & Nation, 2017) be it through Free Voluntary Reading (Krashen, 2004, 2011) or Extensive Reading (Nation, 2015; Webb & Chang, 2015). However, it is estimated that for incidental vocabulary acquisition to take place, learners need to know approximately 95-98 percent of words in a text to successfully be able to infer the meaning of unknown words (Laufer, 1997), and meta-analyses show that even in L1 acquisition only an average of 15 percent of unknown words are acquired incidentally through reading (Swanborn & de Glopper, 1999). Multiple exposures to words with sufficiently rich contexts are also usually required (Rott, 1999; Webb, 2007; Hu, 2013; Webb & Nation, 2017), meaning that low frequency words are seldomly acquired (e.g., Nagy et al., 1985). While several studies have focused on improving the likelihood that incidental vocabulary acquisition takes place (e.g., Laufer & Hulstijn, 2001; Feng & Webb, 2020; Yanagisawa, Webb, & Uchihara, 2020), composite vocabulary gains are generally reported to be minimal (Waring & Takaki, 2003; Laufer, 2005; Mason et al., 2009; Godfroid et al., 2013).

Incidental vocabulary acquisition is therefore viewed as an incremental and gradual process (Webb & Nation, 2017). Even when learners infer word meaning, incorrect inferences can be made (e.g., Hulstijn, 1992; Carpenter et al., 2012). Both L1 and L2 speakers over and undergeneralize word meaning (e.g., Rescorla & Okuda, 1984) and they can confuse "synforms" (Laufer, 1988, 1997), which are words which look and sound alike (e.g., *adapt*/*adopt*, *except*/*accept*).[10] In a study on L2 learners of German, Carpenter et al. (2012) examined the effect of corrective feedback on incorrect inferences acquired through reading. The authors found that learners whose incorrect inferences had been corrected were rarely repeated on post-tests, whereas learners whose incorrect inferences had not been corrected continued to make the same erroneous inferences. Therefore, while the majority of L1 vocabulary is acquired incidentally (Nation, 2013; Webb & Nation, 2017), and incidental L2 vocabulary acquisition is certainly possible (Nagy, Herman & Anderson, 1985; Hulstijn, 1992; Rott, 1999; Rieder, 2003), implicit instruction alone appears to yield poor results

[10] Laufer (1996) uses "synforms" as an umbrella term to refer to words similar in phonographic, orthographic, and morphological form.

(Hyltenstam & Abrahamsson, 2003; Hulstijn, 2003; Hill & Laufer, 2003; Schmidt, 2008, p. 348).[11] Figure 1, which was adapted from Schmitt (2008, p. 341), synthesizes some of the possible reasons why.

- learners who understand the overall message often do not pay attention to the precise meanings of individual words
- guessing from context is often unreliable, especially if the learner does not know 98% of the words in the discourse
- words which are easily understood (guessed) from context may not generate enough engagement to be learned and remembered
- new words which learners have met in discourse need to be met again relatively quickly to avoid their being forgotten. In order for words to be met 10 times in reading, learners would need to read 1–2 graded readers per week. The typical learner simply does not read this much.

(Laufer, 2005)

Figure 1. Issues with Implicit Vocabulary Instruction

Explicit methods, however, can offer a number of advantages (Laufer, 2005; Schmitt, 2008; Elgort & Nation, 2010; Yamamoto, 2014) because it can ease the "learning burden", that is, "the amount of effort required to learn a particular vocabulary item" (Nation, 2013, p. 13). Explicit methods can be effective because of the L1-L2 mapping (Jin & Webb, 2020) as having an L1 translation can be useful because it creates a link to a representation which already exists (Hall, 2002). If a word "represents patterns and knowledge that learners are already familiar with" (Ibid), the learning burden is reduced, whereas if no mapping is provided, learners are left to infer word meaning, which, while simultaneously processing the input for meaning, can increase the learning burden (Laufer, 2005). Historically speaking, a learner's L1 has long had a place in the L2 classroom, the use of bilingual dictionaries being one of the most notable examples (Schmitt, 2008). While using the L1 to create an initial form-meaning mapping can result in negative transfer, by which L2 vocabulary is used in the incorrect contexts (Hemchua & Schmitt, 2006),[12] psycholinguistic evidence suggests that the L1 is still active during L2 lexical processing

[11] In addition to reading, implicit vocabulary instruction can be carried out through informational gap activities and roleplay (Nation & Newton, 1997, p. 244). An example of an informational gap activity is the "two-way interaction" task where learners work in tandem to convey missing information to each other (R. Ellis et al., 2009, p. 11).

[12] An example might be erroneously using *Tabelle* 'table', which is a mathematical table, to refer to the item of furniture *Tisch* 'table', which is an item of furniture.

regardless of whether the L1 is used in the L2 classroom or not (Hall, 2002; Jiang, 2000, 2002; Schmitt, 2008; Knickerbocker & Altariba, 2011).[13] Therefore, in the words of Schmitt (2008), "given the cognitive constraints inherent in learning an L2 […] there is little disadvantage to using the L1 to establish initial meaning" (p. 337).

According to Nation (2001, 2013), knowing a word means knowing its form, meaning, and use.[14] The "form" of the word, or perhaps better rendered "forms", refers to its physical properties, that is, its orthographic and spoken form(s). The "meaning" of a word refers to its semantic content, that is, knowing its concept, referents, and associations. The "use" of a word refers to its natural use in the language by speakers, which means knowing how to use the word grammatically, knowing its collocations, and knowing the contexts in which a given word can appear. Assessing vocabulary knowledge, however, is no easy endeavor. Assessments can evaluate a learner's vocabulary "depth" (Schmidt, 2014, p. 943), that is, how well a word is known, or vocabulary "breadth" or size (Anderson & Freebody, 1981), that is, how many words are known. Different tasks may also call upon either receptive or productive knowledge. Receptive vocabulary knowledge is passive knowledge of a word (Anderson & Freedbody, 1981). For instance, an L2-L1 translation task requires receptive knowledge because L2 learners do not need to actively recall the L2 vocabulary item themselves as they only need to write the L1 equivalent. Productive vocabulary knowledge, on the other hand, is active knowledge of a word. In an L1-L2 translation task, learners require active knowledge of the L2 vocabulary item. A vocabulary test which assesses receptive knowledge is called a receptive retention test, versus a productive retention test which requires productive knowledge. A modified version of the receptive retention test, called an isolated translation task, was used in ExII to assess L2 vocabulary knowledge.

One of the empirical questions which this dissertation addresses is whether providing learners with explicit instruction on the historical relationship between English and German cognates can aid vocabulary learning. Given that some theories of memory suggest that words are stored within a semantic network of related words (e.g., Schwanenflugel & Rey, 1986; Chen &

[13] Researchers who believe that languages within a bi- or multi-lingual speaker are stored independently of each other are referring to a "separate storage model" (Grosjean, 1982) which contrasts with the interactive "common storage model" where the languages are stored in a common space (Kirsner et al., 1984; Green, 1986; Flege, 1995; Jessner, 1997).

[14] These three categories are further sub-divided into nine categories: form (spoken form, written from, word parts), meaning (connecting form and meaning, concept and references, associations), and use (grammatical functions, collocations, constraints on use).

Ng, 1989; Tzelgov & Ezra, 1992), it is reasonable to hypothesize that receiving this associative information explicitly will aid vocabulary learning. According to the Semantic Network Theory, consecutive words similar in meaning are retrieved more quickly than consecutive words which are not (e.g., *tiger – stripes* vs. *apple – car*), a process known as lexical priming (Schwanenflugel & Rey, 1986; Chen & Ng, 1989; Tzelgov & Ezra, 1992). Since memory is thought to have an associative component, the more associations a learner has with a particular word, the higher the likelihood that it is encoded in long-term memory (Bower & Clark, 1969; Craik & Lockhart, 1972; Hulstijn, 2001; Hulstijn & Laufer, 2001; Bolger and Zapata, 2011; Prince, 2012). Given the importance of memory to the discussion of implicit and explicit learning, the role of memory is now addressed in detail in the following section.

2.2 Memory

2.2.1 Conceptualization

Because memory is a Blackbox problem, it is often conceptualized through the use of metaphors (Roediger, 1980).[15] The most commonly used metaphor is the "spatial storage and search metaphor" (Ibid), according to which, memory represents a space where information is stored and can be subsequently accessed; in the same way that data stored on a computer can be accessed through a search interface. For instance, psychologist William James described memory as a house where memories are stored (Roediger, 1980, p. 234), and similarly psychologist Donald Broadbent described memory as a library, with different memories stored in different places like books on a shelf (1971, pp. 464–466). The "spatial storage and search metaphor" suggests that stored information remains intact and is ready to be retrieved at any time. However, despite the implications of such a metaphor, it is widely acknowledged that memory is not a static copy of an original event or experience (Schmidt, 2004). In reality, memories have been shown to be much more malleable, and people can even experience memories of events which have never happened (Garry et al., 1996; Clancy et al., 2002; Schmidt, 2004; Chan & McDermott, 2006; Shaw & Porter, 2015). This process of erroneously remembering an event can happen due to memory's malleability, that is, each time a memory is recalled, the previous retrieval event is reconstructed,

[15] A Blackbox problem refers to instances where it is not possible to look directly inside something. Since we cannot look directly inside the mind (Larson, 2010, p. 13), memory is a blackbox problem.

and it is this reconstructed event which serves as the new memory trace as opposed to the original encoded event (Bartlett, 1932; Loftus & Pickrell, 1995; Kalish et al., 2007).

With the development of new technology, since the 1960s, memory has been compared to the digital computer (Simon & Feigenbaum, 1964). This computational metaphor has become so pervasive in memory research that the terminology used to describe memory has been heavily influenced by Computer Science (Ormrod, 2008), as is clear from memory terms such as "encoding", "storage", and "retrieval" (Roediger, 1980). "Encoding" is the initial registration or acquisition of information, which, for the purpose of this dissertation, is a stage which is affected by implicit or explicit instruction. "Storage" is the maintenance of information over time which can be strengthened or weakened through repetition and practice, and "retrieval" is the stage of access to the stored information.

2.2.2 Declarative and Procedural Memory

Memory is traditionally divided into "procedural memory" and "declarative memory" (Anderson, 1976; Milner et al., 1998; Squire, 2004). Procedural memory refers to memory or knowledge of how to carry out particular activities such as driving, riding a bike, and swimming; skills which often involve motor coordination (DeKeyser, 2009). In contrast, declarative memory refers to memory of factual information or the ability to explain why something is the way it is (Tulving, 2002).[16] Declarative memory can be subdivided into "episodic memory" and "semantic memory" (Ibid). Episodic memory refers to the ability to verbalize episodes, events or experiences (Conway & Pleydell-Pearce, 2000) whereas semantic memory is used for recalling factual information (e.g., *how many days there are in a week*).[17]

Because declarative memory is thought to be a rapid process and procedural memory is thought to be a gradual one (Poldrack & Packard, 2003; Ullman, 2013), neurocognitive studies

[16] Procedural memory is also sometimes called "implicit memory" or "non-declarative memory", and declarative memory is sometimes referred to as "explicit memory".

[17] To consolidate the difference between declarative memory and procedural memory, the following dichotomy is useful. When asked by a customer service representative to recall your online banking password, such a task can be difficult because it requires declarative memory, that is, you need to declare or put into words the password explicitly (i.e., my password is *AlbertEinstein123*). However, when presented with a computer keyboard, the same individual can correctly enter the password. This inability to call the password to memory in the first task, yet successfully call it to memory in the second, is due to these two types of memory at play. The former uses the declarative memory system whereas the latter uses the procedural memory system. Many studies have found instances where declarative and procedural memory compete with one another, thus affecting the ability to complete a task (e.g., Stroop, 1935; Loftus & Zanni, 1975; Kane & Engle, 2003).

(Hamrick, 2015; Hamrick et al., 2018; Ullman & Lovelett, 2018), as well as models of memory (Ullman, 2004, 2005, 2015, 2016; Paradis, 2009), suggest that, at least in the early stages of exposure, declarative memory plays a crucial role in L2 vocabulary acquisition. A recent meta-analysis of correlational studies in adult learners (Hamrick et al., 2018) provides support for this hypothesis, with low-level L2 experience correlating with the use of declarative memory and higher-level L2 experience correlating with the use of procedural memory. Age is also thought to be a factor which influences the predominance of one memory system over the other, with younger speakers relying more frequently on procedural memory, and older speakers relying more frequently on declarative memory (Ullman 2001, 2005, 2012). The age effect therefore makes a prediction about the role of declarative memory in adolescent or adult L2 acquisition, namely that declarative memory plays more of a central role in the acquisition of an L2 than the L1. This may also explain why L2 implicit instruction, especially in adult learners, has been found to be less effective than L2 explicit instruction (Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015).

While both memory systems can be involved in L2 acquisition, declarative memory is thought to underly the mental lexicon (Ullman, 2004, 2005). Given that declarative memory plays more of a central role in adult skill and language acquisition, and is also crucial for lexical memory, it can be argued that declarative memory plays an important role in L2 vocabulary acquisition. Its importance is summarized by Ruiz et al. (2021):

> "as for L2 vocabulary learning, declarative memory is even more crucial and beneficial, as it is the memory system that specializes in rapid learning of arbitrary associations[…]. In fact, learning lexical/semantic information (e.g. word meanings) is always dependent on the declarative memory system, implying that L2 learners rely on this system to learn foreign words, regardless of their proficiency level" (p. 515).

While neurocognitive studies also provide evidence for a structural separation between declarative knowledge/memory and procedural knowledge/memory systems in the brain (Poldrack et al., 2001; Morgan-Short et al., 2010), whether declarative knowledge can become proceduralized knowledge has been a topic of much debate (Krashen, 1982, 1985; Anderson, 1983; Gregg, 1984; R. Ellis, 1994; McLaughlin, 1987; DeKeyser, 1997; Mitchell & Myles, 1998; Hulstijn, 2002, 2005; Paradis, 2009). In research on Second Language Acquisition, the different stances regarding the proceduralization of explicit knowledge are expressed through interface positions: the "non-

interface position" (Krashen, 1982, 1985; Hulstijn, 2002, 2005; Paradis, 2009), the "weak interface position" (Long, 1991; R. Ellis, 1994), and the "strong interface position" (Anderson, 1983; R. Ellis, 1994; DeKeyser, 1997, 2007).

The basis of the "non-interface position" was Krashen's (1981) difference between "acquired knowledge" which is the subconscious internalization of grammar rules, and "learned knowledge" which is the conscious formulation of explicit grammar rules. Krashen asserted that because acquired knowledge and learned knowledge are stored in different parts of the brain, learned knowledge cannot be converted into acquired knowledge, suggesting that there is no interface between the two types of memory/knowledge. The diametrically opposed view is the "strong interface position" which states that declarative/explicit knowledge can in fact become proceduralized (Anderson, 1983; R. Ellis, 1994; DeKeyser, 1997). As Nassaji (2017, p. 207) points out, the strong interface position has empirical support through the Skill Acquisition Theory (DeKeyser, 2015), as well as neurolinguistic studies which suggest that implicit knowledge is a product of proceduralized explicit knowledge.

As mentioned in Section 2.1, the Skill Acquisition Theory (DeKeyser, 2015) postulates that if L2 learners receive explicit instruction which leads to explicit knowledge, through sufficient practice the explicit knowledge can become proceduralized and automatized as implicit knowledge. In other words, the more this knowledge is accessed via practice, the easier it becomes to access, thus becoming proceduralized and automatized (Ortega, 2009, p. 85). This claim is supported by neuroscience with the process of "Long Term Potentiation", whereby synaptic connections between neurons become strengthened with frequent activation, which is the primary neural basis for the explanation of learning (Nicoll, 2017). This claim is also supported by the so-called "spacing effect" which shows that if material is spread out over time, as opposed to being crammed, retrieval rates are higher (Karpicke & Bauernschmidt, 2011; Rogers, 2017).

The attempt to proceduralize explicit declarative knowledge in the L2 classroom is often operationalized through PPP 'Presentation-Practice-Production' in explicit instruction (Byrne, 1986; Ur, 1996; Nakata et al., 2007). First, FonFS instruction draws explicit attention to a particular form/rule/vocabulary item. Second, the learners have the opportunity to put to practice what they have learned. Finally, this knowledge results in production. The fact that several empirical studies have showcased the benefits of explicit instruction provides further support for the presence of an interface communication of some kind. This middle ground between the two positions is called

the "weak interface position" which postulates that explicit knowledge can become implicit knowledge but there are some constraints conditioning how and when this can happen (Long 1991; N. Ellis, 2005).

2.2.3 Short Term and Long Memory

On a temporal dimension, memory can be divided into three memory stores: "sensory memory", "short-term memory", and "long-term memory" (Atkinson & Shiffrin, 1968).[18] While short-term memory, also called "working memory" (Wilhelm et al., 2013), is known to be limited in capacity, long-term memory is thought to have an unlimited capacity (Juffs & Harrington, 2011). Using the computational spatial storage and search metaphor, long-term memory can be compared to information saved on a hard drive, whereas working memory can be compared to RAM 'Random Access Memory' which acts as a temporary workspace where information can be lost at any point, such as closing a word document or web browser. Although information can be temporarily stored in short-term memory through intentional processes such as the "phonological loop" (Baddeley, 2007), unless information is transferred to long-term memory, it is lost (Atkinson & Shiffrin, 1968). It is therefore argued that for successful learning to take place, information must be passed from short-term memory to long-term memory (Atkinson & Shiffrin, 1968).

"Rehearsal" is an encoding mechanism through which this serial transfer from short-term to long-term memory can take place (Atkinson & Shiffrin, 1968; Craik & Watkins, 1973; Craik & Tulving, 1975). According to Craik & Watkins (1973), there are two types of rehearsal: "maintenance rehearsal" and "elaborative rehearsal". Maintenance rehearsal is the conscious attempt to maintain information in short-term memory, through, for instance, the phonological loop. In contrast, elaborative rehearsal, or "elaboration" as it is often referred to in second language acquisition research (e.g., Barcroft, 2002), is a metacognitive strategy which encodes additional features to a memory trace in attempt to make it more memorable and distinctive (Gerrig & Zimbardo, 2010, p. G-5). Unlike maintenance rehearsal, only elaboration is thought to result in transfer to long-term memory (Craik & Tulving, 1975; Baddeley, 1990; Craik, 2002) because elaboration involves "deep processing" whereas maintenance rehearsal involves "shallow

[18] "Sensory memory", divided into "echoic memory" (i.e., the auditory sensory memory) and "iconic memory" (i.e., the visual sensory memory), is the shortest of the three memory stores, which is too short of a time span to be relevant to the present discussion. For more information on sensory memory, interested readers are directed to the following sources (Atkinson & Shiffrin, 1968; Baddeley & Hitch, 1974; Winkler & Cowan, 2005).

processing" (Craik & Lockhart, 1972). Therefore, in the context of vocabulary acquisition, it is claimed that "the more a learner pays attention to a word's morphophonological, orthographic, prosodic, semantic and pragmatic features and to intraword and interword relations, the more likely it is that the new lexical information will be retained" (Hulstijn, 2001, p. 285).

Deep processing, broadly defined as the building of associations (Anderson & Reder, 1978), is thought to result in transfer to long-term memory because deep processing activates connections in semantic memory (Craik & Lockhart, 1972; Woolfolk, 2013). The first study to provide empirical support for the effects of elaborative rehearsal and deep processing on memory was Craik & Tulving (1975). Since this initial study, various studies have found positive evidence for this claim (e.g., Hulstijn & Laufer, 2001; Turk et al., 2008; Nemati, 2009; Bolger & Zapata, 2011; Ghorbani & Riabi, 2011; Prince, 2012; Adrada-Rafael, 2017). Similar to the notion of elaboration is the Involvement Load Hypothesis (Laufer & Hulstijn, 2001), which maintains that the more involved learners are, the more likely they are to retain word meaning. A recent meta-analysis of 42 studies on L2 vocabulary learning validated this hypothesis, with more involvement leading to more learning (Yanagisawa & Webb, 2021).

2.2.4 Associationism

A common way to carry out "elaborative rehearsal" and engage in "deep processing" is to build associations (Reber et al., 2009, p. 251). Broadly defined, association building is the process of linking novel information stored in short-term memory to already existing information stored in long-term memory (Nairne et al., 2004, p. 269). Hermann Ebbinghaus (1885) was the first to test the effects of association building on memory. Ebbinghaus compared the number of trials it took to learn a string of nonsensical syllables which have no meaning with the number of trials it took to learn meaningful syllables. Syllables which were meaningful were easier to learn than nonsensical syllables because of the associations which learners can use when committing them to memory.

Since Ebbinghaus (1885), a variety of studies have provided empirical support for the effects of association building on memory and learning (Bower & Clark, 1969; Craik & Lockhart, 1972; Rogers et al., 1977; Slamecka & Graf, 1978; Symons & Johnson, 1997; Hunt & McDaniel, 1993; Hulstijn & Laufer, 2001; Bolger & Zapata, 2011; Kirsch, 2012; Prince, 2012; Ge, 2015). For instance, Bower & Clark (1969) asked 24 participants to learn 12 lists of 10 nouns. The

participants were divided into two groups. One group was asked to memorize the list without any instructions, and the other group was asked to memorize the words by putting them into a meaningful narrative. The non-narrative group recalled only 13 percent of the words, whereas the narrative group recalled 93 percent of the words. The study therefore demonstrated the benefits of using narratives as a form of associative learning. In a more recent study, Prince (2012) found that presenting L2 vocabulary in a narrative framework also resulted in more vocabulary retention than words presented in unrelated sentences. Similar results were found in Ge (2015) with L2 learners of Chinese, where the effects of storytelling on L2 vocabulary learning were compared with the effects of rote-memorization. Ge (2015) found that the storytelling group outperformed the rote-memorization group. In general, "storytelling has been used in language teaching and learning for many years; for example, it is widely used as an effective approach to teach L1 and L2 languages to pre-school teaching" (Ge, 2015, p. 256). All in all, previous findings suggest that memory is facilitated or enhanced when novel information is encoded in the form of a narrative or has an association with something which has already been encoded in long-term memory.

Association building is the foundation of widely used memory techniques such as mnemonics, the so-called "Method of Loci" (Yates, 1966; Worthen & Hunt, 2011), and the "keyword" method (Atkinson & Raugh, 1975).[19] In the words of Hulstijn & Laufer (2001), "rich (qualitative) and numerous (quantitative) associations with existing knowledge (e.g., in the form of establishing similarities and contrasts between old and new information) increase the chances that the new information will be retained" (p. 541). Nevertheless, while some experimental research highlights the benefits of elaboration and association building on L2 vocabulary acquisition (Laufer, 2006; Laufer & Rozovski-Roitblat, 2011; Schmitt, 2008; Sonbul & Schmitt, 2009), proponents of implicit learning maintain that instructors should not introduce vocabulary explicitly (e.g., Krashen, 1982).

In this dissertation, because the explicit condition in ExII received explicit instruction on the relationship between English-German cognates, this type of instruction relates to the work on

[19] In studies on Second Language Acquisition, the "keyword" method has been operationalized to promote elaboration in vocabulary acquisition (Hustijn, 1997; Holden, 1999; Sagarra & Alba, 2006; Tavakoli & Gerami, 2012). In this strategy, an acoustic link is made with the novel L2 word and the learners' L1. To use a somewhat crude but memorable example of the keyword method, with a little creativity the German word *Vater* 'father' has some acoustic similarity to the English noun for someone who passes gas. Therefore, a mental image of a father breaking wind may help learners remember the meaning of *Vater*. As Lindstromberg (2020) points out, "the keyword method can result in impressive rates of receptive word learning" (p. 249), with the study by Atkinson & Raugh (1975) reporting that 120 words can be learned in just a few days through this approach.

narrative learning, elaboration, and association building. The hypothesis, revisited at the end of this chapter, is that the explicit condition will recall the meaning of more cognates than non-explicit condition because the explicit condition will have had the opportunity to make an association between the L2 vocabulary items and their already existing English lexicon. The major difference between the narratives which the explicit condition received and the ones employed in the aforementioned previous studies, is that the narratives the explicit condition received are not fictitious, but instead are based on reported etymologies and histories of given words.

2.3 Phonetics and Phonology

The following section turns to a review of the relevant literature on German L2 speech. Section 2.3.1 reviews the five previous studies on German pronunciation instruction, and Section 2.3.2 reviews the formal aspects of German phonetics and phonology as they relate to ExI. This section provides the foundation for the experimental design and data analysis of ExI.

2.3.1 L2 German Pronunciation Intervention

2.3.1.1 Previous Studies

This subsection reviews the five studies, to date, on German pronunciation instruction (McCandless & Winitz, 1986; Dlaska & Krekeler, 2013; Roccamo, 2015; Bryan, 2019; Peltekov, 2020). Not only are the results inconclusive, but the methodology differs from study to study. Moreover, there are also a number of confounding factors which likely affected the results of the experiments. These shortcomings influenced the design and structure of ExI in this dissertation.

First, McCandless & Winitz (1986) examined the effects of different types of L2 instruction on German pronunciation. Four groups, each consisting of 10 learners, were used: a traditional grammar translation group, an auditory comprehension group, a control group with no prior knowledge of German, and a native speaker group. In the traditional grammar translation group, American L2 learners of German, enrolled in a two-semester German class at a community college, followed a curriculum of textbook-oriented instruction, which emphasized translation exercises and oral pronunciation drills. In the audio comprehension group, American L2 learners of German who were enrolled in a two-semester German class at university received more communicative instruction. They carried out activities, such as preparing meals, playing games,

performing light physical exercise, and visiting department stores, in the target language. “The purpose of each activity was to provide the students with meaningful spoken German tailored to their level of understanding” (p. 358). The three experimental groups conducted a post-test where they listened to model sentences in German and had to imitate the pronunciation. Their responses were recorded and were rated impressionistically by four native speakers. The results indicated that the auditory comprehension group was rated as having more native-like pronunciation than the other two experimental groups.

There were, however, a number of confounds which likely impacted the outcome of the experiment. First, the auditory comprehension group had more input than the grammar-translation group (pp. 360–361). They engaged in more input-rich activities, their class was entirely monolingual, they had four instructors who were all present, and learners had to listen to one hour of German audio cassettes per day. In contrast, the grammar-translation group had only one instructor, the class was taught in English, and they had fewer homework assignments. Second, the population of the groups was fundamentally different (Ibid). The traditional grammar translation group consisted of students at a community college whereas the students in the comprehension group were at a university. Therefore, “it could be claimed that their language learning ability was not equivalent” (p. 360). Third, the assessment used to evaluate learners’ pronunciation was only used at the end of the semester, that is, there was no pre-test, which means that it is unclear whether the students in the comprehension group had better pronunciation to begin with. Given that the comprehension group consisted of university students as opposed to community students, this likely impacted the results. Fourth, learner pronunciation was rated impressionistically. Because an impressionistic analysis is subjective, learners in the grammar-translation group could objectively have had more native-like pronunciation but this was not perceptible to the raters.

The second study is Dlaska & Krekeler (2013). The authors examined the effects of implicit and explicit feedback on German L2 pronunciation. A total of 169 adult learners of German from 33 different countries who were spending time in a German-speaking country were divided equally into two learning conditions: the implicit feedback learning condition and the explicit feedback learning condition. In the implicit condition, learners were asked to read a text aloud and their pronunciation was recorded. After the recording, they listened to a native model reading of the text and were subsequently asked to re-record the reading. In the explicit condition, the same procedure

applied, except learners also received explicit feedback on their pronunciation. The explicit feedback instruction addressed their pronunciation of individual consonants and vowels, word stress, and other prosodic features such as intonation (p. 29). Their recordings were then rated impressionistically by native speakers for comprehensibility. The explicit condition was rated as more comprehensible than the implicit condition. However, although there was a statistically significant difference between the two groups, the effect of the interventions was low. "Only 22% of participants in the Listening only-group and only 44% in the ICF-group improved their comprehensibility" (p. 31).

In terms of potential confounds, like McCandless & Winitz (1986), impressionist ratings were used. While impressionist analyses are an appropriate means for testing comprehensibility, as aforementioned, many speakers can improve their pronunciation, yet the improvement is not perceptible to the raters. On the one hand, one could argue that if improvements in articulation are not perceptible, then it is not worth focusing on improving pronunciation of specific target sounds. However, at the same time, it is possible that improvement in the articulation of several segments collectively results in a perceptible difference. Nevertheless, whether improvement is perceptible or not, an acoustic analysis of speech samples would have objectively determined whether the interventions had an effect or not, at least based on scientifically grounded acoustic correlates. A second confound was the input, as the explicit group had more time and more input than the implicit group. While it is challenging to control the amount of input, the higher improvement in the explicit group may simply be attributed to the additional instruction. A third confound, which the authors point out, was that the study only investigated the short-term effect of the feedback conditions. Whether the feedback improved learners' pronunciation long-term was not investigated. Finally, explicitly pointing out differences between learner pronunciation and native pronunciation may not be sufficient for learning to take place. While it is important for learners "to notice the gap" between their speech and the speech of a native model (Swain, 1985), noticing or perceiving a difference does not mean that learners suddenly know how to configure their articulation to match a native model. Doing so would likely require sufficient practice, with sufficient spacing (e.g., Karpicke & Bauernschmidt, 2011).

The third study is Roccamo (2015). In this study, the effects of incorporating ten minutes of explicit pronunciation instruction in the L2 German classroom were compared with the effects of not receiving ten minutes of explicit pronunciation instruction. The explicit instruction focused

on lexical stress, /r/ sounds, and the fricatives [ç] and [x]. In a pre- and post-test, learners carried out a recorded production task. First, they had to record themselves reading 48 test words and 27 distractors. Second, they were asked to read six paragraphs which contained the same test and distractor stimuli, and finally they had to respond to five question prompts such as *was ist dein Hauptfach*? 'what is your major?', *wann hast du Geburtstag?*, 'when is it your birthday?'. Their recordings were subsequently rated impressionistically by five native speakers. Results from the impressionistic rating indicated that the explicit group was considered more comprehensible than the pseudo-control group. However, a shortcoming of the study, like with the previous two, was the absence of acoustic analyses to determine whether any objective improvement in the production of the target sounds took place. Moreover, it is unclear in the write-up of the experiment whether recordings were carried out under experimental conditions in a sound-proof room or whether they were carried out at home as homework. Since L2 pronunciation was rated for comprehensibilty, variability in the quality of recordings could have had an impact on the results.

The fourth study, based on his master thesis (Peltekov, 2017), is Peltekov (2020). The author examined the effects of explicit and implicit instruction on L2 German accent and comprehensibility. Three groups were included: an explicit pronunciation instruction group, an implicit pronunciation instruction group, and a control group. Due to a number of factors, such as incompletion of a pre- or post-test, only five learners per group were included in the analysis. The intervention consisted of 10 minutes of instruction per week for 10 weeks, amounting to an hour and forty minutes in total. A number of phonetic and phonological features were targeted, such as /r/ sounds and front rounded vowels. The explicit group received explicit instruction on German pronunciation whereas the implicit group was exposed to German native recordings and was asked to imitate what they heard. A pre-test was carried out at the beginning of the semester and a post-test was carried out at the end of the semester. The test consisted of a spontaneous speech component and a reading component where target stimuli were embedded within carrier phrases. Like with the previous three experiments, speech samples from the pre and post-test were rated impressionistically by native speakers. No significant differences between the three groups were observed. The sample size and use of impressionistic ratings were potential confounds.

The final study is Bryan (2019). In her doctoral dissertation, Bryan (2019) used acoustic measurements to examine potential changes in pronunciation. While acoustic analyses of speech samples collected before and after pedagogical intervention have been carried out widely for

Spanish (e.g., Lord, 2005; Kissling, 2013; Offerman, 2020), prior to the present dissertation, Bryan (2019) was the only study I am familiar with to have attempted this for German. University students enrolled in second-semester German classes were divided into two groups: an explicit pronunciation group and a quasi-control group. The explicit group received a 50-minute lesson on the articulation of the front rounded vowels /y, ʏ, ø, œ/. However, there were no significant improvements in perception and articulation of the front rounded vowels in either the explicit or control group.

However, like with the previous studies, Bryan (2019) was unable to make claims about the effectiveness of explicit pronunciation instruction relative to implicit instruction due to various confounds. First, the explicit intervention took place in a 50-minute laboratory session, which "may not have been enough time for students in the experimental group to fully benefit from the lesson" (p. 77). Not only was 50 minutes insufficient time for learners to improve their pronunciation, but both instruction and practice took place in the 50-minute session. De Graaff (1997, p. 250) mentions that many studies on explicit learning conditions have short treatment periods and meta-analyses which have investigated treatment duration as a variable have found that longer treatment times result in more significant effects (Lee et al., 2015). A reasonable explanation for this is the role of frequency, that is, the number of opportunities learners are given to practice and revisit material (Schmidt, 1990; N. Ellis, 1996, 2002, 2006a, 2006b). Even had it not been possible to increase the time spent on the explicit pronunciation instruction, breaking the 50 minutes into small chunks of exposure, like in Roccamo (2015), could have affected the outcome of the experiment. After all, work in both Cognitive Psychology (Karpicke & Bauernschmidt, 2011) and Second Language Acquisition (Nakata, 2015; Suziki & DeKeyser, 2017) has shown that "distributed practice", that is, the spreading or spacing of information over longer intervals, result in significantly better retention in memory than "massed practice" such as cramming.

Second, in Bryan (2019), the instructor was not controlled for. In other words, the learners who participated in the experiment had different instructors since they were enrolled in a multi-section course, with the caveat that the same instructor was used for the explicit phonetic instruction. Therefore, it is not clear what exposure different learners had and how effective their language instruction was. Third, for the production component of the experiment, learners carried out their recordings simultaneously in the same classroom in a non-sound-proof room. The

microphones not only picked up background noise from other learners' recordings, but the room was not designed to record high quality sounds. Therefore, the quality of the recordings was inevitably affected which may have ultimately affected the acoustic analysis. Fourth, there were also issues with the makeup of the control group, given that they had more language learning experience beyond English and German than the experimental group. Many of these shortcomings and issues in the design, which the author pointed out in her discussion of her results, likely compromised the advantage of the only acoustic analysis to date.

2.3.1.2 Moving Forward

Having reviewed the five classroom-based studies on German pronunciation instruction, it is clear that there were a number of shortcomings and methodological confounds. A summary of these confounds is reported in Table 1, accompanied with a brief explanation why. Moving forward, these shortcomings influenced the design of the first experimental study in this dissertation, namely the experiment on implicit and explicit L2 German pronunciation instruction. While it was not possible to eliminate all confounds, the experiment was designed with the aim of avoiding as many confounds as possible to ensure the reliability of the results.

Table 1. Summary of Previous Confounds

Issues	Why
Lack of a pre-test or delayed-post-test	Failure to control for previous knowledge. Moreover, no delayed-post-test was carried out in either of the five studies.
Assessment	Impressionistic analyses can be problematic as objective improvements may not be perceptible to the raters.
Sound Quality	Recordings can be compromised by background noise. The comprehensibility of a speaker may be affected by the recording quality. If acoustic analyses are carried out, a sound-proof room is recommended to remove external noise as this may affect acoustic analyses.
Small Sample Sizes	Representative sample sizes are necessary so results are generalizable.
Different Populations	Comparing different populations or different level learners may be a reason for differences in results, not the type of intervention.
Different instructor	Different instructors may have led to different types of input.
Not Controlling for Input	When comparing different groups, if one group has more input than the other, this bias may confound the results.

2.3.2 L2 Speech Challenges for Learners of German

2.3.2.1 Cross-Linguistic Influence

It is well understood that a learner's L1 can interfere with L2 phonology due to crosslinguistic or crosslanguage transfer (Flege & MacKay, 2004). Unlike in monolingual L1 acquisition, L2 acquisition is confounded by the existence of an already established L1 phonological system which can act as a template or foundation for the developing L2 phonological system (Pennington & Rogerson-Revell, 2019, pp. 70–71). As Pennington & Rogerson-Revell (2019) point out, "L2 pronunciation errors are rarely random attempts to produce unfamiliar sounds but typically reflect the learner's L1 phonological system" (p. 148). Therefore, when learning the sound system of German, learners need to become acquainted with differences between the L1-L2 phonetic system. They need to learn to produce and perceive the sounds which do not exist in their L1 phonetic inventory, but they also need to learn to produce them in the appropriate phonological environments. The following subsection outlines two areas of German L2 speech which may pose difficulty for English-speaking L2 learners of German.

2.3.2.2 German Stops

Although German has the same number of stops as standard varieties of English [p, b, t, d, k, g, ʔ], the distribution, that is, the phonological contexts in which they appear, is different. Unlike in English, German stops, more specifically German obstruents, are devoiced word-finally, or at the end of a syllable before a morpheme boundary (Wiese, 2011, pp. 102–104; O'Brien & Fagan, 2016, p. 115).[20] Some examples of this phonological process are reported in (1), and the formal notation is reported in (2). Given that there are fewer German words ending in either fricatives or affricates compared to stops, for the purpose of pedagogical simplicity, in this dissertation German Final Devoicing refers exclusively to the devoicing of underlyingly voiced word-final stops.[21]

[20] Note that several terms have arisen in the English literature to describe this phenomenon, such as "final devoicing" (Hyman, 1975, p. 71), "obstruent devoicing" (Rischel, 1991), "final obstruent devoicing" (Brockhaus, 1991, p. 18), or "terminal devoicing" (King, 1969, p. 47; Escure, 1975). In the German literature, it is commonly referred to as *Auslautverhärtung* 'the hardening of the coda'.

[21] A possible reason why stops are preferred in codas over fricatives and affricates might be attributed to the Sonority Sequencing Principle (Clements, 1988).

1) STOPS:

bilabial:	*Dieb* 'thief' [di:p]	*Diebe* 'thieves' [di:bə]
alveolar:	*Lied* 'song' [li:t]	*Lieder* 'songs' [li:dɐ]
velar:	*Tag* 'day' [ta:k]	*Tage* 'days' [ta:gə]
FRICATIVES:		
labio-dental	*brav* 'brave' [bʁa:f]	*brave* 'brave.FEM' [bʁa:və]

2) SPE Notation: obstruents → devoiced / ____]$_{\sigma}$

Feature Notation: [- sonorant] → [- voice] / ____ [- sonorant]$_{\sigma}$

For English-speaking L2 learners of German, the articulation of the stops should pose little difficulty since these already exist in the L1 phonetic inventory. Instead, it is likely that the difficulty arises with the acquisition of a different phonological process (Smith & Peterson, 2012; Young-Scholten 2002, 2004; Young-Scholten & Langer, 2015). Because both voiced and voiceless stops are permitted in word-final position in English, if learners transfer their L1 phonology to German, they will fail to devoice German stops word-finally. Although explicit instruction on Final Devoicing might require some overt metalinguistic knowledge, according to the simple and complex rule classification (e.g., DeKeyser, 1995), word-final devoicing can be classified as a "simple categorical rule" because voiced obstruents are systematically devoiced in word-final position. If the focus is on the devoicing of word-final stops as opposed to the devoicing of word-final obstruents, this phonological rule can be summed up to L2 learners with the simple explicit explanation that /b/, /d/, /g/ become [p], [t], [k] at the end of a word.[22] On the basis of previous research which suggests that "simple categorical rules" are amenable to explicit instruction (DeKeyser, 1995; Robinson, 1996), it is reasonable to hypothesize that teaching this rule explicitly to L2 learners of German would be effective. However, despite the rule being classified as a simple rule, L2 learners are usually left to learn this rule implicitly, and the absence of such explicit instruction correlates with its perceived difficulty of acquisition among L2 learners (Smith & Peterson, 2012; Young-Scholten, 2002, 2004; Young-Scholten & Langer, 2015).

[22] Formally, this simplification in SPE would be: $\begin{bmatrix} b \\ d \\ g \end{bmatrix} \rightarrow \begin{bmatrix} p \\ t \\ k \end{bmatrix} / \_\_\_\#$

German orthography may also interfere with the acquisition of this phonological rule (Young-Scholten, 2002; Hayes-Harb, Brown & Smith, 2018; Hayes-Harb & Barrios, 2021). Because German does not distinguish underlyingly voiced word-final and non-word-final stops orthographically (e.g., *Hund* [hʊnt] vs. *Hunde* [hʊndə]), the phonological difference may be less perceptible to L2 learners.[23] The issue of orthography is further complicated by neutralization, as underlyingly voiced stops and underlyingly voiceless stops are neutralized in word-final position (e.g., *Rad* [ʁa:t] 'wheel' vs. *Rat* 'advice' [ʁa:t]). Because there is an orthographic distinction for minimal pairs where there is neutralization, learners may be encouraged to use the orthography as a cue to differentiate pronunciation, unaware that the phonemic contrast is neutralized.

In general, orthography is known to interfere with the acquisition of L2 phonology (Young-Scholten, 2002; Bassetti, 2006; Young-Scholten & Langer, 2015; Hayes-Harb, Brown & Smith, 2018; Bürki et al., 2019; Hayes-Harb & Barrios, 2021). This interference is attributed to the fact that most L2 learners encounter the orthographic system before their L2 phonological system has fully developed (Young-Scholten, 1995, p. 113; Young-Scholten & Langer, 2015, p. 95). Consequently, learners are likely to map L2 orthography onto their L1 phonology. For instance, Young & Scholten (2015) found that English-speaking L2 learners of German still mapped German word-initial <s> to the English [s] even though it is realized natively as [z].[24] Such L2-L1 mappings have been found to take place with Final Devoicing too (Young-Scholten, 2002, 2004; Hayes-Harb, Brown & Smith, 2018). In a study on the influence of orthographic input in the L2 acquisition of German Final Devoicing, Hayes-Harb, Brown & Smith (2018) exposed native speakers of English with no prior knowledge of German to a number of nonce words which ended in underlyingly voiced obstruents. Even though the speakers were presented with auditory input, the orthography had an effect on the perceptual status of the underlyingly voiced obstruents. Subjects failed to devoice word-final obstruents because of the absence of an orthographic distinction.

[23] Note, however, that an orthographic distinction used to be made in earlier stages of the language, such as in Middle High German (ca. 1050-1350). For instance, the Middle High German word for *Tag* 'day' was written as *tak* not *tag* (but, note *tages*.GEN.SG 'of the day').

[24] It should be noted, however, that in Swiss German <s> is realized as [s] word-initially, and in Modern Standard German, <s> in clusters such as <st> and <str> as in *Student* 'student' and *Straße* 'street', is realized as [ʃ].

2.3.2.3 German Fricatives

Unlike with German stops, when learning German fricatives, English-speaking L2 learners of German face both phonetic and phonological challenges. At the phonetic level, they are faced with the challenge of learning to produce and perceive novel fricatives which do not exist phonemically in Present Day English, namely [ç] and [x]. [25] At the phonological level, they face the challenge of having to learn a different allophonic distribution. Formally, [ç] and [x] are considered allophones of the same phoneme, but there is some debate as to which phone is the underlying form. Following Hall (1989), the notation in (3a-b) adopts the view that /ç/ is the underlying phoneme, which surfaces as [x] after back vowels, and [ç] is the elsewhere allophone.[26] In the German literature, this alternation is commonly referred to as the *ich*-and-*ach-Laut* alternation.

3) (a) SPE Notation: [ç] → [x] / _____ [back vowels]

(b) Feature Notation: $\begin{bmatrix} \text{- son} \\ \text{+ cont} \\ \text{+ high} \end{bmatrix}$ → _____ [- front, + back]

(c) Examples:

Dach 'roof'	[dax]	*Dächer* 'roofs'	[dɛçɐ]
Loch 'hole'	[lɔx]	*Löcher* 'holes'	[lœçɐ]
Buch 'book'	[bu:x]	*Bücher* 'books'	[by:çɐ]

Because [ç] and [x] do not exist natively in North American English, North American L2 learners of German have to learn to configure their articulators in a way they are not accustomed to. The Speech Learning Model (Flege, 1995, 1999) predicts that English-speaking learners of German would substitute the palatal fricative [ç] with fricatives such as /ʃ/ because it is the nearest fricative in terms of place of articulation.[27] Moulten (1962, p. 31) reported this to be the case for

[25] The term "Present Day English" is used since historically these fricatives did exist in Old English. It should also be noted that the palatal fricative does have a similar phonetic equivalent in English, as in *huge* [hjud͡ʒ] and *human* [hjumən] (Ladefoged, 2006: 164), and certain dialects of English (e.g., Northern varieties of British English) have similar allophonic variants to [ç] and [x] (cf. Honeybone, 2001).

[26] Elsewhere conditions include initial and final position after the sonorants /l, m, n, r/ as in *Milch* 'milk' [mɪlç] and *Mönch* 'monk' [mœnç].

[27] Sounds which are dissimilar are thought to be easier to acquire than sounds which are similar because distinct sounds are thought to be noticed more easily. Moreover, both L1 and L2 phonetic categories are thought to co-exist in a

English-speaking L2 learners of German, and Kitzing (1967) found this to be the case with Swedish learners of German. The allophone [x] is also known to be substituted by [k] (Kitzing 1967, p. 28). Because there is a phonemic contrast in Standard German between the palatal fricative [ç] and the postalveolar fricative [ʃ], as in *Kirche* 'church' and *Kirsche* 'cherry', being able to accurately produce these fricatives would seem important. Substituting [ç] for [ʃ] may therefore affect comprehensibility.[28] Since [ç] and [x] are represented by a common digraph <ch> (e.g., *Licht* [lɪçt], *schwach* [ʃvax]), and a different phoneme-grapheme mapping exists in English [t͡ʃ] as in *catch* [kæt͡ʃ], this may also pose difficulty in the L2 acquisition process. The effect of orthography is further obfuscated by the fact that [ʃ] is represented by a similar graphical correspondence <sch>. In O'Brien's (2004) perceptual survey of L2 pronunciation, L1 speakers of German reported that dorsal fricatives [x] and [ç], as well as German rhotics, are the most poorly pronounced by non-native speakers. However, while these dorsal fricatives can be difficult to acquire, research shows that L2 learners can indeed learn the contrast in production (Young-Scholten, 2004) and perception (Lindsay, 2013).

2.3.3 Acoustic Correlates

In contrast to impressionistic analyses, acoustic analyses are objective and can be used to analyze the acoustic properties of specific segments. Impressionistic analyses, on the other hand, are subjective and focus on the comprehensibility of an entire string of speech as opposed to individual segments. Therefore, impressionistic analyses can be problematic because what we perceive is not always a reflection of the acoustic reality (Johnson, 2012, pp. 100–102). A well-known example is the McGurk Effect where visual input interferes with auditory input (McGurk & MacDonald, 1976). Because a cornerstone of the analysis of ExI is the acoustic analysis, this sub-section briefly reviews the acoustic correlates relevant to the analysis of German stops and fricatives.

common phonological space (Flege, 1995, 1999, 2002). Scott (2019) found that in perceptual tasks, beginning English-speaking L2 learners of German map [x] to the L1 categories /h/ /k/ or /r/ and [ç] to the L1 categories /h/ /k/ ʃ/ or /t͡ʃ/.

[28] However, it should be pointed out that German is only one of three documented languages in which [ç] and [ʃ] are reported as contrastive (Mielke, 2008), and many dialects of German neutralize this contrast (Dirim & Auer, 2004; Wedel et al., 2013; Hall, 2014). The dialectal neutralization often leads to hypercorrection in Standard German, whereby speakers try to consciously use the palatal fricative in words which never had it previously, for instance *komisch* 'strange' [komɪʃ] → [komɪç] (Herrgen, 1986). In certain southern dialects of German, such as Swiss German, the palatal fricative is also realized as a velar fricative in all positions (Tronnier & Dantsuji, 1993, p. 217; Guntern, 2012, p. 104).

2.3.3.1 Stop Consonants

The production of a stop consonant can be divided into three phases: the shutting, the closure, and the release (Johnson, 2012, p. 169). To measure these three phases, a number of spectral and temporal acoustic measurements can be used, such as duration, voicing, and aspiration (Colantoni, Steele & Escudero, 2015, p. 190). Voiced stops are associated with the presence of a voice bar on the spectrogram (Hogan & Rozsypal, 1980), the presence of periodic glottal pulsing on the waveform (Colantoni, Steele & Escudero, 2015, p. 187), continuation of voicing into closure (Port & O'Dell, 1985; Charles-Luce & Dinnsen, 1987; Lousada et al., 2010), and a durationally shorter closure and release (Port & O'Dell, 1985; Port & Crawford, 1989). In contrast, voiceless stops are associated with shorter voicing into closure, and a durationally longer closure and release (Ibid). These acoustic correlates have been used widely as a measure of voicing when analyzing the presence or absence of Final Devoicing in languages such as German (Port & O'Dell, 1985; Port & Crawford, 1989; Smith et al., 2009; Roettger et al., 2014), Russian (Dmitrieva et al., 2010; Simonchyk & Darcy, 2018), Polish (Slowiaczek & Dinnsen, 1985), and Dutch (Warner et al., 2004; Simon, 2010).[29]

In addition to measuring these three phases of stops, the duration of the vowel preceding stops can also be used as an acoustic correlate of voicing. Vowels preceding voiced stops are typically durationally longer than vowels preceding voiceless stops (Maack, 1953; House & Fairbanks, 1953; Peterson & Lehiste, 1960; House, 1961; Chen, 1970; Slowiaczek & Dinnsen, 1985; Port & O'Dell, 1985; Pye, 1986; Warner et al., 2004; Simon, 2010; Roettger et al., 2014; Simonchyk, & Darcy, 2018), which is used as a perceptual cue for determining laryngeal status, particularly for word-final segments (Peterson & Lehiste, 1960; Mack, 1982; Port & Dalby, 1982; Kluender et al., 1988; Jongman et al., 1992; Simon, 2010). This durational difference has been well documented in English (House & Fairbanks, 1953; Peterson & Lehiste, 1960; House, 1961; Simon, 2010) and in German (Maack, 1953; Port & O'Dell, 1985; Roettger et al., 2014), as well as in a number of other languages (Fintoft, 1961; Fischer-Jørgensen, 1964; Slis & Cohen, 1969). For instance, in English, Simon (2010) found that there is a durational difference in the length of the vowel in *bed* and *bet*, the former being durationally longer than the latter. In German, Port &

[29] The phenomenon of "boundary-lengthening" should also be noted, whereby segments at the boundary domains tend to be longer than domain-medial ones (e.g., Turk & Shattuck-Hufnagel, 2007, cf. Kohler, 1983 for German). Therefore, word-final voiced stops are durationally longer not only because they are voiced, but also because they are domain final.

O'Dell (1985) found that German vowels preceding underlyingly voiced word-final stops were 15 milliseconds longer than those preceding underlyingly voiceless word-final stops. Phonetically, it has been argued that vowel length increases before voiced consonants to create sufficient time for the appropriate laryngeal adjustments to be made which are needed to maintain glottal vibration during oral constriction or closure (Kluender et al., 1988, p. 154, see also Chomsky & Halle, 1968). Vowels are also thought to shorten before voiceless stops for aerodynamic reasons (Chen, 1970). A summary of the relevant acoustic correlates of voicing with stops is reported in Table 2.

Table 2. Summary of Acoustic Correlates of Voicing for Stop Consonants

Acoustic Correlates	
Voiced Stops: ➢ Durationally longer preceding vowels ➢ Durationally shorter closures ➢ Durationally shorter bursts ➢ Longer voicing into closure	Voiceless Stops: ➢ Durationally shorter preceding vowels ➢ Durationally longer closures ➢ Durationally longer bursts ➢ Shorter voicing into closure

2.3.3.2 Fricative Consonants

In contrast to stop consonants, fricatives are characterized by a narrow constriction as opposed to a complete obstruction of airflow (Shadle, 1991; Stevens, 1998). As a result, fricatives are produced with turbulent airflow and are characterized by energy in a spectrum range. Acoustically, fricatives are differentiated from each other in terms of energy across the spectrum. Four spectral moments are commonly used to evaluate and compare the energy distributions, namely Standard Deviation, Skewness, Center of Gravity, and Kurtosis (Forrest et al., 1988; Wayland & Wong, 2000). Of particular interest in this dissertation is Center of Gravity (henceforth, COG), that is, the mean concentration of energy, as this parameter correlates with the place of articulation (Forrest et al., 1988; Jongman et al., 2000; Boersma & Hamann, 2008; Johnson, 2012; Czaplicki et al., 2016; Conrad, 2021). Because the spectral properties of fricatives are shaped predominantly by the cavity in front of the noise source (Bronson, 2004, p. 37), fricatives with a lower COG are associated with a place of articulation farther back in the oral cavity, whereas fricatives with a higher COG are associated with a place of articulation closer to the front of the oral cavity (Boersma & Hamann, 2008, p. 229; Colantoni, Steele & Escudero, 2015, p. 211). This correlation

between COG and place of articulation therefore predicts that [ʃ] has a higher COG than [ç] because [ʃ] is postalveolar whereas [ç] is palatal. In contrast, [ç] should have a higher COG than [x].

2.4 Historical Linguistics

Having reviewed the relevant literature on German phonetics and phonology, the following section turns to a review of the historical relationship between English and German. This section lays the foundation for ExII.

2.4.1 The Historical Relationship between English and German

Germanic is a branch of Indo-European, which is traditionally split into North Germanic (Norwegian, Danish, Swedish, Icelandic, and Faroese), East Germanic (Gothic), and West Germanic (English, German, Dutch, and Frisian) (Robinson, 2003, p. 12; Bousquette & Salmons, 2018, p. 388).[30] In linguistic terms, the West Germanic sub-branch is often described as further splitting into Low German, Central German, and Upper German; where "German" refers to Germanic.[31] Low German(ic) refers to English, Frisian and the modern descendants of Old Saxon, whereas Central and Upper German(ic) are umbrella terms for the various German dialects spoken in Central and Southern Germany, as well as Switzerland, Austria and Liechtenstein.[32]

The traditional narrative from Venerable Bede's Old English translation of the *Historia Ecclesiastica Gentis Anglorum* 'Ecclesiastical History of the English People' recounts that English was brought to Britain in 449 CE by three Germanic tribes (Angels, Saxons, Jutes) from the northern parts of modern-day Germany (Crystal, 1995, p. 6). It is from the Angles where the word *English* is thought to get its name, that is, from the language or dialect of the Angles (OE

[30] This traditional categorization suggests there was a tripartite split from Proto Germanic into three respective sub-branches (Young & Gloning, 2004, p. 22). Note, however, that there is scholarship which challenges the notion of an equal split given the commonalities between West and North Germanic when compared to East Germanic (Nielsen, 1989; Heather, 2010; Salmons, 2012, p. 84).

[31] However, it should be noted that West Germanic languages form part of a continuum, with some languages more closely related than others. See, for instance, work on the Anglo-Frisian Hypothesis (Bremmer, 2009; Salmons, 2017).

[32] In historiographical terms, three Germanic tribes are identified in the literature: the Ingvaeones, Istvaeones, and the Erminones. In archaeological terms, the speakers of West Germanic divide into three cultural groups: the North Sea Germanic tribes (historically the Angles, Saxons and Frisians), the Weser-Rhein Germanic tribes (historically the Hessens and Franks), and the Elbe Germanic tribes (historically the Langobards, the Alemanni, and the Bavarians) (Maurer, 1952). For more information, see Moser et al. (1981, pp. 24–27).

anglisc/englisc) , as well as the name *England* (Brinton & Arnovick, 2006, p. 145).[33] Because of their shared ancestry, English and German share a large number of cognates. For the purpose of this dissertation, cognates are defined as words which can be traced back to the same ancestral form, such as *arm-Arm*, *hand-Hand, finger-Finger*.[34]

However, unlike with the transparency of *arm-Arm*, *hand-Hand, finger-Finger*, because of various historical changes which have taken place, many cognates are not as easily recognizable to most L2 learners of German.[35] The German word *Zimmer* 'room' provides a concrete example. This noun is cognate with the English word *timber* (from OE *timbrian* 'to build', OE *getrimbro* 'building', see also Gothic *timreinai* 'building-DAT.SG'). The word *timber* originally meant 'building' or 'structure' (from PGmn **timran* 'building') but in the history of the English language its meaning narrowed to refer to the type of material used to make buildings, namely 'wood'. In terms of sound change, the difference between *Zimmer* and *timber* can be explained through a series of predictable, systematic, phonological developments which took place in German, but not in English. The /t/ in *timber* systematically became the affricate /t͡s/ in word-initial position in Upper German dialects (represented by <z> orthographically), which is part of a series of sound changes called the Second Germanic Sound Shift. As for the *mb* > *mm*, this change is a type of progressive assimilation which took place between Middle High German (ca. 1050-1350) and Early New High German (1350-1650). This assimilation accounts for why English has words such as *dumb* where the <b> is retained orthographically, whereas the German cognate *dumm* has undergone full assimilation. However, without this historical knowledge, it is reasonable to hypothesize that most English-speaking L2 learners of German are unable to automatically map *Zimmer* to English *timber*.

[33] Note the following abbreviations (OE = Old English, OHG = Old High German).

[34] It should be noted, however, that this is not always the case in Second Language Acquisition research (e.g., Peters & Webb, 2018). In language textbooks, cognates can sometimes be used to refer to a similarity between L1 and L2 words regardless of whether they are loanwords or not.

[35] The claim that many cognates are not recognizable to English-speaking L2 learners of German is supported by the low recognition scores on the pre-test in ExII (explained in Chapter 6).

2.4.2 Diachronic Changes in English and German

2.4.2.1 Sound Changes

While there are various sound changes which have contributed to the seemingly dissimilarity of English-German cognates, many of the differences can be explained through the Second Germanic Sound Shift and Ingvæonic Palatalization.[36]

2.4.2.1.1 Second Germanic Sound Shift

Unlike the First Germanic Sound Shift, which differentiated Germanic languages from other Indo-European languages (Salmons, 2012, p. 37-50; König, Elspaß & Möller, 2015, p. 45), the Second Germanic Sound Shift differentiated Low German (e.g., English, Dutch, and Frisian) from Upper German (e.g., Modern Standard German) (Salmons, 2012, p. 112-118; König, Elspaß & Möller, 2015, p. 63). Despite having taken place early on in the history of Germanic, the Second Germanic Sound Shift is still considered the "most important" linguistic criteria used by modern Germanic dialectologists (Stevenson et al., 2017, p. 43). Because this sound shift affected stop consonants in Upper German, but not in Low German, it is also sometimes referred to as the High German Consonant Shift, as opposed to a Low German Consonant Shift. While it is not clear which stop consonants were affected first, these changes are often viewed as a chain shift which follow the stages of lenition (Honeybone, 2001). Therefore, one set of changes catalyzed another set of changes. Upper German, or pre-Old High German voiceless stops /p, t, k/, became affricated in initial position, before a consonant, or when geminated (Salmons, 2012, p. 112).

The Second Germanic Sound Shift accounts for why English has *apple*, *ten*, and *drink* but Upper German dialects have forms such as *Apfel*, *zehn*, and *trinken* [tʁɪŋk͡xn̩].[37] The affrication of /p/ explains word-initial differences such as *pound*, *pipe*, *pepper*, *pan* and *Pfund*, *Pfeife*, *Pfeffer*, and *Pfanne*. Upon first inspection, the affrication of /t/ is not visible because the affricate /t͡s/ is represented orthographically in German with <z>. However, orthography aside, this change explains differences such as *tongue-Zunge*, *too-zu*, *twelve-zwölf*, *twig-Zweige.* As part of this chain

[36] For information on other historical changes which distinguish English and German diachronically, interested readers are directed to the following sources (Salmons, 2012; Schmidt, 2013; König, Elspaß & Möller, 2015).

[37] Note that the affrication of /k/ did not take place in the varieties which ultimately became Modern Standard German (O'Brien & Fagan, 2016, p. 146). Therefore, Modern Standard German has the velar stop in *trinken* 'drink' whereas Swiss German has the affricate [kx] in [tʁɪŋk͡xn̩].

shift, affricates conditionally became spirants intervocalically ([p͡f], [t͡s] > [f], [s] /V__V), and after vowels in final position (e.g., [p͡f], [t͡s] > [f], [s] /V__#). This shift therefore explains why English has words such as *hope*, *weapon*, *help*, *sweat, nut, hate* whereas German has words such as *hoffen, Waffe*, *helfen*, *schweissen*, *Nuss, hassen.*

Another phase of the Second Germanic Sound Shift was the so-called *Medienverschiebung* 'a shift in voiced stops' (Salmons, 2012, 117-118; König, Elspaß & Möller, 2015, p. 63).[38] In this phase, voiced stops became voiceless. Therefore, English has *door* and German has *Tür* (d > t).[39] This process whereby stops become affricates, and affricates become fricatives, can be described as lenition (Lass, 1984, p. 178; Honeybone, 2001).[40]

Stedje (2001, p. 61) also suggests that the phonological change of the proto-Germanic (henceforth, PGmc) interdental fricative to a voiced alveolar stop was another "possible further chain reaction" of the Second Germanic Sound Shift. This change accounts for the difference between English words such as *thing*, *think*, *that*, *thorn*, *thistle*, *thirst* and German words such as *Ding*, *denken*, *das*, *Dorn*, *Dissel*, *Durst*.[41] For the purpose of this dissertation, since declarative knowledge of this sound change may help learners to predict the meaning of cognates, this sound change was also taught as an extension of the Second Germanic Sound Shift. All in all, although the Second Germanic Sound Shift can be formalized using relatively intricate phonological notation as shown in Figure 2 and 3, L2 learners do not need to be phonologists to understand, for instance, that *p* became *pf* in German word-initially. Yet knowing these systematic sound changes, may allow learners to draw upon their existing knowledge of English to identify cognates in German which, in turn, may improve their vocabulary.

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[38] As Salmons (2012) points out, in traditional terminology, Grimm used the terms "mediæ" to refer to the voiced stops /b/ /d/ /g/ and "tenues" to refer to the voiceless stops /p/ /t/ /k/ (p. 117).

[39] It should be noted, however, that the devoicing of /b/ and /g/ which took place in Upper German dialects, such as Alemannic and Bavarian, did not affect the varieties which ultimately became Modern Standard German. As Wells (2003) points out, "not all the resultant HG [High German] dialects are affected in the same degree, and the shift appears in most complete form in the southern dialects, Bav. and Alem" (p. 422). Since parts of the Second Germanic Sound Shift, such as the devoicing of /b/ and /g/ are not directly helpful for English-speaking L2 learners of German, only the relevant parts were introduced in the explicit pedagogical intervention for this dissertation. The process whereby stops become affricates, and affricates become fricatives, can be described as lenition; which is typologically more common than fortition (Lass, 1984, p. 178; Honeybone, 2001).

[40] In fact, this sequence of changes appears to have taken place in varieties of English, such as in Liverpudlian English. For instance, (k > kx) as in *crime* [kxɾaɪ̯m], and (k > kx > x), as in *attack* [at͡sax], (k > kx > x) and *expect* [ɛxspext], and (t > t͡s > s) as in *matter* [masə] (Trudgill, 1999, p. 73; Honeybone, 2001, p. 213-238).

[41] This sound change, in combination with the previously mentioned fricativization of Upper German [p], explains the relationship between German *Dorf* 'village', and the affixoid suffix present in many British place names *-thorp(e)* as in *Scunthorpe*, *Moorthorpe*, *Mablethorp*. There are reported to be 155 places in Yorkshire (England) alone with -thorp(e) (Staff, 2015).

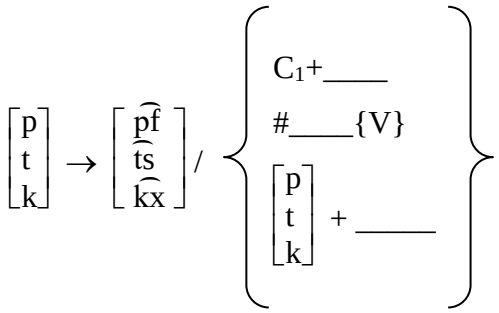


Figure 2. Formal Notation of Second Germanic Sound Shift
(adapted from Wells, 2003)[42]

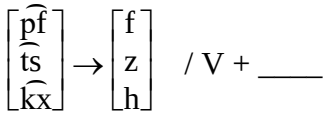


Figure 3. Formal Notation of Second Germanic Sound Shift
(adapted from Wells, 2003, p. 425)

2.4.2.1.2 Ingvæonic Palatalization

Unlike the Second Germanic Sound Shift, which did not affect English, Ingvæonic Palatalization affected English, but not German. This sound change, also referred to as "North Sea Germanic Palatalization" or "Anglo-Frisian Palatalization" (van der Hoek, 2010), affected Anglo-Frisian velar stops, and thus differentiated English and Frisian from other West Germanic languages (Barbour & Stevenson, 1990, p. 31). When the velar stop [k] occurred before front vowels, it became palatalized and was subsequently affricated. This sound change accounts for why English has words such as *chin, child, church, cheese* but the counterparts in German *Kinn, Kind, Kirche, Käse* are unpalatalized. This palatalization was thought to have taken place in the prehistory of English, as is clear with the following Old English counterparts: *cinn* [t͡ʃɪn] 'chin', *cild* [t͡ʃɪld] 'child', *cyrice* [t͡ʃyrit͡ʃe] 'church', and *cēse* [t͡ʃeze] 'cheese' (Quirk & Wrenn, 1994, p. 15). Like German, with the exception of Frisian, other Germanic languages did not undergo this sound change; as is clear with Gothic *kinnus* 'chin' and OHG *kinni* 'chin' (Lass, 1994, p. 55).

[42] C_1 means any consonant except [s] [f] and [x].

The differences between several English and German cognates can therefore be accounted for through Ingvæonic Palatalization. For instance, Ingvæonic Palatalization explains the difference between Old English *ceorl* '*guy*', which archaically lives on in Present Day English as '*churl*', and its cognate German counterpart *Kerl* 'guy'[43] Ingvæonic Palatalization is also responsible for differences between the velar stop in *speak* and the affricate in *speech*, along with German *Krücke* and the English *crutch* (OE *cryc* [kry:t͡ʃ]). The palatalization of PGmc *k also explains the [t͡ʃ] in the verb *choose* (from OE *cēosan* 'choose'), which is cognate with German *küren* 'choose' (cf. OHG *kiosan* and MHG *kiesen*).[44] Other examples include English *chest* (OE *cist/cest*) and German Kiste (OHG *kista*),[45] and English *chew* (OE *cēowan*) and German *kauen* (OHG *kiuwan*).

While English-speaking L2 learners of German might benefit from declarative knowledge of this sound change, it should be noted that there are a number of exceptions to this rule, which require knowledge of Proto Germanic or other diachronic sound changes. While these exceptions are described here for completeness, for reasons of pedagogical simplicity they were not explained to learners in ExII. First, although [k] became palatalized and subsequently affricated to [t͡ʃ] before front vowels in English, sometimes the conditioning environment is lost, making it challenging for the modern speaker to understand why Ingvæonic Palatalization took place. For instance, in Old English, the plural of book (OE *boc*) was *bec* [bet͡ʃ]. The reason palatalization took place in the plural form was it came from PGmc *bōkiz, where [k] was palatalized because of the following [i]. Similarly, the English word *bench* [bɛnt͡ʃ] (OE *benc*) contains the affricate [t͡ʃ] because it came from PGmc *bankiz, where [i] triggered the change from [k] to [t͡ʃ]. Therefore, to understand these exceptions, knowledge of Proto Germanic is often necessary. Second, [k] also became palatalized and subsequently affricated after [i] unless it was followed by a front vowel in the next syllable.

[43] Because a large part of the English lexicon was borrowed from Anglo-Norman in the Middle English period, many of the words affected by this palatalization no longer exist in the English lexicon. For instance, one of the Old English verbs for 'to buy' was *ceapian* (Baker, 2012, p. 229), where the <c> represented [t͡ʃ] before front vowels (p. 15). The verb *ceapian* is cognate with the German verb *kaufen* (Laker, 2008, p. 178), related to the English word *cheap* (OE *ceāp* [t͡ʃɛəp] 'cattle/slave/bargain'), Icelandic *kaupman* 'tradesman' and Norwegian *kjøpe* 'buy'. There is also a place in the United Kingdom called *Cheapside* which goes back to the original meaning of *cheap*, that is, 'mercantile'. These reflexes go back to Proto Germanic **kaupaz*, which was thought to have been a continental borrowing from the Latin *caupō* 'shopkeeper'.

[44] The change from *s* > *r* in *kiesen* to *küren* is a product of Germanic rhoticism, a process which accounts for many alternations in both German, as in *verlieren* '*to lose*' and *Verlust* 'loss', *frieren* 'freeze', and *Frost* 'frost', and in English, as in *was/were*, *sneeze*/*snore*, and Latin-borrowed words such as *acquire/acquisition*.

[45] Technically, *chest* was a loan word from Latin into Continental Germanic, that is, before the Germanic languages split up into different languages (Brinton & Arnovick, 2006, p. 167).

This explains why Old English *ic* 'I' was pronounced [it͡ʃ] and *dic* 'ditch' was pronounced [dit͡ʃ], but the nominative plural *dicas* was pronounced [dikas]. Third, deaffrication and depalatalization also took place in Old English where [t͡ʃ] reverted back to [k] when it occurred immediately after a consonant. This phonological process explains the difference between Old English *micel* [mit͡ʃel] 'much' and the declined form *micles* [mikles], as in the archaic remnant 'mickle'. Finally, the [k] in some Old English words did not become [t͡ʃ] because of *i-mutation* or *i-Umlaut* (Lass, 1994, p. 55). For instance, the word for 'king' in Old English was *cyning*. However, the [y] is thought to have not triggered palatalization because the original vowel was [u], that is, a back vowel, and became fronted because of the [i] in the next syllable. As Lass points out, "wherever we find an OE front vowel that fails to cause palatalization, we are likely to find (a) evidence for a historical back vowel in the root...and (b) an /i/ or /j/ in the following syllable of an ancestral or ancestor-like form" (Ibid).[46]

2.4.3 Semantic Shifts

Traditionally, semantic change has been described using a simple taxonomy: narrowing versus broadening, pejoration versus amelioration, and metaphor versus metonymy (Bréal, 1990; Traugott & Dasher, 2001, p. 54). While these descriptions do not provide the mechanisms of change, they do describe the direction or scope of change, and are potentially simple and categorical enough to be used in the L2 classroom to explain semantic differences between English and German cognates (Stockwell & Minkova, 2001, p. 156).

Starting with a general narrowing of meaning, a number of labels have been used, such as semantic narrowing (Arloto 1972, p. 1972; Stockwell & Minkova, 2001, p. 158), restriction (Ullmann, 1962, p. 227; Bréal, 1990, p. 106; Ronberg, 1992, p. 32), and specialization (Stockwell & Minkova, 2001, p. 158; Brinton & Arnokick, 2006, p. 77; Riemer, 2010). A historical example of semantic narrowing in English is *deer*, which in Old English used to refer to any type of animal (OE *deor*). However, because people would hunt a certain type of animal, namely an animal with antlers, people associated the word *deer* with a specific type of animal, which thus resulted in the narrowing or specialization of the word. As Ullmann (1957) points out, "semantic change will occur whenever a new name becomes attached to a sense and/or a new sense to a name" (p. 171).

[46] For more information on these exceptions, see Hogg (1992) and Fulk (2014).

The English word *deer* is cognate with the German word *Tier* 'animal'; which in German still retains the original broader meaning of the word (cf. Norwegian *dyr* 'animal'). The sound change from *d* > *t* (*deer-Tier*) can be explained by the Second Germanic Sound Shift.[47]

Generalization, also referred to as semantic broadening (Crowley & Bowern, 2010, p. 2000; Campbell, 2013, p. 223), expansion (Bréal, 1990, p. 115), extension (Ullmann, 1962, p. 227; Crystal, 1995, p. 136) and widening (Campbell, 2013, p. 223), describes the process whereby a word's meaning extends and generalizes. For instance, the word *dog* used to refer to a specific breed of dog (OE *dogge*), but over time its meaning broadened, becoming the hypernym of all dogs. Interestingly, the opposite happened with *hound*, which used to be a superordinate term for all dogs, but now refers to only one type of dog (Stockwell & Minkova, 2001, p. 159); but in German the cognate *Hund* 'dog' is still the superordinate term.

Pejoration, also called degradation, deterioration (Crystal, 1995, p. 136), and degeneration (Campbell, 2013, p. 227), refers to a word adopting "more negative connotations" (Traugott & Dasher, 2001, p. 55). For instance, the Old English adjective *sælig* originally meant 'blessed' or 'holy'; this meaning is still retained in Modern Standard German *selig* 'holy'. However, in the history of the English language, *sælig* took on a more negative connotation, resulting in the present-day adjective *silly* (OED, silly, *adj.*, *n.*, and *adv*). According to Rayevska (1979, p. 149), pejoration can take place whenever a word is associated with something of lower significance in society, or as Ullmann (1962) puts it, "social prejudice against certain classes or occupations has deformed the meaning of many words" (p. 232). Another example of pejoration is *stench.* In Modern English, *stench* denotes a negative smell (OED), but in Old English *stence* was typically a positive smell, similar in meaning of Modern English 'fragrance' and German *Duft* 'fragrance'. This former positive denotation can be found in the Old English Blickling Homilies in examples such as *þa was eall þaet hus gefylled mid þon swetan stence* 'then the whole house was filled with the sweet stench' and *godes stennce* 'good smell' (from *The Blickling Homilie*). Since 'sweet stench' and 'good stench' would be oxymorons, it is evident that stench used to have a positive denotation, but its meaning has pejorated throughout time.

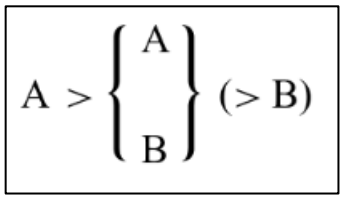
[47] It should be noted, however, that it is hypothesized that the Proto-Germanic root of **deor* meant 'wild animal', which would therefore suggest that the meaning broadened throughout the history of the German language (Traugott & Dasher, 2001, p. 57).

The opposite of pejoration is amelioration, which is also sometimes called "elevation" (Campbell, 2013, p. 229). Amelioration describes the process of a word adopting "more positive connotations" throughout time (Ibid) or "social climbing" (Stockwell & Minkova, 2001, p. 159). For instance, the German verb *geniessen* originally meant 'to use', but today it means 'to enjoy'. The English word *knight* originally meant 'manservant' or 'stable boy' (OE, *cniht*) but the social status of the word has improved (Stockwell & Minkova, 2001, p. 156); the former meaning which is still retained in the Modern Standard German word *Knecht*. An example of amelioration which is particularly relevant to the topic of this dissertation is *pedagogue*, which originally meant "a slave who takes the children to school", but now its meaning has broadened and has been ameliorated to refer to any teacher (Stockwell & Minkova, 2001, p. 160). According to Stockwell & Minkova (2001, p. 159), "words are more likely to lose their status and respectability in the language than to go up in the world". In other words, pejoration is more commonly observed than amelioration.

Metonymy describes the "association of one word with another" (Traugott & Dasher, 2001, p. 57), or as Stockwell & Minkova (2001, p. 152) put it, "an association of a particular type, usually accidental association in space or time". For instance, the English word *bead* is derived from the Old English noun *gebed* 'prayer' and *biddan* 'to pray'. Because people would often pray using rosary beads, speakers associated the word *gebed* with *bead*. In Modern English, the original meaning of *gebed* has been lost, but this meaning is still retained in German with *Gebet* 'prayer' and *beten* 'to pray' (Stern, 1931, p. 168). Metaphoric change refers to "the mapping of one concept onto another e.g. space > time" (Traugott & Dasher, 2001, p. 57). An example in English is *behind*, which originally referred only to the hind/buttocks, but now can refer to positions, as in, *put the card behind the tree*. This original word *behind* is also related to the German word *Hintern* 'buttocks', which also gave rise to the preposition *hinter* 'behind'.

While these semantic shifts describe the direction of change, it should be noted that this semantic taxonomy is an oversimplification (Traugott & Dasher, 2001). For instance, Traugott & Dasher (2001, pp. 10–11) mention that for these shifts to take place a stage of polysemy is necessary where both meanings co-exist. In other words, semantic change does not proceed from A > B but rather from A > AB which may lead to B, although A > AB > A can happen too. A graphical depiction is reported in (4). In the example *sælig* 'blessed' which became *silly*, there were multiple stages involved (Brinton & Arnovick, 2006, p. 78). The meaning of *blessed* first

became *pious*, which subsequently became *harmless* then *helpless* then *deserving of pity* then *feeble-minded*, and then finally *foolish*/*silly* (Samuels, 1972, p. 66).

4) 

(Taken from Traugott & Dasher, 2001, p. 11)

In many cases, an etymon can undergo different semantic shifts in different daughter languages. For instance, Proto Germanic **wīb* 'woman', narrowed its meaning in English to mean a specific type of woman, namely a married woman, i.e., *wife*. The former meaning of 'woman' is still retained in the compound *midwife*, which literally means 'with woman' (Campbell 2013, p. 223). In German, **wīb* underwent pejoration and is now a derogative term for a woman, i.e., *Weib*. While the aforementioned semantic taxonomy fails to provide the actuation of semantic change, in light of the reviewed importance of narrative and elaborative rehearsal in memory research, a working hypothesis, elaborated at the end of Chapter 2, is that knowledge of historical or etymological narratives will aid the acquisition of English-German cognates.

2.4.4 Diachronic Instruction in the L2 Classroom

While several scholars have called for various types of explicit diachronic instruction in the L2 German classroom (Horsford, 1987; Wolff, 1993; Lightfoot, 2007; O'Brien & Fagan, 2016, pp. 329–331), to date, no empirical studies have examined its effectiveness relative to other pedagogical interventions. However, the effects of knowledge of language history has been tested on L2 learners of French (Arteaga & Herschensohn, 1995). This section reviews the previous literature on incorporating historical instruction into the L2 German classroom (Smith, 1968; Horsford, 1987; Krawford, 1988; Wolff, 1993; Lightfoot, 2007). The empirical study on French is also reviewed (Arteaga & Herschensohn, 1995).

In 1968, Smith published an article entitled *Historical Linguistics and the Teaching of German* in which he outlines some diachronic changes which may enhance vocabulary learning. These aspects include: the Second Germanic Sound Shift, semantic shifts with cognates (e.g., *sterben* vs. *starve*), vowel change differences (e.g., [aɪ̯] vs. [o:] *Eiche*, *heilig* and *oak* and *holy*), the

loss of nasals before fricatives in English (*fünf, Gans, sanft, uns* and *five, goose, soft, us*), and *Ablaut* 'strong verbs' relations (e.g., *drink/drank/drunk – trink/trank/getrunken*).[48] While Smith mentions that these are "instances where a teacher of German may well have occasion to allude to the historical development of the language", he also mentions that "he must take care not to become tedious with it" because "he is *not* teaching a course in historical linguistics" (p. 238).

Almost two decades later, it seems the discussion had moved no further. Horsford (1987) points out that applied historical linguistics "seems to have become somewhat unfashionable" and "language history has been placed into the service of pedagogy only rather tentatively and sporadically" (p. 278). In an attempt to reawaken interest in language history awareness, Horsford (1987) points out six benefits of incorporating factual information about the historical development of German and English. First, Horsford mentions that not all learners of German know that English is a Germanic language and by pointing this out it can make German seem less foreign to learners.

> "When introducing the four most troublesome German phonemes /ç/ and /x/, /ü/ and /ö/, we might mention that Old English (documented since the 8th century) had the same spirants and rounded front vowels. The former are no longer pronounced but still spelled as 'gh' in words such 'brought, right, through' cognates to *brachte, recht, durch*" (pp. 278–279).

While Horsford (1987) does not mention this, in Old English <h> was pronounced [ç] after front vowels (e.g., *siht* [sɪçt] 'sight') or [x] after back vowels, like with Dorsal Fricative Assimilation in Modern Standard German. Second, awareness of language history can offer pedagogical tools such as predicting the meaning of words based on declarative knowledge of sound changes (pp. 279–280). Third, awareness of language history provides learners with explanations for irregularities which cannot be understood synchronically. Fourth, awareness of language history leads to a more accurate and realistic description of German. For instance, German L2 instruction creates the perception of the existence of a homogenous German language, yet in reality there is a great deal of linguistic diversity as a result of its history (pp. 281–282). The fifth reason Horsford gives is that learning the etymological history of German words promotes a deeper understanding of culture. For instance, *Zaun* 'fence' is cognate with German word *town* because medieval towns were fortified by a *Zaun*. *Bürger* 'citizen' is someone who historically lived in a *Burg* 'city fort'

[48] Smith does not point out, however, that the words affected by the loss of nasals before fricatives are so basic that they would likely be learned before the instructor would need to mention etymological relations (p. 234).

and many German cities today still have remnants of the fortified stones. The same relationship is observed with *city* and *citizen* (pp. 282–284). The final reason given for incorporating language history in the L2 German classroom is that it "adds world-wide dimensions to the study of German". This is because being able to identify cognates, also means an improvement ability of being able to determine loanwords. Teaching the histories of given loanwords therefore improves learners' knowledge about many languages.

In an article published a year later, Crawford (1988) also presents historical aspects of the German language which may either "palliate the feeling of the 'foreignness' of the foreign language experienced by many first year students or to enliven the review of grammar in more advanced" (p. 204). Crawford mentions that "we can stress the relationship between German and English in the first weeks of instruction by pointing out many cognates in the two languages" (p. 204). Crawford also mentions that many aspects of German which may seem foreign, used to exist in English, such as the case and gender system, complex plurals, inflectional endings etc. However, like Smith (1967) and Horsford (1987), Crawford (1988) did not test the effectiveness of incorporating historical instruction in the German classroom empirically.

Following the footsteps of previous commentary, Wolff (1993) adds to this discussion by mentioning 12 aspects of the German language which might benefit from a historical explanation, such as the irregularities of the verb forms in *sein* 'to be'. However, while the basic premise of the article points to the possible benefits of integrating historical linguistics in the language classroom, no explanations as to how the historical explanation can be presented to learners were given. Nevertheless, it should be acknowledged that sample activities on what the instruction could look like in the L2 classroom does not seem to have appeared until Lightfoot (2007). While others such as O'Brien & Fagan (2016) suggest that knowing relevant sound changes can help English-speaking L2 learners of German identify English-German cognates (pp. 329–331), to date, no studies have tested the effectiveness of explicit instruction of the relevant aspects of language history on L2 German acquisition. The only study close to addressing this empirical question was a recent doctoral dissertation by a student of Lightfoot, Coffman (2018). In her study, Coffman examined the effect of exposure to historical linguistics on L2 motivation. Learners of German, Spanish, and French were taught the First Germanic Sound Shift and a number of relevant factual information about their respective Indo-European daughter languages. Results from surveys and

oral interviews indicate that the historical instruction did have an effect of L2 motivation. Whether the historical instruction affected their learning, however, was not tested.

While no empirical studies have examined the effects of explicit historical instruction on L2 German learners, Arteaga & Herschensohn (1995) examined the effects of historical instruction on the French circumflex on L2 Learners of French. The orthographic circumflex in Modern Day French is a reflection of a historical sound change which marks the compensatory lengthening which took place after the deletion of [s], as in *hôte* 'host', *fête* 'feast' and *hôpital* 'hospital'. The authors examined whether knowledge of this historical information allowed L2 learners to predict the meaning of French words. There were two groups: an experimental group which received explicit historical instruction and a control group which did not receive any historical instruction. Results indicated that the experimental group significantly outperformed the control group. Whether similar findings can be observed for German, is the topic of the second experiment in this dissertation.

The application of historical linguistics outside of linguistics may be aptly referred to as "applied historical linguistics", a term that has been used in a number of different, but often related ways (Horsford, 1987, p. 278; Campbell, 2013, p. 405; Crystal, 2016, p. 223; Dollinger, 2019, p. 211). For instance, Crystal (2016) used this term when describing efforts to teach Shakespearean pronunciation to stage actors, as it was necessary to teach the pronunciation of the time for a more authentic portrayal of the language (p. 211). While "applied historical linguistics" can also be used to refer to linguistic paleontology (Campbell, 2013, p. 405), in line with Crystal (2016, p. 223), "applied historical linguistics" may be an adequate term for describing the integration of historical linguistics in the L2 classroom. After all, Horsford (1987) used it in his German pedagogy article: "discussions of applied historical linguistics rarely appear in professional journals" (p. 278).

2.5 Literature Review Summary

The previous four sections laid out the implicit-explicit debate on learning and instruction, it reviewed the relevant research on human memory, it outlined the previous studies on L2 German pronunciation instruction, as well as the pertinent aspects of German phonetics and phonology. Finally, it reviewed relevant historical changes which differentiate English-German cognates, as well as previous studies on the use of historical linguistics in the L2 classroom. From this review, two overarching gaps become clear.

First, despite the advocation of implicit instruction in many CLT classrooms (e.g., Krashen & Terrell, 1983), the majority of research suggests that explicit instruction is more effective than implicit instruction for the accelerated acquisition of L2 grammar rules (Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Kang et al., 2019). However, the extent to which these findings are generalizable to other linguistic domains, such as L2 speech and L2 vocabulary, as well as other languages, such as German, is unclear. Although several studies have showcased the benefits of explicit pronunciation instruction in the L2 classroom (e.g., Field, 2005; Chung, 2008; Saito, 2011; Lee, Jang & Plonsky, 2015; Darcy, 2018; Olson & Offerman, 2021), only a selected few have examined the applicability of these findings to the L2 German classroom (e.g., Roccamo, 2015; Bryan, 2019; Peltekov, 2020). Of these studies, various confounding factors, such as the absence of objective acoustic measurements and instructor differences, make an objective evaluation of the amenability of German L2 speech to explicit instruction inconclusive. This gap lays the foundation for the first experiment (ExI) in this dissertation.

Second, although English and German share a common ancestor, no studies have tested empirically whether explicit declarative knowledge of the various historical changes which distinguish English and German is advantageous when learning English-German cognates. Given that decades of research have highlighted the advantages of elaborative rehearsal and deep processing on human memory and learning (Craik & Lockhart, 1972; Baddeley, 1990; Craik, 1999; Hulstijn & Laufer, 2001; Ghorbani & Riabi, 2011; Prince, 2012; Ge, 2015), it is reasonable to hypothesize that receiving explicit instruction on the association between English-German cognates would result in longer retention in memory and thus more effective learning. With these two empirical gaps in mind, the following section turns to the research questions and the respective hypotheses.

2.6 Research Questions

To tap into these two macro research questions regarding the effectiveness of explicit instruction on L2 pronunciation and L2 vocabulary, seven micro research questions were formulated. These seven questions were addressed across two experiments. The first experiment (ExI) tested the effectiveness of explicit and implicit instruction on German phonetics and phonology in the L2 classroom. The second experiment (ExII) tested the effectiveness of explicit German vocabulary instruction in the L2 classroom.

2.6.1 Experiment I: L2 Speech

RQ1: Final Devoicing

As measured by four acoustic correlates of voicing (namely, preceding vowel duration, duration of closure, release duration, and durational presence of glottal pulsing), is there a statistically significant difference between the two learning conditions (implicit and explicit) in the production of underlyingly voiced word-final and non-word-final stops?

H1: Hypothesis 1

Because several studies have found that explicit pronunciation instruction can improve L2 pronunciation (Field, 2005; Chung, 2008; Saito, 2011; Lee, Jang & Plonsky, 2015; Darcy, 2018; Olson & Offerman, 2021), and simple rules, such as Final Devoicing, are more amenable to explicit instruction (DeKeyser, 1995; Reber, 1989; R. Ellis, 1990), the explicit condition will outperform the implicit condition with respect to the acquisition of German Final Devoicing, as measured by the acoustic correlates of voicing. Since orthography can interfere with the acquisition of L2 phonology (Young-Scholten, 2002; Bassetti, 2006; Young-Scholten & Langer, 2015; Hayes-Harb, Brown & Smith, 2018; Bürki et al., 2019), the absence of overt orthographic marking of German Final Devoicing may lead to less noticing in the implicit condition than the explicit condition. In contrast, the explicit instruction that the explicit condition will receive, will provide them with the declarative knowledge to overcome this interference. Since noticing (Schmidt, 1990, 1993, 1994) correlates with an increase in intake (e.g., Rosa & O'Neil 1999; Leow, 2000; Rosa & Leow, 2004; Radwan, 2005; Mackey, 2006; Hama & Leow, 2010; Grey, Williams & Rebuschat, 2014), and it is not possible to attend to too much input simultaneously (Kahneman, 1973; Robinson, 1995, 2003; Hyman et al., 2010), the difference between underlyingly voiced word-final and non-word-final stops will be significantly longer in the explicit condition than the implicit condition.

RQ2: Articulation of Fricatives

As measured by the acoustic correlate Center of Gravity (CoG), is there a statistically significant difference in the production of the German fricatives [ʃ], [ç] and [x] among the two learning conditions (implicit and explicit)?

H2: Hypothesis 2

Following previous research on explicit pronunciation instruction (Field, 2005; Chung, 2008; Saito, 2011; Lee, Jang & Plonsky, 2015) and the Skill Acquisition Theory (DeKeyser, 2015), the explicit condition will outperform the implicit condition in the production of these three fricatives. According to the Speech Learning Model (Flege, 1995, 1999), the distinction between [ʃ] and [ç] should be challenging for English-speaking L2 learners of German to acquire. However, because the explicit condition will receive explicit instruction on place of articulation, the Skill Acquisition Theory predicts that, with sufficient practice, their declarative knowledge will be converted into procedural and automatized knowledge, ultimately allowing them to articulate the three fricatives appropriately. While there will be a significantly larger distinction in CoG between the three fricatives in the explicit condition than the implicit condition, the Speech Learning Model (Flege, 1995, 1999) also predicts that a contrast between [x] and [ʃ, ç] should not pose difficulty in either learning conditions because of their dissimilarity.

RQ3: Dorsal Fricative Assimilation

As measured by the acoustic correlate Center of Gravity (CoG), which of the two learning conditions (implicit and explicit) will acquire the phonological process Dorsal Fricative Assimilation more accurately?

H3: Hypothesis 3

Based on the previous literature on pronunciation instruction (e.g., Field, 2005; Chung, 2008; Saito, 2011; Lee, Jang & Plonsky, 2015), attention (e.g., Kahneman, 1973; Robinson, 1995, 2003; Hyman et al., 2010), and awareness (e.g., Schmidt, 1990, 1993, 1994; Rosa & O'Neil 1999; Rosa & Leow, 2004; Radwan, 2005; Grey, Williams & Rebuschat, 2014), the explicit condition will outperform the implicit condition with the acquisition of this rule.

RQ4: Discrimination Task

On a perceptual discrimination task, which of the two learning conditions (implicit or explicit) more accurately discriminate between the German phonemes [ʃ], [ç], and [x]?

H4: Hypothesis 4

Given the research suggesting that pronunciation training can improve perceptual skills (Linebaugh & Roche, 2015), the explicit learning condition will outperform the implicit condition in this perceptual task. This hypothesis is supported by previous research on implicit and explicit instruction (e.g., Robinson, 1994; DeKeyser, 1995, 1997; Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Berges-Puyó, 2018).

RQ5: Identification Task

On a perceptual identification task, which of the two learning conditions (implicit or explicit) more accurately identifies which fricative [ʃ] [ç] is played to them when presented with minimal pairs?

H5: Hypothesis 5

As with H4, based on the previous research on the benefits of explicit pronunciation instruction, and the correlation between explicit pronunciation instruction and an improvement in perceptual skills, the explicit learning condition will outperform the implicit condition on the identification task.

2.6.2 Experiment II: L2 Vocabulary

RQ6: Vocabulary Recall

Based on an isolated translation task, is there a statistically significant difference between the number of cognates identified by L2 learners who received explicit historical instruction (explicit condition) and L2 learners who did not receive explicit historical instruction (non-explicit condition)?

H6: Hypothesis 6

Given the benefits of elaborative rehearsal and association building on memory (Craik & Lockhart, 1972; Baddeley, 1990; Craik, 1999; Hulstijn & Laufer, 2001; Prince, 2012; Ge, 2015), the explicit group will outperform the non-explicit group in the learning of English-German cognates because the explicit group will have encoded additional features to the memory trace which will make them more memorable. The more associations learners have with a particular word (i.e., deep processing), the higher the likelihood they are to remember it (e.g., Lockhart & Craik, 1990; Craik, 1999; Hulstijn & Laufer, 2001; Nemati, 2009; Bolger and Zapata, 2011; Prince, 2012). Therefore, the historical instruction on

sound and semantic shifts will allow the explicit condition to create an association between the novel German words and their English cognate counterparts which are already stored in their long-term memory.

RQ7:

Based on an isolated translation task, is there a statistically significant difference between the two learning conditions (explicit and non-explicit) in the number of German cognates L2 learners were able to correctly predict the meaning of? Unlike in RQ6, these are cognates which learners will have not encountered in their pedagogical interventions.

H7: Hypothesis 7

Because the explicit condition will have declarative knowledge about the Second Germanic Sound Shift and Ingvæonic Palatalization, the explicit condition will outperform the non-explicit condition because these systematic sound shifts provide a toolkit for predicting the meaning of English-German cognates. For instance, if learners have the declarative knowledge that */p/ became /p͡f/ word-initially in German, when they encounter a cognate they have not seen before, such as *Pfanne*, they should theoretically be able to predict the English counterpart, namely ‘pan’.

CHAPTER 3. METHODOLOGY: EXPERIMENT I

3.1 Overview

Experiment 1 (ExI) tested the effectiveness of implicit and explicit learning conditions on the acquisition of German L2 speech. Two sections of the same course (German III) were used: one section served as the implicit condition and one section served as the explicit condition. Both sections were taught by the same instructor to minimize the teacher as a potential confound. Learners in the two conditions had been placed in third-semester German either through completion of a placement test or through successful completion of the previous semester (German II). Over the course of a 16-week semester, learners received either implicit or explicit instruction on German pronunciation, and they completed a pre-test (at the beginning of the semester during week 1-2), post-test (after the implicit/explicit pedagogical intervention during week 7-8), and delayed-post-test (at the end of the semester during week 15-16). They also filled out a Language Background Questionnaire at the beginning of the semester, and an Exit Survey at the end of the semester. The Exit Survey is described at the end of this chapter.[49]

3.2 Learner Sample

Although there were slightly more participants in the explicit condition (n = 16) than the implicit condition (n = 13), the distribution for gender did not differ: explicit (male = 63%, female = 37%) and implicit (male = 62% female = 38%).[50] The mean average age was also consistent across the two learning conditions: explicit (M = 19 years) and implicit (M = 19 years). English was the L1 of 70 percent of the learners in the explicit condition (n = 11/16) and 84 percent of the learners in the implicit condition (n = 11/13). Mandarin Chinese (n = 1/16), Vietnamese (n = 1/16), Indonesian (n = 1/16), and Spanish (n = 1/16) made up the L1 for the remaining 30 percent of the explicit condition (n = 4/16), and Mandarin Chinese was the L1 of the remaining 16 percent of learners (n = 2/13) in the implicit condition. Only one learner self-identified as having more than one L1, namely English and Tamil (a learner in the explicit condition). Nevertheless, on the basis of their

[49] Both experiments (ExI and ExII) were approved by the Institutional Review Board and were thus included as mandatory parts of the course. Completion of the pre-/post-/delayed-post-tests and the training sessions were therefore included as participation on the course syllabi.

[50] There were initially 14 learners in the implicit condition, but one learner failed to complete the post and delayed-post-tests and was therefore removed from the pool of analysis.

TOEFL and English proficiency admission scores, all learners who were not L1 speakers of English were proficient speakers of the language.[51] To ensure that the L1 of the speaker was not a confounding variable, LEARNER-L1 was included as a fixed factor in the multivariate analyses.

In the explicit condition, only one learner reported having L2 knowledge of a language outside of English and German, namely Spanish, whereas, in the implicit condition, three learners reported knowledge of Spanish and French, through exposure at high school (average mean exposure of 3.5 years). As for the mean exposure of German, the implicit condition had learned German for slightly longer (M = 2 years) than the explicit condition (M = 1.5 years). Out of the two learning conditions, only one learner, namely a learner in the implicit condition, reported having spent time in a German-speaking country. However, none of the learners reported having an instructor who came from, had lived in, or had visited a German-speaking country other than Germany.[52]

3.3 Pre-/Post-/Delayed-Post-Test

3.3.1 Production

On the first day of the semester (week 1), learners completed the Language Background Questionnaire (Appendix A), and on the second day of the semester (week 1) learners were asked to select a time to meet individually with the instructor outside of regular class time to complete the production pre-test (Appendix B). The same procedure was followed for the post-test (during week 7-8) and delayed-post-test (during week 15-16). During their selected time slot, students were taken to a soundproof room and were asked to read 24 slides aloud, which were presented to them on a screen. Each production test was completed individually, outside of the classroom, to maximize the quality of the acoustic recordings. Their speech was recorded in Praat

[51] Because they were university students enrolled at a North American university, they had to pass an initial English proficiency exam. With the exception of foreign language classes, all classes at the university were also taught in English.

[52] This background information is particularly important when analyzing the production of learners' German fricatives because in regions such as Switzerland, the palatal fricative can be realized as a velar or uvular fricative. Therefore, if learners have exposure to these varieties of German and they realize the palatal fricative as a velar fricative (e.g., [ʔɪx] as opposed to [ʔɪç]), their pronunciation may be attributed to the acquisition of a dialectologically different phonological system as opposed to a phonological error. However, since no learners reported having had any exposure to these varieties, a velarized realization of the palatal fricative in the incorrect environment (e.g., [x] after front vowels) is indicative of an issue with the acquisition of Dorsal Fricative Assimilation.

(Boersma & Weenink, 2019) using a Snowball ICE Microphone, which was digitized at a sampling rate of 44,100Hz, with a 16-bit resolution, on a mono-channel. The 24 slides were randomized using the random generator on Quizlet.

The 24 slides consisted of target stimuli (words and carrier phrases) which were deliberately chosen to test learners' articulation of three German fricatives, namely [ç], [ʃ], and [x], and six German stops, namely [p, b, t, d, k, g]. Other than the one speaker in the explicit condition whose L1 was Spanish, none of the learners' L1s contained the palatal and velar fricative.[53] As for the stops, although the same six stops existed in the L1 of all learners, the phonological constraints are different because, unlike in German, their L1s permit voiced stops in word-final or syllable-coda position.

The 24 slides consisted of 188 words, which contained 36 underlyingly voiced stops. Of the 36 underlyingly voiced stops, 23 surface as voiceless because they appeared in word-final position, and 13 surface as voiced because they were not in word-final position. A list of the target stimuli containing the German stops in word-final and non-word-final position is provided in Table 3. There were nine words containing the underlyingly voiced /b/, of which six surface as voiceless (*lob*, *lieb*, *gib*, *gelb*, *ob*, *Brob*) and three surface as voiced (*loben*, *lieben*, *Brobe*). Six of these words alternated phonologically: *loben/lob*, *lieb/lieben*, *Brob*/*Brobe*. There were 19 words containing the underlyingly voiced /d/, of which 12 surface as voiceless (*Rad*, *Land*, *Kind*, *Hund*, *fand*, *Grund*, *Hemd*, *wird*, *sind*, *Deutschland*, *erminkeld*, *Pind*) and six surface as voiced (*Räder*, *Länder*, *Kinder*, *Hunde*, *finden*, *Freunden*). Twelve of these words alternated phonologically: *Rad*/*Räder*, *Land*/*Länder*, *Kind*/*Kinder*, *Hund*/*Hunde*, *fand*/*finden*, *Pind*/*Pinde.* There were eight words containing the underlyingly voiced /g/, three surface as voiced (*Kriege*, *Teige*, *Piege*), and five surface as voiceless (*Krieg*, *Teig*, *mag*, *Tag*, *Pieg*), of which three pairs alternated: *Krieg*/*Kriege*, *Teig*/*Teige* and *Pieg*/*Piege.*

Seven of the stops were pseudowords. These were included because learners could theoretically learn the correct pronunciation of individual words (e.g., *Hund* is pronounced [hʊnt]) but are unable to apply the underlying rule to new words (e.g., with *Brob*, *Pind*, *Pieg*). Put

[53] Spanish contains the velar fricative [x]. As for the postalveolar fricative [ʃ], this existed in the L1 inventory of all the learners, with the exception of Spanish. However, the L1 speaker of Spanish was a native speaker of Argentinian Spanish which does in fact have [ʃ] in its phonetic inventory. Nevertheless, [ʃ] typically poses little to no difficulty to acquire for Spanish speakers since they also produce this sound for non-linguistic purposes (e.g., when telling someone to be quiet). According to the UPSID database, [ʃ] is among the three most frequent fricatives (https://phoible.org/contributors/UPSID).

differently, pseudowords were included to account for the fact that learners may pronounce some words correctly (e.g., *Hund* → [hʊnt]) because they are high frequency words and learners have learned to imitate the input and may have therefore not necessarily acquired the underlying phonological rule. Alternating pseudowords were included for each of the three underlyingly voiced stops: *Brob*/*Brobe*, *Pind*/*Pinde*, *Pieg*/*Piege*. The remaining nonce word was *erminkeld*, which contained the voiced alveolar /d/ after a lateral, which according to German Final Devoicing, should, at least phonologically speaking, surface as [t].[54]

As for the fricatives, there were 34 palatal fricatives, eight velar fricatives, and six postalveolar fricatives. With the exception of [x], which cannot appear word-initially in Modern Standard German, [ç] and [ʃ] appeared word-initially, word-medially, and word-finally (see Table 4). The adjective form *chinesisches*, which consists of *chinesisch* 'Chinese' plus the neuter nominative and accusative adjective ending *-es*, was included because this word may prove particularly challenging for L2 learners to articulate as it contains the palatal fricative, voiced alveolar fricative, postalveolar fricative, and voiceless alveolar fricative in quick succession [çi.ne.zi.ʃəs]. Thirteen of the words containing the target fricatives were partial minimal pairs: *sich/Sach*(en), *mich*/*mach*(en)/*möcht*(en), *Dach/Dächer*, *nach*/*nicht*, *klicht*/*klacht*/*klücht*; the latter three were pseudowords.[55] With the exception of the pseudowords, most target words were embedded in carrier phrases.[56] These phrases, which appeared on the 24 slides, are reported in Table 5. To ensure that the acoustic parameters, delineated in previous literature (as outlined in Section 2), could be used as correlates of voicing and place of articulation, a 26-year-old female native speaker of German from Freiburg also carried out the production task. The acoustic parameters were first tested on the recording produced by the native speaker before being used to examine the learner production data.

[54] Phonetically speaking, stops following voiced segments such as nasals and liquids may not be devoiced completely due to voice assimilation.

[55] The pseudowords do not violate German phonotactics.

[56] While it could be argued that not including the pseudowords in carrier phrases may have given away their status as nonce words, some target words also appeared in isolation (e.g., *Teige*). Although the words *unter* 'under' and *Uber* 'the car-taxi service' did not appear in carrier phrases, they were chosen to test changes in vowel production. However, vowel production data were not analyzed in this dissertation.

Table 3. List of Target Words Containing Underlyingly Voiced Stops

Sound	Word	Word-Final	Transcription	Non-Word-Final	Transcription
/b/	Real	lob lieb gib gelb ob	[lo:p] [li:p] [gi:p] [gɛlp] [ʔɔp]	loben lieben	[lo:bn̩] [li:bn̩]
	Nonce	Brob	[bʁo:p]	Brobe	[bʁo:bə]
/d/	Real	Rad Land Kind Hund fand Grund Hemd wird sind Deutschland	[ʁa:t] [lant] [kɪnt] [hʊnt] [fant] [gʁʊnt] [hɛmt] [vɪʁ̞t] [zɪnt̪] [dɔɣ̞t͡ʃlant]	Räder Länder Kinder Hunde finden Freunden	[ʁe:dɐ] [lɛndɐ] [kɪndɐ] [hʊndə] [fɪndn̩] [frɔɣ̞ndn̩]
	Nonce	Pind erminkeld	[pɪnt] [ɛa̯mɪŋkɛlt]	Pinde	[pɪndə]
/g/		Krieg mag Tag Teig	[kʁi:k] [ma:k] [ta:k] [taɪ̯k]	Kriege Teige	[kʁi:gə] [taɪ̯gə]
	Nonce	Pieg	[pi:k]	Piege	[pi:gə]

Table 4. List of Target Words Containing Fricatives

Fricative	Type	Position	Word	Transcription
[ç]	Real	Initial	China Chemnitz chinesisches	[çi:na] [çɛmnɪt͡s] [çine:zɪʃəs]
		Medial	möchten echt [*n* =2] nicht [*n* = 5] Brecht Dächer	[mœçtn̩] [ʔɛçt] [nɪçt] [bʁɛçt] [dɛçɐ]
		Final	ich [*n* =13] mich dich sich freundlich gefährlich lustig	[ʔɪç] [mɪç] [dɪç] [zɪç] [frɔɣ̩ntlɪç] [gə.fɛ:a̯lɪç] [lʊstɪç]
	Nonce		klicht klücht	[klɪçt] [klʏçt]
[x]	Real	Medial	machen Sachen kochen	[maxn̩] [zaxn̩] [kɔxn̩]
		Final	nach Dach auch	[nax] [dax] [ʔa͡ʊ̯x]
	Nonce		klacht	[klaxt]
[ʃ]	Real	Initial	schön [*n* = 3]	[ʃø:n]
		Medial	chinesisches	[çi:ne:zɪʃəs]
		Final	komisch [*n* = 2]	[ko:mɪʃ]

Table 5. Target Words, Sentences, and Carrier Phrases in Production Test

1. es wir**d** kühl
2. klicht
3. klücht
4. Lo**b** mich, warum? Ich habe Muetter geholfen
5. Ich fahre gern mit dem Ra**d**. Ah ja, Fahrrä**d**er sind schön. Sie sind echt cool finde ich, aber nicht, wenn ich über die Brücke fahren muss, weil das gefährlich sein kann
6. Uber
7. Pie**g**
8. Mütter lo**b**en oft ihre Kin**d**er unter Freun**d**en
9. klacht
10. Tei**g**e
11. Gi**b** mir den Tei**g**. Ich ma**ch**e mit. Ich ma**g** chinesisches Essen nicht. Echt? Wollen wir andere Sachen kochen?
12. unter
13. Sie machen sich lustig über mich! Ist es Krie**g** oder was! Ich hasse Krie**g**e
14. ich weiß nicht, ob ich dich nach Hause bringen kann
15. Pin**d**
16. erminkel**d**
17. Ich komme aus China, nicht aus Chemnitz, also nicht aus Deutschlan**d**! Ah schön. Übrigens, kennst du Brecht? Ja, er ist super freundlich
18. Guten Ta**g**! Möchten Sie etwas Brot? Ja bitte, das ist lie**b** von dir. Ich lie**b**e Brot! Aber gibt es einen Grun**d** dafür, dass das Brot gel**b** ist?
19. ich komme aus einem komischen Lan**d**, wo es keine Dächer gibt, aber viele Län**d**er haben auch kein Dach
20. Pin**d**e
21. Bro**b**e
22. Bro**b**
23. Pie**g**e
24. ich sah einen Hun**d** mit einem Hem**d**. Normalerweise finden Kin**d**er Hun**d**e schön, aber dieses Kin**d** fan**d** ihn komisch

3.3.2 Perception

In the second week of the semester (week 2), both learning conditions met in a computer laboratory during the scheduled class time to complete the perception pre-test. This procedure was repeated for the post-test (during week 7-8) and the delayed-post-test (during week 15-16). During this session, learners completed an AX discrimination task and a word identification task. In AX discrimination tasks, learners listen to two consecutive stimuli, spaced out with an interstimulus interval, and are asked to decide whether the stimuli are the "same" or "different" (Colantoni, Steele, & Escudero, 2015, p. 95-96). In identification tasks, learners listen to a series of isolated stimuli, one at a time, and are asked to map the stimuli to the listed orthographic forms (cf. Colantoni, Steele, & Escudero, 2015, p. 96-97).

In the present experiment (ExI), once learners had entered the room, they were seated at individual computer stations with audio headsets. The order of the two tasks was counterbalanced: 50 percent of the learners completed the AX discrimination task first, and 50 percent completed the identification task first. Learners wrote their responses to the two tasks on response sheets provided (see Appendix C and D). For the AX discrimination task, *Hund* and *Tisch* were were given as examples for words which are "different", and *Hund* and *Hund* which given as words which are "same". Each task lasted approximately six minutes, and learners were given a ten-minute break between the two tasks.

3.3.2.1 Discrimination Task

To prepare the audio recording, a 36-year-old female native speaker of German from Berlin was used to record 16 minimal pairs (see Table 6) in a soundproof room. The minimal pairs contained a four-way contrast: [ç] versus [ʃ], [ʏ] versus [y:], [y:] versus [u:], [ʊ] versus [ʏ].[57] Recordings were carried out in Praat (Boersma & Weenink, 2019) at a sampling rate of 44,100Hz, with a 16-bit resolution, on a mono-channel. Once the stimuli had been recorded, cross-splicing was used to ensure the contrastive sounds were the only acoustic difference. This was done by using one of the minimal pairs as the baseline (e.g., [kɪ:rçə]), removing the target segment (e.g., [kɪ:r__ə]), and splicing the contrastive segment [ʃ] into the stimulus (e.g., [kɪ:rʃə]). Contrastive sounds were

[57] Fricatives [ç] and [ʃ] contrast in place of articulation whereas the vowels have either a lax or tense distinction (e.g., [ʏ] versus [y:]) or are contrastive by frontness or backness of the tongue position [y:] versus [u:].

spliced at zero crossings so that pops were not audible. Figure 4 shows an example of two minimal pairs containing contrastive fricatives after cross-splicing, and Figure 5 shows an example of two minimal pairs containing contrastive vowels after cross-splicing. To remove amplitude as a confounding variable, the amplitude was normalized to 65dB.

Tokens were counterbalanced for order of contrastive (AX or XA) and non-contrastive iterations (AA or XX) and stimuli were arranged in four pairings: AA, AX, XX, XA (see Table 7). This yielded a total number of 64 trials (4 pairings × 16 stimuli = 64 trials). The order of iterations in the recording was also randomized. An example of the randomization is provided in Table 8. The interstimulus interval was 500ms and the response time-out was 2000ms. Once the appropriate intervals had been added, the sound files were concatenated into a single audio file which was loaded onto learners' screens. Prior to the pre-test, to test the authenticity of the audio file, two native speakers of German carried out the AX discrimination task. Both native speakers correctly discriminated all stimuli and were also able to correctly identify their meaning.

Table 6. Recorded Target Segments

			/y:/ and /u:/		
über	[y:bɐ]	'about'	*Uber*	[u:bɐ]	'the taxi service'
kühl	[ky:l]	'cool'	*cool*	[ku:l]	'cool' (something positive)
Güter	[gy:tɐ]	'good'	*gute*	[gu:tə]	'good' + adj. ending -e
klüger	[kly:gɐ]	'clever' +comparative	*kluger*	[klu:gɐ]	'clever' +er ending
			/ʊ/ and /ʏ/		
Mutter	[mʊtɐ]	'mother'	*Mütter*	[mʏtɐ]	'mothers'
musste	[mʊstə]	'must'+past	*müsste*	[mʏstə]	'would have to'
Busche	[bʊʃə]	'bush'+dative	*Büsche*	[bʏʃə]	'bushes'
wusste	[vʊstə]	'knew'	*Wüste*	[vʏstə]	'desert'
			/ʏ/ and /y:/		
Wüste	[vʏstə]	'desert'	*wüsste*	[vy:stə]	'would know'
bücke	[bʏkə]	'I stoop'	*büke*	[by:kə]	'would bake'
Hütte	[hʏtə]	'hut'	*Hüte*	[hy:tə]	'hats'
Füller	[fʏlɐ]	'fountain pen'	*Fühler*	[fy:lɐ]	'sensor'
			[ç] and [ʃ]		
Kirche	[ki:rçə]	'church'	*Kirsche*	[ki:rʃə]	'cherry'
Löcher	[lœçɐ]	'holes'	*Löscher*	[lœʃɐ]	'extinguisher'
Herrchen	[hɛ:çn̩]	'little mr'	*herrschen*	[hɛ:ʃn̩]	'to dominate'
rassig	[rasɪç]	'racy'	*rassisch*	[rasɪʃ]	'racial'

Table 7. Contrast Pairings

Order	Sample	
AX	[ki:rçə]	[ki:rʃə]
XA	[ki:rʃə]	[ki:rçə]
AA	[ki:rçə]	[ki:rçə]
XX	[ki:rʃə]	[ki:rʃə]

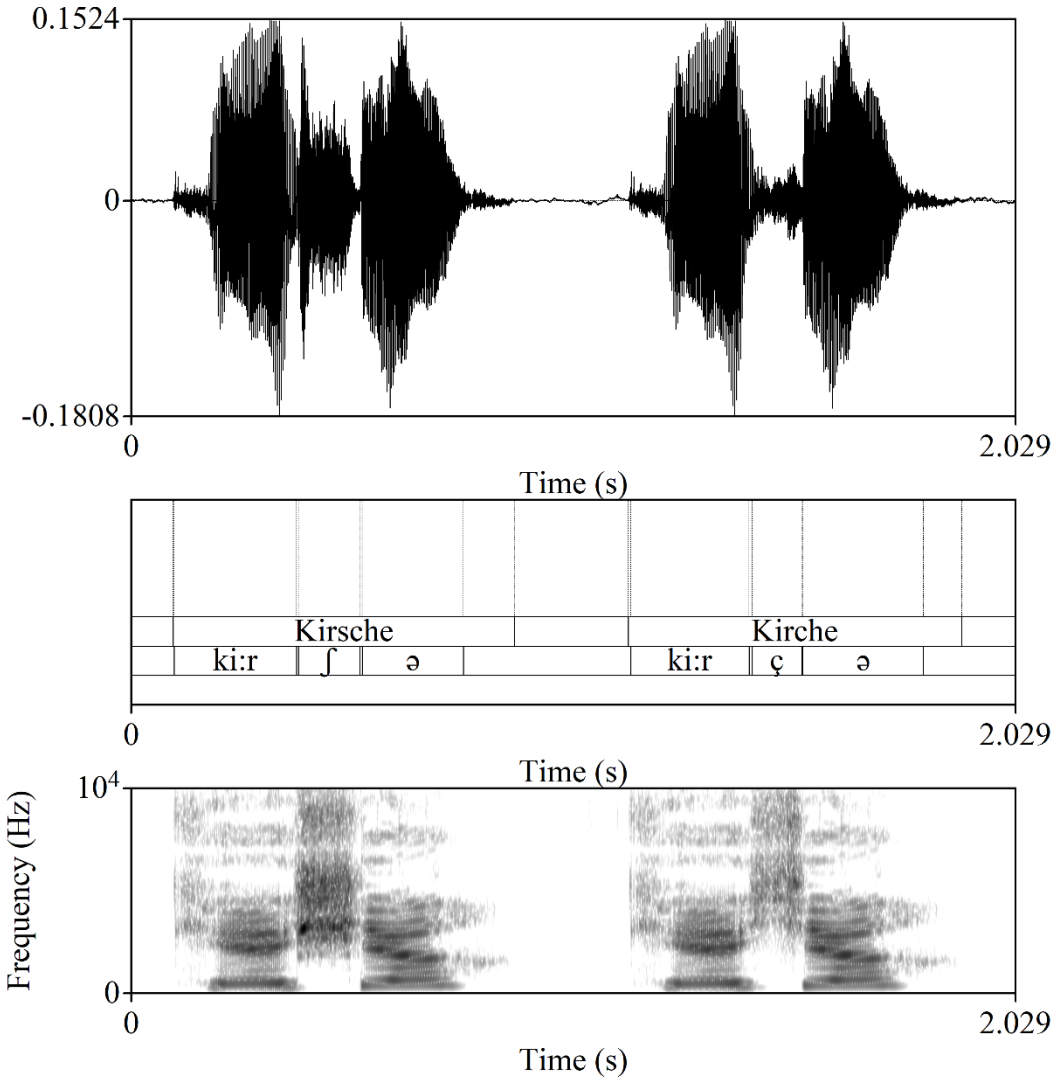


Figure 4. *Kirsche* versus *Kirche* after Cross-Splicing

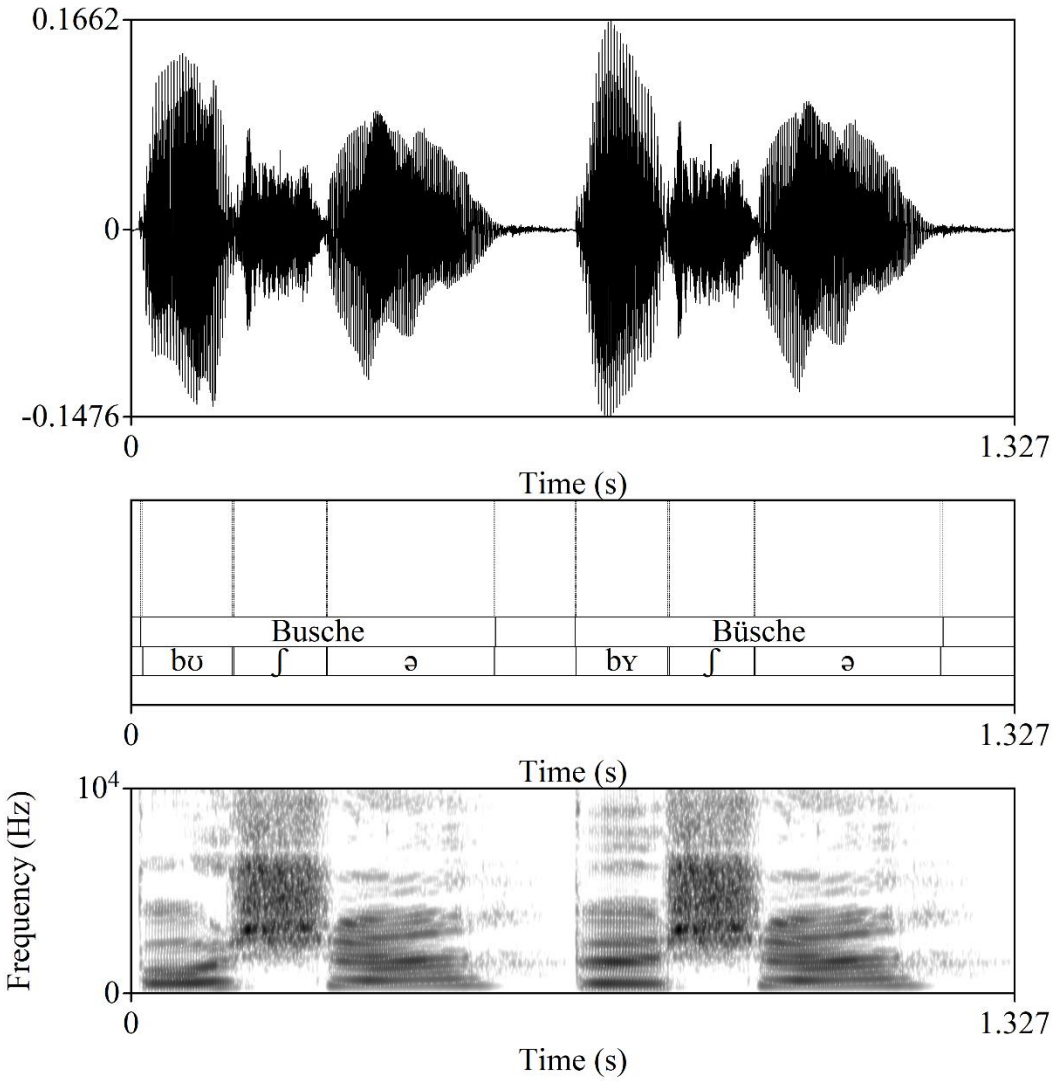


Figure 5. *Busche* versus *Büsche* after Cross-Splicing

Table 8. Sample Order of Target Items in Discrimination Task

1. Uber... über
2. Kirche...Kirche
3. Mütter… Mütter
4. Wüste…wusste
5. gute…Güte
6. cool…cool
7. Büsche…Busche
8. Kirsche…Kirche
9. Herrchen…Herrschen
10. Güte… gute
11. Dünne…Dühne
12. über...Uber
13. rassig…rassisch
14. Löcher… Löcher
15. klüger…kluger
16. musste…müsste
17. Herrschen…Herrchen
18. Busche…Büsche
19. Hütte…Hutte
20. rassisch…rassisch

3.3.2.2 Identification Task

For the identification task, the same stimuli which had been recorded for the AX discrimination task were used. The only difference was the absence of cross-splicing in the creation of the audio file. The audio file contained 26 contrastive words (13 minimal pairs), repeated three times, yielding 78 trials (26 stimuli × 3 occurrences = 78 trials). Each contrastive word was repeated three times throughout the recording to account for the probability of correctly identifying the word by chance. A 4000ms gap was inserted between each word. Therefore, the audio file was just over six minutes in length. Two native speakers of German also carried out the identification task and they were able to correctly map the stimuli to the appropriate orthographic form.

3.4 Data Analysis

For the analysis of the production pre-/post-/delayed-post tests, recordings were annotated in Praat (Boersma & Weenink, 2019) using the TextGrid function (see Figure 6). To examine German Final Devoicing, following previous acoustic analyses (Dmitrieva, Jongman & Sereno, 2010;

Simonchyk & Darcy, 2015), four temporal measures were taken: the duration of the vowel preceding word-final and non-word-final stops, the duration of the closure in word-final and non-word-final stops, the duration of release in word-final and non-word-final stops, and the duration of voicing into closure in word-final and non-word-final stops. The TextGrid annotation facilitated the extraction of these measurements, which were recorded in milliseconds (ms). Vowels were measured from the onset of the first formant on the spectrogram. For the stops which appeared after nasals or laterals, the preceding vowel duration was not taken. Stop closure was taken from the end of the preceding vowel, nasal, or lateral, to the start of the release. Stop release was taken from the end of the closure until the end of visible noise on the spectrogram. Voicing into closure was measured from the end of the preceding vowel, lateral or nasal, until the end of glottal pulsing/vibrations on the waveform. These measurements were taken for both word-final and non-word-final stops so that temporal comparisons could be made for both environments. Doing so accounted for individual differences in duration across speakers because some speakers may produce shorter word-final stops than others, but so long as these stops are significantly longer than their non-word-final counterparts, learners make a phonological contrast.

To examine the three target fricatives, because Center of Gravity correlates with place of articulation (e.g., Forrest et al., 1988; Jongman et al., 2000; Conrad, 2021), the Center of Gravity was taken for each fricative. This measure was taken by highlighting the target fricative, extracting a spectral slice, and then clicking on "Get Center of Gravity" in the Praat Objects window. While the remaining spectral moments, namely Standard Deviation, Skewness, and Kurtosis were also taken, these were not included in the present analysis.

For the analysis of the two perception tasks, responses were coded binomially: correct [1] or incorrect [0]. This categorical coding made it possible to calculate the accuracy rate for each learner, and therefore calculate the average percent correct per learning condition.

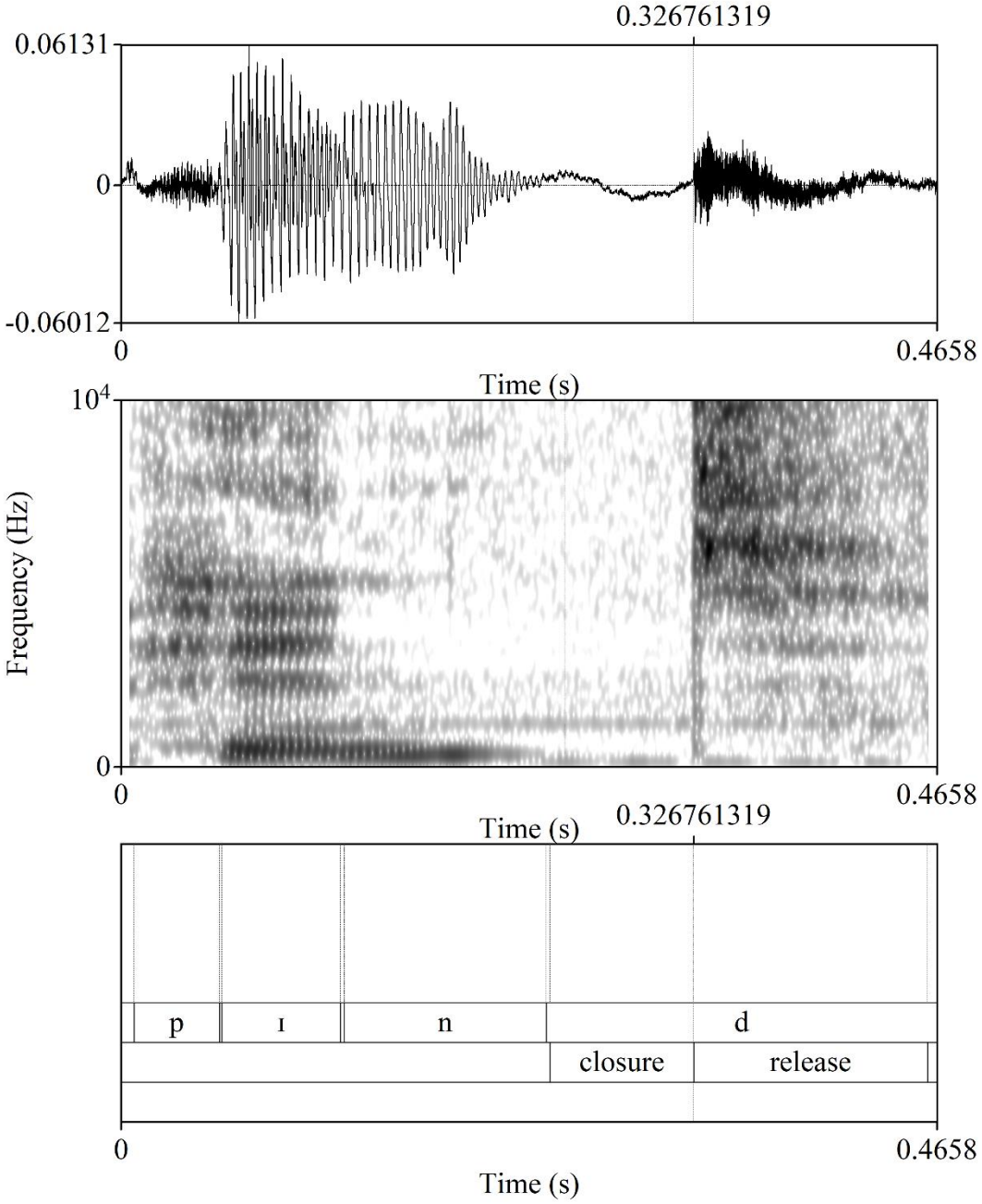


Figure 6. Sample of Acoustic Annotation in Praat

3.5 Exit Survey

At the end of the semester, after the delayed-post-test for production and perception, both learning conditions completed the Exit Survey. However, the survey differed according to the learning condition. While both the implicit and explicit condition were asked the first two questions (5a-b), the explicit condition was asked an additional two questions (5c-d). The latter two questions dealt specifically with explicit instruction.

(5) (a) This semester you have carried out various recordings and listening tasks, do you think that the instruction you received this semester helped you improve your German pronunciation? Yes or No. If yes, why? If no, why?

(b) If you taught this class, is there anything you would change to improve pronunciation skills? If yes, what? If no, why?

(c) This semester we used symbols such as /ç/ for the *ich* sound and /x/ for the *ach* sound. These symbols are part of the International Phonetic Alphabet (IPA). Did you find these symbols useful for pinpointing and describing specific sounds?

(d) This semester you received instruction on German pronunciation. This instruction is part of a larger research project which investigates the effects of receiving instruction on linguistics (i.e. the scientific study of language) on learners' performance when learning a foreign/second language. In your opinion, as a learner of German, do you think it is beneficial to include aspects of linguistics (such as Phonetics and Phonology briefly explained to you this semester) in lessons when learning a foreign language?

3.6 Intervention

During weeks 3-6, both learning conditions received six twenty-minute training sessions. The explicit condition received six twenty-minute explicit training sessions on German phonetics and phonology taught in English. Similarly, the implicit condition received six twenty-minute sessions designed to acquire speaking and listening skills implicitly, but through the medium of German. Although the tasks in the implicit condition had a communicative goal, activities were deliberately crafted to draw implicit attention to the relevant aspects of German L2 speech. A summary of the lesson content from the two learning conditions is provided in Table 9 and 10.

Table 9. Pronunciation Instruction Overview for the Explicit Learning Condition

	Content	Description	Activity
Session 1	Introduction	• The creation of human speech sounds • Overview of places of articulation (e.g., stopping the airflow using the lips creates a labial sound etc) • Tongue position - To demonstrate tongue position, learners were asked to produce various sounds without moving their tongue (such as /l/ and /t/). This provided learners with explicit awareness of tongue position.	Tongue Position Activity - In the last few minutes of the training session, learners were asked to produce various English sounds and describe their tongue position to a partner.
Session 2	Consonants and Vowels	• Definition of Consonants Versus Vowels - Students were informed that the traditional definition that English has five vowels: < *a, e, i, o, u* > refers only to orthography - They were informed that the articulatory difference between consonants and vowels is the level of obstruction. - Obstruction = Consonant, little to no obstruction = vowel - This was demonstrated orally and students were asked to go through the motions of producing the stops themselves. Each of the six target stops (bilabial, alveolar and velar stops) were explained to the students. • Voicing • Final Devoicing Rule - Learners were given the explanation that in German there is a rule which states that when [b], [d] and [g] are at the end of a word they have to be devoiced. In other words, [b] is pronounced as a [p], [d] is pronounced as a [t], and [g] is pronounced as a [k]. Lots of examples were given. - For instance, how do you say 'dog' in German? *Hund* [t] not *Hund* [d]. However, if there are multiple dogs, you say *Hunde*. The <d> is pronounced as a [d] because it is not at the end of a word.	Final Devoicing Activity - Words ending in word-final and non-word-final stops were written on the board (e.g., *Tag* versus *Tage*). Students had to practice pronouncing them. This was a grouped activity done as a class
Session 3	Fricatives	• Review of Previous Material • Five minutes was spent reviewing the previous information on stops; • Definition of a fricative • IPA chart: - The fricative sounds were shown on the IPA chart, but only the sounds relevant for German were given	Final Devoicing Activity - As part of the initial review, learners were asked to practice pronouncing words written on the board containing word-final and non-word-final stops

Table 9 Continued

		- Students were told that many L1 speakers of English produce the [ʃ] in lieu of [ç] when learning German because it is common to substitute non-native sounds with the nearest L1 sound in place of articulation. This explanation was based on the predictions made in the Speech Learning Model (Flege 1995, 1999, 2002). • The palatal fricative [ç] - In attempt to teach learners how to produce the palatal fricative, they were told to think of the sound a cat makes when hissing. - Learners were also told that the sound is similar to the sound produced in most dialects of English in words like *human* and *huge*, except with more turbulence/frication. This is the advice for learners given by O'Brien & Fagan (2016, p. 194) in their book *German Phonetics and Phonology – Theory and Practice*. • Dorsal Fricative Assimilation - Learners were given the explicit explanation that the German <ch> digraph can represent two fricatives in German: [x] and [ç]. It is the previous vowel which determines the pronunciation	Dorsal Fricative Assimilation - Words containing <ch> were written on the board. With a partner, learners had to work out how to pronounce them. Was the <ch> pronounced as a [x] or a [ç]?
Session 4	Vowels	• Review of Previous Material - Five minutes was spent reviewing the two phonological rules • Vowel Trapezoid - Students were introduced to the vowel trapezoid - They were taught how to produce the front rounded vowels by producing vowels they had in their native language such as [i] and rounding the lips.	Pronunciation Practice with explicit feedback Students were given words and sentences and had to practice pronouncing them with a partner.
Session 5	Review	• Review of material	Pronunciation Review Activity (see Appendix E)
Session 6	Review	• Review of material	Review activities Tongue Twisters

Table 10. Pronunciation Instruction Overview for the Implicit Learning Condition

	Content	Description	Activity
Session 1	Listening and Speaking	• This activity was a spin-off of a game called "Heads up" • The instructor stood at the front of the classroom facing the students while a PowerPoint screen was projected behind them. Students could see the screen, but the instructor could not. Every thirty seconds a picture appeared on the screen. Learners were tasked with providing the instructor with sufficient clues as to which word and picture was displayed on the screen without saying the actual word. For instance, if the word was *Hund* 'dog', learners could say something like *es ist ein Haustier mit vier Beinen und es ist nicht eine Katze* 'it is a pet with four legs and it is not a cat'. This activity was designed with the purpose of creating as much negotiation of meaning as possible. The target words in the pre-/post-/delayed-post-tests were the words on the slide. • This game lasted approximately ten minutes. Initially, the instructor was the one who had to guess the words so that I could model the correct pronunciation. • In the first round, the instructor was the 'guesser' so the appropriate pronunciation could be modeled. Afterward, learners replaced the instructor as the person guessing.	Heads Up
Session 2	Listening and Speaking	• Learners played the same game as previously. However, some additional words were added to the list to keep the game interesting • Like in the first training session, learners had to communicate with the instructor so that they could guess and thus model the pronunciation of the word on the screen. This lasted approximately ten minutes • During the last ten minutes of the session, learners were given a list of the words and played the game with a partner. The instructor walked around and provided implicit pronunciation feedback, such as recasts, where necessary possible. No explicit instruction was given on pronunciation.	Heads Up
Session 3	Listening and Speaking	• Students were given a three-by-three table containing words. Some of the words were the target words (from Table 3 and 4), and some were distractors. • The distractors also contained words with both word-final (e.g., *Strand*, *Bild*) and non-word-final stops (e.g., *Bilder*) which were not on the pre-/post-/delayed-post-tests • The distractors also contained words which were not on the pre-/post-/delayed-post-tests, but contained the three fricatives (e.g., *Chemikalien*). • Following the usual rules of Bingo, the instructor read aloud the word, and learners had to circle it on their sheet.	Bingo

Table 10 Continued

Session 4	Listening and Speaking	• Learners engaged in a communicative-based roleplay activity. In this activity, an ethical dilemma was explained to learners in German on the board. After receiving the information about the dilemma, learners were divided into small groups. Their task was to defend their client (i.e., one of the people in the story) in a simulated courtroom environment while simultaneously trying to shift the blame to another person's client. In doing so, this task-based activity created a debate in the target language and therefore attention was directed to meaning. The ethical dilemma presented to learners is provided in Appendix F.	Courthouse Roleplay
Session 5	Listening and Speaking	• Learners were given a series of opportunities to communicate and negotiate meaning through a speed dating activity. • Following the usual rules of speed dating, learners were given a series of topics to discuss with a partner for a limited number of time (namely, two minutes). After the two minutes were up, they moved on to a different partner and discussed a different set of questions. • Learners also carried out an activity where they were asked a question, such as *Was ist dein Lieblingsessen?* 'What is your favorite food' or *Was ist das beste Haustier*? 'What's the best pet' and they had to find other people in the classroom who had the same answer as them. Doing so meant that they had to communicate with other learners in German. Once everyone had found matches, as a class we engaged in small debates as to which answer is best. • During the activity, the instructor listened in and provided recasts when necessary, paying particular attention to the target phonological rules.	Speed Dating What is best….
Session 6	Listening and Speaking	• In the final session, learners were asked to attend the German coffee hour for at least 20 minutes. The German Coffee Hour was an opportunity for learners to meet with and talk to other learners and native speakers of German. Doing so gave them the opportunity to use German in a real-life context. No English was allowed for the duration of the 20 minutes.	German Coffee Hour

3.7 Summary

To summarize, over the course of a 16-week semester, learners received either implicit or explicit instruction on German pronunciation. They were asked to complete a series of pre-tests (at the beginning of the semester during week 1-2), post-tests (after the implicit/explicit pedagogical intervention during week 7-8), and delayed-post-tests (at the end of the semester during week 15-16) which examines changes in production and perceptual knowledge. A summary table of ExI is provided in Table 11.

Table 11. Summary of Experiment (ExI)

Experiment	**Learning Conditions**	**Training Sessions**		**Assessments**
		Explicit	Implicit	
Experiment 1 (ExI) (L2 Speech)	Explicit Condition (*n* = 16) Implicit Group (*n* = 13)	**Phonetics:** Articulation Instruction on Stops, Fricatives and Vowels **Phonology:** Final Devoicing Dorsal Fricative Assimilation	Task-based and communicative-based activities	**Articulation** **Post/Post/Delayed-Post-Test** Students recorded in *Praat* reading 24 slides **Perception** **Discrimination**: (16 minimal pairs, 64 different questions) **Identification**: (16 different words, 64 different questions) **Exit Survey**

CHAPTER 4. RESULTS: EXPERIMENT I

4.1 Overview

This chapter reports the results from the pre-/post-/delayed-post-tests in ExI. The production data is presented in section 4.2, which contains the analysis of the stops (4.2.1) and fricatives (4.2.2). The stops were analyzed using four acoustic correlates of voicing (closure duration, release duration, preceding vowel duration, voicing into closure) and the fricatives were analyzed using the Center of Gravity measure. The results from the two perceptions tasks (discrimination task, identification task) are reported in section 4.3, and the data from the Exit Survey is reported in section 4.4. A conclusion of the results is reported in section 4.5.

4.2 Production

4.2.1 Stops

For the analysis of German stops, four acoustic correlates of voicing were analyzed (closure duration, release duration, preceding vowel duration, voicing into closure) in SPSS26 (IMB Corp., Armonk, NY). In the LMMs (Linear Mixed Models) which follow, an $\alpha = .05$ was used as the criterion for significance, and Cohen's *d* was used to measure effect size using the benchmarks of Plonsky & Oswald (2014): small ($d = .40$), medium ($d = .70$), large ($d = 1.0$). All models were run with the same random effects structure: a random intercept for LEARNER and a random intercept for WORD. The significance of the fixed factors and interactions were assessed using ANOVA tests, and all pairwise comparisons were carried out using Sidak correction. Moreover, reported confidence intervals (CI) are at 95% confidence.

4.2.1.1 Closure Duration

According to previous literature (Port & O'Dell, 1985; Port & Crawford, 1989; Smith et al., 2009), German underlyingly voiced word-final stops have a closure which is durationally longer than underlyingly voiced non-word-final stops. To verify this assumption, an LMM was first run on the closure duration of the stops produced by the native model. The CLOSURE DURATION was run as the dependent variable, and POSITION, which had two levels (WF = word final, NF = non-

word-final), was run as a fixed factor. The model found POSITION to be a significant factor F (2, 728) = 4.300, p = .038, indicating that the difference in CLOSURE DURATION was significant in the native model. On average, underlyingly voiced word-final stops were 27 ms longer (M = 47 ms, SD = 25 ms) than underlyingly voiced non-word-final stops (M = 20 ms, SD = 15 ms), with a large effect size of d = 1.31 (CI = -1.74, 4.36). CLOSURE DURATION was therefore used as a predictor.

To examine the CLOSURE DURATION in the learner production data, an LMM was run with four fixed factors: GROUP, POSITION, TIME, and LEARNER-L1. All possible interactions were included in the model: GROUP × POSITION, GROUP × TIME, GROUP × LEARNER-L1, POSITION × TIME, POSITION × LEARNER-L1, TIME × LEARNER-L1, GROUP × POSITION × TIME, POSITION × TIME × LEARNER-L1, GROUP × POSITION × TIME × LEARNER-L1. The factor GROUP had two levels (explicit condition, implicit condition), POSITION had two levels (word-final, non-word-final), TIME had three levels (pre-test, post-test, delayed-post-test), and LEARNER-L1 had two levels (English L1, Non-English L1).

The results demonstrated a significant effect of GROUP F (1, 2099) = 201.491, p = .001, POSITION F (1, 2099) = 6.024, p = .001, and TIME F (2, 2099) = 18.455, p = .001, but not LEARNER-L1 F (1, 2099) = .073, p = .789. The effect of GROUP was due to significantly longer closures in the explicit condition (M = 50 ms, SD = 40 ms) compared to the implicit condition (M = 33 ms, SD = 27 ms), suggesting the explicit condition devoiced more stops than the implicit condition (d = .50, CI = .24, 1.24). The effect of POSITION was due to significantly longer closures for word-final stops (M = 51 ms, SD = 40 ms) than for non-word-final stops (M = 32 ms, SD = 27 ms), suggesting that some devoicing was occurring word-finally (d = .56, CI = .03, 1.08). Finally, according to post-hoc pairwise comparisons, closures were significantly longer in the post-test (M = 44 ms, SD = 40 ms) and the delayed-post-test (M = 44 ms, SD = 38 ms) compared to the pre-test (M = 40 ms, SD = 30 ms). The results from this omnibus model therefore suggest that the intervention the explicit learning condition received led to an increase in devoicing post intervention, but the learner's L1 played no role in the outcome of the condition.

As for the interactions, there was a significant effect of GROUP × POSITION F (1, 2099) = 43.227, p = .001, a significant effect of GROUP × TIME F (2, 2099) = 25.824, p = .001, a significant effect of POSITION × TIME F (2, 2099) = 22.303, p = .001, and a significant effect of GROUP × POSITION × TIME F (2, 2099) = 27.937, p = .001. The three-way interaction

suggests that the joint effects of POSITION × TIME on CLOSURE DURATION were not the same across the two learning conditions. As Figure 7 shows, the difference in closure duration for word-final and non-final stops in the explicit condition was not statistically significant in the pre-test, but this changed by the post and delayed test in the direction of longer word-final closures. In contrast, as Figure 8 indicates, the implicit condition demonstrated a moderate effect of POSITION, but the size of this effect (ca. 10 ms) did not change from pre-test to post to delayed test.

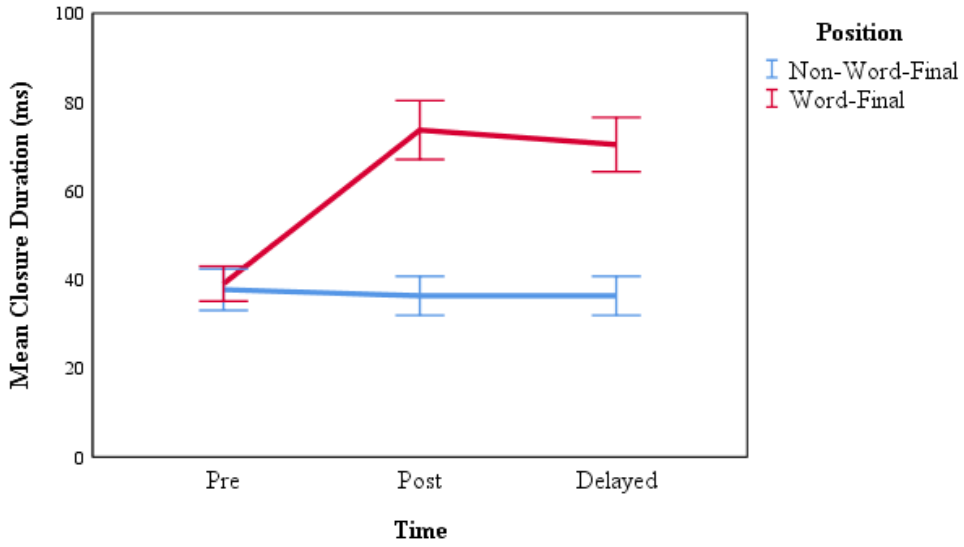


Figure 7. Closure Duration in the Explicit Condition[58]

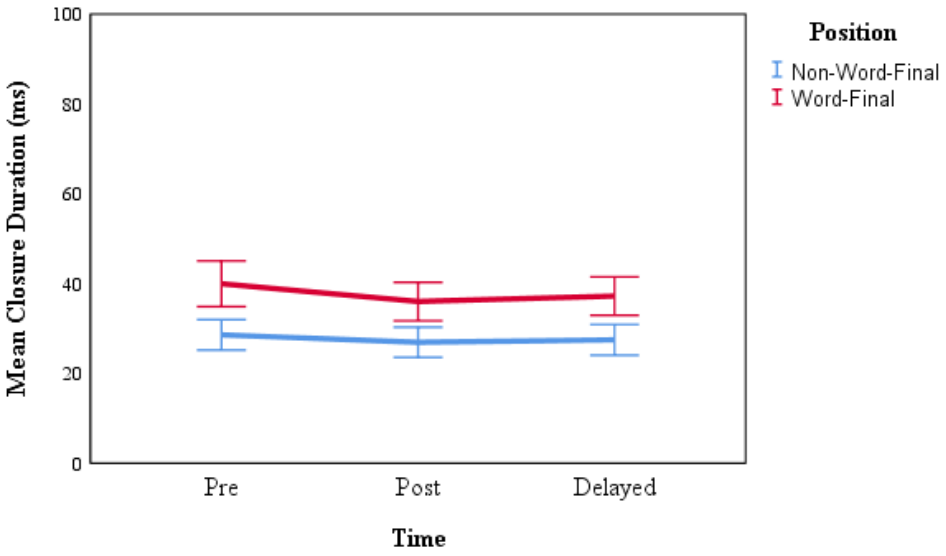


Figure 8. Closure Duration in the Implicit Condition

[58] The whiskers in the following figures represent the 95 % confidence intervals.

To confirm the effect of GROUP, two follow-up models were run. First, an LMM was run using only the data from the explicit condition, with POSITION and TIME run as fixed factors, with a two-way interaction of POSITION × TIME. The model found a significant effect of POSITION F (1,098) = 12.732, p = .001, a significant effect of TIME F (1, 098) = 33.716, p = .001, and a significant effect of POSITION × TIME F (2, 098) = 36.977, p = .001. Second, an LMM was run using only the data from the implicit condition, with the same fixed factors and interactions. Unlike the first model, no significant effects nor interactions were found for the CLOSURE DURATION in the implicit condition. POSITION was insignificant F (1,001) = 1.571, p = .210, TIME was insignificant F (1,001) = .550, p = .577, and POSITION × TIME was insignificant F (1,007) = .137, p = .872. These results therefore confirm that what the implicit condition was doing with closure duration as a function of POSITION remained consistent over time. In contrast, in the explicit condition, there was an interaction between POSITION × TIME, specifically, there was an effect of POSITION in the post and delayed-post-test when compared to the pre-test. In other words, evidence from the CLOSURE DURATION suggests that the intervention the explicit condition received had a significant effect on the acquisition of German Final Devoicing, as the explicit condition increased the CLOSURE DURATION of their word-final stops by 34 ms from pre-test (M = 39 ms, SD = 27) to post-test (M = 73 ms, SD = 46 ms), with an effect size of d = .90 (CI = .17, 1.63).

Following guidelines on data accountable graphics in second language acquisition research (Larson-Hall, 2017; Loewen & Hui, 2021), a parallel coordinate plot of the within-group mean closure duration is provided in Figure 9. Each line represents the average mean closure duration of underlyingly voiced word-final stops for each individual learner from pre-test to delayed-post-test. This plot clearly shows that while each learner in the explicit condition increased their average closure duration, this was not true for all learners in the implicit condition. Although three learners in the implicit condition increased their closure duration from pre-test to post-test, several learners even decreased the closure duration, suggesting that some learners got even worse over time.[59]

[59] Because averages can be skewed by speaker idiosyncrasies, data accountable graphics present average within-group individual differences so that readers can make judgements about the results themselves as opposed to having to rely on the reported group differences which fails to account for within-group variability (Loewen & Hui, 2021).

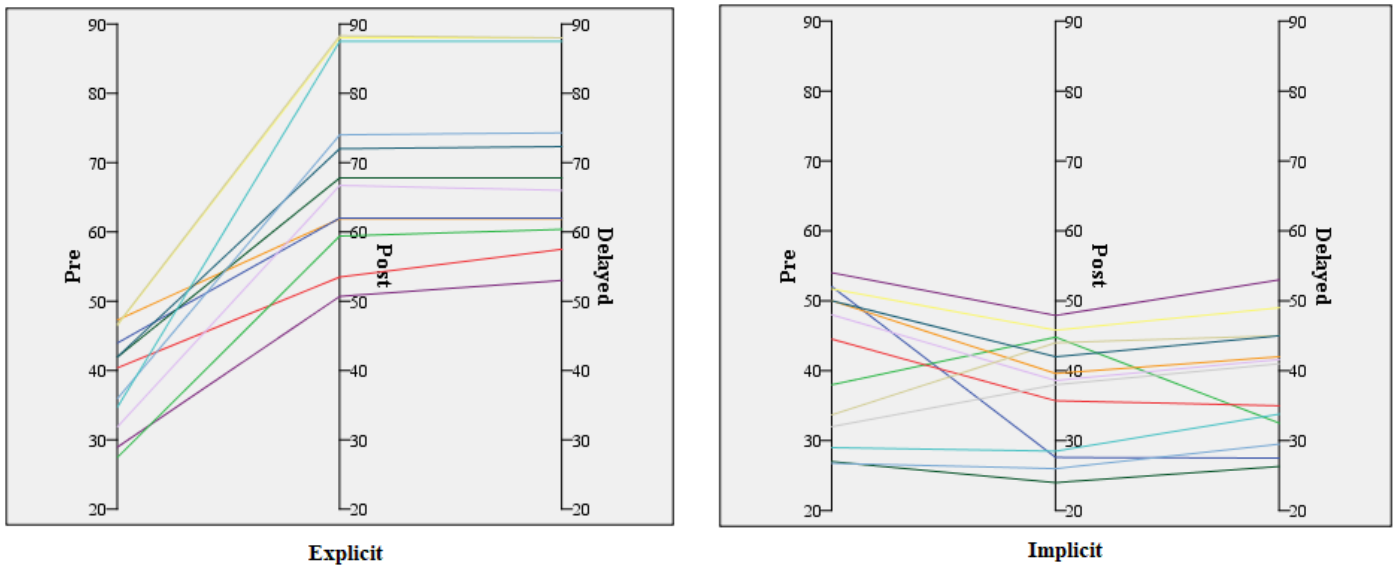


Figure 9. Parallel Coordinate Plot of Individual Mean Differences in Closure Duration of Underlyingly Voiced Word-Final Stops[60]

[60] The y-axis, which ranges from 20-90, is measured in (ms), that is, milliseconds.

4.2.1.2 Release Duration

According to previous literature (Port & O'Dell, 1985; Port & Crawford, 1989; Smith et al., 2009), voiceless stops have durationally longer releases than voiced stops. To confirm this assumption in German, an LMM was run on the RELEASE DURATION of the word-final and non-word-final stops produced by the native speaker. The RELEASE DURATION was run as the dependent variable, and POSITION was run as a fixed factor. The model found POSITION to be a significant factor F (1, 28) = 5.472, p = .027, indicating that the difference in RELEASE DURATION was significant in the native model. On average, underlyingly voiced word-final stops were 24 ms longer (M = 38 ms, SD = 42 ms) than their underlyingly voiced non-word-final counterparts (M = 14 ms, SD = 21 ms), with an effect size of d = .72. Therefore, RELEASE DURATION was used as a predictor.

To examine the RELEASE DURATION in the learner production data, an initial LMM was run with four fixed factors: GROUP, POSITION, TIME, and LEARNER-L1. Like with previous models, all possible interactions were included. The model found a significant effect of GROUP F (1, 2116) = 195.879, p = .001, POSITION F (1, 2116) = 34.297, p = .001, and TIME F (2, 2,116) = 39.042, p = .001, but not LEARNER-L1 F (1, 2,116) = 3.103, p = .078. The effect of GROUP was due to a significantly longer RELEASE DURATION in the explicit condition (M = 47 ms, SD = 57 ms) compared to the implicit condition (M = 23 ms, SD = 31 ms), with an effect size of d = .5 (CI = .43, .62), suggesting, as did the analysis of CLOSURE DURATION, that the explicit condition devoiced more stops than the implicit condition. The effect of POSITION was due to a significantly longer RELEASE DURATION for word-final stops (M = 19 ms, SD = 31 ms) than for non-word-final stops (M = 52 ms, SD = 56 ms), with an effect size of d = .73 (CI = .64, .82), suggesting that some devoicing was occurring word-finally. According to post-hoc pairwise comparisons, releases were significantly longer in the post-test (M = 41 ms, SD = 54 ms) and the delayed test (M = 41 ms, SD = 54 ms) when compared to the pre-test (M = 24 ms, SD = 30 ms), while the post and delayed test did not differ from each other.

As for the interactions, there was a significant effect of GROUP × POSITION F (1, 2116) = 97.190, p = .001, a significant effect of GROUP × TIME F (2, 2116) = 40.895, p = .001, a significant effect of POSITION × TIME F (2, 2116) = 25.871, p = .001, and a significant effect of GROUP × POSITION × TIME F (2, 2166) = 43.455, p = .001. The three-way interaction suggests that the joint effects of POSITION × TIME on RELEASE DURATION were different

across the two learning conditions. As Figures 10 and 11 show, in the explicit condition, the difference in RELEASE DURATION in word-final and non-final stops in the pre-test was not statistically significant. However, by the post and delayed test, the difference was statistically significant in the direction of longer word-final releases. In contrast, in the implicit condition, the RELEASE DURATION did not change significantly across the three tests, differing in word-final position by an average of only 2 ms. The results therefore suggest that the implicit condition did not benefit from the learning intervention insofar as the acquisition of German Final Devoicing is concerned, which is consistent with the findings from the analysis of the CLOSURE DURATION.

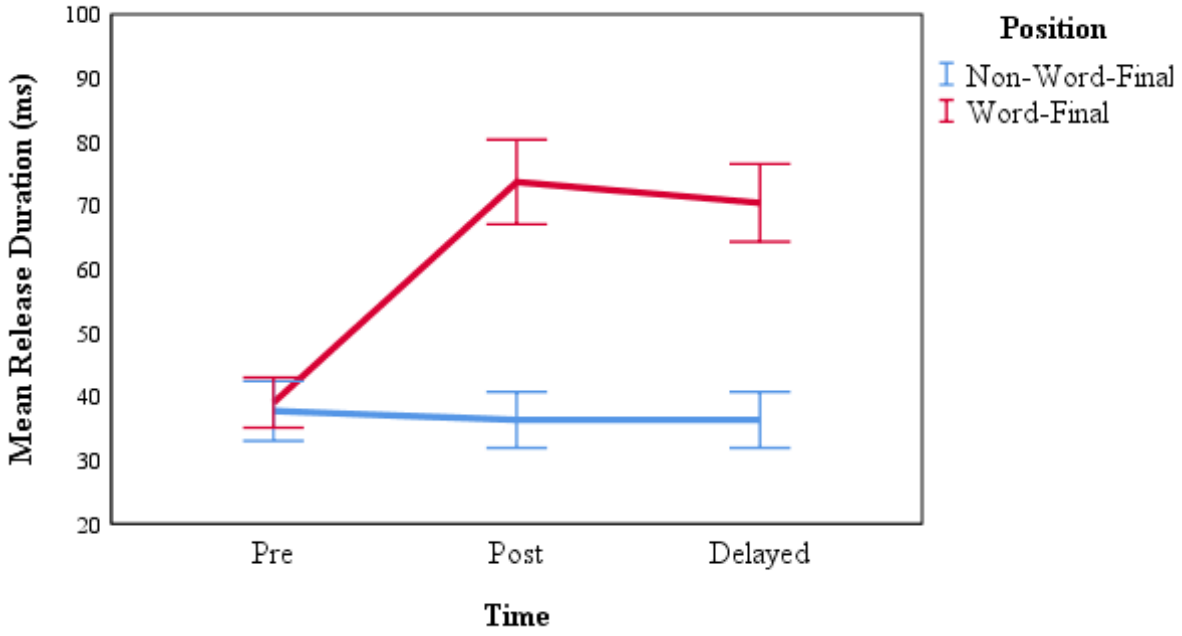


Figure 10. Release Duration in the Explicit Condition

To confirm this hypothesis from the omnibus model, two follow-up models were run, one LMM on the RELEASE DURATION in the explicit condition and one LMM on the RELEASE DURATION in the implicit condition. In both models, POSITION and TIME were run as fixed factors, and a two-way interaction of POSITION and TIME was included. As was expected, the explicit model found a significant effect of POSITION F (1,115) = 292.232, p = .001, a significant effect of TIME F (1,115) = 54.920, p = .001, and a significant effect of POSITION by TIME F (1,115) = 46.453, p = .001. By comparison, while the implicit model found a significant effect of POSITION F (1,001) = 70.235, p = .001, no significant effect of TIME F (1,001) = .189, p = .828

was found, nor was there an interaction of POSITION by TIME F (1,001) = .1667, p = .189. The coordinate plot of the within-group differences in Figure 12 also illustrates how the RELEASE DURATION increased in the explicit condition, but not in the implicit condition. These final models therefore confirm that although the implicit model made a distinction in RELEASE DURATION between word-final and non-word-final stops, the RELEASE DURATION did not change significantly from pre-test, to post-test, to delayed-post-test. In other words, the intervention the implicit condition received did not have a significant effect on the release duration of word-final and non-word-final stops, but it did on the explicit condition.

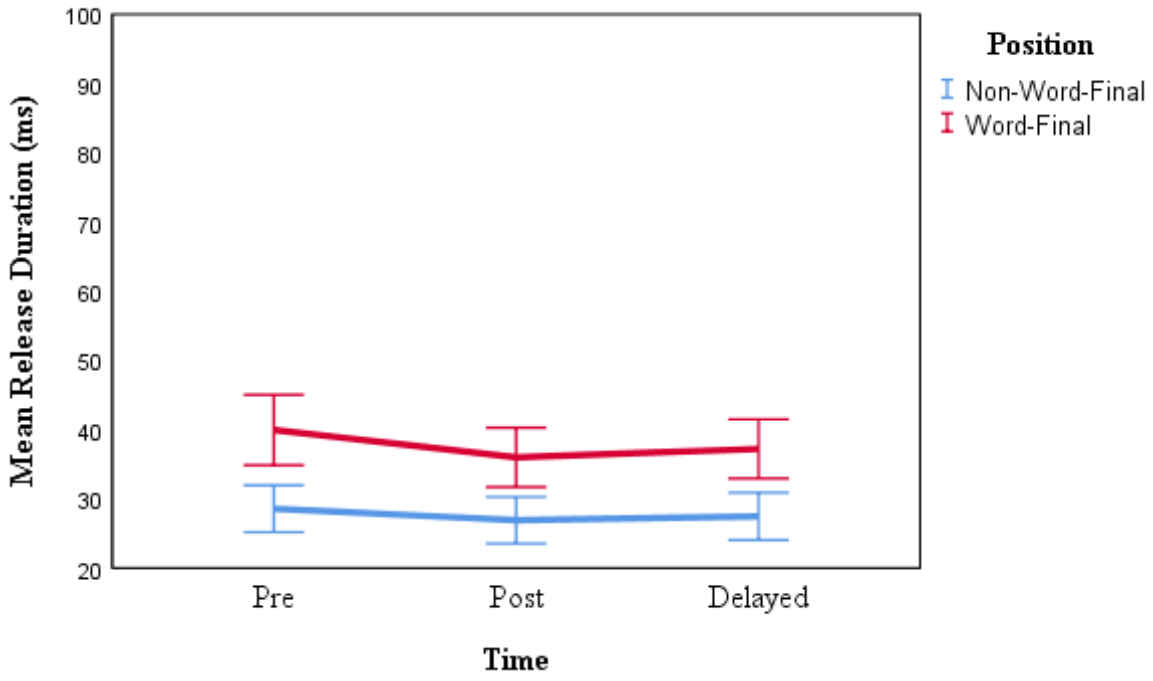


Figure 11. Release Duration in the Implicit Condition

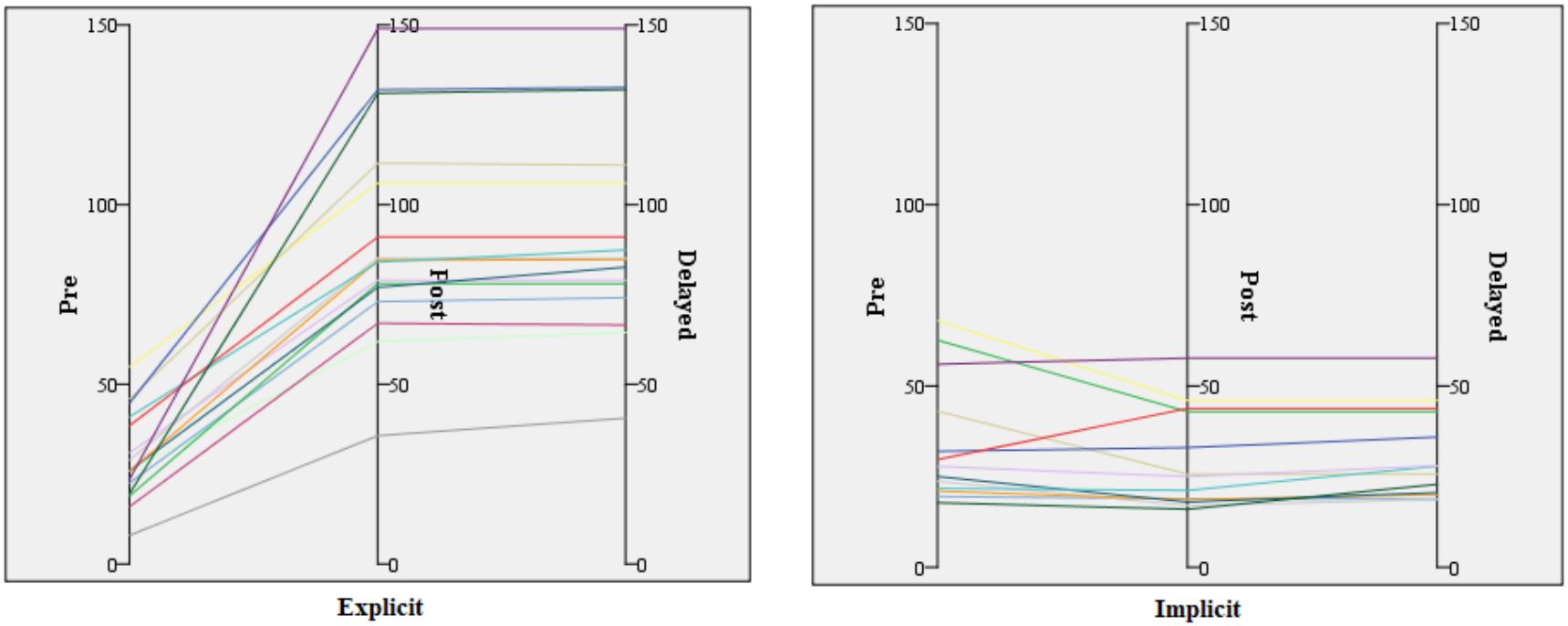


Figure 12. Parallel Coordinate Plot of Individual Mean Differences in Release Duration of Underlyingly Voiced Word-Final Stops

4.2.1.3 Preceding Vowel Duration

According to previous acoustic analyses (Maack, 1953; Chen, 1970; Port & O'Dell, 1985; Simon, 2010), vowels preceding voiceless stops are durationally shorter than vowels preceding voiced stops. Because underlyingly voiced word-final stops are devoiced in German, their preceding vowels should be durationally shorter than their non-word-final counterparts. To confirm this assumption, an LMM was run on the data from the native model, with preceding VOWEL DURATION run as the dependent variable, and POSITION run as a fixed factor. The model found POSITION to be a significant factor F (1, 13) = 7.553, p = .017, showing that the difference in preceding vowel duration for word-final and non-word-final stops was statistically significant in the native model. On average, vowels preceding underlyingly voiced word-final stops (M = 138 ms, SD = 33 ms) were 55 ms shorter than the duration of vowels preceding underlyingly voiced non-word-final stops (M = 193 ms, SD = 45 ms), with a large effect size of d = 1.39. Therefore, PRECEDING VOWEL DURATION was used as a reliable predictor.

Like with the previous acoustic parameters, to examine the duration of vowels preceding word-final and non-word-final stops in the two learning conditions, an LMM was run with the same four fixed factors: GROUP, POSITION, TIME, LEARNER-L1. The same aforementioned interactions were included in the model. Results demonstrated a significant effect of GROUP F (1, 1228) = 5.337, p = .021, but the fixed factors POSITION F (1, 1228) = 1.351, p = .245, and TIME F (2, 1228) = .536, p = .585 were insignificant. The effect of GROUP was due to durationally shorter preceding vowels in the explicit condition (M = 160 ms, SD = 92 ms) when compared to the implicit condition (M = 180 ms, SD = 57 ms), with an effect size of d = .14 (CI = .14, .39).

Although POSITION was not significant by itself, the interaction of POSITION × TIME was significant F (2, 1228) = 5.781, p = .003. As Figure 13 shows, in the explicit condition, in the pre-test, word-final stops were durationally longer (M = 194 ms, SD = 187 ms) than non-word-final stops (M = 135 ms, SD = 47 ms), with an effect size of d = .43 (CI = .31, .56), suggesting that learners initially failed to devoice the majority of word-final stops. The higher mean duration for the word-final stops suggests that many of the stops were voiced at the time of the pre-test. However, the lower mean duration for non-word-final stops suggests that many non-word-final stops had been erroneously devoiced too. This erroneous devoicing was the case for several highly

frequent stimuli, such as *Hunde* 'dogs'.[61] The duration of their vowels preceding non-word-final stops (*M* = 154 ms, *SD* = 40 ms) increased by an average of 19 ms, and the duration of vowels preceding word-final stops (*M* = 161 ms, *SD* = 69 ms) decreased by an average of 33 ms. These trends therefore suggest that, on the one hand, the explicit condition devoiced more word-final stops and fewer non-word-final stops after receiving the intervention. In contrast, as Figure 14 illustrates, while the implicit condition also reduced their duration of vowels preceding word-final stops from pre-test (*M* = 193 ms, *SD* = 58 ms) to delayed-post-test (*M* = 183 ms, *SD* = 62 ms), they reduced it by an average of only 10 ms, as opposed to the 33ms in the explicit condition. Therefore, the results suggest that although both learning conditions showed improvement in the devoicing of word-final stops after the intervention, the explicit condition learned to devoice more.

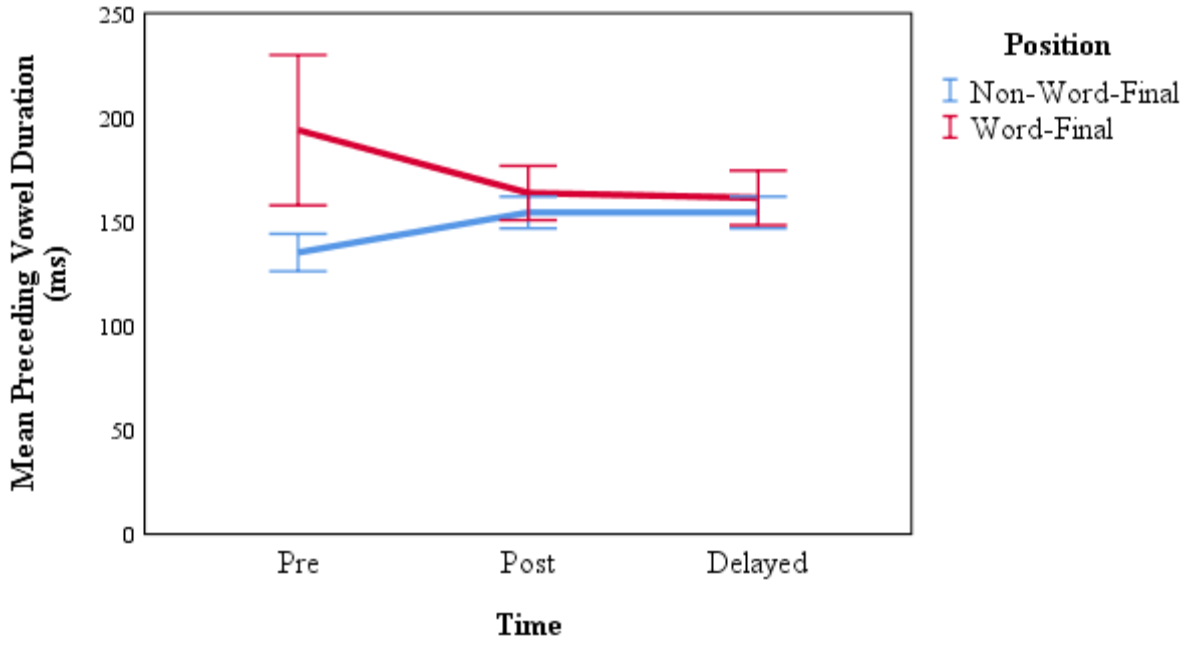


Figure 13. Preceding Vowel Duration of Stops in the Explicit Condition

[61]A possible explanation for durationally shorter preceding vowels for non-word-final stops is that because learners first encounter these words in the singular (i.e., *Hund* 'dog') where they notice that the final <d> is voiceless, as in [hʊnt], they assume that the underlying form is also voiceless. In other words, because they notice <d> corresponds to [t], when they produce the plural form *Hunde* 'dogs', where the <d> is no longer in coda position, they pronounce it as [hʊnte]. However, by the post- and delayed-post-test, this error was repaired in the explicit condition.

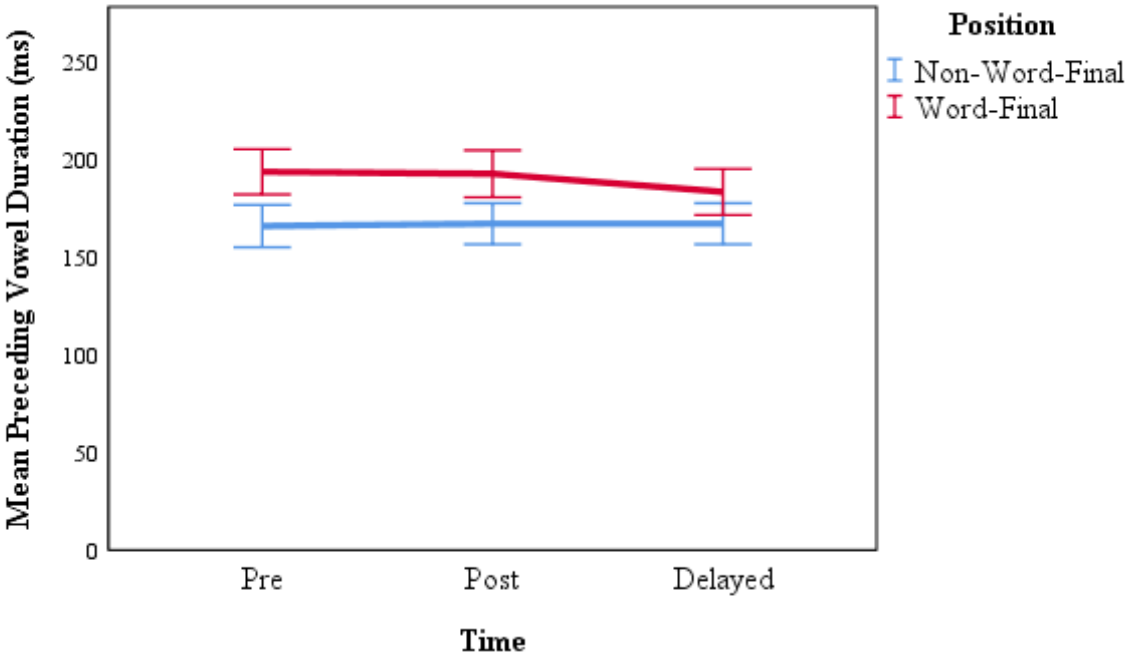


Figure 14. Preceding Vowel Duration of Stops in the Implicit Condition

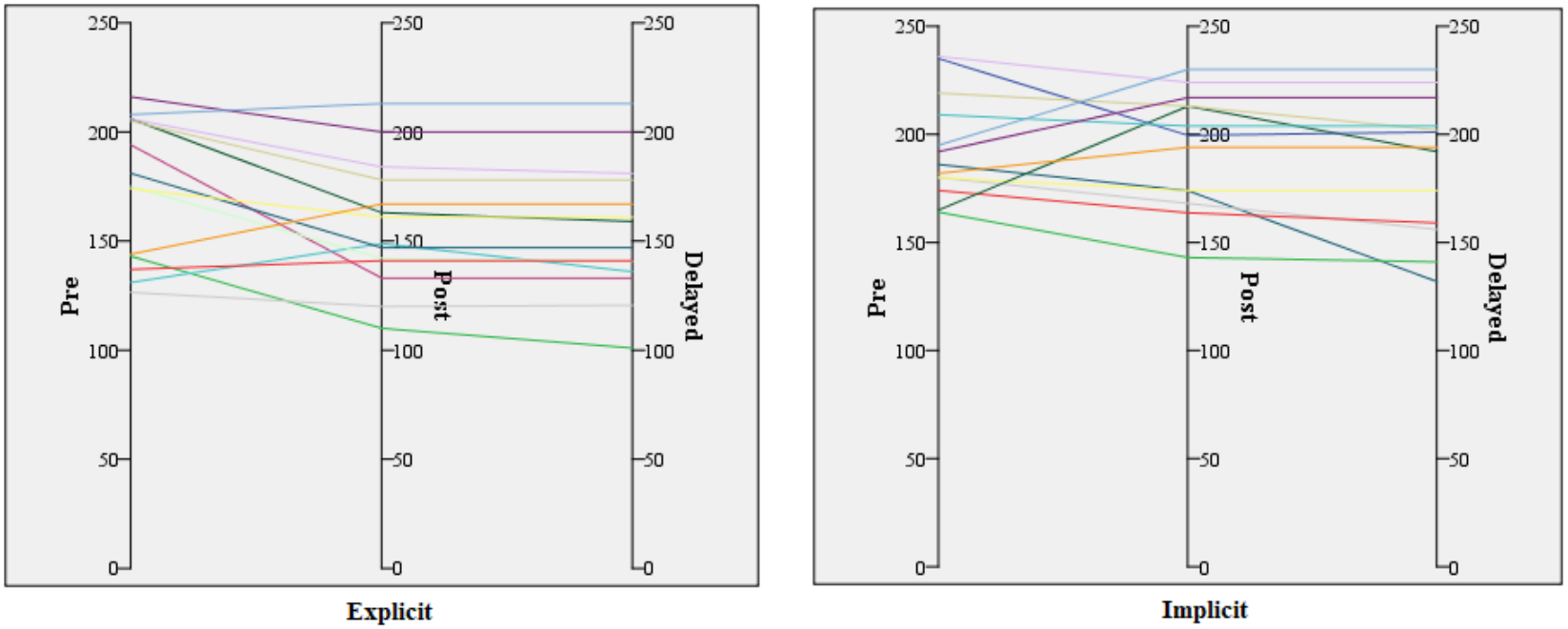


Figure 15. Parallel Coordinate Plot of Individual Mean Differences in Preceding Vowel Duration of Underlyingly Voiced Word-Final Stops

4.2.1.4 Voicing into Closure

Longer voicing into closure is also associated with voiced stops (Port & O'Dell, 1985; Charles-Luce & Dinnsen, 1987). To confirm the assumption that German underlyingly voiced word-final stops have significantly shorter voicing into closure, an LMM was run on the native model, with VOICING INTO CLOSURE run as the dependent variable, and POSITION run as a fixed factor. The model found POSITION to be a significant predictor F (1, 32) = 202.283, p = .001, showing that the difference in voicing into closure duration was significant in the native model. On average, voicing into closure was present only five percent of the time for the production of underlyingly voiced word-final stops compared with 97 percent of the time for non-word-final stops.

To examine the VOICING INTO CLOSURE for word-final and non-word-final stops in the two learning conditions, an LMM was run, using POSITION, GROUP, TIME, and LEARNER-L1 as fixed factors. All possible interactions were included. The model found a significant effect of POSITION F (1, 2122) = 195.645, p = .001, GROUP F (1, 2122) = 35.561, p = .001, and TIME F (2, 2122) = 71.734, p = .001. The effect of POSITION was due to significantly longer voicing into closure with non-word-final stops (M = 42 ms, SD = 8 ms) when compared with word-final stops (M = 37 ms, SD = 19 ms). The effect of GROUP was due to a significant difference in voicing into closure duration between the implicit (M = 39 ms, SD = 9 ms) and explicit condition (M = 28ms, SD = 20ms), suggesting that more devoicing was taking place in the explicit condition. Pairwise comparisons indicated that the effect of TIME was due to significant differences in voicing into closure duration from pre-test (M = 42 ms, SD = 7 ms), to post-test (M = 28 ms, SD = 19 ms), to delayed-post-test (M = 23 ms, SD = 19 ms). As for the interactions, TIME by GROUP was significant F (2, 2122) = 46.373, p = .001, GROUP by POSITION was significant F (1, 2122) = 92.975, p = .001, and TIME by POSITION was significant F (2, 2122) = 41.609, p = .001. There was also a three-way interaction of TIME by GROUP by POSITION F (2, 2122) = 33.579, p = .001.

To explore these differences further, two additional LMMs were run. The first model was run on the explicit condition and the second model was run on the implicit condition. TIME and POSITION were included as fixed factors, as well as an interaction of TIME by POSITION. The model for the explicit condition found a significant effect of TIME F (2, 1,494) = 287.696, p = .001, and POSITION F (1, 1494) = 921.452, p = .001, as well as a significant effect of TIME by POSITION F (2, 1,494) = 196.000, p = .001. As Figure 13 shows, in the pre-test, the explicit

condition's word-final stops (*M* = 41 ms, *SD* = 9 ms) and non-word-final stops (*M* = 43 ms, *SD* = 5 ms) differed only minimally, suggesting that word-final stops were not being devoiced. However, by the post-test (*M* = 11 ms, *SD* = 16 ms), the explicit condition reduced the duration of VOICING INTO CLOSURE for word-final stops by an average of 30 ms (*M* = 11 ms, *SD* = 16 ms). In contrast, in the implicit model, only POSITION was significant *F* (1, 711) = 17.158, *p* = .001, suggesting that there was a significant difference between word-final (*M* = 39 ms, *SD* = 9ms) and non-word-final (*M* = 42 ms, *SD* = 6 ms) VOICING INTO CLOSURE, but this did not change over time. A comparison between the Figure 13 and Figure 14 illustrates the effect of the two learning conditions on VOICING INTO CLOSURE over time.

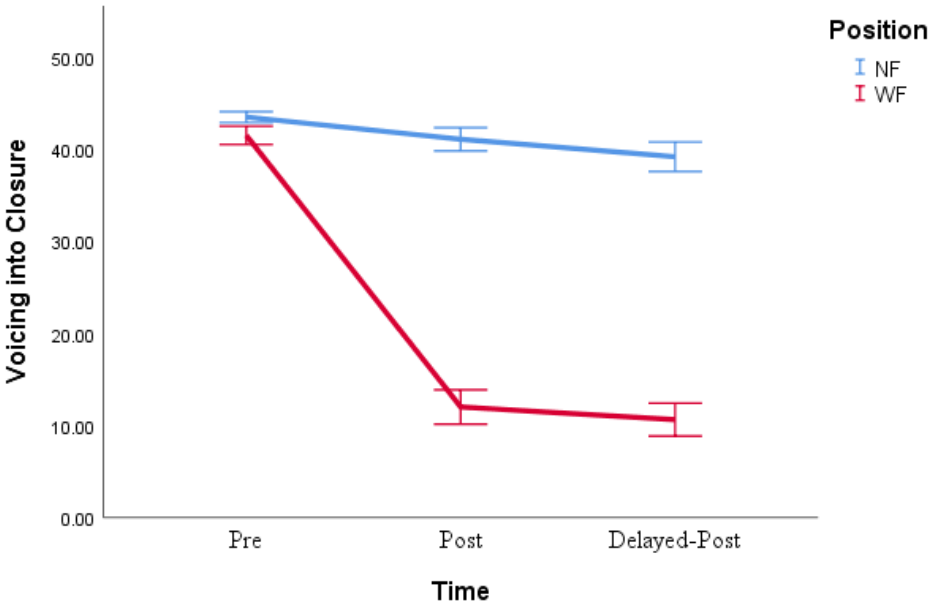


Figure 16. Duration of Voicing into Closure in the Explicit Condition

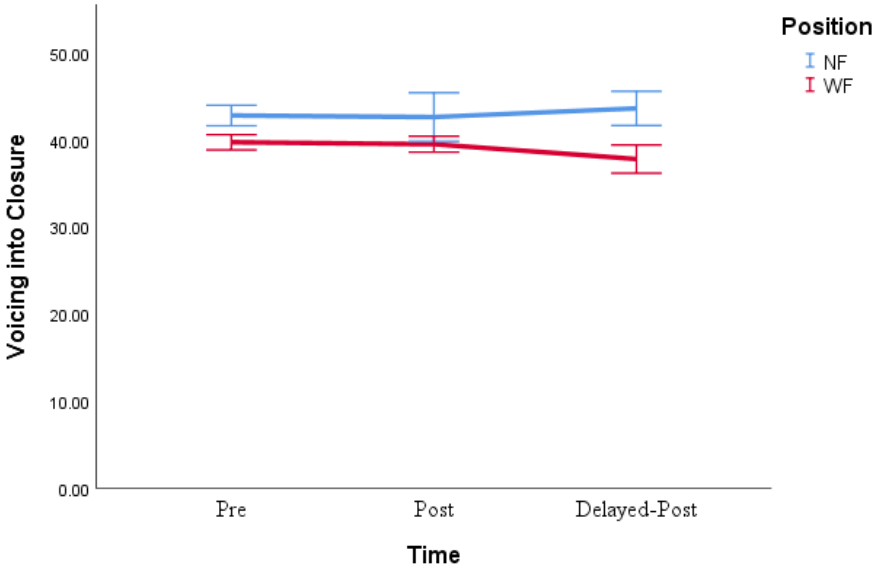


Figure 17. Duration of Voicing into Closure in the Implicit Condition

4.2.1.5 Summary: RQ1

RQ1 set out to investigate which of the two learning conditions (implicit or explicit) devoice more underlyingly voiced word-final stops, as measured by four acoustic correlates of voicing. The composite analysis of the four acoustic parameters (closure duration, release duration, preceding vowel duration, voicing into closure) indicate that the explicit condition devoiced significantly more underlyingly voiced word-final stops than the implicit condition, with all four parameters demonstrating significant effects. Hypothesis 1 (H1), namely that the explicit condition would outperform the implicit condition in the acquisition of German Final Devoicing, is therefore confirmed.

4.2.2 Fricatives

4.2.2.1 Center of Gravity

Center of Gravity (CoG) is an acoustic measure which has been used as a proxy for place of articulation (Forrest et al., 1988; Jongman et al., 2000; Boersma & Hamann, 2008; Johnson, 2012; Czaplicki et al., 2016; Conrad, 2021). Fricatives with a more fronted place of articulation are associated with a higher CoG, whereas fricatives with a more backed place of articulation are

associated with a lower CoG (Boersma & Hamann, 2008, p. 229; Colantoni, Steele & Escudero, 2015, p. 211). To confirm that CoG is a reliable predictor, an LMM was run using the fricative data in the native model. CoG was run as the dependent variable, and FRICATIVE TYPE, which had three levels [ç, ʃ, x], was run as a fixed factor. The model found a significant difference between the three fricatives F (2, 44) = 37.380, p = .001. As was expected, even though the difference between all three fricatives was significant, post-hoc pairwise comparisons confirmed that the difference between the postalveolar [ʃ] and velar fricative [x] was significantly greater than the difference between the postalveolar [ʃ] and the palatal fricative [ç]. As Figure 18 shows, the further back the place of articulation, the lower the CoG. The CoG of the postalveolar fricative was on average 1086 Hz higher (M = 4718Hz, SD = 931Hz) than the palatal fricative (M = 3632 Hz, SD = 1046 Hz) and 3420 Hz higher than the velar fricative (M = 1298 Hz, SD = 359 Hz). Effect size comparisons confirm that the difference between the postalveolar fricative and the velar fricative (d = 4.85, CI = 2.8, 6.9) was greater than the difference between the postalveolar and the palatal fricative (d = 2.9, CI = 1.98, 3.99), and also confirm the reliability of CoG as a measurement.

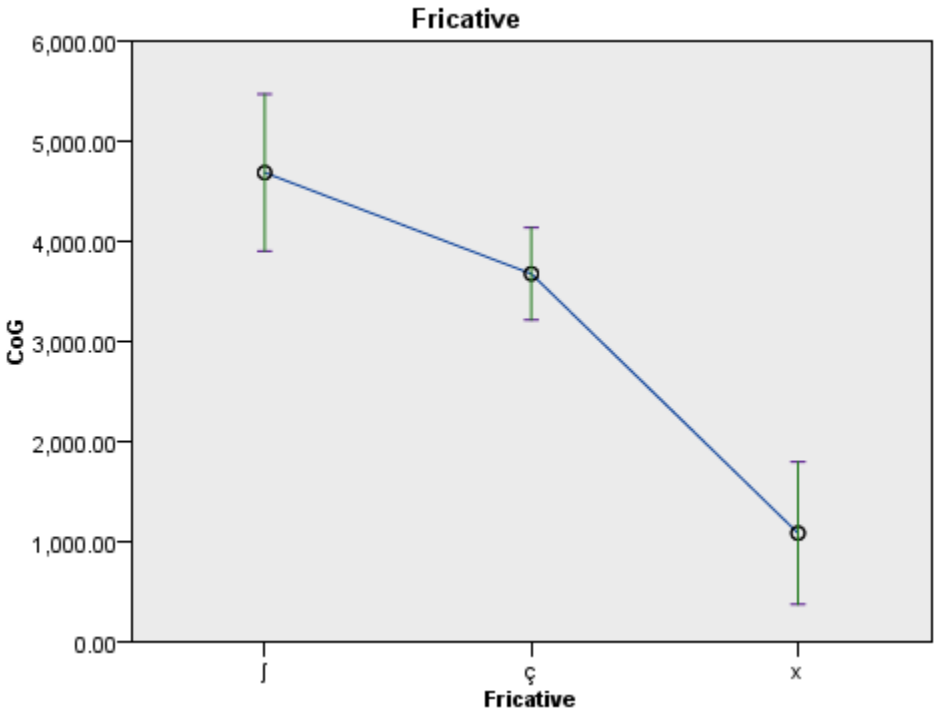


Figure 18. Mean Center of Gravity of German Fricatives [ʃ] [ç] [x]

Turning to the learner data, an LMM was run using CoG as the dependent variable and GROUP, FRICATIVE, TIME, and LEARNER-L1 run as fixed factors. All possible interactions were included in the model. The factor GROUP had two levels (explicit condition, implicit condition), FRICATIVE had three levels ([ç, ʃ, x]), TIME had three levels (pre-test, post-test, delayed-post-test), and LEARNER-L1 had two levels (English L1, Non-English L1). The model demonstrated a significant effect of GROUP F (1, 2471) = 6.413, p = .011, and FRICATIVE F (2, 2471) = 398.520, p = .001, but not TIME F (2, 2471) = .598, p = .550. The effect of GROUP was due to a significantly higher CoG in the implicit condition (M = 3239 Hz, SD = 1148 Hz) compared to the explicit condition (M = 3173 Hz, SD = 1375 Hz), suggesting, that at least initially, the implicit condition produced fricatives which had a more fronted place of articulation (e.g., [ʃ]) than the explicit condition. According to post-hoc pairwise comparisons, the effect of FRICATIVE was due to a significant difference in CoG between the postalveolar fricative (M = 3965 Hz, SD = 899 Hz), the palatal fricative (M = 3338, SD = 1215 Hz), and the velar fricative (M = 1733 Hz, SD = 841 Hz), suggesting that a distinction in place of articulation was present for the three fricatives.

As for the interactions, there was a significant effect of GROUP × TIME F (2, 2471) = 3. 946, p = .019, and a significant effect of GROUP × FRICATIVE F (2, 2471) = 4.717, p = .009. However, no significant effect of TIME × FRICATIVE F (2, 2471) = .953, p = .432, and GROUP × TIME × FRICATIVE F (4, 2471) = .871, p = .480, was found. The interaction of GROUP by TIME, and the interaction of GROUP by FRICATIVE, suggests that the two learning conditions differed in their production of the fricatives over time. In the pre-test, the CoG of the palatal fricative was higher in the explicit condition (M = 3550 Hz, SD = 1419 Hz) than the implicit condition (M = 3288 Hz, SD = 1042 Hz), suggesting that the place of articulation was more fronted in the explicit condition, that is, learners initially produced a segment which resembles the acoustic properties of the English fricative [ʃ]. However, by the post-test, the explicit condition reduced their CoG by an average 398 Hz (M = 3152 Hz, SD = 1143 Hz) which is descriptively greater than the decrease of 136 Hz (M = 3152 Hz, SD = 1075 Hz) in the implicit condition. The difference in CoG for [ʃ] and [ç] had increased two-fold in size in the explicit condition from pre-test (average difference = 496 Hz) to post-test (average difference = 871 Hz). In contrast, although the implicit condition made a higher distinction in CoG in the pre-test (average difference = 541 Hz), the post-test difference was shorter when compared with the difference in CoG in the post-test for the explicit condition (average difference = 702 Hz).

To explore this relationship further, two separate LMMs were run. The first model was run on the CoG of the fricatives produced by explicit condition, and the second model was run on the CoG of the fricatives produced by the implicit condition. In both models, FRICATIVE and TIME were run as fixed factors, and a two-way interaction of FRICATIVE × TIME was included. The explicit model found a significant effect of FRICATIVE F (1,033) = 191.965, p = .001, a significant effect of TIME F (1,033) = 8.943, p = .003, and a significant effect of FRICATIVE × TIME F (2,1033) = 3.796, p = .023. Post-hoc pairwise comparisons found significant differences between all three post-test and delayed-post-test fricatives. As Figure 19 illustrates, while the CoG of [ʃ] remained consistent from pre-test to post-test, the CoG of [ç] and [x] decreased over time. The decrease in CoG suggests that [ç] and [x] were produced further back in the oral cavity in the post-test when compared to the pre-test, thus demonstrating a significant improvement concomitant to the explicit pedagogical intervention.

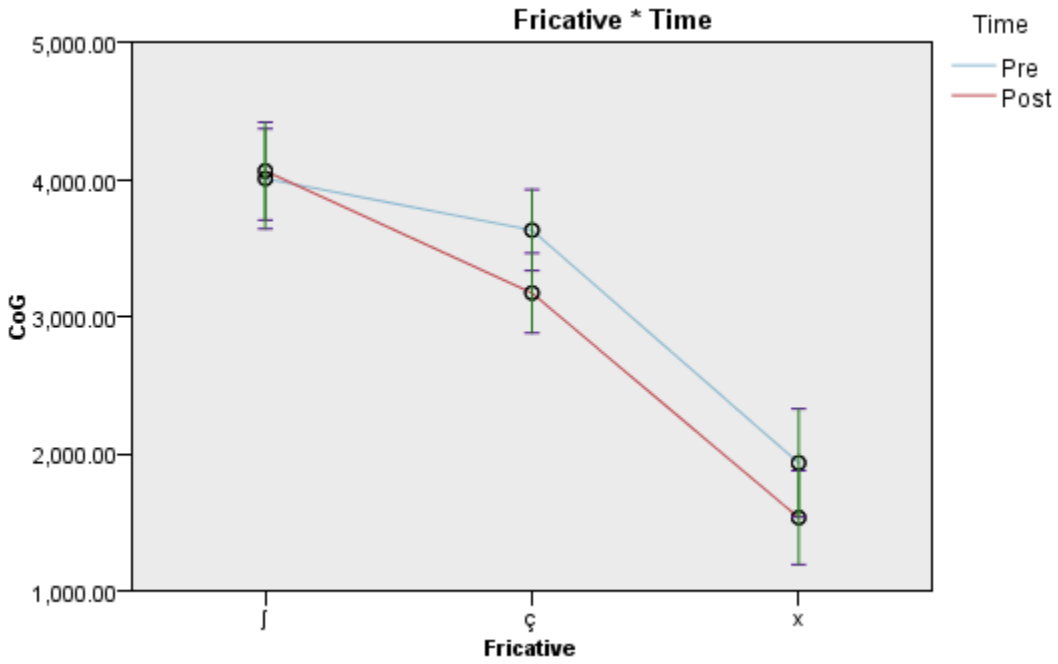


Figure 19. Mean Center of Gravity of Target Fricatives in the Explicit Condition

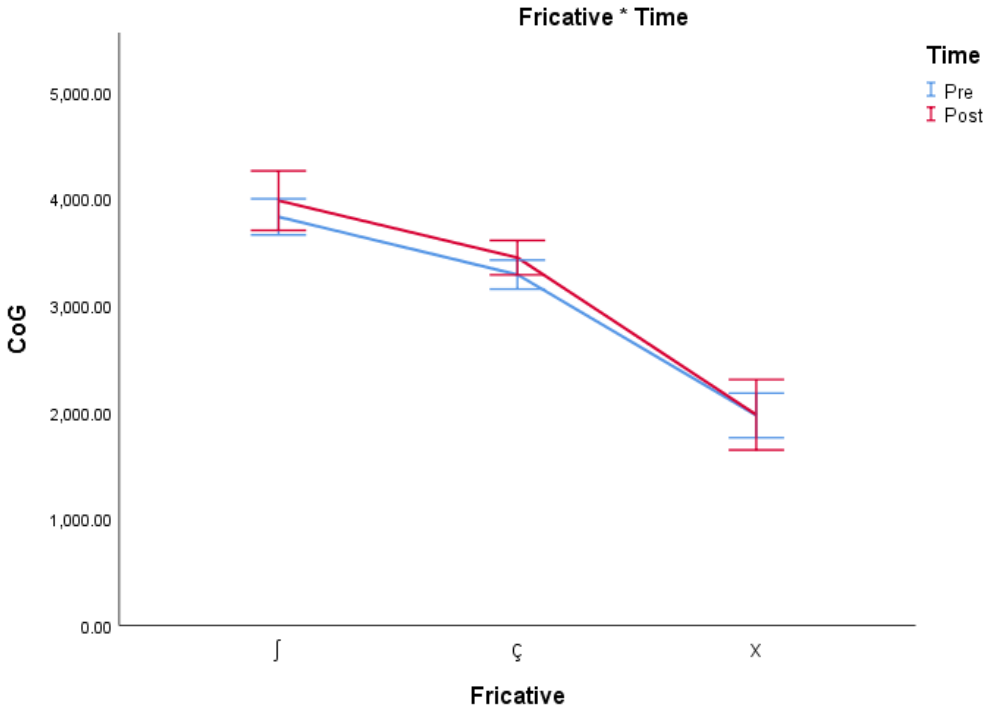


Figure 20. Mean Center of Gravity of Target Fricatives in the Implicit Condition

In contrast, while the implicit model found a significant effect of FRICATIVE F (2, 933) = 108.367, p = .001, no significant effect of TIME F (2,933) = 1.392 p = .239, nor FRICATIVE by TIME F (2,933) = .345, p = .708 was found. Although there was a significant difference between the three fricatives, there was no change over time (see Figure 20), that is, the implicit intervention they received did not have a significant effect on the production of their fricatives. According to my impressionist analysis, none of the learners in the implicit condition could correctly produce the palatal fricative in the pre-test, post-test, or delayed-post-test. All instances of /ç/ were either realized as [ʃ], [x], [k], or [t͡ʃ]. For instance, one learner in the implicit condition consistently produced the postalveolar fricative for all three fricatives across the three tests (e.g., *ich* was pronounced as [ɪʃ] as opposed to [ʔɪç], and *Sachen* [zaxn̩] was pronounced as [zaʃn̩]).

4.2.2.2 Summary: RQ2

RQ2 set out to examine the effect of the two learning conditions on the articulation of three German fricatives. Based on the acoustic parameter CoG, the explicit condition outperformed the implicit condition in the articulation of German fricatives. By the post and delayed-post-test, the difference

in CoG for the fricatives [ʃ], [ç], and [x] was significantly larger in the explicit condition than the implicit condition. However, by the post-test, the explicit condition had significantly decreased the CoG of [ç], suggesting that learners had learned to produce the palatal fricative further back in the oral cavity. Hypothesis 2 (H2), which predicted that the explicit condition would outperform the implicit condition, is therefore confirmed.

4.2.2.3 Phonological Representation

According to the rules of German Dorsal Fricative Assimilation (O'Brien & Fagan, 2016, p. 115-117), when the palatal fricative /ç/ appears after back vowels, it surfaces as the velar fricative [x]. When it appears after front vowels, it surfaces as [ç], where [ç] is the elsewhere phone. Using the CoG measurements, it was possible to tap into learners' phonological representation of the phoneme /ç/ and thus learner acquisition of Dorsal Fricative Assimilation. Fricatives produced with a CoG range of 1,000-2,000 Hz were coded as [x] being the learner's phonological representation, whereas fricatives with a CoG with a range of 2,001-3,999 Hz were coded as [ç] as the learner's phonological representation.[62] This coding strategy made it possible to compare the learner's representation with the target phonological representation. In doing so, an average error rate for Dorsal Fricative Assimilation for each learner was calculated.

An LMM was run on the data from the explicit condition using the ERROR RATE as the dependent variable, with TIME run as a fixed factor. The model found TIME to be statistically significant F (2, 93) = 8.819, p = .001, and post-hoc pairwise comparisons indicated that there was a significant difference from pre-test to post-test (p < .002) and from pre-test to delayed-post-test (p < .001). As Figure 18 illustrates, the effect of TIME was significant because the ERROR RATE in the explicit condition had reduced by 15 percent from pre-test (M = 55%, SD = 37%) to post-test (M = 30%, SD = 31%) and by 26 percent from pre-test to delayed-post-test (M = 24%, SD = 28%), suggesting that the explicit pedagogical intervention had a significant effect on the acquisition of Dorsal Fricative Assimilation. The same model was run on the implicit condition using the ERROR RATE as the dependent variable. However, TIME was not statistically significant F (2, 93) = .234, p = .087, and their ERROR RATE remained stable across time. In the

[62] A wider range of 2,001-3,999 Hz was used to categorize palatal-like realizations because if learners produce [ʃ] in lieu of [ç], they may still have the correct phonological representation but are unable to physically produce [ç]. Therefore, their issue may be with articulation as opposed to phonological representation.

pre-test, their ERROR RATE was 54% (*SD* = 28%) and by the post-test and delayed-post-test their ERROR RATE reduced by only 2 percent (*M* = 52%, *SD* = 27%), suggesting that the intervention the implicit condition received had little to no effect on the learners' phonological representation.

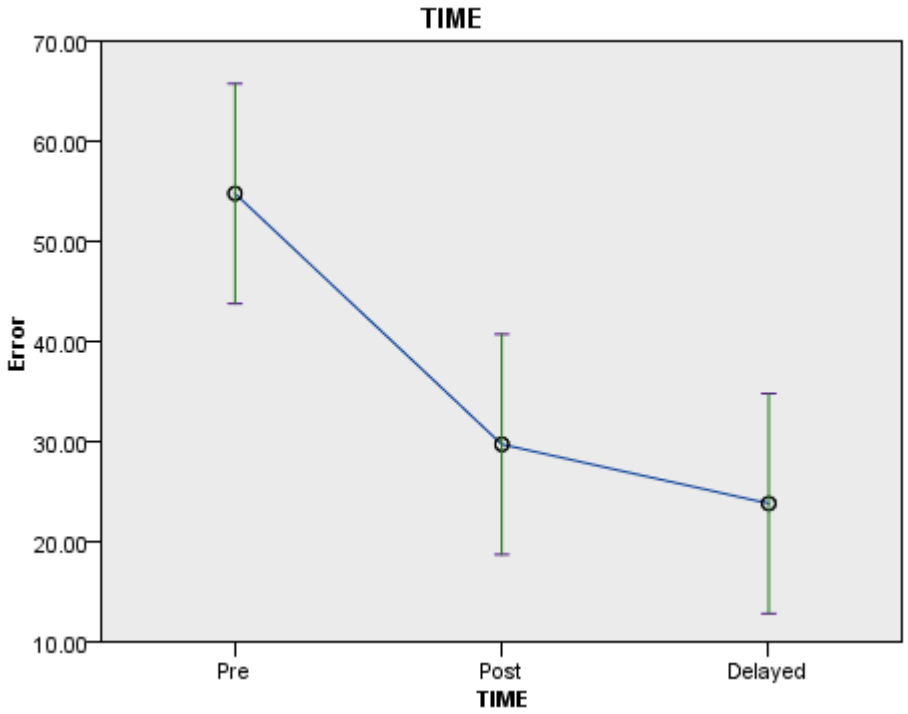


Figure 21. Error Rate of Dorsal Fricative Assimilation in the Explicit Condition

Qualitatively, in terms of the phonological errors, in the pre-test, several learners produced the affricate [t͡ʃ] for /ç/, likely due to orthographic interference from English <ch>. One learner in the pre-test always produced the affricate [t͡ʃ] for /ç/, that is for both [ç] and [x] allophones (e.g., *ich* [ɪt͡ʃ] and *Sachen* [zat͡ʃn̩). This error illustrates that the learner initially had no knowledge of Dorsal Fricative Assimilation and instead relied on English orthography to pronounce the <ch> digraph. In addition to the use of an affricate, several learners also resorted to stopping, a process whereby fricatives are replaced by stops. For instance, four learners (three explicit, one implicit) produced [k] for both the palatal and velar fricative in the pre-test (e.g., [ɪk] for [ʔɪç], [ɛkt] for [ʔɛçt], and [au̯k] for [ʔau̯x]). While stopping is common in some German dialects, during the 16-week semester, learners did not receive any input of stops being used in place of fricatives. Stopping was not present in the post and delayed-post test for the three explicit learners; they had

reduced their error rate from 100 percent to 27 percent. In contrast, the learner in the implicit condition continued to use stops for [x] and [ç] in the post and delayed-post-test.

4.2.2.4 Summary: RQ3

RQ3 set out to examine the acquisition of Dorsal Fricative Assimilation. The analysis of the acoustic recordings allowed for the calculation of the accuracy and error rate for this phonological rule over time. Results indicated that the explicit condition had acquired Dorsal Fricative Assimilation more accurately than the implicit condition. The explicit condition had improved significantly over time from pre-test to post-test. In contrast, the implicit condition did not. Hypothesis 3 (H3) was therefore supported.

4.3 Perception

4.3.1 Discrimination Task

For the discrimination task, learners listened to two stimuli and had to select between two possible outcomes: "same" or "different". Their responses were given a score of [1] or [0] depending on their correctness. Following previous work (e.g., Best, 1995, Best et al., 2001), this binomial coding system made it possible to calculate the PERCENT CORRECT for each learner. To examine the difference in PERCENT CORRECT from pre-test to post-test to delayed-post-test, an LMM was run, with TIME, GROUP, and LEARNER-L1 run as fixed factors. The model found a significant effect of TIME F (1, 81) = 18,.916, p = .001, and GROUP F (1, 81) = 15.526, p = .001. The effect of GROUP was due to a significant difference in PERCENT CORRECT between the implicit (M = 75, SD = 7.2) and explicit learning condition (M = 83, SD = 7.3), suggesting that the pedagogical intervention had a significant effect on one of the condition's performance. As for TIME, post-hoc pairwise comparisons indicated that the difference in PERCENT CORRECT was significantly higher in the post-test (M = 84, SD = 6.6) and delayed-post-test (M = 86, SD = 6.5) when compared to the pre-test (M = 73, SD = 5.9), whereas the post-test and delayed test did not differ significantly from each other.

To explore these differences in greater detail, additional LMMs were run. In the first model, only the data from the explicit condition were used, whereas in the second model, only the data from the implicit condition were used. TIME was included as a fixed factor in both models. While

both analyses indicated that the two learning conditions performed significantly better on the post- and delayed-post-test when compared to the pre-test, the improvement in the explicit condition was significantly greater F (2, 30) = 10.741, p = .003 than the implicit condition F (2, 51) = 4.291, p = .047. In the pre-test, the PERCENT CORRECT in the explicit condition was 73% (M = 72, SD = 5.8) and the PERCENT CORRECT in the implicit condition was 72% (M = 72, SD = 6.2). However, by the post-test, the explicit condition had improved their accuracy score by a mean average of 18% (M = 90, SD = 2.5) whereas the implicit condition had improved by a mean average of only 8% (M = 79, SD = 7.3). This statistically significant difference was confirmed by running separate LMMs, using either the implicit or explicit learner data. The difference between the two groups is shown graphically in Figure 19.

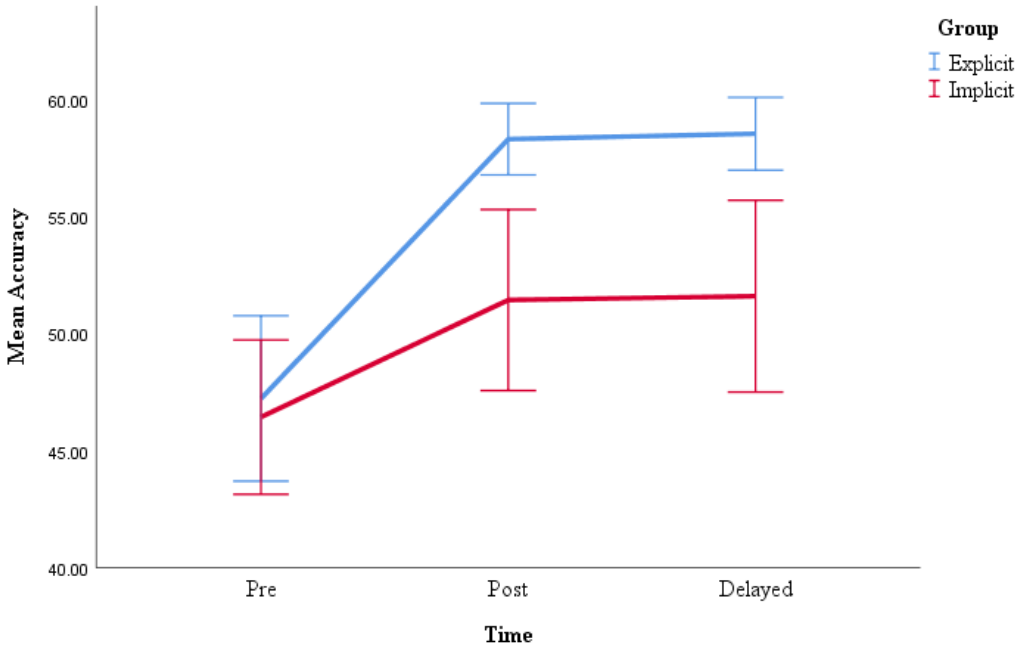


Figure 22. Percent Correct on the Perceptual Discrimination Task[63]

[63] Note that the "Mean Accuracy" is out of 64 since there were 64 questions in the discrimination task. Despite significant improvement following the two learning interventions, only one learner, namely a learner in the explicit condition scored 64/64. They scored 50/64 in the pre-test and 64/64 in the post and delayed-post-test.

4.3.2 Identification Task

In the identification task, learners had to map an audio stimulus to one of two German spellings. Like with the analysis of the discrimination task, the scores were also coded binomially for correctness: [1] versus [0]. To examine the PERCENT CORRECT, an omnibus model was run, with TIME and GROUP included as fixed factors. A two-way interaction of GROUP by TIME was also included in the model. The model found a significant effect of TIME F (2, 90) = 15.384, p = .001, and GROUP F (1, 90) = 5.779, p = .018. The effect of GROUP was due to a significant difference in PERCENT CORRECT between the implicit (M = 57/78, SD = 5.6) and explicit condition (M = 53/78, SD = 10.5). Pairwise comparisons indicated that the effect of TIME was due to a significant difference in PERCENT CORRECT in the pre-test (M = 50/78, SD = 11) when compared to the post-test (M = 57/78, SD = 6) and delayed-post-test (M = 57/78, SD = 5.8). As for the interaction of GROUP by TIME, the model found this to be statistically significant F (2, 90) = 4.824, p = .010.

To explore these differences in greater detail, additional models were run using either the implicit or explicit learner data. As Figure 20 shows, the models indicated that there was a significant difference F (1, 30) = 5.601, p = .025 between the pre-test scores in the implicit (M = 55/78, SD = 7) and explicit condition (M = 46/78, SD = 12.8), where the explicit condition scored an average of 9 points better than the implicit condition. However, while both groups improved significantly following the pedagogical intervention, the improvement in the explicit condition was significantly greater than the implicit condition F (2, 90) = 4.824, p = .010. The explicit condition improved by an average of 10 points from pre-test (M = 46/78, SD = 12.8) to post-test (M = 56/78, SD = 7) whereas the implicit condition improved by only 3 points from pre-test (M = 55/78, SD = 7) to post-test (M = 58/78, SD = 5).

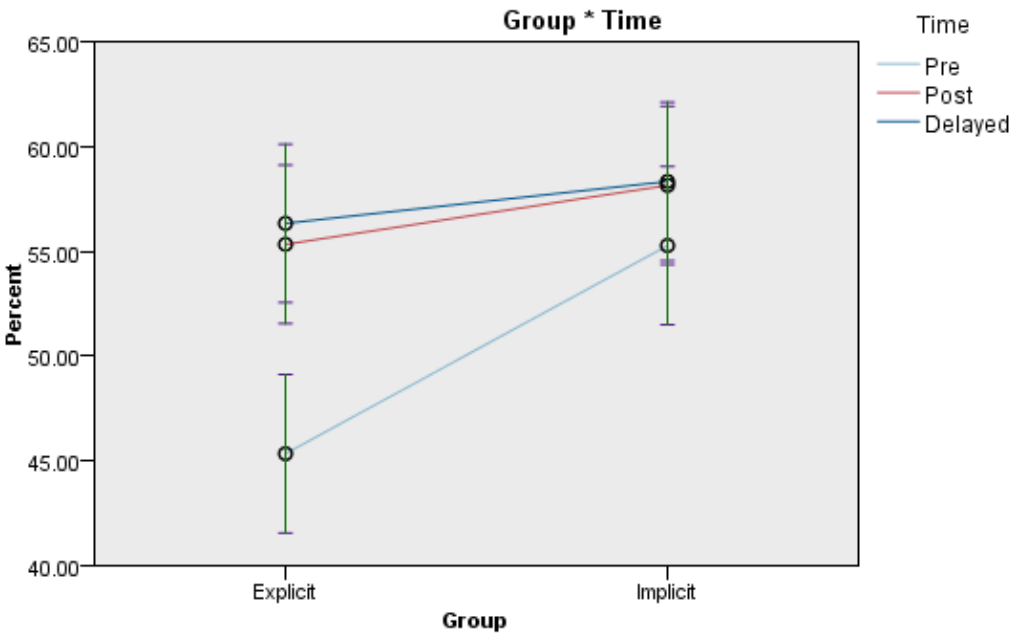


Figure 23. Percent Correct on the Perceptual Identification Task

4.3.3 Summary: RQ4 & RQ5

RQ4 and RQ5 set out to examine which of the two learning conditions had a greater effect on L2 perceptual skills. Results indicated that although both learning conditions improved their L2 perceptual skills as measured by the discrimination and identification skills, the explicit condition performed significantly better than the implicit condition. Hypotheses 5 (H5) and 6 (H6) were therefore supported.

4.4 Exit Survey

After completion of the delayed-post-tests, both learning conditions filled out the Exit Survey. The implicit condition answered two questions, and the explicit condition answered four questions. The first question asked learners if they thought the instruction they received helped them improve their German pronunciation. 94 percent of the explicit condition (n = 15/16) responded *yes* versus only 54 percent (n = 7/13) of the implicit condition. An LMM indicated that this difference was statistically significant F (1, 27) = 4.739, p = .038. Learners' impression that their pronunciation had improved is supported by the acoustic analyses in section 4.1. However, it is intriguing that

over 50 percent of the implicit condition believed their pronunciation had improved as a result of their instruction even though objectively it did not.

A sample of the qualitative responses from the explicit condition are reported in (6) and the implicit condition responses in (7). With the exception of one learner, the explicit condition reported that they were satisfied with the explicit instruction they received. Their responses suggest that the explicit instruction may have allowed them to notice rules which they previously knew nothing about (6a-c), it allowed them to avoid crosslinguistic influence (6c), and in some cases, it gave them more confidence to speak (6f). On the other hand, the responses from the implicit condition were mixed. Some learners believed that the intervention they received improved their pronunciation (7a-b) and made them more confident (7c-d), whereas other learners were unsure (7e-f).

6) Explicit Condition Response:
   (a) "Yes, because the instruction we received helped me sound more like a native German speaker, which is ultimately the end goal of me taking these classes. Prior to this class, I was never taught that the pronunciation changes if a word ends in d, g, b"
   (b) "Yes because it taught me how words were actually pronounced that I had been mispronouncing the whole time"
   (c) "Yes because there are many obscure rules about pronunciation I wouldn't have known about otherwise"
   (d) "Receiving the instruction on phonetics provided us with a toolkit to pronounce words accurately. If we don't know about phonetics, then we just pronounce words based on our native pronunciation"
   (e) "I usually have difficulty with pronouncing some German words, but through breaking down the specific sounds I now have a better understanding"
   (f) "The instruction helped me improve my pronunciation and helped me feel more confident"
   (g) "Yes, because it gave me solid guidelines on how to pronounce a lot of German words"

7) Implicit Condition Response:
   (a) "Yes because we had lots of speaking practice and that's the best way to improve pronunciation"

(b) “We carried out lots of listening and respond tasks which allowed me to focus on how I pronounce things versus how something should be pronounced”
(c) “Yes! I feel more confident about communicating in German than I did that the beginning of the semester!”
(d) “I feel much more confident about my German pronunciation than I did at the beginning of the semester. Immersion is the most effective way to learn a foreign language”
(e) “I really enjoyed the activities we did, but I am just as confused about pronunciation as I was at the beginning of the semester. We didn’t really talk about it. I would have liked to have received explanations on German pronunciation rules”
(f) “I don’t think I have noticed any improvements, but who knows, maybe I did?”
(g) “I thought that the activities we did were fun! We used German in the proper context, which I feel is the best way to improve your language skills”

The second question asked learners whether they would have changed the structure of the class to improve their pronunciation if given the opportunity. 75 percent of the explicit condition (n = 12/16) responded *no,* pointing out that they were satisfied with the instruction insofar as it helped with their pronunciation. In contrast, only 54 percent (n = 7/13) in the implicit condition were satisfied with the instruction they received. However, the difference in satisfaction was not statistically significant F (1, 27) = 1.388, p = .249. Their qualitative responses present some ambivalent messages. The 25 percent of the learners in the explicit condition (n = 4/16) who reported that they would have changed the instruction they received, responded that they would have liked more communicative activities. In contrast, the 46 percent of learners in the implicit condition (n = 6/13) who reported that they would have changed the instruction wrote that they would have preferred some direct or explicit pronunciation instruction.

Questions three and four were asked only to the explicit condition because they dealt specifically with explicit learning. The third question asked learners if they thought the use of IPA symbols was helpful. 56 percent (n = 9/16) responded *yes,* and 44 percent (7/16) responded no. A sample of their responses are reported in (8). Some learners thought that the symbols helped them with pronunciation because the same letter can be pronounced in different ways (8a-c), whereas others thought the IPA was too “abstract” or “confusing” (8d-f). The final question asked learners if they think it is beneficial to include instruction on aspects of linguistics (i.e., phonetics and

phonology) in the L2 classroom. 88 percent (n = 14/16) of learners responded *yes*. A list of reasons why is reported in (9).

8) Explicit Condition Responses:
   (a) "Yes, the symbols helped me differentiate the sounds"
   (b) "It helped me remember which sounds were used for each word, as the letters in the alphabet were the same"
   (c) "Yes, they help me pronounce the words correctly. Without [ç] and [x] I would usually guess how to pronounce <ch>"
   (d) "No, it is too abstract and confusing"
   (e) "No, I just found the symbols confusing personally"
   (f) "No, I preferred to use terms like "ich-Laut" and "ach-Laut".
9) Explicit Condition Responses:
   (a) "It helps me understand the language more"
   (b) "It helps the overall structure of the language in mind"
   (c) "Having this knowledge makes for a better language learner"
   (d) "Yes, because I prefer sounding at least somewhat native-like when I speak a foreign language and knowledge of linguistics helps"
   (e) "Yes, I wish all language classes would do the same"
   (f) "Yes, because this instruction allowed me to improve my pronunciation and identify the correct pronunciation than to correct it later down the line"
   (g) "Yes, it helps separate different languages you have in your head and it makes it easier to recall words/definitions/structures"
   (h) "Yes, I think this type of instruction is crucial and should be taught starting in Level I!"
   (i) "Yes, they are like the fine tuning details that can be the icing on the cake"
   (j) "No, as a learner, I want to learn to speak fluently, not receive deep explanations behind the theory of the language"

4.5 Summary

The chapter reported the results from ExI which addressed five research questions. A summary of the research questions, along with the corresponding hypotheses, are reported in Table 12.

Table 12. Summary of Results (ExI)

Research Question		Hypothesis		Results
RQ1:	As measured by four acoustic correlates of voicing (namely, preceding vowel duration, duration of closure, release duration, and durational presence of glottal pulsing), is there a statistically significant difference between the two learning conditions (implicit and explicit) in the production of underlyingly voiced word-final and non-word-final stops?	H1:	Yes, there will be significant difference in the devoicing of underlyingly voiced word-final stops, with the explicit condition devoicing more word-finally than the implicit condition.	Hypothesis supported
RQ2:	As measured by the acoustic correlate Center of Gravity (CoG), is there a statistically significant difference in the production of the German fricatives [ʃ], [ç] and [x] among the two learning conditions (implicit and explicit)?	H2:	Yes, there will be significant difference in the production of the German fricatives between the two learning conditions, with significantly higher differentiation in Center of Gravity in the explicit condition than the implicit condition.	Hypothesis supported
RQ3:	As measured by the acoustic correlate Center of Gravity (CoG), which of the two learning conditions (implicit and explicit) will acquire the phonological process Dorsal Fricative Assimilation more accurately?	H3:	The explicit condition will significantly outperform the implicit condition with the acquisition of Dorsal Fricative Assimilation.	Hypothesis supported

Table 12 Continued

RQ4:	On a perceptual discrimination task, which of the two learning conditions (implicit or explicit) more accurately discriminate between the German phonemes [ʃ] [ç], [x]?	H4:	The explicit learning condition will significantly outperform the implicit condition in this perceptual task.	Hypothesis supported
RQ5:	On a perceptual identification task, which of the two learning conditions (implicit or explicit) more accurately identifies which fricative [ʃ] [ç] is played to them when presented with minimal pairs?	H5:	The explicit learning condition will significantly outperform the implicit condition in this perceptual task.	Hypothesis supported

CHAPTER 5. METHODOLOGY: EXPERIMENT II

5.1 Overview

Experiment II (ExII) tested the effects of explicit historical instruction on the learning and identification of English-German cognates. Like in ExI, two sections of the same course (German III) were used. One section served as the explicit condition and one section served as the non-explicit condition.[64] Both sections were also taught by the same instructor. Over the course of a 16-week semester, learners engaged in one of the two learning conditions and completed a pre-test (at the beginning of the semester), post-test (after the pedagogical intervention), and delayed-post-test (at the end of the semester). They also filled out a Language Background Questionnaire at the beginning of the semester and an Exit Survey at the end of the semester.

5.2 Learner Sample

There was a balanced number of students in both the explicit (n = 18) and the non-explicit group (n = 17).[65] Like in ExI, there were more male students in both conditions: explicit: (male n = 13 [72%], female n = 5 [18%]), non-explicit: (male n = 10 [59%], female n = 7 [41%]). English was the dominant L1 in both conditions: (explicit n = 11 [61%]), (non-explicit n = 13 [76%]). In the explicit condition, the remaining 39 percent had non-English L1s (n = 7): Russian (n = 2, 11%), Mandarin (n = 2, 11%), Spanish (n = 2, 11 %), and Portuguese (n = 1, 6%). In the non-explicit condition, non-English L1s made up 24 percent of the sample (n = 4): Mandarin (n = 2, 12%), Spanish (n = 1, 6%), and Hindi (n = 1, 6%).

Other than some rudimentary knowledge of Spanish and Italian, no learners reported having any L2 knowledge of a language other than English and German. No learners in either learning condition reported knowledge of a Germanic language beyond English and German. As for the mean exposure of German, the non-explicit condition had learned German for slightly longer (M = 3.5 years) than the explicit condition (M = 2 years). Two learners in the explicit

[64] The label *non-explicit* is used instead of *implicit* to describe the quasi-control group. This label is used because the activities learners carried out could not always be categorized as implicit. Instead, the activities consisted of a combination of both incidental learning and implicit learning. For a description of these activities, see Table 17.

[65] At the beginning of the semester, there were 20 students in the explicit condition and 21 in the non-explicit condition. However, because six students missed either the mandatory training sessions or the pre-/post-/delayed-post-tests, they were removed from the present analysis.

condition reported having visited Germany for two weeks or shorter, and one learner had reported having visited Germany for a period of four months.

5.3 Pre-Test/Post-Test/Delayed-Post-Test

On the first day of the semester, both learning conditions completed a pre-test during regular class time. The pre-test was an isolated translation task, which called for an L1 translation of a list of 126 German words. Although non-native speakers of English were given the option to provide a translation in their L1, all learners provided translations in English. Given the nature of the task, it tested receptive as opposed to productive vocabulary knowledge, it focused specifically on the "meaning" category of vocabulary knowledge (Nation, 2013), and tested vocabulary breadth/size as opposed to vocabulary depth. The order of the 126 words was counterbalanced with three possible orders, and the tests were administered on paper. The same isolated translation task was carried out as a post-test in week 9 (after the pedagogical intervention), and a delayed-post-test in week 16 (at the end of the semester).

Of the 126 words, 50 percent (n = 63) were target cognates and 50 percent (n = 63) were distractors. Of the 63 target cognates, 42 were cognates which both learning conditions would encounter during the explicit or non-explicit training sessions. The remaining 21 target cognates were words which learners would not encounter in the training sessions. Dividing the cognates into words which learners would encounter and words they would not encounter made it possible to test the effect of explicit historical instruction on both cognate learning and cognate predictability.[66] Of the 42 words which learners would encounter in the training sessions, 50 percent (n = 21) were cognates which were chosen because they are less recognizable due to historical sound changes, and 50 percent (n = 21) were cognates which are less recognizable because of historical semantic shifts. Dividing the stimuli in this way also made it possible to examine the effect of the two different types of historical changes (sound and semantic). Table 13 provides a quantitative summary of the words on the tests, Table 14 provides a qualitative breakdown of the 21 target cognates affected by semantic changes, and Table 15 provides a qualitative breakdown of the 42 target cognates which had undergone sound changes. An example

[66] Because the words on the post and delayed-post-test were identical to the pre-test, technically both learning conditions had been exposed to the 21 "unencountered" cognates. However, neither learning condition received instruction on the "unencountered" cognates unlike the "42 "encountered" cognates.

of the pre-test is provided in Appendix G. A reliability analysis found a Cronbach's alpha of α = .818 for the responses on the target cognates (n = 63), suggesting a high confidence level for the reliability of the testing instrument.

Table 13. Summary of Words on the Pre-/Post-/Delayed-Post-Tests

Word Type	*N*	
Distractors	63	
Cognates	63	
	Encountered	Unencountered
	42	21

Table 14. Target Words and their Semantic Changes[67]

Cognate	Semantic Relationship
1. *weh* 'pain'	cognate 'woe'
2. *sterben* 'to die'	cognate 'to starve' – semantic narrowing in English
3. *Weib* 'woman (pej)'	cognate 'wife'– (OE* *wīf*) used to mean 'woman'
4. v*ersehren* 'to injure'	cognate 'sore' – related to German *sehr* 'very', used to mean 'pain'
5. *Zimmer* 'room'	cognate 'timber' – semantic narrowing in English and German
6. *Vogel* 'bird'	cognate 'fowl' (OE *fugol*) – semantic narrowing in English
7. *Gebet* 'prayer'	cognate 'bead' – change by association
8. *beten* 'to pray'	cognate 'bead' (same as *Gebet*)
9. *Zwilling* 'twin'	cognate 'two' – German *zw-* is English *tw* – e.g., *zwischen* 'between'
10. *Knecht* 'servant'	cognate 'knight' (OE *cniht*) – amelioration in English
11. *Tier* 'animal'	cognate 'deer' (OE *deor*) – semantic narrowing in English
12. *satt* 'full'	cognate 'sad', originally meant *full*, as in *satisfy*
13. *selig* 'holy'	cognate 'silly' – pejoration in English
14. *Waren* 'goods'	cognate *-ware*, as in *silverware, hardware* and *warehouse*
15. *Burg* 'fortress'	cognate *-burg*(*h*) as in Edinburgh (people used to live in a *Burg*)
16. *Bürger* 'citizen'	cognate *-burg*(*h*) – people who lived in a *Burg* were *Bürger* (lit. 'of the *Burg*').
17. *Zaun* 'fence'	cognate 'town' (OE *tūn*). Original meaning was enclosed space
18. *Bein* 'leg'	cognate 'bone'
19. *reißen* 'to rip'	cognate 'to write' (OE *wrītan*). People used to rip/carve into wood to 'write' something
20. *Urlaub* 'holiday'	cognate 'to allow'. It was necessary to ask permission to take 'leave'
21. *wissen* 'to know'	cognate 'wit' – (OE *witan* 'to know') – relict 'to have your wits about you'

[67] It should be pointed out that many of the cognates affected by semantic changes were also affected by sound changes too (e.g., *Zimmer*, *Zaun*).

Table 15. Target Words and their Sound Changes

Ingvæonic Palatalization k > t͡ʃ/ ____[high front vowels]	
Encountered Cognates	Non-Encountered Cognates
*Kinn** > chin *Käfer* > chafer (type of beetle) *Kerl* > cherl (archaic word for man)	*Krücke* > crutch *strecken* > to stretch *kauen* > chew
Second Germanic Sound Shift p > p͡f /#_____	
Encountered Cognates	Non-Encountered Cognates
pipe > *Pfeife* pan > *Pfanne* pound > *Pfund*	penny > *Pfennig* pole > *Pfahl* pepper > *Pfeffer*
p > p͡f / V___V	
to tap > z*apfen* copper > *Kupfer* drop (as in eye drops) > *Tropfen*	to hop > *hüpfen* to stamp > *stampfen* apple > *Apfel*
p > f / $\left(\underline{\quad}^{\text{nasal}}_{\text{liquid}}\right)$	
open > *offen* weapon > *Waffe* ripe > *reif*	grip > *Griff* sharp > *scharf* to slurp > *schlürfen*
t > t͡s / #___	
tongue > *Zunge* tin > *Zinn* toe > *Zeh*	to fart > *furzen* wart > *Warze* twig > *Zweig*
t > s /$\left(\begin{smallmatrix}\#\_\_\_\\ V\_\_V\end{smallmatrix}\right)$	
to let > *lassen* hate > *Hass* better > *besser*	kettle > *Kessel* to sweat > *schweißen* nut > *Nuss*
[θ/ð] > d $\left(\begin{smallmatrix}\#\_\_\_\\ V\_\_V\end{smallmatrix}\right)$	
thing > *Ding* thirst > *Durst* these > *diese*	thorn > *Dorn* feather > *Feder* thistle > *Dissel*

*German cognates are italicized

5.4 Data Analysis

Responses on the isolated translation task were graded on a linear scale between 0-1. Fully correct answers received a score of 1 and incorrect answers received a score of 0. Answers which were partially correct received a score between 0-1. This linear grading system was necessary because, given the nature of the stimuli, learners could correctly identify the English cognate, but due to a lack of knowledge of the historical semantic changes, fail to provide a correct translation. For instance, the German word *Bein* is cognate with English 'bone', but in German *Bein* means 'leg' not 'bone'. Therefore, learners who wrote 'bone' as a translation received a score of .5 for correctly identifying the English cognate but did not receive a score of 1 for failing to identify the contemporary meaning. Learners who correctly identified the meaning but chose the wrong part of speech received a score of .75 (e.g., *offen* 'open' erroneously translated as 'to open').

5.5 Exit Survey

At the end of the semester, after the delayed-post-test had been completed, both learning conditions carried out the Exit Survey. However, like in ExI, the survey was different depending on the learning condition. The non-explicit learning condition was asked to answer only three questions (10a-c) whereas the explicit learning condition was asked to answer all four questions (10a-d). The final question mirrored the last question given to the explicit learning condition in ExI.

10) Exit Survey Questions

(a) Based on the instruction you received and the answers you put on the three vocabulary tests, do you feel as though your vocabulary size has improved throughout the semester?"

(b) Do you feel as though the activities you completed this semester significantly helped you learn these words?

(c) A big question in Second Language Teaching is the most effective way to teach a foreign language. There are two main approaches: the communicative approach (learning through context, tasks and interaction) or explicit instruction (learning the rules or reasons for why something is the way it is). Based on your instruction this semester, which method do you prefer? Please indicate why.

(d) This semester you have engaged in several activities to learn vocabulary. This instruction is part of a larger research project which investigates the effects of receiving instruction on linguistics (i.e. the scientific study of language) on learners' performance when learning a foreign language. In your opinion, as a learner of German, do you think it is a good idea to include aspects of linguistics (such as Historical Linguistics briefly explained to you during the semester) in lessons when learning a foreign language?

5.6 Intervention

After completion of the pre-test in week 1, between weeks 2-7, the explicit group received six twenty-minute training sessions on historical linguistics as it relates to the learning of English-German cognates. During this time, learners received explicit instruction on two historical sound changes: the Second Germanic Sound Shift and Ingvæonic Palatalization. They also received instruction on general semantic changes (e.g., narrowing, broadening, etc) as they relate to English-German cognates. Similarly, during weeks 2-7, the non-explicit group received six twenty-minutes sessions, engaging in various communicative, often task-based activities, wherein they would encounter the same cognates. Like in ExI, time-on-task was controlled for, with twenty-minute training sessions conducted in the classroom, during regular class time. Given the metalinguistic terminology needed to explain the material, the explicit condition received the instruction in English, whereas in the non-explicit condition, German was the medium of communication. Overviews for the six training sessions in the two learning conditions are provided in Table 16 and 17.

Table 16. Vocabulary Instruction Overview for Explicit Learning Condition

	Content	Description
Session 1	Historical Linguistics	• Learners were introduced to the notion that English and German are both (West) Germanic languages, and both descend from a common ancestor, namely (Proto) Germanic. • Explanation of the traditional narrative of 'English' being brought to Britain by three Germanic tribes (Angles, Saxons, Jutes) was provided • Learners were introduced to the concept of a cognate, defined as two or more words which trace back to the same ancestral form • Learners were told that English and German share many cognates because they are both Germanic languages. However, because of various historical changes, upon first inspection, many of the German cognates do not appear to be related to their English counterparts. • Instruction on Ingvæonic Palatalization: However, terms like *Ingvæonic Palatalization* were avoided. Learners were simply told that there was a sound change which happened in English which did not take place in German. As a result, words like *Kinn* became *chin* etc. N.B. The orthographic symbol <ch> was used to represent the affricate /t͡ʃ/ since it was assumed that they had no previous IPA training.
Session 2	Sound Change	• Review • Instruction on Second Germanic Sound Shift
Session 3	Sound Change	• Review on Second Germanic Sound Shift • Instruction on the remaining sound changes delineated in Table 15
Session 4	Semantic Change	• Students were introduced to the idea that words change their meaning throughout time (a few examples from English were given to evoke interest) • Students were then introduced to five general semantic shifts: semantic broadening, semantic narrowing, amelioration, pejoration, and change by association. Learners were given examples of these changes with English-German cognates (see Table 14).
Session 5	Review	• Review
Session 6	Review	• Review • In the final activity, they also completed some additional activities on the First Germanic Sound Shift and sound changes in other Germanic languages (to evoke further interest). N.B. Example provided in Appendix H

Table 17. Vocabulary Instruction Overview for Non-Explicit Learning Condition

	Content	Description
Session 1	Communicative Activity	• Two-way interaction task containing cognates and definitions. Learners had to communicate in German to find appropriate matches. • Oral interaction task: learners were given a list of words (target words + distractors). One learner chose a word from the list and had to provide a definition to their partner. Their partner had to guess what the word was.
Session 2	Reading	• Read short German text (250 words) containing some of the target words (+ distractors) • Learners answered follow-up comprehension questions.
Session 3	Roleplay	• Learners created a short roleplay based on a word list (target words + distractors) containing L2 definitions. Dictionary use was permitted. N.B. See Appendix I for an example.
Session 4	Heads-Up	• Learners played a spinoff of the game "Heads up" (https://www.warnerbros.com/games-and-apps/heads). One learner held up a list of cognates and distractors and their partners had to provide them clues in the target language so they could guess it correctly.
Session 5	Speed Dating	• Learners were given three words (target cognates + distractors) and they had a two-minute conversation (with ten different people) containing the words (e.g., target word = *Tier*, response: *Was ist dein Lieblingstier* 'what's your favorite animal?').
Session 6	Reading: Cloze Test	• Short (250 word) reading containing some target cognates (+ distractors), followed by comprehension questions and a Cloze Test.

5.7 Summary

To summarize, over the course of a 16-week semester, learners received either explicit instruction on vocabulary or they were assigned to a traditional learning condition where vocabulary learning was either implicit or incidental, but not explicit. They were asked to complete a pre-test (at the beginning of the semester), post-test (after the pedagogical intervention), and delayed-post-test (at the end of the semester) which examined changes in their vocabulary knowledge throughout the semester. A summary of ExII is provided in Table 18.

Table 18. Summary of Experiment (ExII)

Experiment	**Learning Conditions**	**Training Sessions**		**Assessments**
		Explicit	Non-Explicit	
Experiment 2 (ExII) L2 Vocabulary	Explicit Condition (*n* = 18) Non-Explicit Condition (*n* = 17)	**Sound Changes:** 2nd Ger. Sound Shift Ingvæonic Palatalization **Semantic Changes:** Broadening Narrowing Pejoration Amelioration Change by Association	Task-based and communicative-based activities	**<u>Vocabulary</u>** **Pre-/Post-/Delayed-Post Test** 126 words (63 cognates, 63 non-cognates) Of the 63 cognates (42 cognates with sound changes, 21 with semantic changes) Of the 42 sound change cognates (21 encountered, 21 not encountered) **Exit Survey**

CHAPTER 6. RESULTS: EXPERIMENT II

6.1 Overview

This chapter reports the results from the pre-/post-/delayed-post-tests in ExII. The results concerning the encountered cognates are reported in section 6.2, and the results concerning the unencountered cognates are reported in section 6.3. The Exit Survey results are reported in section 6.3, with a summary of the results in section 6.4.

6.2 Acquisition of Encountered Cognates

6.2.1 Overall Acquisition Scores

To examine the effect of the two learning conditions on the acquisition of the 42 encountered cognates, a series of LMMs (Linear Mixed Models) were run in SPSS26 (IMB Corp., Armonk, NY). In the LMMs (Linear Mixed Models) which follow, an $\alpha = .05$ was used as the criterion for significance, and Cohen's *d* was used to measure effect size using the benchmarks of Plonsky & Oswald (2014): small (*d* = .40), medium (*d* = .70), large (*d* = 1.0). All pairwise comparisons were performed with Sidak correction. The random effects structure was also the same, with LEARNER and WORD run as random intercepts. Moreover, the reported confidence intervals (CI) are at 95% confidence.

First, an initial omnibus model was run, with TRANSLATION ACCURACY run as the dependent variable, and GROUP, TIME, and LEARNER-L1 run as fixed factors. GROUP had two levels [explicit, non-explicit], TIME had three levels [pre-test, post-test, delayed-post-test], LEARNER-L1 had two levels [English, non-English], and TRANSLATION ACCURACY was continuous. All possible interactions were included in the model: a two-way interaction of GROUP × TIME, GROUP × LEARNER-L1, TIME × LEARNER-L1, and a three-way interaction of GROUP × TIME × LEARNER-L1.

The omnibus model demonstrated a significant effect of GROUP F (1, 4,398) = 27.656, p = .001, and TIME F (2, 4,398) = 138.307, p = .001, but not LEARNER-L1 F (1, 4,398) = .862, p = .35. The effect of GROUP was due to a significantly higher TRANSLATION ACCURACY in the explicit condition (M = 17/42, SD = .48) compared to the non-explicit condition (M = 6/42, SD = .33), with an effect size of d = .63 (CI = .05, 1.31). Post-hoc pairwise comparisons indicated that

the effect of TIME was due to significant differences in TRANSLATION ACCURACY in the pre-test (*M* = 5/42, *SD* =.31) compared to the post (*M* = 16/42, *SD* = .48) and delayed-post-test (*M* =15/42, *SD* =.48). However, the effect size from pre-test to post-test (*d* = .64, CI = .16, 1.1) and pre-test to delayed-post-test (*d* = .59, CI = .12, 1.1) suggests that either the effect was small or there was some interference of GROUP. As for the interaction between the three fixed factors, there was only a significant effect of GROUP × TIME *F* (2, 4,398) = 88.756, *p* = .001. As the overall mean scores in Figure 21 show, the explicit condition acquired 48 percent of the encountered cognates from pre-test (*M* = 5/42, *SD* = .33) to post-test (*M* = 24/42, *SD* = .49). While the non-explicit group also showed an improvement of 7 percent from pre-test (*M* = 4/42, *SD* = .31) to post-test (*M* = 7/42, *SD* = .35), the percent of increase was 41 percent lower than the improvement in the explicit condition. The omnibus model therefore suggests that the historical instruction the explicit condition received on sound and semantic changes had a significantly greater effect on the acquisition of the 42 cognates than the intervention the non-explicit condition received.

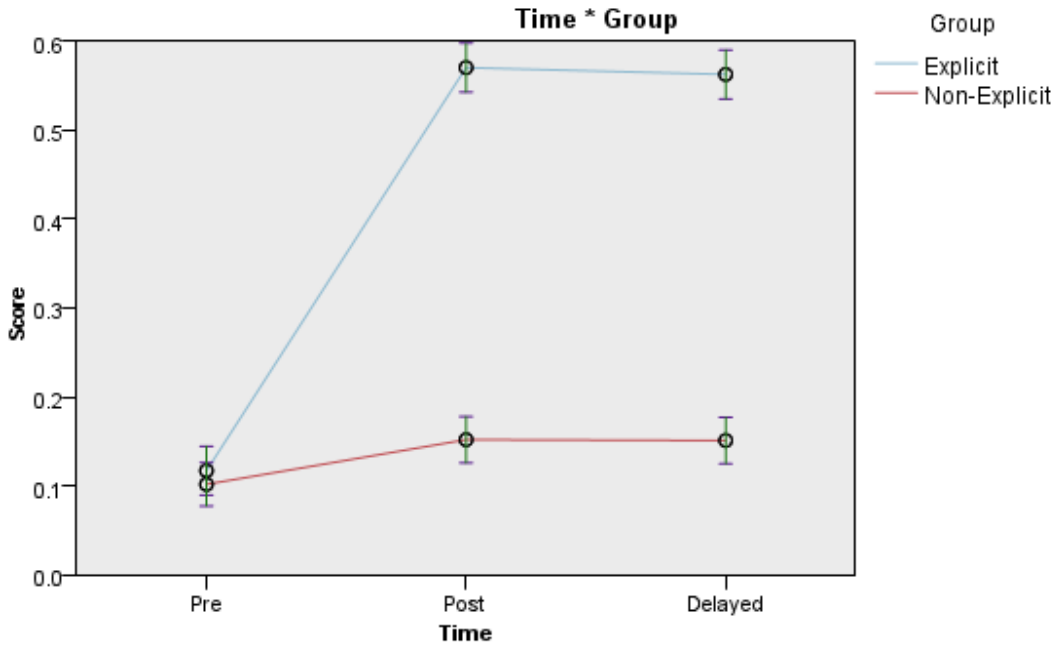


Figure 24. Knowledge of Encountered Cognates from Pre-Test to Delayed-Post-Test

To confirm the effect of TIME, two separate LMMs were run: one using the TRANSLATION ACCURACY in the explicit condition, and one using the TRANSLATION ACCURACY in the non-explicit condition. The model on the explicit condition confirmed that there was a significant effect of TIME F (2, 2,262) = 317.904, p = .001 from pre-test (M = 5/42, SD = .33) to post-test (M = 24/42, SD = .49), with an effect size of d = 1.1 (CI = .38, 1.8), and from pre-test (M = 5/42, SD = .33) to delayed-post-test (M = 23/42, SD = .48), with an effect size of d = 1.0 (CI = .35, 1.7), but not from post-test (M = 24/42, SD = .49) to delayed-post-test (M = 23/42, SD = .48). These results therefore confirm that the instruction the explicit condition received had a significant effect on the acquisition of German cognates. Although the LMM run on the non-explicit condition also found a significant difference in pre-test scores (M = 4/42, SD = .31) compared to post (M = 7/42, SD = .35) and delayed-post-test scores (M = 7/42, SD = .35), the effect sizes were lower than the minimal threshold: from pre-test to post-test (d = .24, CI = -.43, .92), and from pre-test to delayed-post-test (d = .24, CI = -.43, .92), suggesting that the intervention the non-explicit group received had little effect on cognate acquisition. Therefore, on the basis of the significance of GROUP in the omnibus model, and comparisons of effect size in the separate models, it is clear that the explicit condition outperformed the non-explicit condition with respect to TRANSLATION ACCURACY (see Figure 21). The insignificance of LEARNER-L1 in both the explicit F (1, 2,262) = 1.326, p = .250, and non-explicit condition F (1, 2,136) = .030, p = .861 indicates that the learners' L1 had no impact on the effect of the two interventions. Learners with a non-English L1 performed equally as well as learners whose L1 was English. This finding therefore suggests that taking advantage of the historical relationship between English and German when learning cognates is effective in an English-speaking classroom, assuming learners are proficient speakers of English.

Following guidelines on data accountable graphics in Second Language Acquisition research (Larson-Hall, 2017; Loewen & Hui, 2021), a parallel coordinate plot of the mean scores is provided. Each line represents the average mean score of each individual learner from pre-test to delayed-post-test, which clearly shows that while each learner in the explicit condition increased their score over time, this was not true for all learners in the non-explicit condition. A three-dimensional plot of the mean group scores also highlights differences in performance before and after the intervention.

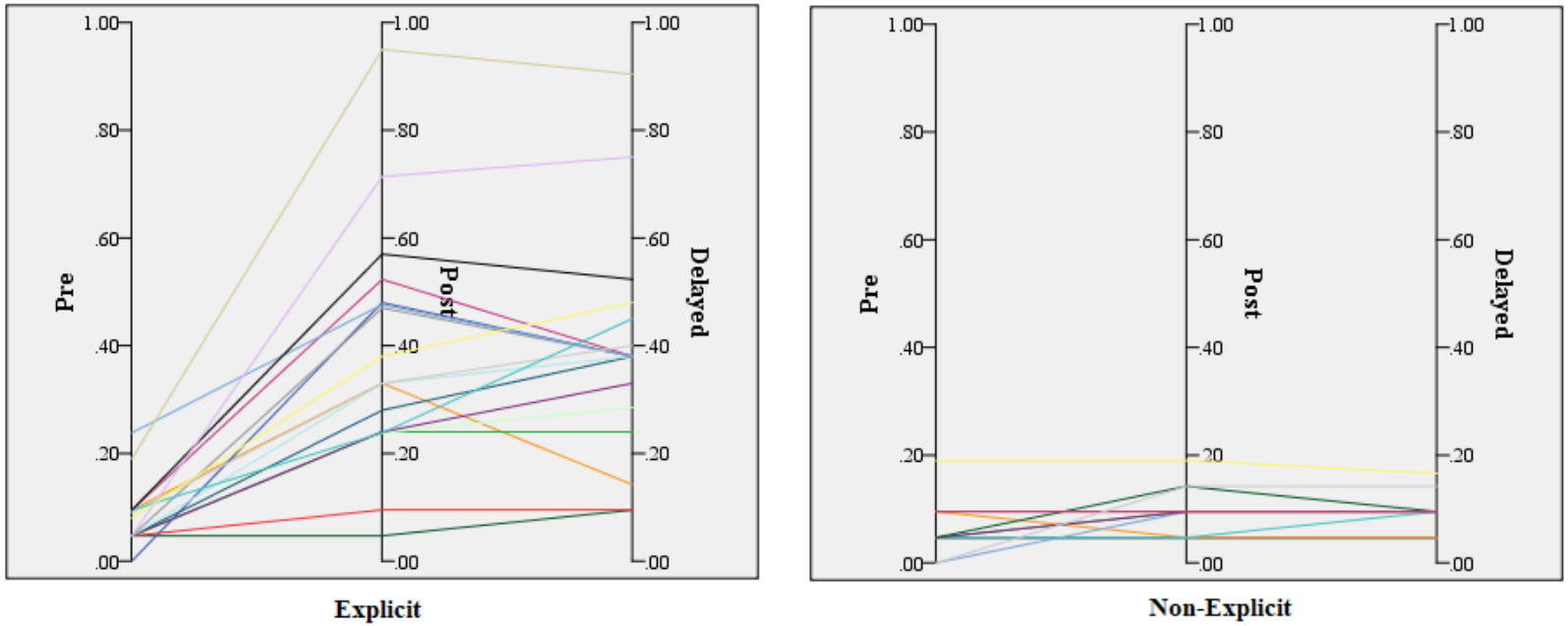


Figure 25. Parallel Coordinate Plot of Mean Vocabulary Scores from Pre-Test to Delayed-Post-Test

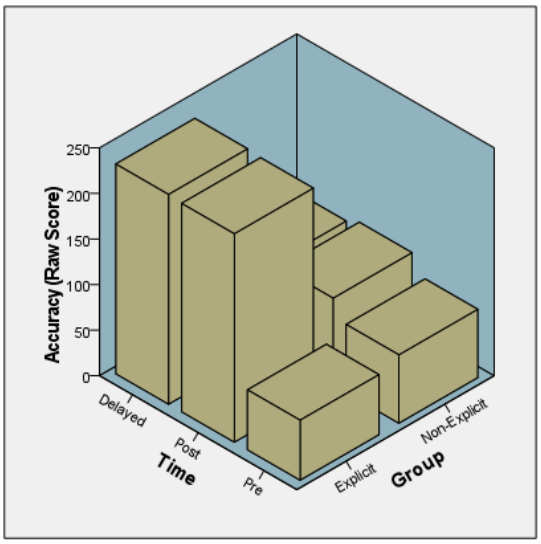


Figure 26. Three-Dimensional Representation of Knowledge of Encountered Cognates from Pre-Test to Delayed-Post-Test

6.2.2 Acquisition of Cognates Affected by Semantic Shifts

To examine the specific effect of receiving historical semantic instruction in the explicit condition, an LMM was run on the translation scores provided for the 21 cognates affected by historical semantic changes. GROUP, TIME, and LEARNER-L1 were run as fixed factors, and TRANSLATION ACCURACY was run as the dependent variable. The model found a significant effect of GROUP F (1, 2,193) = 25.293, p = .001, and TIME F (2, 2,193) = 64.210, p = .001, as well as a significant interaction between the two F (2, 2,193) = 31.441, p = .001. Like in the previous model, LEARNER-L1 was not statistically significant (p = .067). The effect of GROUP was due to significant differences in the TRANSLATION ACCURACY of the cognates affected by semantic changes between the explicit (M = 8/21, SD = .48) and non-explicit condition (M = 4/21, SD = .39), with an effect size of d = .43 (CI = .35, .52), suggesting that the semantic explanations the explicit condition received had a greater effect on the acquisition of German cognates than the task-based activities the non-explicit condition engaged in. As Figure 25 shows, the effect of TIME was due to a significantly higher improvement from pre-test (M = 4/21, SD = .39) to post-test (M = 13/21, SD = .48) in the explicit condition (d = .98, CI = .28, 1.7) versus the improvement from the pre-test (M = 3/21, SD = .36) to post-test (M = 5/21, SD = .41) in the non-explicit condition (d = -.26, CI = -.96, .44). While both conditions improved, the explicit

condition improved by 43 percent from pre-test to post-test, whereas the non-explicit condition improved by only 10 percent from pre-test to post-test.

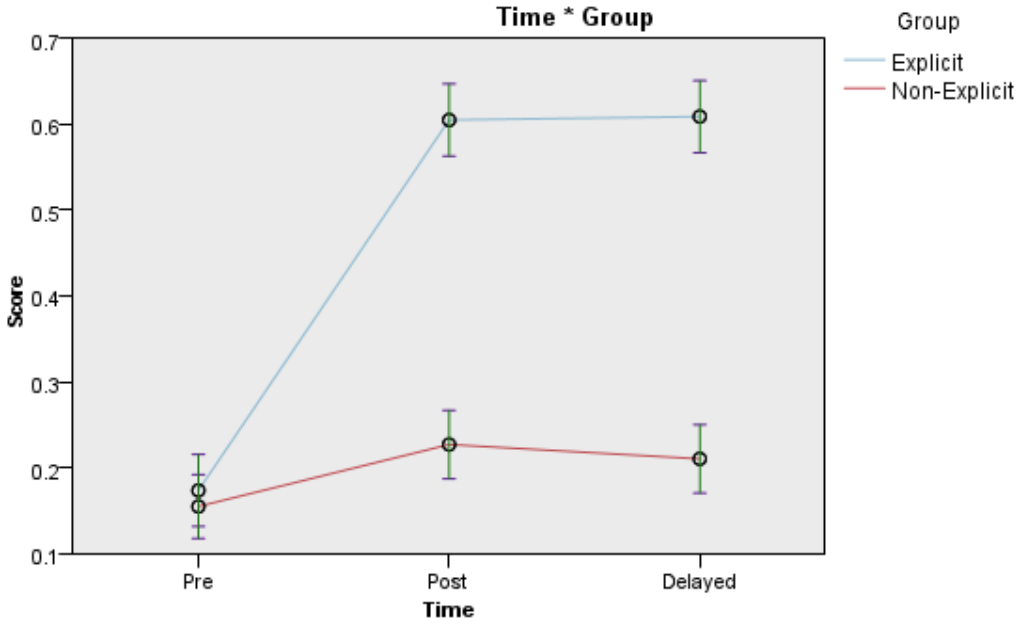


Figure 27. Knowledge of Encountered Cognates Affected by Semantic Changes from Pre-Test to Delayed-Post-Test

Although the explicit condition outperformed the non-explicit condition, both learning conditions made theoretically interesting errors. First, even though the explicit condition improved from post to delayed-post-test, many learners in the delayed-post-test provided only the English cognate as a translation for the German word, as opposed to the modern contemporary translation. For instance, three learners correctly translated *Weib* as 'woman' in the post-test but put only the cognate 'wife' as a translation in the delayed-post-test. Four learners correctly translated *Zaun* as 'fence' in the post-test but wrote 'town' as a translation in the delayed-post-test. These errors reveal that receiving a semantic explanation on the relationship between English-German cognates allowed learners to create an English-German form-meaning link. Even two months after receiving the explicit instruction, the English-German connection was retained. Given that the explicit condition outperformed the non-explicit condition in the acquisition of these cognates, it is clear that associating previous knowledge with novel information can aid L2 vocabulary acquisition.

The second error concerned the non-explicit condition. Based on their translations, it is evident that implicit and/or incidental learning conditions resulted in both over and undergeneralization of word meaning. For instance, by the post-test, four learners wrote 'pet' as a translation of *Tier* 'animal', likely due to the influence of the compound noun *Haustier* 'pet' [*Haus* 'house' + *Tier* 'pet]. Three learners wrote 'mayor' as a translation of *Bürger* 'citizen', likely due to the influence of the compound noun *Bürgermeister* 'mayor' [*Bürger* 'citizen' + *Meister* 'master']. Several different semantically related translations appeared for *Waffe* 'weapon', such as 'sword', 'army', 'military', and 'group'. One learner also translated *Zimmer* 'room' as 'class', likely due to the influence of the compound *Klassenzimmer* 'classroom' [*Klasse* 'class' + *n* + *Zimmer* 'room']. These responses suggest that, under non-explicit learning conditions, learners are not always able to correctly infer word meaning. When learners infer, they may arrive at a meaning which is in the correct semantic field contextually (e.g., *Zunge* 'tongue' translated as 'tooth', and *Bein* 'leg' translated as 'knee' and 'arm'), but their inferred meaning is over or undergeneralized. Moreover, when learners encounter words in compound structures under non-explicit conditions, because of their lack of metalinguistic awareness, they often fail to recognize morpheme boundaries (i.e., *Haustier* = *Haus* + *Tier*) and consequently generalize the meaning of the compound (e.g., *Haustier* 'pet') to the non-compound word form (e.g., *Tier* 'animal' – but erroneously translated as 'pet'). [68]

6.2.3 Acquisition of Cognates Affected by Sound Changes

To examine the effect of the explicit instruction on sound changes, an LMM was run on the TRANSLATION ACCURACY of the 21 cognates affected by diachronic sound changes. These were the cognates that both learning conditions had encountered during their training sessions. The LMM found a significant effect of GROUP F (1, 2,193) = 25.736, p = .001, and TIME F (2, 2,193) = 83.147, p = .001, as well as a significant effect of GROUP × TIME F (2, 2,193) = 68.354, p = .001. LEARNER-L1, however, was not statistically significant (p < .996). As Figure 26 indicates, the effect of GROUP was due to significant differences in TRANSLATION ACCURACY between the non-explicit (M = 1/21, SD = .25) and explicit condition (M = 7/21, SD = .48),

[68] This type of error was observable even with the distraction words. For instance, two learners in the non-explicit condition translated *Fuß* 'foot' as 'ball', likely because they had been exposed to the word *Fußball* in the two of the intervention activities.

suggesting that declarative knowledge of the Second Germanic Sound Shift and Ingvæonic Palatalization had a significantly greater effect than non-explicit learning conditions on the learning of the cognates (*d* = .82, CI = .13, 1.5). According to post-hoc pairwise comparisons, the effect of TIME was due to significant differences in the pre-test (*M* = 1/21, *SD* = .23) when compared to the post (*M* = 7/21, *SD* = .46) and delayed-post-test (*M* = 6/21, *SD* = .45). The significant effect of GROUP × TIME suggests that the learning conditions performed differently over time (Figure 26).

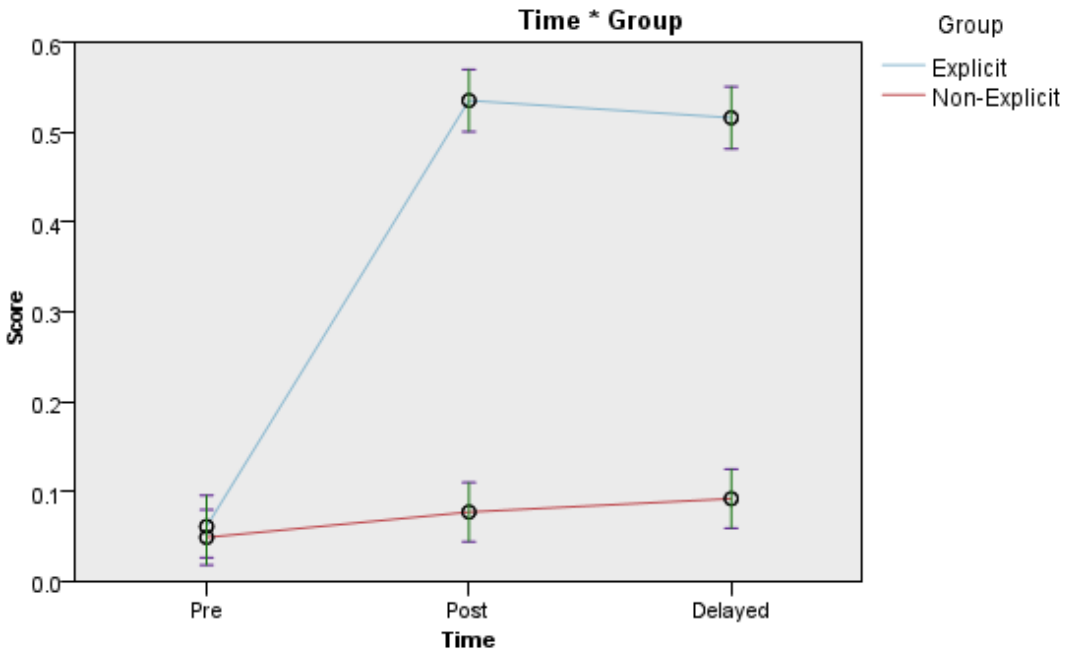


Figure 28. Knowledge of Encountered Cognates Affected by Sounds Changes from Pre-Test to Delayed-Post-Test

Two follow-up models were run to confirm these effects. The first model run on TRANSLATION ACCURACY in the explicit condition found a significant effect of *F* (2, 1,128) = 177.143, *p* = .001. Post-hoc pairwise comparisons indicated that the difference from pre-test (*M* =1/21, *SD* = .25) to post-test (*M* = 11/21, *SD* = .49) was significant (*p* < .001), with an effect size of *d* = 1.2 (CI = .49, 1.9). The difference from pre-test (*M* = 1/21, *SD* = .25) to delayed-post-test (*M* = 10/21, *SD* = .49) was significant (*p* < .001), with an effect size of *d* = 1.1 (CI = .40, 1.8), but the difference in post-test (*M* = 11/21, *SD* = .49) and delayed-post-test (*M* = 10/21, *SD* = .48) was not statistically significant (*p* = .471, *d* = .13, CI = .054, .079). In contrast, the second model on

the non-explicit condition found no significant effect of TIME F (2, 1,065) = 545, p = .580. Therefore, the combined effects of the different LMMs indicate that although both learning conditions acquired the meaning of some German cognates over the course of the 16-week semester, improvement was more gradual in the non-explicit condition than the explicit condition.

6.2.4 Summary: RQ6

RQ6 set out to investigate the effects of explicit historical instruction on the learning of English-German cognates. While both the explicit and non-explicit groups correctly identified the meaning of significantly more cognates after the intervention (as measured by the isolated translation task), the explicit condition significantly outperformed the non-explicit condition. The explicit condition acquired 37 percent of the cognates from pre-test to post-test, whereas the non-explicit condition acquired only 7 percent. The quantitative results therefore confirm that the effects of explicit instruction are more immediate whereas implicit or incidental vocabulary acquisition is a more gradual process. Hypothesis 6 (H6), which predicted that the explicit condition would acquire the meaning of more cognates due to the explicit instruction, is therefore supported. Qualitative results also suggest that implicit or incidental learning lead to a higher probability of over and undergeneralization.

6.3 Acquisition Accuracy of Non-Encountered Cognates

6.3.1 Scores on Prediction

Unlike the previous section which dealt with the acquisition of 42 encountered cognates, this section presents the results for the 21 unencountered cognates, namely those which were not introduced to learners in the intervention they received. To examine differences in PREDICTION ACCURACY between the two conditions, an omnibus model (LMM) was run with the PREDICTION ACCURACY of the 21 unencountered cognates as the dependent variable, with GROUP, TIME, and LEARNER-L1 run as fixed factors. Like in the previous models, LEARNER and WORD were run as random intercepts. All possible interactions were included in the model.

The model found a significant effect of TIME F (2, 2,193) = 15.372, p = .001 and GROUP F (2, 2,193) = 41.890, p = .001, a significant interaction of GROUP × TIME F (2, 2,193) = 18.513,

p = .001, but no significant effect of LEARNER-L1 *F* (2, 2,193) = .010, *p* = .994. The effect of GROUP was due to significant differences in PREDICTION ACCURACY between the non-explicit (*M* = 2/21, *SD* = .29) and explicit condition (*M* = 6/21, *SD* = .50), with an effect size of *d* = .46 (CI = .21, 1.2). Post-hoc pairwise comparisons indicated that the effect of TIME was due to significant differences in PREDICTION ACCURACY in the pre-(*M* = 1/21, *SD* = .25) when compared to the post-test (*M* = 5/21, *SD* = .44), with an effect size of *d* = .53 (CI = .05, 1.1), and the delayed-post-test (*M* = 5/21, *SD* = .43), with an effect size of *d* = .44 (CI = .04, .91). As Figure 27 illustrates, the interaction of GROUP by TIME indicates that the PREDICTION ACCURACY in the explicit condition improved significantly over time.

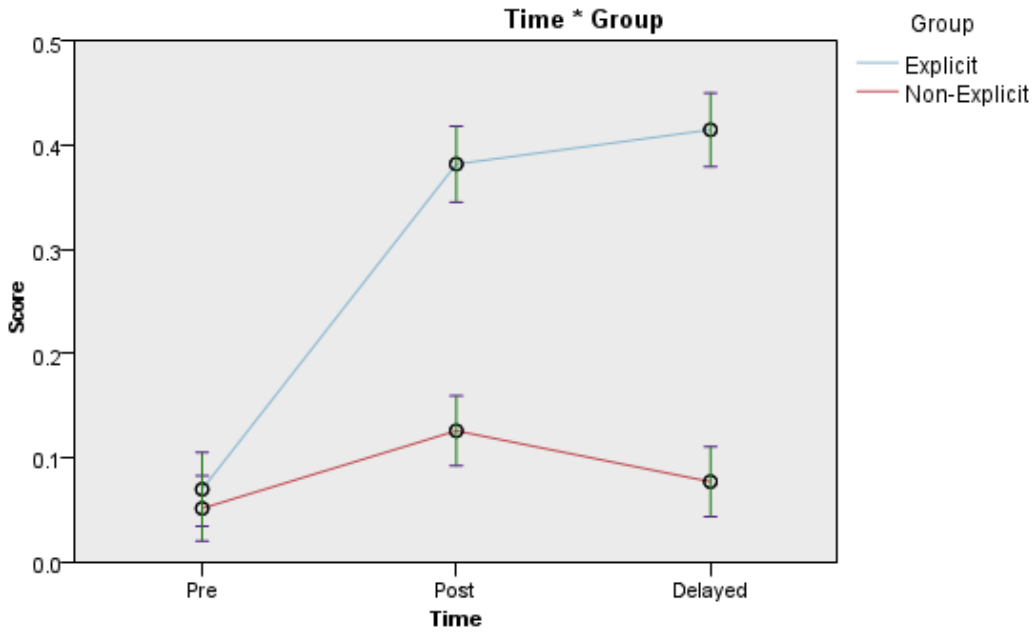


Figure 29. Knowledge of Unencountered Cognates Affected by Sounds Changes from Pre-Test to Delayed-Post-Test

To confirm these results, two separate follow-up models were run on the non-explicit and explicit prediction data. The results confirmed TIME as a significant factor in the explicit *F* (2, 1128) = 71.033, *p* = .001, but not in the non-explicit condition *F* (1, 1,065) = 1.571, *p* = .340, suggesting that the intervention the non-explicit condition received did not have a significant effect on the ability to correctly predict the meaning of English-German cognates, whereas the explicit instruction the explicit condition received did. At the time of the pre-test, the explicit condition

provided a correct L1 translation for an average of only two of the 21 words (*SD* = .26). However, by the post-test, the explicit condition was able to correctly predict the meaning of an average of six additional cognates (*SD* = .49). Although PREDICTION ACCURACY in the explicit condition continued to improve over time, suggesting that the declarative knowledge the condition had obtained remained with them approximately two months after the intervention, post-hoc pairwise comparisons indicated that only the pre-test (*M* = 2/21, *SD* = .26) compared to the post (*M* = 8/21, *SD* = .49) or delayed-post-test (*M* = 8/21, *SD* = .49) was significant. The effect size from pre-test to post-test was *d* = .74 (CI = .06, 1.4). Figure 28 reports the prediction accuracy of cognates in the explicit condition, which indicates that the cognates whose meaning were most frequently correctly predicted were *Pfennig* 'penny', *Nuss* 'nut', *Griff* 'grip/handle', *hüpfen* 'to hop', *kauen* 'to chew', *Apfel* 'apple', and *stampfen* 'to stamp'; the latter two whose meaning were correctly predicted by most learners in both conditions in the pre-test.

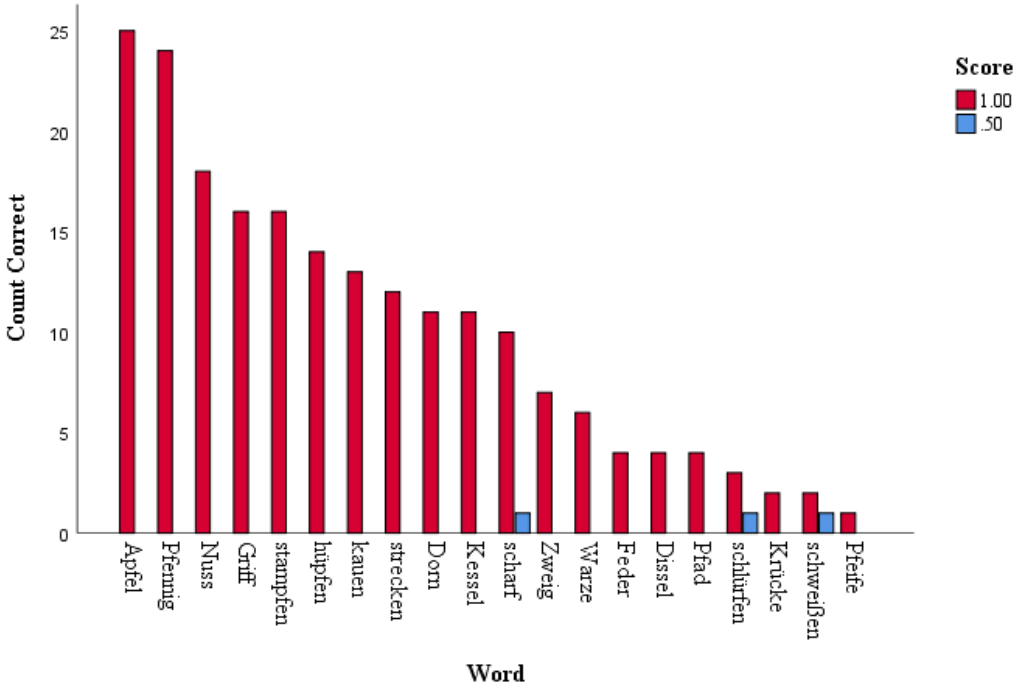


Figure 30. Cognate Meaning Correctly Predicted in the Explicit Condition

While the explicit condition relied upon their newly acquired declarative knowledge to predict the meaning of unencountered cognates, the responses from the non-explicit condition suggest that they were left to erroneously infer the cognate meaning based on the similarity of the

words in English. For instance, in the non-explicit condition, *Kessel* 'kettle' was often translated as 'castle', *schweißen* 'to sweat' was often translated as 'to swipe' or 'switch', and *Dorn* 'thorn' was often translated as 'dorm'. Similar guessing strategies were also present for cognates the non-explicit condition had encountered. For instance, in the non-explicit condition's post-test, *Bürger* 'citizen' was translated as 'burger' by five learners, *offen* 'open' was translated as 'often' by ten learners, and *Kinn* 'chin' was translated as 'family/child/kids' by four learners. In contrast, although two learners in the explicit condition translated *Waffe* as 'waffle' in the pre-test, and seven learners in the explicit condition translated *Krücke* 'crutch' as 'crook' in the pre-test, these incorrect translations were corrected by the post-test. Qualitative evidence also suggests that the non-explicit condition was more sensitive to "synformy" or "synforms" (Laufer, 1988, 1996) than the explicit condition, that is, the similarity of word forms. This was true for both encountered (e.g., *reißen* 'to rip' confused with *reisen* 'to travel', and *Gebet* 'prayer' confused with *Gebiet* 'area') and unencountered cognates (e.g., *Zweig* 'twig' confused with *Zwerg* 'dwarf', *Griff* 'grip/handle' confused with *Giraffe* 'giraffe' and *Angriff* 'attack').

In line with data accountable guidelines (Larson-Hall, 2017), like in Section 6.1, a series of parallel coordinate plots of the means are provided. Figure 29 is a parallel coordinate plot of the mean prediction scores from pre-test to post-test. The bold black line shows a steeper cline for the explicit condition, indicating larger differences in prediction accuracy following the intervention. In contrast, the unidirectional nature of the lines for the non-explicit plot show that while the prediction accuracy improved for some learners, it did not for others. It should also be noted that the scale is smaller for the non-explicit plot, with learners improving by a maximum mean of .15 whereas improvements for some learners in the explicit condition were almost nine times larger. Figure 30 is a profile plot of the mean prediction scores for both learning conditions from pre-test to post-test to delayed-post-test. The higher concentration of black lines in the top left periphery indicates larger success in the explicit condition whereas the higher concentration of red lines in the bottom left periphery indicates a lower mean performance for the non-explicit condition. Finally, a three-dimensional plot of the mean scores is also provided in Figure 31 to highlight differences in performance before and after the intervention.

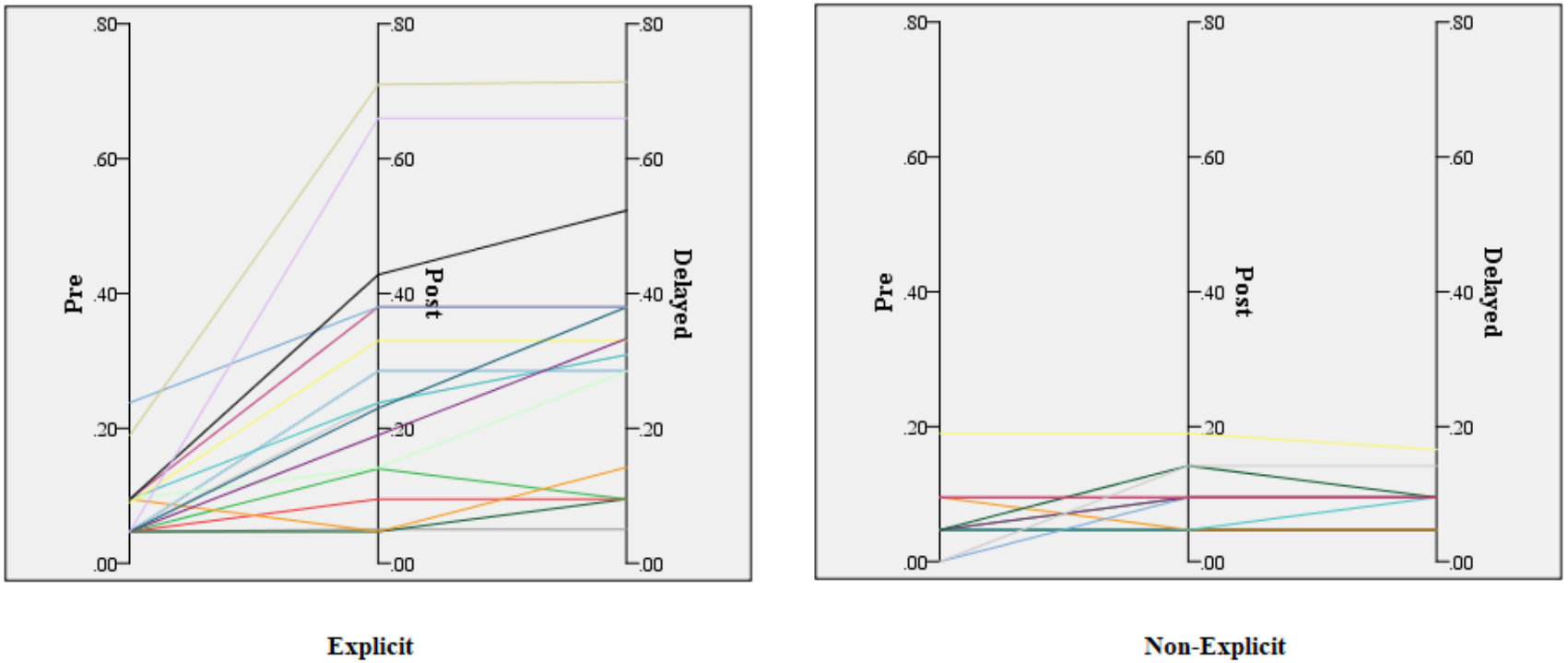


Figure 31. Parallel Coordinate Plot of Mean Prediction Scores from Pre-Test to Delayed-Post-Test

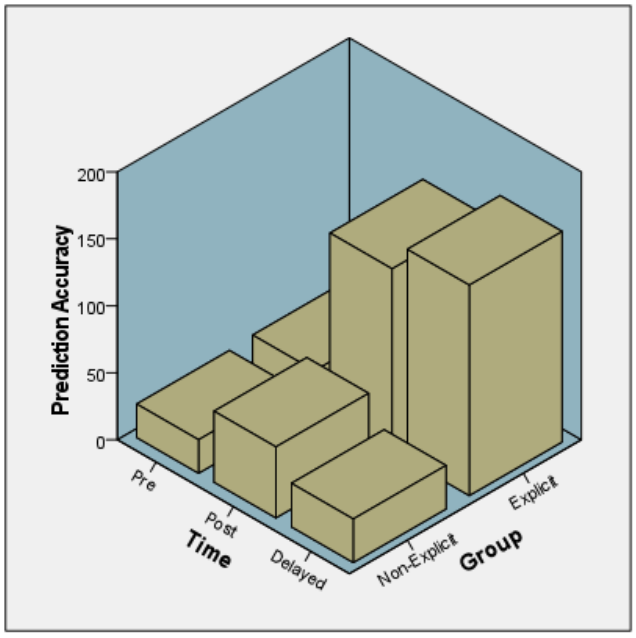


Figure 32. Three-Dimensional Representation of Knowledge of Unencountered Cognates in the Explicit and Non-Explicit Condition from Pre-Test to Delayed-Post-Test

6.3.2 Summary: RQ7

RQ7 set out to investigate whether knowledge of historical linguistics would allow learners to correctly predict the meaning of some cognates they had not encountered before. The descriptive and multivariate analyses show that the explicit group significantly outperformed the non-explicit group in prediction accuracy. As Hypothesis 7 (H7) predicted, the explicit group was likely able to correctly predict the meaning of more cognates they had not encountered before because they had the declarative knowledge of two relevant sound changes (Second Germanic Sound Shift and Ingvæonic Palatalization). There is, however, one caveat. The test which was used to assess learners' vocabulary called upon explicit knowledge. There was therefore a bias toward explicit testing. One learner from the non-explicit condition wrote on their post-test, "I know more of the words, I just can't think of them right now. Maybe if they were used in a sentence, I would remember what they mean". However, it should be noted that the majority of assessments which are used in language tests in North America call upon explicit knowledge, even if the instruction or learning conditions are predominantly non-explicit.

6.4 Exit Survey

After completion of the delayed-post-tests, both learning conditions filled out the Exit Survey. Both learning conditions answered three of the same questions, with one additional question directed only to the explicit condition. The first question asked learners whether they "feel as though" their "vocabulary size has improved throughout the semester". 94 percent (n = 17/18) of the explicit condition answered *yes*, with one learner (6%) responding *yes*, but not significantly. Interestingly, 88 percent (n = 15/17) of the non-explicit condition also responded yes, despite the fact that they had improved by an average of only three words on the isolated translation task throughout the course of the semester versus an average improvement of 15 words in the explicit condition. The second question asked learners if they felt "as though the activities" they completed during the semester significantly helped them learn more words on the vocabulary test. All learners (n = 18/18) in the explicit condition responded *yes*. While 70 percent of the non-explicit condition (n = 12/17) also responded *yes*, their qualitative responses clearly show some doubt or hesitation on the part of the learners. A sample of the responses from the explicit condition appear in (11) and a sample of responses from the non-explicit condition appear in (12). While the explicit condition had only positive things to say about the instruction, the non-explicit condition was less satisfied. The response in (12a) suggests that some non-explicit learners were unsure how the activities related to vocabulary growth, suggesting that they were unable to infer word meaning incidentally or acquire it implicitly. Some learners said the activities were beneficial, but they were not sufficient, and other learners were disappointed that they did not receive explicit definitions.

11) Explicit Responses:
   (a) "Yes, because the letter changes are a very good trick to know. Background information is always nice to know. Everyone wants to know why things are the way they are."
   (b) "I never remember words if we don't talk about them directly. If you take time to explain the meaning of the word and its history, that helps me remember the meaning"
   (c) "The instruction definitely helped me because it allowed me to recognize changes which distinguish English and German"
   (d) "Yes, because of the instruction we received about historical linguistics I was able to dissect some of the words on the tests toward the end of the semester. The explanations we received also helped me keep the meaning in memory"

(e) “I feel my vocab improved over the course of this semester because the activities equipped me with the tools to recognize various parts of words that helped me deepen their meaning”

(f) “Yes, it taught me new ways to connect words to words I already know (like the English equivalents)”

(g) “Yes because we were able to create a connection with the English words which helped me learn vocabulary”

12) Non-explicit Responses:

(a) “Yes, but I feel as though words weren’t a big focus of this semester”

(b) “Yes, it probably helped, but I feel as though just hearing the words in passing isn’t enough”

(c) “Yes, I think the activity we did where we had to explain the word in German without saying the word really helped”

(d) “Yes, the activities helped me short-term, but not long-term. I still don’t know if I know the correct meaning of the words we encountered”

(e) “Yes, I think the instruction brought more of a familiar feeling to the word”

(f) “I’m not entirely sure. We certainly heard these words a lot, but because I focused on the overall meaning of the sentence, I don’t know if I learned their meaning”

(g) “No, because we never received definitions”

(h) “No, in the activities I can work out the meaning, but weeks later I forget them”

The third question asked learners if they preferred communicative language teaching or explicit instruction. 17 percent of the explicit condition (*n* = 3/18) responded in favor of communicative language teaching, 22 percent responded in favor of a combination of the two (*n* = 4/18), and 61 percent (*n* = 11/18) wrote that they preferred explicit instruction. Some sample responses from the explicit condition are provided in (13) and from the non-explicit condition in (14). As for the non-explicit condition, 82 percent (*n* = 14/17) wrote that they preferred communicative language teaching, with only 18 percent (*n* = 3) preferring explicit instruction. The response in (14c) is particularly revealing. The learner reported a preference toward communicative language teaching because they had been made to believe that explicit instruction has no scientific basis. Ironically, the results from ExII show that such an assertion is false. The final question asked the explicit condition if “it is a good idea to include aspects of linguistics (such as Historical Linguistics briefly explained to you during the semester) in lessons when

learning a foreign language". 100 percent responded *yes* (*n* = 18/18). A sample of the responses is provided in (15).

13) Explicit Responses

(a) "I prefer explicit instruction because it gives you definite information as opposed to trying to guess what a word means"

(b) "I prefer explicit instruction. Communicative approach does not work for me at all. There are songs that I listen to in German and I would never understand the meaning if I didn't look the words up"

(c) "I prefer explicit instruction because it gives me a better overall understanding of the language"

(d) "The communicative approach leaves too much room for guessing and therefore opportunities to fall behind. In the past, communicative activities meant dumb activities that increased my anxiety"

(e) "Explicit instruction is helpful because it is straight fact, no guessing"

(f) "I prefer explicit instruction because it is less stressful. If I don't know something, I can think back to the rule and make inferences. Explicit instruction allows for a more complete understanding of the language, rather than words being thrown in my face"

(g) "Explicit instruction first, then communicative approach. If the professor starts teaching in the foreign language straight away, the students will be scared away. Please do not use the foreign language to teach on the first day. This shatters people's confidence"

(h) "I like the communicative approach the best, but I think a combination of the two methods is healthy"

(i) "I prefer explicit instruction but a harmony of the two would be ideal"

14) Non-explicit Responses:

(a) "I believe a communicative approach would be the best course of action"

(b) "Communicative approach is better. I tend to pick up on things better if they are in certain contexts"

(c) "Communicative language teaching is better. I've always been told that explicit instruction has no scientific basis in language teaching since that is not how we acquire language."

(d) "I prefer communicative language instruction because it's more engaging"

15) Linguistics in the Classroom?

(a) “Yes, it certainly has its place in the classroom. Not only does it allow for a better understanding of how languages have evolved, but it also shows how one language differs from another”

(b) “Yes, not only did I find the history interesting, but it helped me learn more vocab”

(c) “Yes because it shows how similar languages are to each other and it provides a way for us to connect knowledge about different languages”

(d) “Yes, learning about a words’ relations makes a huge difference. I have learned more in this semester than any other time before because the historical instruction helps me remember more”

(e) “Yes, definitely! I only wish I had this knowledge before!”

(f) “Yes, by knowing the history and origin of a word, you can associate the word with the definition which helps it stick in your brain”

(g) “Yes, knowing the evolution of the word really helped me remember the word. It breathed fresh air into vocab learning which usually is just plain memorization”

(h) “Yes, languages are always evolving. In my opinion, it is easier to understand the now if we learn about the then. Students can also make connections between their native language”

6.5 Summary

This chapter reported the results from ExII, which addressed two research questions. A summary of the research questions, along with the corresponding hypotheses, are reported in Table 19.

Table 19. Summary of Results (ExII)

Research Question		Hypothesis		Results
RQ6:	Based on an isolated translation task, is there a statistically significant difference between the number of cognates acquired by L2 learners who received explicit historical instruction (explicit condition) and L2 learners who did not receive explicit historical instruction (non-explicit condition)?	H6:	Yes, there will be a significant difference, with the explicit condition significantly outperforming the non-explicit condition.	Hypothesis supported
RQ7:	Based on an isolated translation task, is there a statistically significant difference between the two learning conditions in the number of German cognates L2 learners were able to correctly predict the meaning of? Unlike in RQ6, these are cognates which learners have not encountered in their pedagogical interventions.	H7:	Yes, there will be significant difference, with the explicit condition correctly predicting the meaning of more cognates they had not encountered before relative to the non-explicit condition.	Hypothesis supported

CHAPTER 7. DISCUSSION

7.1 Introduction

In response to a call in the literature for a rigorous empirical testing of different instructional practices, this dissertation examined the effects of explicit instruction on varying aspects of second language acquisition. While many studies have showcased the benefits of explicit instruction, on the basis of previous literature it was unclear whether previous findings were applicable to the acquisition of L2 speech and L2 vocabulary. To address these gaps, this dissertation conducted two experiments, each addressing the effects of explicit instruction on the acquisition of either L2 German speech or L2 German vocabulary. Results from both experiments indicated that the explicit groups significantly outperformed the non-explicit groups. In ExI, the explicit group had significantly greater success with the acquisition of German Final Devoicing (RQ1), German Dorsal Fricative Assimilation (RQ2-RQ3), and L2 perceptual knowledge (RQ4-RQ5) than the implicit group. In ExII, the explicit group was able to identify the meaning of a significantly greater number of cognates than the non-explicit group (RQ6-RQ7). This chapter discusses these results in the context of previous literature and their potential contribution to Instructed Second Language Acquisition, Applied Linguistics, and Language Pedagogy.

7.2 Attention and Metacognitive Awareness

In line with the Skill Acquisition Theory (Dekeyser, 2015), one possible explanation for the significantly higher performance and greater improvement in the two explicit conditions compared to the non-explicit conditions is the access to declarative knowledge. The Skill Acquisition Theory postulates that the skill acquisition process starts with declarative knowledge, which in the context of second language acquisition, is metalinguistic and metacognitive awareness of the L2. Assuming second language acquisition is comparable to skill acquisition, one interpretation of these results is that the explicit instruction provided learners with the opportunity to acquire declarative knowledge, which through practice, resulted in significantly more learning than the non-explicit conditions, as measured on the pre-/post-/delayed-post-tests. While there was also evidence that some learning took place in the non-explicit conditions, in both experiments the speed of acquisition was slower, which supports the hypothesis that declarative knowledge is learned more rapidly than, for instance, procedural knowledge (Ullman, 2013, p. 160).

In ExI, the explicit condition had opportunities to acquire declarative knowledge concerning speech production and underlying phonological rules. Since learners were asked to produce novel speech sounds, the declarative knowledge of voicing and place and manner of articulation may have provided explicit learners with the opportunity to notice the gap between their L1 and their L2 articulatory system. This declarative knowledge may have also provided them with tools to configure their speech apparatus consciously to be able to produce, with a closer approximation, the novel speech sounds. Similarly, because the explicit condition also received explicit instruction on the phonological rules, unlike the implicit condition, the explicit condition had declarative knowledge of the underlying rules which theoretically they had access to in the speech production task, potentially explaining the significant differences in performance.

In ExII, the explicit condition was able to identify the meaning of a significantly greater number of cognates than the non-explicit condition. Since a notable difference between the two learning conditions was the type of instruction, one logical interpretation of this finding is that the declarative knowledge the explicit condition had acquired had a significant effect on the learning of cognates. In line with work on human memory and learning (e.g., Craik & Watkins, 1973; Craik & Tulving, 1975; Craik, 2002), the declarative knowledge of the semantic changes appears to have had a significant effect on the learning of cognates because of the degree of elaboration, a metacognitive strategy which encodes additional features to a memory trace in attempt to make it more memorable and distinctive. In other words, the historical explanations equipped the explicit condition with a method to associate novel L2 cognates with their already existing English lexicon, regardless of whether the learners were L1 speakers of English or not. The explicit instruction the learners in the explicit condition received may have allowed them to engage in deep processing, which has been hypothesized to have a significant effect on long-term memory (Craik & Lockhart, 1972). This hypothesis is supported by the fact that two months after receiving the instruction on semantic changes the English-German connection was retained. The historical explanation may have aided the transfer from short-term to long-term memory since, according to the Involvement Load Hypothesis (Laufer & Hulstijn, 2001), the more involved learners are (in this case, they have historical background about the cognates), the more likely they are to retain word meaning. The declarative knowledge also provided explicit learners with a toolkit to correctly predict the meaning of several cognates they had not previously encountered before. Because procedural memory is thought to attenuate with age (Janacsek et al., 2012; Long, 2017), it is more common

for adult learners to rely on declarative knowledge than procedural knowledge (Robinson, 2013, p. 162), and the declarative knowledge of the historical sound changes likely provided the explicit condition with the opportunity to problem solve when faced with novel words.

Related to the role of declarative knowledge is the role of awareness. It has long been hypothesized that awareness plays a crucial role in second language acquisition (Schmidt, 1990, 1995), with the finding that awareness at the level of understanding correlates with a significant improvement in intake (e.g., Grey et al., 2014; Medina, 2015; Kerz et al., 2017). Awareness at the level of understanding may result in deep processing whereas awareness at the level of noticing, such as the type of noticing instigated by input enhancement (e.g., Lee & Huang, 2008; Winke, 2013), may result in shallow processing. This distinction may have the potential to account for the observed differences in performance between the explicit and non-explicit conditions. Whereas declarative knowledge may have provided the explicit conditions with awareness at the level of understanding, the absence of this knowledge may have contributed to a significantly lower performance in the non-explicit conditions on the post and delayed-post-tests. Responses on the Exit Survey seem to support this hypothesis, with some learners in the non-explicit conditions in both experiments reporting having noticed some of the input during the pedagogical intervention but noticing was insufficient for the conversion of input to intake. Similarly, responses from some of the learners in the non-explicit condition point to a lower level of awareness, with reports of confusion as to how the instruction they received was suppposed to catalyze learning. In the Exit Survey for ExI, some learners in the implicit condition reported that they were unsure how they could improve their pronunciation without receiving explicit instruction on the underlying rules, a finding which is in line with research on lower perceptibility of implicit types of feedback such as recasts (Lyster & Ranta, 1997; Lyster, 2007). Similarly, in ExII, a learner in the non-explicit condition wrote, “I feel as though words weren’t a big focus of this semester”, suggesting, given their lower performance on the vocabulary tests, that non-explicit learners were unable to successfully infer word meaning. Since evidence suggests that when attention is divided, the learning of declarative knowledge can be affected (Foerde et al., 2006), a possible explanation for the higher success of the explicit conditions is the role of attention.

7.3 L2 Speech

Despite the growth in L2 pronunciation research (e.g., Lord, 2005; Saito, 2011; Kissling, 2013; Gordon & Darcy, 2016), there is a clear language bias in the literature, with English and Spanish accounting for around two thirds of the languages examined (Thomson & Derwing, 2015; Levis, 2019). Research on the effects of explicit German pronunciation instruction is underrepresented in L2 pronunciation research, with only a limited number of studies attempting to address the effects of implicit or explicit German pronunciation instruction (e.g., Roccamo, 2015; Peltekov, 2020). Of these studies, there are mixed results, with a number of methodological confounds potentially influencing the outcome of the experiments. To address these gaps, ExI compared the effects of receiving implicit or explicit pronunciation instruction on the acquisition of German Final Devoicing and German Dorsal Fricative Assimilation. An acoustic analysis of learner speech before and after intervention showed that the explicit condition significantly outperformed the implicit condition. Unlike in previous research which relied on impressionistic ratings which can be thought of as subjective, the acoustic analysis confirmed that German explicit pronunciation instruction can have a significant effect on the acquisition of German Final Devoicing and German Dorsal Fricative Assimilation. Learners in the explicit condition also learned to apply their knowledge of the two underlying phonological rules to pseudowords (e.g., *Brob*/*Brobe*), suggesting that acquisition of the rules took place.

There are a number of possible explanations why the explicit pronunciation condition outperformed the implicit condition. Related to the role of declarative knowledge mentioned in Section 7.2, orthography may have interfered in the learning of L2 phonology. Because L2 learners already have a fully developed L1, and they usually encounter the L2 orthographic system before their L2 phonological system has fully developed (Young-Scholten & Langer, 2015, p. 95), learners likely map L2 orthography onto their L1 phonology. When acquiring German Final Devoicing, using the L1 phonological system as a template can be problematic if underlyingly voiced stops are not devoiced word-finally in the L1. According to the Language Background Questionnaire, none of the learners had an L1 in which word-final stops were devoiced, meaning that if learners map German orthography to their L1, they will fail to devoice the stops. This appears to have been the case for the implicit condition which, according to the four acoustic correlates of voicing, did not improve significantly over time. While orthography could have affected the explicit condition too, the effects were much clearer in the implicit condition, likely

because the explicit condition received instruction which may have helped them overcome this interference. In addition to the absence of systematic Final Devoicing in learners' L1, the lack of an overt orthographic distinction between German word-final and non-word-final stops may have obfuscated matters further. Even though the implicit condition received input in which German stops were devoiced during the pedagogical intervention (e.g., *Bild* vs. *Bilder*), the meaning-focused input, plus the opaque orthography, appears to have resulted in a failure to notice this rule, at least at the level of understanding. Although the number of recasts given was not quantified, it appears they were insufficient for the acquisition of the phonological rule to take place.

As for the acquisition of Dorsal Fricative Assimilation, unlike in the explicit condition, there was no significant reduction in the error rate in the implicit condition before and after intervention (e.g., /ç/ erroneously realized as [x] in the wrong environments). Similarly, unlike in the explicit condition, there were no significant differences observed in articulation of the three target fricatives before or after intervention in the implicit condition. On the basis of learners' pronunciation in the production task, it can be concluded that orthography affected the implicit condition's pronunciation. According to my impressionistic analysis, none of the learners in the implicit condition could correctly produce the palatal fricative in the pre-test, post-test, or delayed-post-test. While some implicit learners tried to produce [ʃ] in place of /ç/ (e.g., *ich* [ɪʃ]), suggesting a possible issue with articulation as opposed to phonological representation, some implicit learners produced [t͡ʃ] for German <ch> (e.g., *Sachen* [zat͡ʃn̩]), which is not a possible allophone of /ç/ in German. The use of [t͡ʃ] is a clear indicator of the influence of English orthography.

In addition to the finding that explicit pronunciation instruction can have a positive effect on the acquisition of German L2 phonetics and phonology, the findings from ExI also contribute to the understanding of the amenability of simple versus complex rules to explicit instruction. Early research in second language acquisition (Reber, 1989; R. Ellis, 1990; DeKeyser, 1995) suggested that simple categorical rules, such as those which are generalizable (e.g., add the orthographic <s> for English plurals) are more amenable to explicit instruction than complex rules, such as those which are not generalizable (e.g., *buy* > *bought*, *sing* > *sang*, *fly* > *flew*). Since learners in ExI received instruction on both simple (i.e., Final Devoicing) and complex rules (i.e, Dorsal Fricative Assimilation), it was possible to test this hypothesis. Assuming, of course, that Dorsal Fricative Assimilation can in fact be categorized as a prototypical fuzzy rule, the results suggest that both rules, simple and complex, are amenable to explicit instruction. While there may be a hierarchy in

terms of success, with simple rules being more amenable to explicit instruction than complex rules, this hierarchy may be a consequence of the complexity of the rule as opposed to the adequacy of explicit instruction. One way of testing this hypothesis would be to compare the effects of explicit instruction on the acquisition of Final Devoicing and Dorsal Fricative Assimilation. The average effect size for the effect of explicit instruction on the acquisition of Final Devoicing was .76 (CI = .34, 1.47) versus only .31 (CI = -.39, 1.01) for the changes in the production of the palatal fricative. Effect size comparisons therefore confirm this hypothesis.

Although the focus in ExI was not L2 perception, since previous research suggests that pronunciation training can improve perceptual skills (e.g., Linebaugh & Roche, 2015), two perceptual tasks were included in the experimental design. Results from the perceptual discrimination and identification tasks indicated that although both learning conditions improved their perceptual skills over time, there was a significantly greater improvement in the explicit condition compared to the implicit condition. This finding therefore could provide support for the hypothesis that pronunciation training can improve perceptual skills. From a theoretical standpoint, this finding is also interesting because models such as the Speech Learning Model (Flege, 1995, 1999, 2002) suggest that perception precedes production. However, there is a notable confound. Even though the focus in the explicit intervention was production not perception, one of the training sessions did draw explicit attention to the difference between the palatal and postalveolar fricative. Learners were given an explanation why English-speaking learners of German often substitute the palatal fricative with the postalveolar on the basis of Flege's hypothesis (1995, 1999, 2002). Therefore, even though the explicit condition did not practice perception in the pedagogical intervention, the declarative knowledge explicit learners gained as a result of the explicit instruction may have been sufficient for improvement on the perceptual tasks, suggesting a potential benefit of declarative knowledge in practical tasks. Practicing articulation may have also primed learners to pay more attention or to be more atuned to perceptual differences since, according the Noticing Hypothesis (Schmidt, 1990, 1993, 1995), more noticing means more learning.

7.4 L2 Vocabulary

In the last few decades, L2 vocabulary research has placed great emphasis on incidental vocabulary acquisition. However, learning and teaching vocabulary explicitly may offer a number of

advantages for L2 learners, especially when acquiring a language which is historically related to a learner's L1 or an L2 that learners already speak. Given the historical relationship between Engilsh and German, ExII explored the effects of receiving explicit instruction on relevant historical sound and semantic changes on the learning of English-German cognates. RQ6 investigated whether there was a significant difference in the number of cognates acquired by the two learning conditions, as measured by an isolated translation task. While both learning conditions were able to provide a higher number of correct answers post intervention, the explicit condition significantly outperformed the non-explicit condition in translation accuracy. One logical interpretation of these results is that the historical instruction the explicit condition received had a significant effect on the learning of the cognates due to the degree of elaboration. In other words, the historical explanations provided the explicit condition with a method for associating novel L2 cognates with their already existing English lexicon, regardless of whether the learners were L1 speakers of English or not. The effect of elaborative rehearsal (Craik & Watkins, 1973; Craik & Tulving, 1975) has been demonstrated for decades in work on human memory and learning (Bower & Clark, 1969; Craik & Lockhart, 1972; Hulstijn & Laufer, 2001; Bolger & Zapata, 2011; Kirsch, 2012; Prince, 2012). However, the somewhat novel contribution of the findings from the present study is that historical narratives, such as being cognizant of the etymological association between L1-L2 cognates (specifically English-German cognates), may significantly aid in the vocabulary acquisition process in the L2 classroom. While previous work called for diachronic instruction in the L2 German classroom (Horsford, 1987; Wolff, 1993; Lightfoot, 2007), prior to the present study, no empirical studies had investigated its effect on the learning of German L2 vocabulary. Some studies had been carried out on other language pairings such as English-French (Arteaga & Herschensohn, 1995), but no studies had tested the joint effects of receiving explicit instruction on both sound and semantic changes.

The small effect of cognate acquisition in the non-explicit condition also reaffirmed a number of previous findings. First, incidental vocabulary acquisition, as gradual of a process as it is, is indeed possible. Although the improvements in the non-explicit condition were minimal, the performance on the isolated translation task suggests that learners still managed to infer the meaning of three words, which is in line with previous findings on incidental vocabulary acquisition. However, I am not entirely convinced that the increase in vocabulary size in the non-explicit condition is not attributed to a learning or testing effect since one would expect learning

of some kind to take place after 120 minutes of instruction, and there is a well-documented testing effect (e.g., Roediger & Karpicke, 2006) where testing is known to lead to more learning, and more learner involvement (e.g., Peters et al., 2009). That said, it should also be pointed out that there was likely a testing effect for the explicit condition too since the testing conditions matched the learning conditions, a factor which has been shown to have a significant effect on learning (e.g., Goddon & Baddeley 1975; Weingartner et al., 1976; McDaniel et al., 1989).

A second finding confirmed by the results from the non-explicit condition was the prevalence of inference errors in incidental vocabulary learning (Hulstijn, 1992; Carpenter et al., 2012). While it was clear from the translations on the vocabulary tasks that the non-explicit condition made attempts to infer word meaning, their inferences often resulted in over and undergeneralization. This was particularly prominent with compound nouns where a lack of metalinguistic awareness of morpheme boundaries appears to have resulted in incorrect generalizations (e.g, *Tier* 'animal' erroneously translated as 'pet' due to *Haustier* 'pet' [*Haus* 'house' + *Tier* 'pet']). After all, metalinguistic awareness is thought to account for individual differences in incidental vocabulary acquisition (Nagy, 2007). The non-explicit learning condition was also more sensitive to confusion of "synforms" (Laufer, 1988, 1996), confusing words which look alike (e.g., *Gebet* 'prayer' confused with *Gebiet* 'area', *Zweig* 'twig' confused with *Zwerg* 'dwarf), which may be a consequence of meaning-focused instruction in general. Interestingly, however, many incorrect translations provided by the explicit condition in the pre-test (e.g., *Krücke* 'crutch' translated as 'crook') were not repeated by the post-test. In contrast, errors in the non-explicit group (e.g., *Bürger* 'citizen' was translated as 'burger') were repeated across all three tests. This finding is in line with research which suggests that incorrect inferences are repeated unless corrected (e.g., Carpenter et al., 2012).

RQ7 set out to examine the effect of the historical instruction on the ability to correctly predict the meaning of cognates. As was hypothesized, the explicit condition significantly outperformed the non-explicit condition, most likely due to the acquired declarative knowledge of the historical sound changes. The effect of the declarative knowledge of the sound changes on the ability to correctly predict the meaning of unencountered cognates was supported by learner responses in a debrief questionnaire. Seventeen of the 18 learners in the explicit condition wrote that their newly acquired declarative knowledge helped them to recognize more cognates. Even if learners had somehow encountered the "unencountered" cognates outside of the classroom, the

probability of encountering these words was the same in both learning conditions, yet the non-explicit condition performed significantly worse. Since the 21 "unencountered" target cognates were affected by either Ingvæonic Palatalization or the Second Germanic Sound Shift, in many cases, learners in the explicit condition were able to use this knowledge to deduce their meanings. Because acquiring a language is more than just imitation, repetition, and rote-memorization of input, it seems only reasonable to provide L2 learners with a toolkit, when available, to allow them to correctly infer meaning themselves. Work on reading shows that outside knowledge is crucial in L2 reading comprehension (e.g., Anderson, 2004), and the results from this dissertation show that similar outside knowledge (i.e., knowledge of the history of the language) can be just as effective in L2 vocabulary acquisition.

7.5 Limitations and Shortcomings

While this dissertation addressed a range of different questions, as with any study, there are a number of limitations which need to be acknowledged. First, even though the results from the experiments indicate higher performance and improvement in the explicit conditions than the non-explicit conditions, it is important to acknowledge that there was a bias toward explicit testing. While the non-explicit condition was encouraged to acquire cognate meaning under implicit or incidental learning conditions, they were asked to call upon declarative knowledge for the assessments. Since research has shown that assessments which match the learning conditions exhibit higher performance (e.g., Baddeley, 1990, pp. 268–270), and the general assumption is that, at least in the initial stages of acquisition, implicit instruction leads to implicit knowledge (Rebuschat, 2013), testing the implicit learners in solely explicit meanings is a drawback of the experimental design. In general, it is assumed that declarative memory underlies conscious learning whereas procedural memory underlies non-conscious learning (Robinson, 2013, p. 160). If this is the case, then it makes sense that explicit conditions would outperform non-explicit conditions because the learning conditions match the testing conditions. However, that said, it is also important to acknowledge that the majority of assessments used in the North American L2 classroom call upon explicit knowledge, even if the instruction or learning conditions are predominantly implicit (Schmitt, 2010, p. 144).

Second, related to the bias toward explicit testing is the relevance and comparability of the activities included in the learning conditions. Although both learning conditions received the same

amount of time (i.e., twenty-minute training sessions, six times), it should be acknowledged that some of the activities in the non-explicit condition were not always as directly related to L2 speech or L2 vocabulary as the activities in the explicit condition. For instance, session 5 of the non-explicit training sessions in ExI and ExII was spent doing a speed dating activity. While the activity certainly gave students several opportunities to negotiate meaning and practice communication skills, the activity was not particularly relevant. The intention was to give students as many opportunities as possible to receive input, produce output, and gain feedback in the form of recasts, but the execution was always ideal. Moreover, at times, the non-explicit learning condition became an incidental learning condition, especially in ExII.[69]

Third, even though the explicit conditions outperformed the non-explicit conditions, the language of instruction could have been a confounding factor. Given the nature of explicit instruction (e.g., explicit instruction on the articulatory system and sound change), the twenty-minute training sessions were carried out in English in the explicit conditions. Since all speakers had higher proficiencies in English than German, having the explicit instruction in English may have given the explicit condition an unfair advantage. The question of including the L1 of students in the language classroom is not an uncontroversial one. Although CLT does not have to be monolingual (Spada, 2007), teachers who advocate CLT have a tendency to teach predominantly in the target language (p. 280). While the initial goal of CLT was not to completely remove explicit instruction, "there are still many L2 instructors who firmly believe that an exclusive focus on meaning via comprehensible input and interaction activities is sufficient for second/foreign language learning to succeed" (Spada, 2007, p. 275–276). One argument for its exclusion is the maximum exposure hypothesis (Cummins & Swain, 1986) since explicit instruction often requires the use of metalanguage and thus the use of the L1, which minimizes exposure to the L2. While it is clear that sufficient input of the target language is necessary, including the L1 in the L2 classroom is thought to aid cognitive processing (Hall, 2002), whereas excluding the L1 may deny learners the opportunity to utilize their L1 metalinguistic knowledge. Moreover, according to the responses in the Exit Survey, the use of English in the explicit conditions was well received (88 %), with some reporting that it helped them avoid crosslinguistic transfer as it allowed them to notice differences between English and German. Nevertheless, the language of instruction is a confounding factor which needs to be acknowledged when interpreting the results.

[69] In follow-up journal articles on ExII, this distinction will be made clearer.

Fourth, related to the second point, the results from this dissertation should be contextualized within the bounds of the used sample size. Although the sample size was in line with the average size used in classroom-based SLA studies (Plonsky, 2013), as Loewen & Hui (2021) point out, a sample size of 19 or lower for each learning condition is insufficient to make strong claims about the broader efficacy of a given type of instruction. Although the reported mean differences, individual differences, statistical significance differences, and effect size measures from the present study point toward the potential benefits of explicit historical instruction when acquiring a language which is historically related to a language which learners are familiar with, the broad range for the reported confidence intervals supports Loewen & Hui's (2021) observation about small sample sizes. If a larger sample size had been used and the same differences between groups were found, the confidence intervals would have been tighter and thus more reliable, which would have put more confidence in the generalizability of the study's findings to the L2 classroom. At this stage, it is clear that further follow-up studies with larger sample sizes are necessary to confirm the broader generalizability of these findings. Naturally, the small sample size used was a natural by-product of carrying out this study in a classroom-based setting, which, according to the ACTFL guidelines (American Council of the Teaching of Foreign Languages, 2012, p. 5), should not exceed a 15:1 student-teacher ratio. However, Loewen & Hui (2021) suggest a number of ways, such as multi-cite research collaboration, which instructed L2 acquisition researchers can use to deal with low sample size constraints without affecting the student-teacher ratio. Nevertheless, the findings from the present study point to potential benefits of the use of applied linguistic instruction in the L2 classroom, be it in the form of phonetics, phonology, or historical linguistics, and hopes to have laid the foundation and paved the way for future research into scientific inquiry of this kind, especially in the context of Instructed Second Language Vocabulary Acquisition. While the benefits of short bursts of explicit pronunciation instruction on L2 speech are not unheard of, the empirical effects of applied historical instruction have not been explored widely in L2 vocabulary research or L2 research more generally.

7.6 Summary of Findings and Implications

In the interest of making multi-purpose dissertations of this kind accessible to a range of audiences, a summary of the major findings from this dissertation is provided in Table 18.

Table 20. Summary of Major Findings

No.	Findings
	L2 speech
1.	The **explicit** learning condition significantly **outperformed** the implicit learning condition in the acquisition of **German Final Devoicing**
2.	The **explicit** learning condition significantly **outperformed** the implicit learning condition in the acquisition of **Dorsal Fricative Assimilation**
3.	The **explicit** learning condition significantly **outperformed** the implicit learning condition in L2 **perceptual knowledge**
4.	Comparisons of **acoustic analyses** of learner speech production before and after intervention indicated that **explicit German pronunciation instruction** had a **significant** effect on German articulation. Previous literature was unable to determine this on the basis of impressionistic analyses.
5.	**German L2 orthography** appears to have interfered with **German L2 phonology**
6.	Potential **support** for the **hypothesis** that **pronunciation training can aid perceptual growth**
7.	**Declarative knowledge** appears to have **provided** learners with a **toolkit** to learn to **produce novel speech** sounds with a closer approximation than with not having such declarative knowledge
	L2 vocabulary
8.	The **explicit** learning condition significantly **outperformed** the non-explicit learning condition in the identification of English-German **cognates**
9.	**Declarative knowledge** of **semantic changes** had a significant and positive effect on memory and the **acquisition of cognates**
10.	**Declarative knowledge** of **historical sound changes** enhanced learners ability to **correctly predict** the meaning of (to them) unknown cognates
11.	**Degree of elaboration** appears to have had a significant effect on memory and learning

Table 20 continued

12.	Learner **L1** did **not** have a significant **effect** on the success of explicit **instruction,** suggesting that as long as learners are competent in English, the historical relationship between English and German can be drawn upon when teaching L2 German cognates
13.	**Vocabulary** learning under implicit or incidental learning conditions was **slow** and **gradual**
14.	Qualitative **evidence** suggests that the **non-explicit condition** was **more sensitive** to "synformy" or "synforms" and **over** and **undergeneralization of meaning**
15.	Evidence suggests that **applied historical linguistics** can be **beneficial** when learning a language (e.g., German) which is historically related to a language students already speak (e.g., English)
	SLA and Learning
16.	Some empirical support for the Noticing Hypothesis. Evidence that **attention** plays an **important role** in Instructed Second Language Acquisition.
17.	Some evidence in support of the **Skill Acquisition Theory**

CHAPTER 8. CONCLUSION

The question of whether second languages are best learned implicitly or explicitly has been a topic of much empirical debate. Since the majority of previous studies had focused on the acquisition of L2 grammar rules, this dissertation tested the effects of explicit learning conditions on L2 speech and L2 vocabulary. Findings from the two experiments indicate that the explicit conditions significantly outperformed the non-explicit conditions, suggesting that learners, specifically those enrolled in university language courses, benefit from explicit learning or explicit instruction. The results are consistent with previous findings which have pointed to the benefits of explicit learning and explicit instruction (Norris & Ortega, 2001; Spada & Tomita, 2010; Goo et al., 2015; Kang et al., 2019). While some learning took place in the non-explicit groups, learning was much slower, and unlike in the explicit groups, differences between pre and post-tests were not always significant. Several explanations may account for these differences in performance, such as the role of attention, metacognitive awareness, and declarative knowledge.

According to the Skill Acquisition Theory (DeKeyser, 2015), skill acquisition starts with declarative knowledge, and since this is the initial product of explicit instruction, this may explain why learners in the explicit groups faired better on the post and delayed-post-tests than learners in the non-explicit groups. While languages can be learned implicitly, it has been argued that the capacity for implicit learning may attenuate with age (Janacsek et al., 2012; Long, 2017), meaning it is more common for adult learners to rely on declarative knowledge than procedural knowledge (Robinson, 2013, p. 162). In contrast, explicit learning seems to be possible at most ages (Bialystok, 1994, p. 566). Bley-Vroman (2009) even proposed that the implicit learning mechanisms available for L1 acquisition may no longer be adequate for L2 acquisition. Since all learners in the two experiments were university students over the age of eighteen, it seems reasonable that the access to declarative knowledge was a decisive factor in their performance. Many students in the Exit Survey also reported the expectation of declarative knowledge as a function of higher education classes, and learners in the non-explicit condition were disappointed when they did not receive explicit information about the underlying rules, suggesting the importance of explicit learning and instruction in university-level language courses.

As for the role of attention, it has long been postulated that awareness plays a crucial role in second language acquisition, with awareness at the level of understanding often correlating with larger learning gains (e.g., Kerz et al., 2017). The Involvement Hypothesis (Laufer & Hulstijn,

2001) also suggests that the more involved learners are, the higher the likelihood that learning will take place. Since the explicit conditions drew explicit attention to form, be it through instruction on speech production, underlying phonological rules, or historical changes affecting vocabulary, it is appropiate to hypothesize that this type of instruction created higher levels of awareness for learners in the explicit conditions. In contrast, under implicit conditions, learners appear to have relied heavily on their L1 phonological system and fell victim to over and undergeneralization of meaning when learning vocabulary. While there are certainly shortcomings and factors which may have confounded comparisons of the two learning conditions, on the basis of the positive results yielded, it is reasonable to assert that second language learners at the university level (or at least the population tested in this dissertation) can benefit from explicit instruction, pointing towards the important role of metacognitive awareness in adult second language acquisition.

While testing the effects of explicit German pronunciation instruction was not unique to this dissertation, the effects of knowledge of historical linguistics when learning German vocabulary was. Although several scholars have called for explicit diachronic instruction in the L2 German classroom, no studies had tested its effects empirically on the acquisition or learning of L2 German vocabulary. The positive effects observed in this dissertation may suggest that historical linguistics deserves a place, when relevant, in the L2 classroom, at least when learning a language which is historically related to a language that the learners already speak. This would add a new dimension to the term "applied historical linguistics", with applications to the L2 classroom. If integrated appropriately and explained in terms which non-linguists can understand, speakers of English and/or other Germanic languages may have an advantage when learning a historically related language. While the focus in this dissertation was on English-speaking L2 learners of German, it is likely this type of instruction would be just as valuable for German-speaking L2 learners of English. Similarly, it is possible that English-speaking L2 learners of other Germanic languages (e.g., Norwegian) could also benefit from similar types of instruction. One could also speculate that knowledge of the First Germanic Sound Shift (as opposed to the Second Germanic Sound Shift) could be beneficial for learners of other Indo-European languages too (e.g., Spanish, Russian). However, naturally, future studies would need to test this claim empirically. There are also two caveats which should be acknowledged. The first is the assumption that instructors are equipped to provide this type of explicit information to students. In reality, like with giving explicit instruction on speech production (Darcy, 2018), instructors are rarely well equipped

to include this information. The second caveat is that this type of pedagogical approach may be more suitable for certain types of learners, namely those who are more analytic or have better phonemic coding capacities. Therefore, additional studies with larger sample sizes and various kinds of learners are necessary to determine the generalizability of these results.

In my view, one of the most remarkable findings which arose from this dissertation was the effect of the historical instruction on the ability to correctly predict the meaning of cognates that students had not received instruction on. This finding suggests that declarative knowledge of relevant historical changes may be a useful toolkit for students in extending their vocabulary size, which again, may point towards the benefits of including such historical instruction in the L2 classroom. While the content and goals of a course on historical linguistics are clearly different to the goals of a German or other language course, this dissertation showed that short, but relevant historical tidbits (e.g., *sterben* is related to English *starve*), can provide students with memory techniques that allow them to create a connection between a novel stimulus (i.e., the L2 item) and information already stored in their long-term memory (i.e., the corresponding English cognate). Non-native speakers of English benefited from the historical instruction just as much as native speakers, suggesting that instruction of this kind may be applicable to L2-L3 historically-related pairings too. By way of example, none of the learners in the explicit condition failed to remember the meaning of *sterben* after receiving information on its association with *starve*, while few in the non-explicit condition were able to correctly infer this meaning by the post or delayed-post-test.

In conclusion, the results from this dissertation point towards the overall benefits of explicit learning and instruction in adult or university-level second language acquisition courses. The purpose of this dissertation was not to downplay the role of implicit or incidental learning, but rather, in line with (Derwing & Munro, 2015), simply test the empirical validity of different instructional practices. Instructional practices may be inconsequential for instructors, but life-changing for students, especially if one type of instruction leads to superior learning over others. While both implicit and explicit learning is valuable, the results from the two experimental studies in this dissertation highlighted the benefits of explicit learning and explicit instruction. In short, the empirical evidence suggests that, despite being downplayed in several CLT classrooms in North America for the last few decades, explicit learning and instruction have an important place in university-level language practices.

APPENDIX A. BACKGROUND QUESTIONNAIRE

Name _____

Age _____

Sex _____

Native Language(s) _____

How long have you learned German for? _____

Where did you learn German? High school, at university, or both?

_____

_____

Had your previous German instructor spent time in a German speaking country? If so, which?

_____

_____

Have you ever spent time in a German speaking country? If so, which and for how long?

_____

_____

Do you have knowledge of a language other than English? If so, which, and how many years have you learned or spoken it for?

_____

_____

_____

APPENDIX B. SIGN-UP SHEET

Office Hour Appointment (James Stratton) – Pronunciation

We will meet in Stanley Coulter, 220 (SLC Resource Center)

Tuesday

12:00	
12:10	
12:20	
12:30	
12:40	
12:50	
1:00	
1:20	
1:30	
1:40	
1:50	
2:00	
2:10	
2:20	
2:30	

Thursday

12:00	
12:10	
12:20	
12:30	
12:40	
12:50	
1:00	
1:20	
1:30	
1:40	
1:50	

APPENDIX C. DISCRIMINATION TASK RESPONSE SHEET

Name _____ Section Time _____

1.	29.	57.
2.	30.	58.
3.	31.	59.
4.	32.	60.
5.	33.	61.
6.	34.	62.
7.	35.	
8.	36.	
9.	37.	
10.	38.	
11.	39.	
12.	40.	
13.	41.	
14.	42.	
15.	43.	
16.	44.	
17.	45.	
18.	46.	
19.	47.	
20.	48.	
21.	49.	
22.	50.	
23	51.	
24.	52.	
25.	53.	
26.	54.	
27.	55.	
28.	56.	

APPENDIX D. IDENTIFICATION TASK RESPONSE SHEET

1.	gute	Güte	23.	Löcher	Löscher
2.	Wüste	wüsste	24.	cool	kühl
3.	Herrchen	Herrschen	25.	Herrschen	Herrschen
4.	Mutter	Mütter	26.	wusste	Wüste
5.	kluger	klüger	27.	Uber	über
6.	rassig	rassisch	28.	musste	müsste
7.	musste	müsste	29.	gute	Güte
8.	Kirche	Kirsche	30.	wusste	Wüste
9.	wusste	wüsste	31.	Kirche	Kirsche
10.	cool	kühl	32.	kluger	klüger
11.	Löcher	Löscher	33.	Herrchen	Herrschen
12.	Busche	Büsche	34.	wusste	wüsste
13.	rassig	rassisch	35.	Uber	über
14.	Uber	über	36.	gute	Güte
15.	gute	Güte	37.	Kirche	Kirsche
16.	musste	müsste	38.	Mutter	Mütter
17.	Kirche	Kirsche	39.	rassig	rassisch
18.	cool	kühl	40.	kluger	klüger
19.	rassig	rassisch	41.	Löcher	Löscher
20.	Busche	Büsche	42.	Mutter	Mütter
21.	wusste	Wüsste	43.	Kirche	Kirsche
22.	kluger	klüger	44.	cool	kühl

45. Busche	Büsche
46. musste	müsste
47. Herrchen	herrschen
48. gute	Güte
49. Mutter	Mütter
50. kluger	klüger
51. Wüste	wüsste
52. Uber	über
53. Kirche	Kirsche
54. Busche	Büsche
55. wusste	wüsste
56. cool	kühl
57. Busche	Büsche
58. Löcher	Löscher
59. musste	müsste
60. Herrchen	Herrschen
61. gute	Güte
62. Wüste	wüsste
63. musste	müsste
64. rassig	rassisch
65. Wüste	wüsste
66. Uber	über
67. wusste	wüsste
68. Löcher	Löscher
69. Uber	über
70. Mutter	Mütter
71. cool	kühl
72. Busche	Büsche
73. kluger	klüger
74. rassig	rassisch
75. Löcher	Löscher
76. Mutter	Mütter
73. wusste	wüsste

APPENDIX E. SAMPLE PRONUNCIATION ACTIVITY

1) Pronounce the following words

Langes u /u:/	**Langes ü** /y/
Bruder	Brüder
Gut	Über
Blut	Lüge
Super	Fühlen
Hut	Kühl
Fuß	Füße

Kurzes u /ʊ/	**Kurzes ü** /ʏ/
Mutter	Mütter
der Kuss	küssen
Kunst	die Künste
Busch	Büsche
Ich muss	wir müssen

2) Complete the following *ich-ach* activity

- ‘ch’ is pronounced as /ç/ after ‘front vowels’ such as <i> <e> <ö> <ä> <ü> and when the word starts with <ch>
- ‘ch’ is pronounced as /x/ after ‘back vowels’ such as <a> <o> <u>

Examples:

ich möchte	ich mochte
Echt	ach
Chemie	machen
Chemnitz	Sachen

Order the following words and put them into the correct table depending on the pronunciation of the ‘ch’ sound:

Buch, buchen, Bücher, Sache, mochte, möchte, Sprache,

sprechen, Chemikalien, Chemie, Machen, China, Spruch, Sprüche

Chöl, dach, dächer

ç (the cat sounding ‘hissing’ noise)	x (the guttural sound)

3) Auslautsverhärtung

Remember when b, d, g are at the end of the word they are devoiced and pronounced like p, t, k

- Order the following words and put them into the correct table depending on the pronunciation

Hund, Hunde, Band, Bände, Tag, Tage, ob, obwohl, der Weg

sagen, sag mir! Mag, mögen, Hemd, Hemde

Pronounced like b, d, g	Pronounced like p, t, k

4) Context (Putting Everything in Practice)

ich sehe einen Hund. Ich sehe keine Hunde

ich habe ein Hemd. Ich habe keine Hemde

das Kind ist freundlich

ich komme aus England

das Dach > die Dächer

das Geld in dem Feld ist gelb

Echt?

Ist das echt?

Ich komme aus China

Ich komme aus Deutschland

der Krieg > die Kriege

Lob ihn!

ich fahre gern mit dem Rad

APPENDIX F. ETHICAL DILEMMA ACTIVITY

German Script:

Das hier ist ein Land und es heißt [...Name]. In der Mitte des Landes gibt es einen Fluss. Wisst ihr was ein Fluss ist? Was ist ein Fluss? In dem Fluss leben Krokodile. Also, es ist zu gefährlich in dem Fluss zu schwimmen, aber es gibt eine Brücke. Im Süden wohnt eine Frau, die Sarah heißt und sie ist mit Johann verheiratet, aber Johann wohnt im Norden. Sie haben ein Kind zusammen und das Kind wohnt auch im Norden. Sarah wohnt im Süden, weil sie da arbietet aber am Wochenende geht sie über die Brücke und sie besucht Johann. Eines Tages gibt es einen großen Sturm und die Brücke wird zerstört. Die Brücke ist kaputt – nicht mehr da! Sarah weiß nicht was sie tun soll, weil sie zu Johann und ihr Kind gehen will. Sie will nach Hause gehen. Also geht sie zu Wolfgang. Er hat ein Boot. Wolfgang sagt ihr, „ich bringe dich über den Fluss aber du musst mit mir schlafen". Sarah weiß nicht, was sie tun soll. Sie will nicht mit Wolfgang schlafen aber sie will nach Hause gehen. Also geht sie zu ihrer Mutter und fragt sie was sie tun soll. Die Mutter sagt „ich habe zu viel Stress im Moment. Lass mich allein". Sarah weiß nicht, was sie tun soll also schläft sie mit Wolfgang und Wolfgang bringt sie über den Fluss. Sarah geht zu Johann und erklärt ihm alles was passiert ist. Johann wird sehr böse (*böse* bedeutet ‚angry') und schreit Sarah an. Sarah rennt weg und in die Kneipe. Sie erklärt alles einem Mann, der Sebastian heißt. Sebastian wird sehr böse und geht zu dem Haus von Johann und schlägt ihn. Johann muss jetzt ins Krankenhaus gehen. Meine Frage an euch ist „wer ist schuldig?"? Jemand muss ins Gefängnis gehen und ihr musst euch entscheiden wer das sein soll.

English translation:

This here is a land called […Name]. In the middle of the land there's a river. Do you know what a river (*Fluss*) is? What is a *Fluss*? In the river are crocodiles. So it's too dangerous to swim in the river but there is a bridge. In the south of the land lives a woman called Sarah and she's married to Johann, but Johann lives in the north. They have a child together and the child lives in the north with Johann. Sarah lives in the south because she works there but at the weekend she goes over the bridge to the north of the land to visit her family. One day, there's a big storm and the bridge is destroyed. The bridge is broken so it's no longer there. Sarah doesn't know what she should do because she wants to get to her husband and child. She wants to get home. So, she goes to see a guy called Wolfgang who has a boat. Wolfgang says to her, "I'll take you over the river in my boat under one condition, you have to sleep with me". Sarah doesn't know what to do. She doesn't want to sleep with Wolfgang but she wants to get home. So, she goes to her mom who lives in the south and asks her what to do. The mom says I have too much stress at the moment and tells Sarah to leave her alone. Once again, Sarah doesn't know what to do so she decided to sleep with Wolfgang and Wolfgang takes her over the river as promised. Sarah goes to Johann and explains to him what happened. Johann got so angry and yells at Sarah. Sarah runs away to the pup. She explains everything to a guy called Sebastian. Sebastian also gets angry about the situation and goes to Johann and hits him. Now Johann has to go to hospital because of his injuries. My question to you (to the class) is "who is guilty?" Someone has to go to jail and you have to decide who that should be.

APPENDIX G. ISOLATED VOCABULARY TRANSLATION TASK

Name: _____ Native Language _____

1) sprechen
2) reden
3) das Zimmer
4) versehren
5) der Vogel
6) das Kinn
7) der Pfad
8) das Handy
9) kauen
10) das Bein
11) singen
12) arbeiten
13) zapfen
14) das Zinn
15) die Distel
16) das Fenster
17) reif
18) schlürfen
19) der Tropfen
20) die Waren
21) selig
22) das Bein
23) stricken
24) der Feierabend
25) die Feier
26) die Krücke
27) das Pfung
28) feindlich
29) das Kupfer
30) hüpfen
31) die Waffe
32) der Griff
33) die Zunge
34) der Zweig
35) der Hass
36) beten
37) reißen
38) weh
39) das Weib
40) der Knecht
41) satt
42) der Bürger
43) der Zaun
44) der Kerl
45) die Pfeife
46) stampfen
47) schreiben
48) das Auto
49) scharf
50) die Warze

51) der Kessel
52) dies
53) offen
54) der Pfennig
55) der Käfer
56) das Ding
57) das Gebet
58) der Zwilling
59) das Tier
60) der Durst
61) die Burg
62) die Pfanne
63) das Pfahl
64) der Apfel
65) furzen
66) die Hitze
67) schweißen
68) der Nuss
69) wissen
70) der Dorn
71) die Feder
72) der Fuß
73) stark
74) die Technologie
75) die Decke
76) der Fernseher
77) der Tisch
78) das Bett
79) der Stift
80) die Decke
81) die Hose
82) das Buch
83) springen
84) das Handy
85) die Tastatur
86) verzichten
87) leben
88) drinnen
89) die Tafel
90) das Regal
91) die Handschuhe
92) schicken
93) die Mauer
94) das Rad
95) das Lenkrad
96) aufladen
97) herunterladen
98) eine SMS
99) versenden
100) der Anschluss
101) der Knopf
102) Netzwerk
103) das Fenster
104) die Mütze
105) das Hemd
106) Hygiene
107) bewältigen
108) die Umwelt
109) das Bild
110) das Gemälde

111) die Uhr

112) der Bleistiff

113) krank

114) Krankenwagen

115) Krankenhaus

116) üben

117) erkündigen

118) Übersetzung

119) die Katastophe

120) vergleichen

121) reisen

122) verkaufen

123) der Schutz

124) verwenden

125) unterrichten

126) demonstrieren

APPENDIX H. EXPLICIT VOCABULARY ACTIVITY

What do these words mean and can you give a historical explanation?

1. Zwilling/Drilling/Vierling
2. weh (es tut mir weh)
3. das Weib (weiblich)
4. versehren (ich habe mich versehrt)
5. der Vogel
6. der Knecht
7. das Gebet (beten – man betet in der Kirche)
8. das Tier
9. satt (ich bin satt)
10. selig
11. die Burg und die Bürger
12. der Zaun
13. reißen

What are some examples of semantic changes?

Semantic Broadening (a word broadens its meaning)	Semantic Narrowing (a word narrows its meaning)	Amelioration (the meaning improves)	Pejoration (the meaning takes on a negative connotation)
Example:	Example:	Example:	Example:

Sound Change

Write the English translation, work out the rule, and can you think of any other words which follow the pattern?

Ex. 1: Rule: _____

1. das Ding
2. dies
3. der Dorn
4. das Bad
5. denken
6. durch
7. Süd-/Nord-
8. der/die/das

Ex. 2: Rule: _____

1. Pfeife
2. Pfanne
3. Pfennig
4. Kupfer
5. hüpfen
6. Tropfen
7. zapfen

Ex. 3: Rule: _____

1. hoffen
2. offen
3. die Waffe
4. der Griff
5. reif
6. helfen

Ex. 4: Rule _____

1. Zunge
2. Herz
3. Hitze
4. Zweig
5. Warze
6. Zimmer
7. Zahn

Ex. 5: Rule _____

1. schweissen
2. Hass
3. lassen
4. Kessel
5. Nuss

6. Straße
7. aus
8. Fuß

Extra Fun Questions:

1. How do you think the words *cheap* and *kaufen* are related?

2. *Er ist ein reifer Mensch* (*reif* is cognate with which English word? Explain what happened – both sound and semantic change)

3. The word *Zweifel* means doubt in German (e.g., *es gibt keinen Zweifel, dass* ,there's no doubt that.... OR *zweifellos* = doubtless – *der Herr der Ringe ist zweifellos der beste Film aller Zeiten* = 'the lord of the rings is undoubtedly the best film of all time'). Which English words are related to this word and can you think of an explanation as to why it means 'doubt'?

4. The Second Germanic Sound Shift differentiated English from German (e.g., *pound* [originally *pund*] vs. *pfund*, but this sound change also differentiated German from other Germanic languages. Do you think it differentiated English from Dutch?
   Dutch: *slapen* 'to sleep' – English *sleep* – German *'schlafen*'
   Dutch: *appel* 'apple' – German *Apfel*

5. What do you think Dutch *etan* means? *Ik eet appels* OR *ik zal appels* <u>*eten*</u>

6. There is another sound change which affected the consonants which took place which differentiates English from German. See if you can work it out.

fünf	five
Gans	goose
Mund	mouth

7. English and German are Germanic Languages. The Germanic languages family belongs to a bigger language family called “Indo-European”. There are sound changes which took place in Germanic languages and not the other Indo-European languages. See if you can work out which sound changes took place! Also, which are the Germanic languages?

Sanskrit	pitar					trayas	hrd
Latin	pater	pe-	piscis	decem	dentes	tres	cord (cordis)
French	per	pie (pe)	poisson	dis	dent	troi	
Spanish	padre	pie	pez	diez	diente	tres	corazón
Greek	pater	podi		deka	deka	treis	kardia
Hindi	pita:	paira		dasa	dante		
English	father	foot	Fish	ten	ten	three	heart
Icelandic	faðir	fotar		tiu	toen		
Gothic	fadir	fotus		texun	tunþus	þrija	hairto
German	Vater	Fuß	Fisch	zehn	zehn		
Old English	fæder		fisc			þreo	heorte

APPENDIX I. IMPLICIT VOCABULARY ACTIVITY

Familienprobleme
In diesem Kapitel lernen wir über das Familienleben. Macht ein Rollenspiel zu dritt über zwei Brüder, die eine(n) Therapeut(in) besuchen muss, um über ihre Probleme aus ihrer Kindheit zu reden. Sie haben keine gute Beziehung. Bruder A arbeitet auf dem Land als Knecht und denkt, dass seine Arbeit am schwierigsten. Er hat keinen Respekt vor ihrem Bruder, der in einer Kirche arbeitet.Versucht diese Wörter in eurem Rollenspiel zu benutzen. Je mehr Wörter man benutzt, desto besser!

English translation:
In this chapter we're learning about family life. Put together a roleplay in groups of three about two brothers who have to see a family therapist to discuss their problems from their childhood. They do not have a good relationship with each other. Brother A works on a farm and thinks that his work is the hardest. He has no respect for his brother who works in a church. Try to integrate these words (below) into the roleplay. The more words you use, the better!

Familienmitglieder und Haustiere:
Zwilling
Bruder
Schwester
Haustier
Vogel

Kirche verwandte Wörter:
beten
das Gebet
selig
Kirche
hoffen

Landwirtschaftliche Wörter:
helfen
Knecht
Bürger
Pfahl
Pflanze
Zweig
reif

Essen verwandte Wörter:
satt: *ich bin satt*
Käse
Zunge
der Nuss/Nüsse

APPENDIX J. SUMMARY OF TWO EXPERIMENTS

Experiment	Learning Conditions	Training Session		Assessments
		Explicit	Non-Explicit	
Experiment I [L2 speech]	Explicit Condition (*n* = 16) Non-Explicit Condition (*n* = 13)	**Phonetics:** Articulation Instruction on Stops, Fricatives and Vowels **Phonology:** Final Devoicing Dorsal Fricative Assimilation	Task-based and communicative-based activities	**Articulation** **Post/Post/Delayed-Post-Test** Students recorded in *Praat* reading 24 slides **Perception:** **Discrimination**: (16 minimal pairs, 64 different questions) **Identification**: (16 different words, 64 different questions) **Exit Survey**
Experiment II [L2 vocabulary]	Explicit Condition (*n* = 18) Non-Explicit Condition (*n* = 17)	**Sound Changes:** 2nd Ger. Sound Shift Ingvæonic Palatalization **Semantic Changes:** Broadening, Narrowing, Pejoration, Amelioration, Change by Association	Task-based and communicative-based activities	**Vocabulary** **Pre-/Post-/Delayed-Post Test** 126 words (63 cognates, 63 non-cognates) Of the 63 cognates (42 cognates with sound changes, 21 with semantic changes). Of the 42 sound change cognates (21 encountered, 21 not encountered) **Exit Survey**

REFERENCES

Adrada-Rafael, S. (2017). Processing the Spanish imperfect subjunctive: Depth of processing under different instructional conditions. *Applied Psycholinguistics*, *38*(2), 477–508.

Alderson, J. C., Clapham, C., & Steel, D. (1997). Metalinguistic knowledge, language aptitude and language proficiency. *Language Teaching Research*, *1*(2), 93–121.

American Council on the Teaching of Foreign Languages. (2012). ACTFL Position Statements. American Council on the Teaching of Foreign Languages. <http://nadsfl.org/wp-content/uploads/2017/04/ACTFL_Position_Statements.pdf>

Anderson, J. R. (1976). *Language, memory and thought*. Hillsdale, NJ: Erlbaum.

Anderson, J. R. (1983). *The architecture of cognition*. Hillsdale, NJ, US.

Anderson, J. R. (1990). *Cognitive psychology and its implications*. New York: W. H. Freeman.

Anderson, J. R., & Reder, L. M. (1978). An elaborative processing explanation of depth of processing. In L. S. Cermak & F. I. M. Craik (Eds.) *Levels of processing and human memory* (pp. 385–403). Hillsdale, NJ: Lawrence Erlbaum Associates.

Anderson, R. C., & Freebody, P. (1981). Vocabulary knowledge. In J. Guthrie (Ed.), *Comprehension and teaching: Research reviews* (pp. 77–117). Newark. *DE: International Reading Association*.

Arteaga, D. (2000). Articulatory phonetics in the first-year Spanish classroom. *The Modern Language Journal*, *84*(3), 339–354.

Arteaga, D. L., & Herschensohn, J. (1995). Using diachronic linguistics in the language classroom. *The Modern Language Journal*, *79*(2), 212–222.

Atkinson R. C., & Shiffrin R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation: Advances in research and theory* (pp. 89–195). Academic Press: New York.

Atkinson, R. C., & Raugh, M. R. (1975). An application of the mnemonic keyword method to the acquisition of a Russian vocabulary. *Journal of Experimental Psychology: Human Learning and Memory*, *1*(2), 126–133.

Baars, B. J., & Gage, N. M . (2010). *Cognition, brain, and consciousness: Introduction to cognitive neuroscience*. London: Elsevier Academic Press.

Baddeley, A. D. (1990). *Human memory: Theory and Practice*. Needham Heights, MA: Ally and Bacon.

Baddeley, A. D. (2007). *Working memory, thought, and action*. Oxford: Oxford University Press.

Baddeley, A., & Hitch, G. (1974). Working memory. In G. A. Bower (Ed.), *Psychology of learning and motivation*: *Vol. 8* (pp. 47–89). New York: Academic Press.

Baker, P. S. (2012). *Introduction to Old English* (3rd Edition). Malden, MA: Blackwell.

Barbour, S., & Stevenson, P. (1990). *Variation in German: A critical approach to German sociolinguistics*. Cambridge University Press.

Barcroft, J. (2002). Semantic and structural elaboration in L2 lexical acquisition. *Language Learning*, *52*(2), 323–363.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. Cambridge: Cambridge University Press.

Bassetti, B. (2006). Orthographic input and phonological representations in learners of Chinese as a foreign language. *Written Language and Literacy*, *9*(1), 95–114.

Berges-Puyó, J. G. (2018). The impact of implicit/explicit instruction on the learning process of L2 knowledge in Spanish. *Epos: Revista de Filología*, *33*, 185–207.

Berry, R. (2009). EFL majors' knowledge of metalinguistic terminology: A comparative study. *Language Awareness*, *18*(2), 113–128.

Bialystok, E. (1990). The competence of processing: Classifying theories of second language acquisition. *TESOL Quarterly*, *24*(4), 635–648.

Bialystok, E. (1994). Analysis and control in the development of second language proficiency. *Studies in Second Language Acquisition*, *16*(2), 157–168.

Bley-Vroman, R. (1989). What is the logical problem of foreign language learning. *Linguistic Perspectives on Second Language Acquisition*, *4*, 1–68.

Bley-Vroman, R. (2009). The evolving context of the fundamental difference hypothesis. *Studies in Second Language Acquisition*, *31*(2), 175–198.

Boersma, P., & Weenink, D. (2019). *Praat: Doing phonetics by computer* (Version 6.1. 02) [Computer software]. http://www.fon.hum.uva.nl/praat

Boersma, Paul., & Hamann, S. (2008). The evolution of auditory dispersion in bidirectional constraint grammars. *Phonology*, *25*(2), 217–270.

Bower, G. H., & Clark, M. C. (1969). Narrative stories as mediators for serial learning. *Psychonomic Science*, *14*(4), 181–2182.

Bréal, M. (1900). *Semantics: Studies in the science of meaning*. New York: Dover.

Bremmer, R. H. (2009). *An introduction to Old Frisian: History, grammar, reader, glossary*. Amsterdam: John Benjamins Publishing.

Brinton, L. J., & Arnovick, L. K. (2006). *The English language: A linguistic history* (1st edition). Oxford University Press, USA.

Broadbent, D. E. (1958). *Perception and communication*. New York: Oxford University Press.

Broadbent, D. E. (1971). *Decision and stress*. New York: Academic Press.

Brockhaus, W. G. (1991). *Final devoicing. Principles and parameters* (Doctoral dissertation, Univrsity of London).

Bronson, B. S. (2004). *Phonetically based phonology*. Cambridge University Press.

Bryan, A. D. (2019). *The effectiveness of explicit pedagogical intervention in the L2 perception and production of German vowels* (Doctoral dissertation, Purdue University).

Bürki, A., Welby, P., Clément, M., & Spinelli, E. (2019). Orthography and second language word learning: Moving beyond "friend or foe?". *The Journal of the Acoustical Society of America*, *145*(4), EL265–EL271.

Byrne, D. (Ed.). (1986). *Teaching oral English* (2nd Edition). Harlow, UK: Longman.

Campbell, L. (2013). *Historical linguistics* (3rd Edition). Edinburgh University Press.

Carpenter, S. K., Sachs, R. E., Martin, B., Schmidt, K., & Looft, R. (2012). Learning new vocabulary in German: The effects of inferring word meanings, type of feedback, and time of test. *Psychonomic Bulletin & Review*, *19*(1), 81–86.

Chabris, C. F., Weinberger, A., Fontaine, M., & Simons, D. J. (2011). You do not talk about Fight Club if you do not notice Fight Club: Inattentional blindness for a simulated real-world assault. *iPerception*, *2*(2), 150–153.

Charles-Luce, J., & Dinnsen, D. A. (1987). A reanalysis of Catalan devoicing. *Journal of Phonetics*, *15*(2), 187–190.

Chan, J. C., & McDermott, K. B. (2006). Remembering pragmatic inferences. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition*, *20*(5), 633–639.

Chen, H. C., & Ng, M.-L. (1989). Semantic facilitation and translation priming in Chinese English bilinguals. *Memory and Cognition*, *17*, 454–462.

Chen, M. (1970). Vowel length variation as a function of the voicing of the consonant environment. *Phonetica*, *22*(3), 129–159.

Cheng, L., Li, M., Kirby, J., Qiang, H., & Wade-Woolley, L. (2010). English language immersion and students' academic achievement in English, Chinese and mathematics. *Evaluation and Research in Education*, *23*(3), 151–169.

Cherry, E. C. (1953). Some experiments on the recognition of speech, with one and with two ears. *The Journal of the Acoustical Society of America*, *25*(5), 975–979.

Chomsky, N., & Halle, M. (1968) *The sound patlern of' English*. New York: Harper & Row.

Chung, W. L. (2008). *The effectiveness of explicit, implicit, and noticing instruction: Mandarin speakers' perceptions and production of English sentence stress*. (Doctoral dissertation, Alliant International University).

Clancy, S. A., McNally, R. J., Schacter, D. L., Lenzenweger, M. F., & Pitman, R. K. (2002). Memory distortion in people reporting abduction by aliens. *Journal of Abnormal Psychology*, *111*(3), 455–461.

Clements, G. N. (1988). The sonority cycle and syllable organization. In W. U. Dressler., H. C. Luschützky., O. E. Pfeiffer., & J. R. Rennison (Eds.), *Phonologica* (pp. 63–76). Cambridge: Cambridge University Press.

Coffman, J. M. (2018). The effect of HL exposure on content acquisition, metalinguistic awareness, and L2 motivation, enjoyment, and interest in the university foreign language classroom. *International Journal of Arts Humanities and Social Sciences*, *3*(8), 15-26.

Colantoni, L., Steele, J., & Escudero, P. (2015). *Second language speech: Theory and practice*. Cambridge: Cambridge University Press.

Conrad, F. (2021). Regional differences in the evolution of the merger of /ʃ/ and /ç/ in Luxembourgish. *Journal of the International Phonetic Association*, 1–18. [First View Online Version].

Conway, M. A., & Pleydell-Pearce, C. W. (2000). The construction of autobiographical memories in the self-memory system. *Psychological Review*, *107*(2), 261–288.

Cook, V. (1991). The poverty-of-the-stimulus argument and multi-competence. *Second Language Research*, *7*(2), 103–117.

Cowie, F. (1999). *What's within: Nativism reconsidered*. Oxford: Oxford University Press.

Craik, F. I. M & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General*, *104*(3), 268–294.

Craik, F. I. M. (2002). Levels of processing: Past, present . . . and future? *Memory*, *10*(5-6), 305–18.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: a framework for memory research. *Journal of Verbal Learning and Verbal Behavior*, *11*(6), 671–684.

Craik, F. I. M., & Watkins, M. J. (1973). The role of rehearsal in short-term memory. *Journal of Verbal Learning and Verbal Behavior*, *12*(6), 599–607.

Crawford, R. L. (1988). Some aspects of the history of German and English for the classroom. *Die Unterrichtspraxis*, *21*(2), 204–207.

Crowley, T., & Bowern, C. (2010). *An introduction to historical linguistics*. Oxford University Press.

Crystal, D. (1995). *The Cambridge encyclopedia of language*. Cambridge: Cambridge University Press.

Crystal, D. (2016). Learning to be a linguist: the growth of linguistics in the 20th century. In A. G. Walker (Ed.), *Classics revisited: Wegbereiter der Linguistik neu gelesen* (pp. 195–212). Frankfurt am Main: Peter Lang.

Cummins, J., & Swain, M. (1986). Linguistic interdependence: A central principle of bilingual education. In J. Cummins & M. Swain (Eds.), *Bilingualism in education* (pp. 80–95). New York: Longman Group UK Limited.

Czaplicki, B., Żygis, M., Pape, D., & Jesus, L. M. (2016). Acoustic evidence of new sibilants in the pronunciation of young Polish women. *Poznan Studies in Contemporary Linguistics*, *52*(1), 1–42.

Darcy, I. (2018). Powerful and effective pronunciation instruction: How can we achieve it?. *CATESOL Journal*, *30*(1), 13–45.

De la Fuente, M. J. (2006). Classroom L2 vocabulary acquisition: Investigating the role of pedagogical tasks and form-focused instruction. *Language Teaching Research*, *10*(3), 263–295.

DeKeyser, R. M. (1995). Learning second language grammar rules: An experiment with a miniature linguistic system. *Studies in Second Language Acquisition*, *17*(3), 379–410.

DeKeyser, R. M. (1997). Beyond explicit rule learning: Automatizing second language morphosyntax. *Studies in Second Language Acquisition*, *19*(2), 196–221.

DeKeyser, R. M. (2003). Implicit and explicit learning. In C. J Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 312–348). Oxford: Blackwell.

DeKeyser, R. M. (2007). *Practice in a second language: Perspectives from applied linguistics and cognitive psychology*. New York, NY: Cambridge University Press.

DeKeyser, R. M. (2009). Cognitive-psychological processes in second language learning. In M. H. Long & C. J. Doughty (Eds.), *The Handbook of language teaching* (pp. 119–138). Wiley-Blackwell, Malden, MA.

DeKeyser, R. M. (2015). Skill acquisition theory. In B. VanPatten & J. Williams (Eds.), *Theories in second language acquisition: An introduction* (pp. 94–112). New York: Routledge.

Derwing, T. M. (2003). What do ESL students say about their accents? *Canadian Modern Language Review, 59*(4), 547–566.

Derwing, T. M., & Munro, M. J. (2009). Putting accent in its place: Rethinking obstacles to communication. *Language Teaching, 42*(4), 476–490.

Derwing, T. M. & Munro, M. (2015). *Pronunciation fundamentals: Evidence-based perspectives for L2 teaching and research*. Amsterdam: John Benjamins.

Derwing, T. M., Munro, M. J., Wiebe, G. (1997). Pronunciation instruction for "fossilized" learners: can it help? *Applied Language Learning, 8*(2), 217–235.

Dirim, I., & Auer, P. (2004). *Turkisch sprechen nicht nur die Türken. Über die Unscharfebeziehung zwischen Sprache und Ethnie in Deutchland* (Türkish is Not Only Spoken by Turks. On the Fuzzy Relationship between Language and Ethnos in Germany). Berlin: Walter de Gruyter.

Dlaska, A., & Krekeler, C. (2013). The short-term effects of individual corrective feedback on L2 pronunciation. *System, 41*(1), 25–37.

Dmitrieva, O., Jongman, A., & Sereno, J. (2010). Phonological neutralization by native and non-native speakers: The case of Russian final devoicing. *Journal of Phonetics, 38*(3), 483–492.

Dörnyei, Z. (2009). The 2010s Communicative language teaching in the 21st century: The 'principled communicative approach'. *Perspectives, 36*(2), 33–43.

Doughty, C. (1991). Second language instruction does make a difference: Evidence from an empirical study of SL relativization. *Studies in Second Language Acquisition, 13*(4), 431-469.

Doughty, C. (2001). Cognitive underpinning of focus on form. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 206–257). Cambridge: Cambridge University Press.

Doughty, C. (2003). Instructed SLA: Constraints, compensation, and enhancement. In C. J. Doughty & M. H. Long (Eds.), *The Handbook of Second Language Acquisition* (pp. 256–310). Oxford: Blackwell.

Doughty, C., & Williams, J. (1998). *Focus on form in classroom second language acquisition*. Cambridge: Cambridge University Press.

Drew, T., Võ, M. L.-H., & Wolfe, J. M. (2013). The invisible gorilla strikes again: Sustained inattentional blindness in expert observers. *Psychological Science, 24*(9), 1848–1853.

Ebbinghaus, H. (1885). *Über das gedächtnis: untersuchungen zur experimentellen psychologie*. Leipzig: Duncker & Humblot.

Elder, C., & Manwaring, D. (2004). The relationship between metalinguistic knowledge and learning outcomes among undergraduate students of Chinese. *Language Awareness*, *13*(3), 145–162.

Elder, C., J. Warren, J. Hajek, D. Manwaring, & A. Davies. (1999). Metalinguistic knowledge: How important is it in studying a language at university? *Australian Review of Applied Linguistics*, *22*(1), 81–95.

Elgort, I., & Nation, P. (2010). Vocabulary learning in a second language: Familiar answers to new questions. In P. Seedhouse., S. Walsh., & C. Jenks (Eds.), *Conceptualising 'learning' in applied linguistics* (pp. 89-104). Palgrave Macmillan, London.

Ellis, N. C. (1993). Rules and instances in foreign language learning: Interactions of explicit and implicit knowledge. *European Journal of Cognitive Psychology*, *5*(3) 289–318.

Ellis, N. C. (1996). Sequencing and SLA: Phonological memory, chunking and points of order. *Studies in Second Language Acquisition*, *18*(1), 91–126.

Ellis, N. C. (2002). Frequency effects in language processing: A review with implications for theories of implicit and explicit acquisition. *Studies in Second Language Acquisition*, *24*(2), 143–188.

Ellis, N. C. (2005). At the interface: Dynamic interactions of explicit and implicit knowledge . *Studies in Second Language Acquisition*, *27*, 305–352.

Ellis, N. C. (2006a). Language acquisition as rational contingency learning. *Applied Linguistics*, *27*(1), 1–24.

Ellis, N. C. (2006b). Selective attention and transfer phenomena in L2 acquisition: Contingency, cue competition, salience, interference, overshadowing, blocking and perceptual learning. *Applied Linguistics*, *27*(2), 164–194.

Ellis, N. C. (2011). Implicit and explicit SLA and their interface. In C. Sanz & R. Leow (Eds.), *Implicit and explicit language learning* (pp. 35–47). Washington, DC: Georgetown University Press.

Ellis, N. C. (2015). Implicit and Explicit Learning. In P. Rebuschat, (Ed.), *Implicit and explicit learning of language* (pp. 3–24). Amsterdam: John Benjamins.

Ellis, R. (1990). *Instructed second language acquisition*. Oxford: Oxford University Press.

Ellis, R. (1994). *The study of second language acquisition*. Oxford: Oxford University Press.

Ellis, R. (2003). *Task-based language learning and teaching*. Oxford: Cambridge University Press.

Ellis, R. (2004). The definition and measurement of L2 explicit knowledge. *Language Learning*, *54*(2), 227–275.

Ellis, R. (2008). Explicit form-focused instruction and second language acquisition. In B. Spolsky & F. M. Hult (Eds.), *The handbook of educational linguistics* (pp. 437–455). Oxford: Blackwell.

Ellis, R. (2009). Implicit and explicit knowledge in second language learning, testing and teaching. Toronto: Multilingual Matters.

Ellis, R. (2015). The importance of focus on form in communicative language teaching. *Eurasian Journal of Applied Linguistics 1*(2), 1–12.

Ellis, R., Basturkmen H., & Loewen, S. (2002). Doing focus on form. *System* 30(4), 419–435.

Ellis, R., Loewen, S., & Erlam, R. (2006). Implicit and explicit corrective feedback and the acquisition of L2 grammar. *Studies in Second Language Acquisition*, *28*(2), 339–368.

Ellis, R., Loewen, S., Elder, C., Erlam, R., Philp, J., & Reinders, H. (2009). *Implicit and explicit knowledge in second language learning, testing and teaching*. Bristol: Multilingual Matters.

Ellis, R., Skehan, P., Li, S., Shintani, N., & Lambert, C. (2019). *Task-based language teaching: Theory and practice*. Cambridge University Press.

Ellis, R., Tanaka, Y., & Yamazaki, A. (1994). Classroom interaction, comprehension, and the acquisition of L2 word meanings. *Language Learning, 44*(3), 449–491.

Escure, G. (1975). Weakening and deletion process in language change. (Doctoral Dissertation, Indiana University).

Feng, Y., & Webb, S. (2020). Learning vocabulary through reading, listening, and viewing: Which mode of input is most effective? *Studies in Second Language Acquisition*, *42*(3), 499–523.

Field, J. (2005). Intelligibility and the listener: The role of lexical stress. *TESOL Quarterly*, *39*(3), 399–423.

Fintoft, K. (1961). The duration of some Norwegian speech sounds. *Phonetica*, *7*(1), 19–39.

Fischer-Jørgensen, E. (1964). Sound duration and place of articulation. *Zeitschrift für Phonetik und Allgemeine Sprachwissenschaft, 17*(1–6), 175–207.

Fitts P. M., & M. I. Posner. (1967). *Human performance*. Belmont, CA: Brooks/Cole.

Flege, J. E. (1995). Second-language speech learning: Theory, findings, and problems. In W. Strange (Ed.) *Speech perception and linguistic experience: Issue in cross-language research* (pp. 229–273). Timonium, MD: York Press.

Flege, J. E. (1999). Relation between L2 production and perception. In J. Ohala., Y. Hasegawa., M. Ohala., D. Granville & A. C. Bailey (Eds), *Proceedings of the XIVth International Congress of Phonetics Sciences* (Berkeley, CA: Department of Linguistics, University of California at Berkeley), 1273–1276.

Flege, J. E. (2002). Interactions between native and second-language phonetic systems. In A. Rohde & T. Piske (Eds.), *An integrated view of language development: Papers in honor of Henning Wode* (pp. 217–244). Trier: Wissenschaftlicher Verlag.

Flege, J. E. & MacKay, I. (2004). Perceiving vowels in a second language. *Studies in Second Language Acquisition*, *26*(1), 1–34.

Flege, J. E., Munro, M. J., & MacKay, I. R. A. (1995). Factors affecting strength of perceived foreign accent in a second language. *Journal of the Acoustical Society of America*, *97*(5), 3125–3134.

Foerde, K., Knowlton, B.J., & Poldrack, R.A. (2006). Modulation of competing memory systems by distraction. *Proceedings of the National Academy of Science, 103*, 11778–11783.

Forrest, K., Weismer, G., Milenkovic, P., & Dougall, R. (1988). Statistical analysis of word-initial voiceless obstruents: Preliminary data. *Journal of the Acoustical Society of America 84*(1), 115–123.

Fowler, R. L., & Barker, A. S. (1974). Effectiveness of highlighting for retention of text material. *Journal of Applied Psychology, 59*(3), 358–364.

Fulk, R. D. (2014). *An introductory grammar of Old English*. Tempe: Arizona Center for Medieval and Renaissance Studies.

Garry, M., Manning, C. G., Loftus, E. F., & Sherman, S. J. (1996). Imagination inflation: Imagining a childhood event inflates confidence that it occurred. *Psychonomic Bulletin & Review*, *3*(2), 208–214.

Gerrig, R. J., Zimbardo, P. G., Zimbardo, P. G., Psychologue, E. U., & Zimbardo, P. G. (2010). *Psychology and life* (Vol. 20). Boston: Pearson.

Ghorbani, M. R. & Riabi, N. K. (2011). The Impact of memory strategy instruction on learners' EFL vocabulary retention. *Theory and Practice in Language Studies*, *1*(9), 1222–1226.

Godfroid, A. (2020). *Eye tracking in second language acquisition and bilingualism: A research synthesis and methodological guide*. New York: Routledge.

Godfroid, A., Boers, F., & Housen, A. (2013). An eye for words: Gauging the role of attention in incidental L2 vocabulary acquisition by means of eye tracking. *Studies in Second Language Acquisition*, *35*(3), 483–517.

Gombert, J. (1992). *Metalinguistic development*. Chicago: University of Chicago Press.

Goo, J., Granena, G., Yilmaz, Y., & Novella, M. (2015). Implicit and explicit instruction in L2 learning. In P. Rebuschat (Ed.), *Implicit and explicit learning of languages* (pp. 443–482). John Benjamins.

Goodwin, J. (2014). Teaching Pronunciation. In M. Celce-Murcia., D. M. Brinton & M. A. Snow (Eds.), *Teaching English as a second or foreign language* (4th Edition) (pp. 136–152). Boston: Heinle & Heinle.

Gordon, J., & Darcy, I. (2016). The development of comprehensible speech in L2 learners. *Journal of Second Language Pronunciation*, *2*(1), 56–92.

Green, D. (1986). Control, activation, and resource: a framework and model for the control of speech in bilinguals. *Brain and Language*, *27*(2), 210–223.

Green, P., & Hecht, K. (1992). Implicit and explicit grammar: An empirical study. *Applied Linguistics*, *13*(2), 168–184.

Grey, S., Williams, J. N., & Rebuschat, P. (2014). Incidental exposure and L3 learning of morphosyntax. *Studies in Second Language Acquisition*, *36*(3), 611–645.

Grosjean, F. (1982). *Life with two languages: an introduction to bilingualism*. Cambridge, MA: Harvard University Press.

Guntern, M. (2012). Dialekt und gesprochene Standardsprache: Wie Laien gesprochenes Schweizerhochdeutsch beurteilen. *Sociolinguistica*, *26*(1), 102–119.

Hall, C. J. (2002). The automatic cognate form assumption: Evidence for the parasitic model of vocabulary development. *IRAL*, *40*, 69–87.

Hall, T. A. (2014). Alveolopalatalization in Central German as markedness reduction. *Transactions of the Philological. Society*, *112*(2), 143–166.

Hama, M., & Leow, R. P. (2010). Learning without awareness revisited. *Studies in Second Language Acquisition*, *32*(3), 465–491.

Hamrick, P. (2015). Declarative and procedural memory abilities as individual differences in incidental language learning. *Learning & Individual Differences*, *44*, 9–15.

Hamrick, P., Lum, J. A., & Ullman, M. T. (2018). Child first language and adult second language are both tied to general-purpose learning systems. *Proceedings of the National Academy of Sciences*, *115*(7), 1487–1492.

Hayes-Harb, R., Brown, K., & Smith, B. L. (2018). Orthographic input and the acquisition of German final devoicing by native speakers of English. *Language and speech*, *61*(4), 547–564.

Hayes-Harb, R., & Barrios, S. (2021). The influence of orthography in second language phonological acquisition. *Language Teaching*, *52*, 297–326.

Heather, P. (2010). *Empires and Barbarians: The Fall of Rome and the Birth of Europe*. Oxford: Oxford University Press.

Hemchua, S., & Schmitt, N. (2006). An analysis of lexical errors in the English compositions of Thai learners. *Prospect*, *21*(3), 3–25.

Herrgen, J. (1986). *Koronalisierung und Hyperkorrektion. Das palatale Allophon des /CH/-Phonems und seine Variation im Westmitteldeutschen*. Stuttgart: Franz Steiner.

Higgs, T., & Clifford, R. (1982). The push toward communication. In T. Higgs (Ed.), *Curriculum, competence and the foreign language teacher* (pp. 57–79). Skikie, IL: National Textbook Company.

Hill, M., & Laufer, B. (2003). Type of task, time-on-task and electronic dictionaries in incidental vocabulary acquisition. *International Review of Applied Linguistics*, *41*(2), 87–106.

Hogan, J., & Rozsypal, A. (1980). Evaluation of vowel duration as a cue for the voicing distinction in the following word-final consonant. *Journal of the Acoustical Society of America*, *67*(5), 1764–1771.

Hogg, R. (1992). Phonology and Morphology [of Old English]. In R. Hogg (Ed.), *The Cambridge history of the English language, volume I: The beginnings to 1066* (pp. 67–167). Cambridge University Press, Cambridge, UK.

Holden, W. R. (1999). Learning to learn: 15 vocabulary acquisition activities. Modern English Teacher, 8 (1), 42–47.

Honeybone, P. (2001). Lenition inhibition in Liverpool English. *English Language & Linguistics*, *5*(2), 213–249.

Horsford, H. (1987). Common Sense and Language History. *Die Unterrichtspraxis*, *20*(2), 278–287.

House, A. S. (1961). On vowel duration in English, *Journal of' the Acoustical Society of' America*, *33*, 1174–1178.

House, A. S., & Fairbanks, G. (1953). The influence of consonantal environment upon the secondary acoustical characteristics of vowels. *Journal of the Acoustical Society of' America*, *25*, 105–113.

Housen, A., & Pierrard, M. (Eds.). (2005). *Investigations in instructed second language acquisition* (Vol. 25). Walter de Gruyter.

Hu, G. W. (2002). Psychological constraints on the utility of metalinguistic knowledge in second language production. *Studies in Second Language Acquisition*, *24*(3), 347–386.

Hu, H. M. (2013). The effects of word frequency and contextual types on vocabulary acquisition from extensive reading: A case study. *Journal of Language Teaching and Research*, *4*(3), 487–495.

Hulstijn, J. H. (1992). Retention of inferred and given word meanings: Experiments in incidental vocabulary learning. In P. J. L Arnaud & H. Béjoint (Eds.) *Vocabulary and Applied Linguistics* (pp. 113–125). London: Palgrave Macmillan UK.

Hulstijn, J. H. (1997). Mnemonic methods in foreign language vocabulary learning. In Coady & Huckin (Eds.), *Second language vocabulary acquisition* (pp. 203–224). Cambridge: Cambridge University Press.

Hulstijn, J. H. (2001). Intentional and incidental second language vocabulary learning: Areappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 258–286). Cambridge: Cambridge University Press.

Hulstijn, J. H. (2002). Towards a unified account of the representation, processing and acquisition of second language knowledge. *Second Language Research, 18*(3), 193–223.

Hulstijn, J. H. (2003). Incidental and intentional learning. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 349–381). Malden, MA: Blackwell.

Hulstijn, J. H. (2015). Explaining phenomena of first and second language acquisition with the constructs of implicit and explicit learning. In P. Rebuschat (Ed.). *Implicit and explicit learning of language* (pp. 25–46). Amsterdam: John Benjamins.

Hulstijn, H. J., & de Graaff, R. (1994). Under what conditions does explicit knowledge of a second language facilitate the acquisition of implicit knowledge? *AILA Review, 11*, 97–112

Hulstijn, J. H., & Laufer, B. (2001). Some empirical evidence for the involvement load hypothesis in vocabulary acquisition. *Language learning*, *51*(3), 539–558.

Hulstijn, J., & de Graaff, R. (1994). Under what conditions does explicit knowledge of a second language facilitate the acquisition of implicit knowledge? A research proposal. *AILA Review*, *11*, 97–112.

Hulstijn, J., Hollander, M., & Greidanus, T. (1996). Incidental vocabulary learning by advanced foreign language students: The influence of marginal glosses, dictionary use, and reoccurrence of unknown words. *The Modern Language Journal*, *80*(3), 327–339.

Hunt, R., & McDaniel, M. A. (1993). The enigma of organization and distinctiveness. *Journal of Memory and Language*, *32*(4), 421–445.

Hyltenstam, K., & Abrahamsson, N. (2003). Maturational constraints in SLA. In C. J. Doughty & M. H. Long (Eds.), *Handbook of second language acquisition* (pp. 539–588). Maryland, USA: Blackwell Publishing.

Hyman, L. (1975). *Phonology: theory and analysis*. New York: Holt, Rinehart & Winston.

Hyman Jr, I. E., Boss, S. M., Wise, B. M., McKenzie, K. E., & Caggiano, J. M. (2010). Did you see the unicycling clown? Inattentional blindness while walking and talking on a cell phone. *Applied Cognitive Psychology*, *24*(5), 597–607.

Ingham, J. G. (1957). The effects upon monaural sensitivity of continuous stimulation of the opposite ear. *Quarterly Journal of Experimental Psychology*, *9*(1), 52–60.

Isaacs, T. (2009). Integrating form and meaning in L2 pronunciation instruction. *TESL Canada Journal*, *27*(1), 1–12.

Itti, L., & Koch, C. (2001). Computational modelling of visual attention. *Nature reviews neuroscience* 2(3), 194–203.

Izumi, S. (2002). Output, input enhancement, and the noticing hypothesis: An experimental study on ESL relativization. *Studies in Second Language Acquisition*, *24*(4), 541–577.

James, C., & Garrett, P. (1991). The Scope of Language Awareness. In C. James & P. Garett (Eds.), *Language Awareness in the Classroom* (pp. 3–21). London: Longman.

Janacsek, K., Fiser, J., & Nemeth, D. (2012). The best time to acquire new skills: Age-related differences in implicit sequence learning across the human lifespan. *Developmental Science*, *15*(4), 496–505.

Jeon, E. H., & T. Kaya. (2006). Effects of L2 instruction on interlanguage pragmatic development: A meta-analysis. In J. M. Norris & L. Ortega (Eds.), *Synthesizing Research on Language Learning and Teaching* (pp. 165–211). Amsterdam: John Benjamins.

Jessner, U. (1997). Towards a dynamic view of multilingualism. In M. Pütz (Ed.), *Language choices: conditions, constraints, and consequences* (pp. 17–30). Amsterdam: John Benjamins.

Jiang, N. (2000). Lexical development and representation in a second language. *Applied Linguistics*, *21*, 47–77.

Jin, Z., & Webb, S. (2020). Incidental vocabulary learning through listening to teacher talk. *The Modern Language Journal*, *104*(3), 550-566.

Johnson, K. (2012). *Acoustic and Auditory Phonetics* (3rd Edition). London: Wiley-Blackwell.

Jongman, A., Sereno, J., Raaijmakers, M., & Lahiri, A. (1992). The phonological representation of [voice] in speech perception. *Language and Speech*, *35*(1–2), 137–152.

Jongman, A., Wayland, R., & Wong, S. (2000). Acoustic characteristics of English fricatives. *The Journal of the Acoustical Society of America*, *108*(3), 1252–1263.

Jourdenais, R. (1998). *The effects of textualenhancement on the acquisition of the Spanish preterit and imperfect*. (Unpublished doctoral dissertation, Georgetown University).

Jourdenais, R. (2001). Cognition, instruction, and protocol analysis. In P. Robinson (ed.), *Cognition and second language instruction* (pp. 354–376). Cambridge: Cambridge University Press.

Juffs, A., & Harrington, M. (2011). Aspects of working memory in L2 learning. *Language Teaching*, *44*(2), 137–166.

Kagan, S. (1989). The structural approach to cooperative learning. *Educational leadership*, *47*(4), 12–15.

Kahneman, D. (1973). *Attention and effort*. Englewood Cliffs, NJ: Prentice-Hall.

Kalish, M. L., Griffiths, T. L., & Lewandowsky, S. (2007). Iterated learning: Intergenerational knowledge transmission reveals inductive biases. *Psychonomic Bulletin & Review*, *149*(2), 288–294.

Kalra, P., Gabrieli, J. D. E., & Finn, A. S. (2019). Evidence of stable individual differences in implicit learning. *Cognition*, *190*, 199–211.

Kane, M. J., & Engle, R. W. (2003). Working-memory capacity and the control of attention: the contributions of goal neglect, response competition, and task set to Stroop interference. *Journal of Experimental Psychology: General*, *132*(1), 47–70.

Kang, E. Y., Sok, S., & Han, Z. H. (2019). Thirty-five years of ISLA on form-focused instruction: A meta-analysis. *Language Teaching Research*, *23*(4), 428–453.

Karpicke J. D., & Bauernschmidt A. (2011). Spaced retrieval: Absolute spacing enhances learning regardless of relative spacing. *Journal of Experimental Psychology: Learning, Memory, and Cognition* 37(5), 1250–1257.

Kerz, E., Wiechmann, D., & Riedel, F. B. (2017). Implicit learning in the crowd: Investigating the role of awareness in the acquisition of L2 knowledge. *Studies in Second Language Acquisition*, *39*(4), 711–734.

Khaghaninejad, M., & Maleki, A. (2015). The effect of explicit pronunciation instruction on listening comprehension: Evidence from Iranian English learners. *Theory and Practice in Language Studies*, *5*(6), 1249–1256.

King, R. 1967. *Historical linguistics and generative grammar*. Englewood Cliffs, NJ: Prentice-Hall.

Kirsch, C. (2012). Using storytelling to teach vocabulary in language lessons: does it work? *The Language Learning Journal*, *44*(1), 33–51.

Kirsner, K., Smith, M. C., Lockhart, R., & Jain, M. (1984). The bilingual lexicon: language-specific units in an integrated network. *Journal of Verbal Learning and Verbal Behavior*, *23*(4), 519–539.

Kissling, E. M. (2013). Teaching pronunciation: Is explicit phonetics instruction beneficial for FL learners? *Modern Language Journal*, *97*(3), 720–744.

Kitzing, K. (1967). Några Malmöelevers uttal av tyska spiranter och affrikator [Some Malmö pupils' pronunciation of German fricatives and affricates]. *Pedagogiskpsykolgiska problem: notiser och rapporter från Institutionen för Pedagogik*, *49*, 1–8.

Kluender, K. R., Diehl, R. L., & Wright, B. A. (1988). Vowel-length differences before voiced and voiceless consonants: An auditory explanation. *Journal of Phonetics*, *16*(2), 153–169.

Knickerbocker, H., & Altariba, J. (2011). Bilingualism and the impact of emotion: The role of experience, memory, and sociolinguistic factors. In V. Cook & B. Bassetti (Eds.), *Language and bilingual cognition* (pp. 453–478). New York: Psychology Press.

Kohler, K. (1983). Prosodic boundary signals in German. *Phonetica*, *40*, 89–134.

König, W., Elspaß, S., & Möller, R. 2015. *Dtv-Atlas zur deutschen Sprache* (18th Edition). Munich: Deutscher Taschenbuch Verlag.

Krashen, S. D. (1981). *Second language acquisition and second language learning*. Oxford: Pergamon.

Krashen, S. D. (1982). *Principles and practice in second language acquisition*. New York: Pergamon Press.

Krashen, S. D. (1989). We acquire vocabulary and spelling by reading: Additional evidence for the input hypothesis. *The Modern Language Journal*, *73*(4), 440–464.

Krashen, S. D. (1994). The input hypothesis and its rivals. In N. Ellis (Ed.),*Implicit andexplicit learning of languages* (pp. 45–77). London: Academic Press.

Krashen, S. D. (1996). *The natural approach: Language acquisition in the classroom*. Northumberland, UK: Bloodaxe.

Krashen, S. D. (2004). *The power of reading*. Portsmouth, NH: Heinemann.

Krashen, S. (2011). *Free voluntary reading*. Portsmouth, NH: Heinemann.

Krashen, S. D., & Terrell, T. D. (1983). *The natural approach: Language acquisition in the classroom*. Oxford: Pergamon.

La Cross, C. (2018). *The effectiveness of visual input enhancement across multiple proficiency levels on the noticing and L2 development of German vocabulary and reading* (Doctoral dissertation, Purdue University).

Ladefoged, P. (2006). *A course in phonetics* (5th Edition). Boston, MA: Thomson Wadsworth.

Laker, S. (2008). Palatalization of Velars: A Major Link of Old English and Old Frisian. In H. Bremmer Jr., S. Laker & Oebele Vries (Eds.), *Advances in Old Frisian philology* (pp. 165–85). Amsterdam and Atlanta: Rodopi.

Larson, R. K. (2010). *Grammar as science*. Cambridge, MA: MIT Press.

Larson-Hall, J. (2017). Moving Beyond the Bar Plot and the Line Graph to Create Informative and Attractive Graphics. *The Modern Language Journal*, *101*(1), 244-270.

Lass, R. (1984). *Phonology*. Cambridge: Cambridge University Press.

Lass, R. (1994). *Old English: a historical linguistic companion*. Cambridge: Cambridge University Press.

Laufer, B. (1988). The concept of 'synforms' (similar lexical forms) in L2 vocabulary acquisition. *Language and Education 2*, 113–132.

Laufer, B. (1997). The lexical plight in second language reading: Words you don't know, words you think you know, and words you can't guess. In J. Coady & T. Huckin (Eds.), *Second Language Acquisition: A Rationale for Pedagogy* (pp. 20-34). Cambridge: Cambridge University Press.

Laufer, B. (2005). Focus on form in second language vocabulary learning. In S. H. Foster-Cohen, M. Garcia-Mayo, & J. Cenoz (Eds.), *Eurosla yearbook* (Vol. 5, pp. 223–250). Amsterdam: Benjamins.

Laufer, B. (2006). Comparing focus on form and focus on forms in second-language vocabulary learning. *Canadian Modern Language Review*, 63, 149–166.

Laufer, B., & Hulstijn, J. (2001). Incidental vocabulary acquisition in a second language: The construct of task-induced involvement. *Applied Linguistics*, *22*(1), 1–26.

Laufer, B., & Rozovski-Roitblat, B. (2011). Incidental vocabulary acquisition: The effects of task type, word occurrence and their combination. *Language Teaching Research*, *15*(4), 391–411.

Lee, A., & Lyster, R. (2017). Can corrective feedback on second language speech perception errors affect production accuracy? *Applied Psycholinguistics*, 38(2), 371–393.

Lee, J. F., & VanPatten, B. (2003). *Making Communicative Language Teaching Happen, Second Edition*. New York: McGraw-Hill.

Lee, J., Jang, J., & Plonsky, L. (2015). The effectiveness of second language pronunciation instruction: A meta-analysis. *Applied Linguistics*, *36*(3), 345-366.

Lee, S-K., & Huang, H.-T. (2008). Visual input enhancement and grammar learning. *Studies in Second Language Acquisition*, *30*(3), 307–331.

Leow, R. (1997). The effects of input enhancement and text length on adult L2 readers' comprehension and intake in second language acquisition. *Applied Language Learning*, *8*(2), 151–182.

Leow, R. (2000). A study of the role of awareness in foreign language behavior: Aware versus unaware learners. *Studies in Second Language Acqusitiion*, 22(4), 557–584.

Leow, R. (2018). Explicit learning and depth of processing in the instructed setting: Theory, research, and practice. *Studies in English Education*, *23*(4), 769–801.

Leow, R., Egi, T., Nuevo, A. M., & Tsai, Y-C. (2003). The roles of textual enhancement and type of linguistic item in adult L2 learners' comprehension and intake. *Applied Language Learning 13*,(2), 1–13.

Leung, J. H. C., & Williams, J. N. (2011). The implicit learning of mappings between forms and contextually derived meanings. *Studies in Second Language Acquisition*, *33*(1), 33–55.

Levis, J. (2005). Changing contexts and shifting paradigms in pronunciation teaching. *TESOL Quarterly*, *39*(3), 369–377.

Levis, J. (2015). Learners' views of social issues in pronunciation learning. *Journal of Academic Language and Learning*, *9*(1), 42–55.

Levis, J. (2019). Pronunciation research in recent dissertations. *Journal of Second Language Pronunciation, 5*(2), 181–194.

Lightbown, P. M., Spada, N., & White, L. (1993). The role of instruction in second language acquisition. *Studies in Second Language Acquisition*, *15*(2), 143–145.

Lightfoot, D. (2007). Language history for teaching and learning German. *Die Unterrichtspraxis*, *40*(1), 34–45.

Lindsey, J. (2013). *L2 acquisition of the context-dependent [ç]-[x] alternation in American English learners of German*. (Master's Thesis, Indiana University).

Lindstromberg, S. (2020). Intentional L2 vocabulary learning. In S. Webb (eds.), *The Routledge handbook of vocabulary studies* (pp. 240–254). London/New York: Routledge.

Linebaugh, G., & Roche, T. (2015). Evidence that L2 production training can enhance perception. *Journal of Academic Language and Learning*, *9*(1), 1–17.

Littlewood W. (2011). Communicative language teaching: an expanding concept for a changing world. In E. Hinkel E (Ed.), *Handbook of research in second language teaching and learning: volume II* (pp. 541–557). New York: Routledge.

Lockhart, R. S., & Craik, F. I. M. (1990). Levels of processing: A retrospective analysis of a framework for memory research. *Canadian Journal of Psychology, 44*(1), 87–112.

Loewen S., Sato, M. (eds). (2017). *The Routledge handbook of instructed second language acquisition*. Routledge, New York.

Loewen, S. (2015). *Introduction to instructed second language acquisition*. Routledge, New York.

Loewen, S., & Hui, B. (2021). Small Samples in Instructed Second Language Acquisition Research. *The Modern Language Journal*, *105*, 187–193.

Loewen, S., & Sato, M. (2019). Instructed second language acquisition and English language teaching: Theory, research, and pedagogy. In X. Gao (Ed.), *Second handbook of English language teaching* (pp. 1131–1148). London: Springer.

Loftus, E. F., & Pickrell, J. E. (1995). The formation of false memories. *Psychiatric Annals, 25*(12), 720–725.

Loftus, E. F., & Zanni, G. (1975). Eyewitness testimony: The influence of the wording of a question. *Bulletin of the Psychonomic Society, 5*(1), 86–88.

Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review, 95,* 492–527.

Long, M. H. (1985). A role for instruction in second language acquisition: Task-based language teaching. In K. Hyltenstam and M. Pienemann (Ed.), *Modelling and assessing second language acquisition* (pp. 77–100). Clevedon, UK: Multilingual Matters.

Long, M. H. (1991). Focus on form: A design feature in language teaching methodology. In K. de Bot., R. B. Ginsberg., & C. Kramsch (Eds.), *Foreign language research in cross-cultural perspective* (pp. 39–52). Amsterdam: John Benjamins.

Long, M. H. (1997). Focus on form in task-based language teaching. *Working Papers in ESL, 16*(2), 35–49.

Long, M. H. (2015). *Second language acquisition and task-based language teaching*. Maldan, MA and Oxford, UK: Wiley Blackwell.

Long, M. H. (2017). Instructed second language acquisition (ISLA): Geopolitics, methodological issues, and some major research questions. *Instructed Second Language Acquisition, 1*(1), 7–44.

Lord, G. (2005). (How) Can we teach foreign language pronunciation? On the effects of a Spanish phonetics course. *Hispania, 88*(3), 257–267.

Lord, G. (2008). Podcasting communities and second language pronunciation. *Foreign Language Annuals, 41*(2), 364–379.

Lord, G. (2010). The combined effects of immersion and instruction on second language pronunciation. *Foreign Language Annuals, 43*(3), 488–503.

Lousada, M., Jesus, L. M., & Hall, A. (2010). Temporal acoustic correlates of the voicing contrast in European Portuguese stops. *Journal of the International Phonetic Association, 40*(3) 261–275.

Lyster, R. (1998). Recasts, repetition, and ambiguity in L2 classroom discourse. *Studies in Second Language Acquisition, 20*(1), 55–85.

Lyster, R. (1999). Immersion. In B. Spolsky (Ed.), *Concise encyclopedia of educational linguistics* (pp. 626–632). New York: Pergamon.

Lyster, R. (2007). *Learning and teaching languages through content: A counterbalanced approach*. Amsterdam: John Benjamins.

Lyster, R., & Ranta, L. (1997). Corrective feedback and learner uptake: Negotiation of form in communicative classrooms. *Studies in Second Language Acquisition*, *19*(1), 37–66.

Maack, A. (1953). Die Beeinflussung der Sonantendauer durch die Nachbarkonsonanlen, *Zeitschrift für Phonetik und Allgemeine Sprachwissenschaft, 7*, 104–128.

McCandless, P., & Winitz, H. (1986). Test of pronunciation following one year of comprehension instruction in college German. *The Modern Language Journal*, *70*, 355–362.

Mack, M., (1982). Voicing-dependent vowel duration in English and French: Monolingual and bilingual production. *The Journal of the Acoustical Society of America*, *71*(1), 173–187.

Mackey, A. (2006). Feedback, noticing and instructed second language learning. *Applied Linguistics*, *27*(3), 405–430.

Mason, B., Vanata, M., Jander, K., Borsch, R., & Krashen, S. (2008). The effects and efficiency of hearing stories on vocabulary acquisition by students of German as a second foreign language in Japan. *Indonesian JELT, 5*(1), 1–14.

Mayes, T., & de Freitas, S. (2007). Learning and e-learning: the role of theory. In H. Beethham & R. Sharpe (Eds.), *Rethinking pedagogy for a digital age* (pp. 33–45). London/New York: Routledge.

McGurk, H., & MacDonald, J. W. (1976). Hearing lips and seeing voices. *Nature, 264*, 746-748.

McLaughlin, B. (1987). *Second-language acquisition in childhood: School-age children* (Vol. 2). Lawrence Erlbaum.

Medina, A. (2015). The variable effects of level of awareness and CALL versus non-CALL textual modification on adult L2 readers' input comprehension and learning. In R. P. Leow, L. Cerezo., & M. Baralt (Eds.), *A psycholinguistic approach to technology and language learning* (pp. 109–130). Berlin: De Gruyter.

Mielke, J. (2008). *The Emergence of Distinctive Features*. Oxford: Oxford University Press.

Miller, J. S. (2012). Teaching French pronunciation with phonetics in a college-level beginner French course. *NECTFL Review*, *69*, 47–68.

Moray, N. (1959). Attention in dichotic listening: Affective cues and the influence of instructions. *Quarterly Journal of Experimental Psychology*, *11*(1), 56–60.

Moulton, W. G. (1962). *The sounds of English and German*. Chicago, IL: University of Chicago Press.

Moser, H., H. Wellmann, & N. R. Wolf. (1981). *Geschichte der deutschen Sprache. Vol 1: Althochdeutsch-Mittelhochdeutsch.* Heidelberg: Quelle and Meyer.

Most, S. B., Scholl, B. J., Clifford, E. R., & Simons, D. J. (2005). What you see is what you set: Sustained inattentional blindness and the capture of awareness. *Psychological Review*, *112*(1), 217–242.

Nagy, W. (2007). Metalinguistic awareness and the vocabulary-comprehension connection. In R. Wagner, A. Muse, & K. Tannenbaum (Eds.), *Vocabulary acquisition: Implications for reading comprehension* (pp. 52–77). New York: The Guilford Press.

Nagy, W. E., Herman, P. A., & Anderson, R. C. (1985). Learning words from context. *Reading Research Quarterly*, *20*(2) 233–253.

Nairne, J., Lindsay, S., Paulhus, D., & Smith, M. (2004). *Psychology. The adaptive mind*. Toronto, Canada: Nelson.

Nakata, T. (2015). Effects of expanding and equal spacing on second language vocabulary learning: Does gradually increasing spacing increase vocabulary learning? *Studies in Second Language Acquisition, 37*, 677–711.

Nakata, R., Frazier, K., Hoskins, B., & Graham, C. (2007). *Let's go.* Oxford, England: Oxford University Press.

Nassaji, H. (2017). Grammar acquisition. In S. Loewen & M. Sato (Eds.), *The Routledge handbook of instructed second language acquisition* (pp. 205–223). New York: Routledge.

Nassaji, H., & Fotos, S. (2004). Current developments in research on the teaching of grammar. *Annual Review of Applied Linguistics, 24*, 126–145.

Nation, I. S. P. (1995). The word on words: An interview with Paul Nation. Interviewed by N. Schmitt. *The Language Teacher, 19*(2), 5-7.

Nation, I. S. P. (2001). *Learning vocabulary in another Language*. Cambridge: Cambridge University Press.

Nation, I. S. P. (2013). *Learning vocabulary in another language* (2nd edition). Cambridge: Cambridge University Press.

Nation, I. S. P., & Newton, J. (1997). Teaching vocabulary. In J. Coady & T. Huckin (Eds.), *Second language vocabulary acquisition* (pp. 238–254). New York: Cambridge University Press.

Nemati, A. (2009). Memory vocabulary learning strategies and long-term retention. *International Journal of Vocational and Technical Education, 1*(2), 14–24.

Nicoll, R. A. (2017). A brief history of long-term potentiation. *Neuron, 93*(2), 281–290.

Nielsen, H. F. (1989). *The Germanic languages: Origins and early dialectal interrelations*. University of Alabama Press.

Norris, J. M., & Ortega, L. (2001). Does type of instruction make a difference? Substantive findings from a meta-analytic review. *Language learning*, *51*, 157–213.

Nunan, D. (1988). *Understanding language classrooms: A guide for teacher-initiated action*. Cambridge, U.K.: Prentice Hall International.

O'Brien, M. G. (2004). Pronunciation matters. *Teaching German, 37*(1), 1–9.

O'Brien, M. G., & Fagan, S. M. (2016). *German phonetics and phonology: Theory and practice*. New Haven, CT: Yale University Press.

Offerman, H. M. (2020). *The effects of pronunciation instruction on L2 production and L2 perception in Spanish: A comparative analysis* (Doctoral dissertation, Purdue University).

Offerman, H. M., & Olson, D. J. (2016). Visual feedback and second language segmental production: The generalizability of pronunciation gains. *System, 59*, 45–60.

Olson, D. J. (2014). Benefits of visual feedback on segmental production in the L2 classroom. *Language Learning and Technology, 18*(3), 173–192.

Olson, D. J., & Offerman, H. M. (2021). Maximizing the effect of visual feedback for pronunciation instruction: A comparative analysis of three approaches. *Journal of Second Language Pronunciation, 7*(1), 89–115.

Ormrod, J. (2008). *Human learning*. Upper Saddle River, NJ: Prentice Hall.

Ortega, L. (2009). *Understanding Second Language Acquisition*. Abingdon, UK: Hodder Education.

Paradis, M. (2009). *Neurolinguistic aspects of bilingualism*. Amsterdam: John Benjamins.

Peltekov, P. (2017). *The effectiveness of implicit and explicit instruction on German L2 learners' pronunciation*. (Master thesis, University of Calgary).

Peltekov, P. (2020). The effectiveness of implicit and explicit instruction on German L2 learners' pronunciation. *Die Unterrichtspraxis, 53*(1), 1–22.

Pennington, M. C., & Rogerson-Revell, P. (2019). English pronunciation teaching and research: Contemporary perspectives. Basingstoke: Palgrave Macmillan.

Peters, E., & Webb, S. (2018). Incidental vocabulary acquisition through viewing L2 television and factors that affect learning. *Studies in Second Language Acquisition, 40*(3), 551–577.

Peters, E., Hulstijn, J., Sercu, L., & Lutjeharms, M. (2009). Learning L2 German vocabulary through reading: The effects of three enhancement techniques compared. *Language Learning*, *59*(1), 113–151.

Peterson, S. E. (1991). The cognitive functions of underlining as a study technique. *Literacy Research and Instruction*, *31*(2), 49–56.

Peterson, G., & Lehiste, I. (1960). Duration of syllable nuclei in English. *Journal of the Acoustical Society of America*, *32*, 693–703.

Plonsky, L. & Oswald F. L. (2014). How big is 'big'? Interpreting effects sizes in L2 research. *Language Learning*, *64*, 878–891.

Plonsky, L. (2011). The effectiveness of second language strategy instruction: A meta-analysis. *Language Learning*, *61*(4), 993–1038.

Plonsky, L. (2013). Study quality in SLA: An assessment of designs, analyses, and reporting practices in quantitative L2 research. *Studies in Second Language Acquisition*, *35*(4), 655–687.

Poldrack, R. A., & Packard, M. G. (2003). Competition among multiple memory systems: Converging evidence from animal and human brain studies. *Neuropsychologia*, *41*(3), 245–251.

Poldrack, R. A., Clark, J., Paré-Blagoev, E. A., Shohamy, D., Moyano, J. C., Myers, C., & Gluck, M. A. (2001). Interactive memory systems in the human brain. *Nature*, *414*(6863), 546–550.

Port, R. F., & Dalby, J. (1982). Consonant/vowel ratio as a cue for voicing in English. *Perception & Psychophysics*, *32*(4), 141–152.

Port, R. F., & O'Dell, M. L. (1985). Neutralization of syllable-final voicing in German. *Journal of Phonetics*, *13*(4), 455–471.

Port, R., & Crawford, P. (1989). Incomplete neutralization and pragmatics in German. *Journal of Phonetics*, *17*(4), 257–282.

Prince, P. (2012). Towards an instructional programme for L2 vocabulary: Can a story help?. *Language Learning & Technology*, *16*(3), 103–120.

Pullum, G., & B. Scholz (2002). Empirical assessment of stimulus poverty arguments. *The Linguistic Review*, *19*, 9–50.

Pye, S. (1986). Word-final devoicing of obstruents in Russian. *Cambridge Papers in Phonetics and Experimental Linguistics*, 5, 1–10.

Quirk, R., & Wrenn, C. (1994). *An old English grammar*. Dekalb, IL: Northern Illinois University Press.

Radwan, A. A. (2005). The effectiveness of explicit attention to form in language learning. *System, 33*(1), 69–87.

Rayevska, N. M. (1979). *English Lexicology* (4th edition). Kiev: Vysca Skola Publishers.

Reber, A. S. (1976). Implicit learning of synthetic languages: The role of instructional set. *Journal of Experimental Psychology: Human Learning and Memory*, *2*(1), 88–94.

Reber, A. S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General*, *118*(3), 219–235.

Reber, A. S. (1993). Implicit learning and tacit knowledge: An essay of the cognitive unconscious. New York: Oxford University Press.

Reber, A. S., Allen, R., & Reber, E. S. (2009). *The penguin dictionary of psychology*. New York: Penguin Group.

Rebuschat, P. (2013). Measuring implicit and explicit knowledge in second language research. *Language Learning*, *63*(3), 595–629.

Rebuschat, P., & Williams, J. N. (2012). Implicit and explicit knowledge in second language acquisition. *Applied Psycholinguistics*, *33*, 829–856.

Rebuschat, P. (Ed.). (2015). *Implicit and explicit learning of languages* (Vol. 48). Amsterdam: John Benjamins.

Renou, J. (2001). An examination of the relationship between metalinguistic awareness and second-language proficiency of adult learners of French. *Language Awareness*, *10*(4), 248–267.

Rescorla, L., & Okuda, S. (1984). Lexical development in second language acquisition: initial stages in a Japanese child's learning of English. *Journal of Child Language*, *11*(3), 689–695.

Riemer, N. (2010). *Introducing semantics*. Cambridge: Cambridge University Press.

Rischel, J. (1991). The relevance of phonetics for phonology: a commentary. *Phonetics*, *48*, 233–262.

Robinson, O. W. (2003). *Old English and its closest relatives: a survey of the earliest Germanic languages*. Routledge.

Robinson, P. (1994). *Learning simple and complex second language rules under implicit, incidental, rule-search and instructed conditions*. (Unpublished doctoral dissertation). University of Hawaii at Manoa, Honolulu.

Robinson, P. (1996). Learning simple and complex second language rules under implicit, incidental, rule-search, and instructed conditions. *Studies in Second Language Acquisition*, *18*(1), 27–67.

Robinson, P. (1997). Generalizability and automaticity of second language learning under implicit, incidental, rule-search and instructed conditions. *Studies in Second Language Acquisition*, *19*(2), 233–247.

Robinson, P., Mackey, A., Gass, S. M., & Schmidt, R. (2012). Attention and awareness in second language acquisition. In S. M. Gass & A. Mackey (Eds.), *The Routledge handbook of second language acquisition* (pp. 247–267). London: Routledge.

Roccamo, A. (2015). Teaching pronunciation in just ten minutes a day: A method for pronunciation instruction in first-semester German language classrooms. *Die Unterrichtspraxis*, *48*(1), 59–83.

Rodgers, D. (2006). Developing content and form: Encouraging evidence from Italian content-based instruction. *The Modern Language Journal*, *90*(3), 373–386.

Rogers, J. (2017). The spacing effect and its relevance to second language acquisition. *Applied Linguistics, 38*, 906–911.

Roediger, H. L. (1980). Memory metaphors in cognitive psychology. *Memory & Cognition*, *8*, 231–246.

Roediger, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: taking memory tests improves long-term retention. *Psychological Science*, *17*(3), 249–255.

Roehr, K. (2008). Metalinguistic knowledge and language ability in university-level L2 learners. *Applied Linguistics*, *19*(1), 67–106.

Roehr, K. (2018). *Metalinguistic awareness and second language acquisition*. Routledge: New York & London.

Roettger, T. B., Winter, B., & S. Grawunder. (2014). Assessing incomplete neutralization of final devoicing in German. *Journal of Phonetics*, *43*, 11–25.

Rogers, T. B., Kuiper, N.A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, *35*(9), 677–688.

Ronberg, G. (1992). *A way with words: The language of English renaissance literature*. New York: Routledge.

Roothooft, H., & Breeze, R. (2016). A comparison of EFL teachers' and students' attitudes to oral corrective feedback. *Language Awareness, 25*(4), 318–335.

Rosa, E., & Leow, R. P. (2004). Awareness, different learning conditions, and second language development. *Applied Psycholinguistics*, *25*(2), 269–292.

Rosa, E., & O'Neil, M. (1999). Explicitness, intake, and the issue of awareness: Another piece to the puzzle. *Studies in Second Language Acquisition*, 21(4), 511–556.

Rott, S. (1999). The Effect of Exposure Frequency on Intermediate Language Learners Incidental Vocabulary Acquisition and Retention Through Reading. *Studies in Second Language Acquisition*, *21*(4), 589–619.

Ruiz, S., Rebuschat, P., & Meurers, D. (2021). The effects of working memory and declarative memory on instructed second language vocabulary learning: Insights from intelligent CALL. *Language Teaching Research*, *25*(4), 510–539.

Saalfeld, A. K. (2011). Acquisition of L2 phonology in advanced learners: Does instruction make a difference? In. J. Levis & K. LeVelle (Eds.), *Proceedings of the 2nd Pronunciation in Second Language Learning and Teaching Conference*, Sept. 2010. (pp. 144–152), Ames, IA: Iowa State University.

Salmons, J. (2012). *A history of German*. Oxford: Oxford University Press.

Salmons, J. (2017). The Anglo-Frisian Relationship as Contact and Linkage. *Amsterdamer Beiträge zur älteren Germanistik*, *77*(1-2), 377–388.

Sagarra, N., & Alba, M. (2006). The key is in the keyword: L2 learning vocabulary learning methods with beginning learners of Spanish. *The Modern Language Journal*, *90*(2), 228–243.

Saito, K. (2011). Examining the role of explicit phonetic instruction in native-like and comprehensible pronunciation development: An instructed SLA approach to L2 phonology. *Language Awareness*, *20*(1), 45–59.

Samuels, M. L. (1975). *Linguistic evolution: with special reference to English* (Vol. 5). Cambridge University Press.

Savignon, S. J. (2005). Communicative language teaching: strategies and goals. In E. Hinkel (Ed.), *Handbook of Research in Second Language Teaching and Learning* (pp. 635–651). Mahwah, NJ: Lawrence Erlbaum.

Schmidt, R. (1990). The role of consciousness in second language learning. *Applied linguistics*, *11*(2), 129–158.

Schmidt, R. (1993). Awareness and second language acquisition. *Annual Review of Applied Linguistics*, *13*, 206–226.

Schmidt, R. (1994). Deconstructing consciousness in search of useful definitions for applied linguistics. *AILA Review*, *11*, 11–26.

Schmidt, R. (1995). Consciousness and foreign language learning: A tutorial on the role of attention and awareness in learning. In R. Schmidt (Ed.), *Attention and awareness in foreign language learning* (pp. 1–63). Honolulu, HI: University of Hawaii, Second Language Teaching & Curriculum Center.

Schmidt, R. (2001). Attention. In P. Robinson (Ed.), *Cognition and second language instruction* (pp. 3–32). Cambridge: Cambridge University Press.

Schmidt, R., & Frota, S. (1986). Developing basic conversational ability in a second language: A case study of an adult learner of Portuguese. In R. Day (Ed.), *Talking to learn: Conversation in second language learning* (pp. 237–322). Rowley, MA: Newbury House

Schmidt, S. R. (2004). Autobiographical memories for the September 11th attacks: Reconstructive errors and emotional impairment of memory. *Memory & cognition*, *32*(3), 443–454.

Schmidt, W. (2013). *Geschichte der deutschen Sprache. Ein Lehrbuch für das germanistische Studium* (11th edition). Stuttgart: Verlag Stuttgart.

Schmitt, N. (2008). Review article: Instructed second language vocabulary learning. *Language Teaching Research, 12*(3), 329–363.

Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual*. Basingstoke, England: Palgrave Macmillan.

Schwanenflugel, P. J. & Rey, M. (1986). Interlingual semantic fadlitation: Evidence for a conu-non representational system in a bilingual lexicon. *Journal of Memory and Language*, *25*(4), 605–618.

Schwartz, B. D. & Sprouse, R. A. (1996). L2 cognitive states and the Full Transfer/Full Access model. *Second Language Research, 12*(1), 40–72.

Schwartz, B. D. & Sprouse, R. A. (2000). When syntactic theories evolve: consequences for L2 acquisition research. In J. Archibald (ed.), *Second language acquisition and linguistic theory* (pp. 156–86). Malden, MA: Blackwell.

Schwartz, B. D. (1993). On explicit and negative data effecting and affecting competence and linguistic behavior. *Studies in Second Language Acquisition*, *15*(2), 147–163.

Schwartz, B. D., & Sprouse, R. A. (2013). Generative approaches and the poverty of the stimulus. In J. Herschensohn & M. Young-Scholten (Eds), *The Cambridge handbook of second language acquisition* (pp. 137–158). Cambridge: Cambridge University Press.

Scott, J. H. G. (2019). *Phonemic and phonotactic inference in early interlanguage: Americans learning German fricatives in L2 acquisition* (Doctoral dissertation, Indiana University).

Shadle, C. H. (1991). The effect of geometry on source mechanisms of fricative consonants. *Journal of Phonetics*, *19*(3-4), 409–424.

Sharwood Smith, M. (1991). Speaking to many minds. *Second Language Research*, *7*, 118–132.

Sharwood Smith, M. (1993). Input enhancement in instructed SLA: Theoretical bases. *Studies in second language acquisition*, *15*(2), 165–179.

Shaw, J., & Porter, S. (2015). Constructing rich false memories of committing crime. *Psychological Science*, *26*(3), 291–301.

Shintani, N. (2013). The effect of focus on form and focus on forms instruction on the acquisition of productive knowledge of L2 vocabulary by young beginning-level learners. *TESOL Quarterly*, *47*(1), 36–62.

Simon, E. (2010). Phonological transfer of voicing and devoicing rules: evidence from L1 Dutch and L2 English conversational speech. *Language Sciences*, *32*, 63–86.

Simon, H. A., & Feigenbaum, E. A. (1964). An information processing theory of some effects of similarity, familiarization, and meaningfulness in verbal learning. *Journal of Verbal Learning and Verbal Behavior*, *3*, 385–396.

Simonchyk, A., & Darcy, I. (2018). The effect of orthography on the lexical encoding of palatalized consonants in L2 Russian. *Language and speech*, *61*(4), 522-546.

Skehan, P. (1998). *A cognitive approach to language learning*. Oxford University Press.

Skehan, P. (2009). Modeling second language performance: Integrating complexity, accuracy, fluency and lexis. *Applied Linguistics*, *30*(4), 510–532.

Slamecka, N. J., & Graf, P. (1978). The generation effect: Delineation of a phenomenon. *Journal of Experimental Psychology*, *4*(6), 592–604.

Slis, I. H. & Cohen, A. (1969). On the complex regulating the voiced-voiceless distinction II, *Language and Speech*, *12*, 137–155.

Slowiaczek, L.M., & Dinnsen, D.A. (1985). On the neutralizing status of Polish word-final devoicing. *Journal of Phonetics*, *13*, 325–341.

Smith, B. L., & Peterson, E. A. (2012). Native English speakers learning German as a second language: Devoicing of final voiced stop targets. *Journal of Phonetics*, *40*(1), 129–140.

Smith, B. L., Hayes-Harb, R., Bruss, M., & Harker, A. (2009). Production and perception of voicing and devoicing in similar German and English word pairs by native speakers of German. *Journal of Phonetics*, *37*(3), 257–275.

Smith, S. (1968). Historical Linguistics and the Teaching of German. *The German Quarterly*, *41*(2), 231–238.

Spada, N., & Lightbown, P. (2008). Form-focused instruction: Isolated or integrated? *TESOL Quarterly*, *42*(2), 181–207.

Spada, N., & Tomita, Y. (2010). Interactions between type of instruction and type of language feature: A meta-analysis. *Language Learning, 60*(2), 263–308.

Squire, L. R. (2004). Memory systems of the brain: a brief history and current perspective. *Neurobiology of Learning and ,emory, 82*(3), 171–177.

Squire, L. R., & Zola, S. M. (1998). Episodic memory, semantic memory, and amnesia. *Hippocampus, 8*(3), 205–211.

Stevens, K. N. (1989). On the quantal nature of speech. *Journal of Phonetics*, *17*(1), 3–45.

Stevenson, P., Kristine, H., Langer, N., & Reershemius, G. (2017). *The German-speaking world: A practical introduction to sociolinguistic issues*. New York: Routledge.

Stockwell, R., & Minkova, D. (2001). *English words: History and structure*. Cambridge University Press.

Strayer, D. L., & Johnston. W. A. (2001) Driven to distraction: dual-task studies of simulated driving and conversing on a cellular telephone. *Psychological Science, 12*(6), 462–466.

Strayer, D. L., Watson, J. M., & Drews, F. A. (2011). Cognitive distraction while multitasking in the automobile. *Psychology of Learning and Motivation*, *54*, 29–58.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology, 18*(6), 643–662.

Sturm, J. (2013). Explicit Phonetics Instruction in L2 French: A Global Analysis of Improvement. *System, 41*(3), 654–662.

Suzuki, Y., & DeKeyser, R. (2017). Effects of distributed practice on the proceduralization of morphology. *Language Teaching Research, 21*, 166–188.

Swain, M. (1985). Communicative competence: Some roles of comprehensible input and comprehensible output in its development. In S. Gass & C. Madden (Eds.), *Input in second language acquisition* (pp. 235–253). Rowley, MA: Newbury House.

Swain, M. (1991). French immersion and its offshoots: Getting two for one. In B. F. Freed (Ed.), *Foreign language acquisition research and the classroom* (pp. 91–103). Lexington, MA: D. C. Heath.

Swanborn, M. S., & De Glopper, K. (1999). Incidental word learning while reading: A meta-analysis. *Review of educational research, 69*(3), 261–285.

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: a meta-analysis. *Psychological Bulletin, 121*(3), 371.

Tavakoli, M., & Gerami, E. (2013). The effect of keyword and pictorial methods on EFL learner's vocabulary learning and retention. *Porta Linguarium 19*, 299–316.

Thomson, R.I., & Isaacs, T. (2009). Within-category variation in L2 English vowel learning. *Canadian Acoustics*, *37*(3), 138–139.

Thomson, R. I., & Derwing, T. M. (2015). The effectiveness of L2 pronunciation instruction: A narrative review. *Applied Linguistics*, *36*(3), 326–344.

Thornbury, S. (2016). Communicative language teaching in theory and practice. In G. Hall (Ed.), *The Routledge handbook of English language teaching* (pp. 242–255). Abingdon, Oxon: Taylor & Francis.

Thorndike, E. L., & Rock, R. T. (1934). Learning without awareness of what is being learned or intent to learn it. *Journal of Experimental Psychology*, *17*(1), 1.

Tomlin, R. S & Villa, V. (1994). Attention in cognitive science and second language acquisition. *Studies in Second Language Acquisition*, *16*(2), 183–203.

Traugott, E. C., & Dasher, R. B. (2001). *Regularity in semantic change*. Cambridge University Press.

Treisman, A. M. (1960). Contextual cues in selective listening. *Quarterly Journal of Experimental Psychology*, *12*(4), 242-–48.

Treisman, A. M. (1964). Verbal cues, language, and meaning in selective attention. *American Journal of Psychology*, *77*(2), 206–219.

Tronnier, M. & Dantsuji, M. (1993). Some acoustic characteristics of glottal and palatal fricatives in Japanese and German. *Working* Papers (Lund University Department of Linguistics), *40*, 213–228.

Trudgill, P. (1999). *The dialects of England* (2nd edition). Oxford: Blackwell.

Truscott, J. & Sharwood Smith, M. (2011). Input, intake, and consciousness: the quest for a theoretical foundation. *Studies in Second Language Acquisition*, *33*(4), 497–528.

Tsuchiya, N., & Koch, C. (2005). Continuous flash suppression reduces negative afterimages. *Nature Neuroscience*, *8*(8), 1096–1101.

Tulving, E. (2002). Episodic memory: from mind to brain. *Annual Review of Psychology*, *53*(1), 1–25.

Turk, A. E., & Shattuck-Hufnagel, S. (2007). Multiple targets of phrase-final lengthening in American English words. *Journal of Phonetics*, *35*(4), 445–472.

Turk, D. J., Cunningham, S. J, & Macrae, C. N. (2008). Self-memory biases in explicit and incidental encoding of trait adjectives. *Consciousness and Cognition*, 17, 1040–1045.

Tzelgov, J., & Eben-Ezra, S. (1992). Components of the between-language semantic priming effect. *European Journal of Cognitive Psychology*, *4*(4), 253–272.

Ullman, M. T. (2001). The neural basis of lexicon and grammar in first and second language: The declarative/procedural model. *Bilingualism: Language and cognition*, *4*(2), 105–122.

Ullman, M. T. (2005). A cognitive neuroscience perspective on second language acquisition: The declarative/procedural model. In C. Sanz (Ed.), *Mind and context in adult second language acquisition: Methods, theory, practice*. (pp. 141–178). Washington, DC: Georgetown University Press.

Ullman, M. T. (2013). Decalarative/Procedural Model. In P. Robinson (ed.), *The Routledge encylopedia of second language acquisition* (pp. 160-164). Routledge: London/New York.

Ullman, M. T. (2015). The declarative/procedural model: A neurobiologically motivated theory of first and second language. In B. VanPatten & J. Williams, (Eds.), *Theories in second language acquisition: An introduction* (pp. 135–158). 2nd edition. New York: Routledge.

Ullman, M.T. (2016). The declarative/procedural model: A neurobiological model of language learning, knowledge, and use. In G. Hickok & S. A. Small (Eds.), *Neurobiology of language* (pp. 953–968). Amsterdam: Elsevier.

Ullmann, M. (1999). History and geography through French: CLIL in a UK secondary school. In J. Masih (Ed.), *Learning through a foreign language: Models, methods and outcomes* (pp. 96–105). Lancaster: CILT.

Ullmann, S. (1957). *The principles of semantics* (2nd Edition). Glasgow: Jackson, Son & Co.; Oxford: Basil Blackwell.

Ullmann, S. (1962). *Semantics: an introduction to the science of meaning*. Oxford: Blackwell.

Ur, P. (1996). *A course in language teaching: Practice and theory*. Cambridge, England: Cambridge University Press.

Van der Hoek, M. 2010. *Palatalisation in West Germanic*. Ph.D. dissertation. (Unpublished doctoral dissertation). University of Minnesota.

VanPatten, B. (1996). *Input processing and grammar instruction in second language acquisition*. Norwood, NJ: Ablex.

VanPatten, B. (2003). *From input to output: A teacher's guide to second language acquisition*. Boston: McGraw Hill.

VanPatten, B. (2004). Several reflections on why there is good reason to continue researching the effects of processing instruction. In B. VanPatten, (Ed.), *Processing instruction: Theory, research and commentary* (pp. 325–335). Mahwah, NJ: Lawrence Erlbaum Associates.

VanPatten, B., & Rothman, J. (2015). What does current generative theory have to say about the explicit-implicit debate. In Rebuschat, P. (Ed.). *Implicit and explicit learning of language* (pp. 91–116). Amsterdam: John Benjamins.

Wang, W., Jongman, A., & Sereno, J. A. (2003). Acoustic and perceptual evaluations of Mandarin tone productions before and after perceptual training. *Journal of the Acoustical Society of America*, *113*(2), 1033–1043.

Warden, M., Lapkin, S., Swain, M., & Hart, D. (1995). Adolescent language learners on a three month exchange: Evidence from their diaries. *Foreign Language Annals*, *28*(4), 537–549.

Waring, R., & Takaki, M. (2003). At what rate do learners learn and retain new vocabulary from reading a graded reader? *Reading in a Foreign Language*, *15*(2), 130–163.

Warner, N., Jongman, A., Sereno, J., & Kemps, R. (2004). Incomplete neutralization and other sub-phonemic durational differences in production and perception: Evidence from Dutch. *Journal of Phonetics*, *32*(2), 251–276.

Webb, S. (2007). The effects of repetition on vocabulary knowledge. *Applied Linguistics*, *28*(1), 46–65.

Webb, S., & Chang, A. C. S. (2015). How does prior word knowledge affect vocabulary learning progress in an extensive reading program? *Studies in Second Language Acquisition*, *37*(4), 651–675.

Webb, S., & Nation, P. (2017). *How vocabulary is learned*. Oxford: Oxford University Press.

Wedel, A., Jackson, S., & Kaplan, A. (2013). Functional load and the lexicon: Evidence that syntactic category and frequency relationships in minimal lemma pairs predict the loss of phoneme contrasts in language change. *Language and Speech*, *56*(3), 395–417.

Wei, M. M. (2003). Learning simple and complex rules: Acquisition of Japanese location particles and conjectural auxiliaries. *Japanese Linguistics*, *14*, 54–72.

Wells, C. J. (2003). *German, a linguistic history to 1945*. Oxford: Oxford University Press.

Weingartner, H., Adefris, W., Eich, J. E., & Murphy, D. L. (1976). Encoding-imagery specificity in alcohol state-dependent learning. *Journal of Experimental Psychology: Human Learning and Memory*, *2*(1), 83–87.

White, J., & Ranta, L. (2002). Examining the interface between metalinguistic task performance and oral production in a second language. *Language Awareness*, *11*(4), 259–290.

White, L., Spada, N., Lightbown, P. M., & Ranta, L. (1991). Input enhancement and L2 question formation. *Applied Linguistics*, *12*(4), 416–432.

Wiener, S., Chan, M. K., & Ito, K. (2020). Do explicit instruction and high variability phonetic training improve nonnative speakers' Mandarin tone productions?. *The Modern Language Journal*, *104*(1), 152–168.

Wiese, R. (2011). *Phonetik und Phonologie*. Stuttgart: UTB.

Wilhelm, O, Hildebrandt A, & Oberauer, K. (2013). What is working memory capacity, and how can we measure it? *Frontiers in Psychology, 4*, 1-22.

Williams, J. N. (2005). Learning without awareness. *Studies in Second Language Acquisition 27*(2), 269–304.

Williams, J. N. (2009). Implicit learning in second language acquisition. In W. C. Ritchie & T. K. Bhatia (Eds.), *The new handbook of second language acquisition* (pp. 319–344). Brill.

Winke, P. (2013). The effect of input enhancement on grammar learning and comprehension: A modified replication of Lee 2007, with eye-movement data. *Studies in Second Language Acquisition, 35*(2), 323–352.

Winkler, I., & Cowan, N. (2005). From sensory to long-term memory: evidence from auditory memory reactivation studies. *Experimental Psychology, 52*(1), 3–20.

Wolff, R. A. (1993). The history of the language as an instructional aid. *Unterrichtspraxis 26*(1), 27–35.

Woolfolk, A. E. (2013). *Educational psychology*. (12th Edition). Boston: Pearson.

Worthen, J. B., & Hunt, R. R. (2011). *Mnemonology mnemonics for the 21st century*. New York: Psychology Press.

Yamamoto, Y. (2014). Multidimensional vocabulary acquisition through deliberate vocabulary list learning. *System, 42*, 232–243.

Yanagisawa, A., Webb, S., & Uchihara, T. (2020). How do different forms of glossing contribute to L2 vocabulary learning from reading? A meta-regression analysis. *Studies in Second Language Acquisition, 42*(2), 411–438.

Yanagisawa, A., & Webb, S. (2021). To what extent does the involvement load hypothesis predict incidental l2 vocabulary learning? A meta-analysis. *Language Learning*, *71*(2), 487-536.

Yang, J., & Li, P. (2012). Brain networks of explicit and implicit learning. *PLOS ONE, 7*(8), e42993.

Yates, F. A. (1966). *The art of memory*. London: Routledge & Kegan Paul.

Young, C., & Gloning, T. (2004). *A history of the German language through texts*. New York: Routledge.

Young-Scholten, M. (1995). The negative effects of "positive" evidence on L2 phonology. In L. Eubank, L. Selinker, & M. Sharwood Smith (Eds.), *The current state of interlanguage* (pp. 107–122). Amsterdam: Benjamins.

Young-Scholten, M. (2002). Orthographic input in L2 phonological development. In P. Burmeister, T. Piske, & A. Rohde (Eds.), *An integrated view of language development: Papers in honour of Henning Wode* (pp. 263–279). Trier, Germany: Wissenschaftlicher Verlag Trier.

Young-Scholten, M. (2004). Prosodic constraints on allophonic distribution in adult L2 acquisition. *International Journal of Bilingualism, 8*(1), 67–77.

Young-Scholten, M., & Langer, M. (2015). The role of orthographic input in second language German: Evidence from naturalistic adult learners' production. *Applied Psycholinguistics, 36*(1), 93–114.

Zielinski, B., & Yates, L. (2014). Pronunciation instruction is not appropriate for beginning-level learners. In L. Grant (Ed.), *Pronunciation myths: Applying second language research to classroom teaching* (pp. 56–79). Ann Arbor: University of Michigan Press.