

Parasitic vocabulary acquisition, cross-linguistic influence, and lexical retrieval in multilinguals*

PETER ECKE
University of Arizona

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The first part of this paper reviews research evidence for typological similarity and/or L2 status as determinants of cross-linguistic influence (CLI) in multilingual lexical production. The second part presents a model of vocabulary acquisition as a framework to explain CLI at the levels of form, (syntactic) frame, and meaning, as well as some of the developmental changes that have been reported for CLI patterns in relation to L3 learners' proficiency. It is suggested that these patterns can be related to default processes and stages involved in the acquisition of individual word forms and their integration into networks of existing lexical triads, as described in the Parasitic Model of vocabulary acquisition. The third part of this paper points to research into the complexity and non-linearity of multilingual lexical development and the need to learn more about it.

Keywords: cross-linguistic influence, multilingual, lexical retrieval, production, transfer, third language acquisition, vocabulary acquisition

Introduction

Multilinguals (here, users of three or more languages) can become surprisingly good at controlling and using their languages successfully. Yet the ability to productively use several languages has to be developed and maintained over time, and is subject to occasional failure, as is speech production in monolingual speakers (Garrett, 1993). What makes word production in multilinguals different from that in monolingual or bilingual speakers is the more complex configuration of their lexical network(s), and the number of possible sources and directions for cross-linguistic influence (CLI), reflected in 'errors' and other kinds of retrieval phenomena.

The failure to produce or retrieve words in a multilingual's target language and the observed influence of words of non-target languages has been of interest to researchers for some time (Aronin & Hufeisen, 2009a). Word retrieval failure has been studied in the hope of learning about the mechanisms that underlie multilingual lexical processing (Cenoz, Hufeisen & Jessner, 2003) and to gain insights relevant to multilingual education and the learning and teaching of third languages (Jessner, 2008a).

The term 'third language' (L3) will be used here to refer to an investigated non-native language learned or used by a person who already has knowledge of one or more second languages (L2) acquired after infancy in addition to one

or more first languages (L1) acquired during infancy (Hammarberg, 2010). An L3 is essentially another L2. It will often, but not always, be the third language in order of acquisition. Used and investigated L4 or L5 will still be referred to as L3, but any other non-native language(s) that may or may not influence the processing of the L3 will be referred to as L2. This classification allows for a comparison of L1 vs. L2 effects on L3 production and eliminates the problem of determining the acquisition order of L2 (Hammarberg, 2010, p. 98).

Most research on lexical production in L3 to date has relied on naturalistic or quasi-naturalistic studies, particularly error analyses (e.g., Hufeisen, 1991) and, to a lesser degree, analyses of word-finding problems during translation tasks (e.g., Herwig, 2001) or in tip-of-the-tongue (TOT) states (e.g., Ecke, 2001). Some studies investigated lexical retrieval in L3 in relatively controlled experimental settings in the laboratory using translation, picture-naming (e.g., Abunuwara, 1992) or language-switching tasks (e.g., Festman, 2008). This essay will provide a review of research into multilingual lexical production, the linguistic domain that has received more attention (García-Mayo, 2012) than others such as morphosyntax and phonology (but see Cabrelli Amaro, 2012; García-Mayo & Rothman, 2012; Jaensch, 2013; and Wrembel, Gut & Mehlhorn, 2010, for research in these other domains).

Trilingual speakers' attempts to retrieve a particular word can fail in at least two ways: (1) the target word is automatically replaced by an unintended intrusion of another

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Address for correspondence:

Department of German Studies, 301 Learning Services Building, PO Box 210105, The University of Arizona, Tucson, AZ 85721-0105, USA
eckep@email.arizona.edu

word, resulting in a lexical substitution or a creation/blend of two or more lexical forms; (2) target word retrieval is (temporarily) impaired, incomplete, and partial. In this case, the speaker may pursue an extended, laborious search for the target word form, frequently accompanying this with word associations related in sound and/or meaning to the target. The first kind of retrieval failure is reflected in lexical ‘errors’, also called *DEVIANCES, UNINTENTIONAL LANGUAGE SWITCHES* or *TRANSFER LAPSES* if they include words from a non-target language (Lindqvist, 2009) or *BLENDS* if they combine parts of two or more word forms (Dewaele, 1998). The second kind of retrieval failure is reflected in word-finding problems, such as *TOT* states (Brown, 2012; Ecke, 2009) or elaborate translation attempts (Möhle, 1989). It is often unclear, however, whether the produced non-target items are the result of interfering or mediating processing routines of other lexical items (performance CLI), or of un- or underrepresented target items (competence CLI) (Hall & Ecke, 2003).

Analyses of intruding, preliminary, and partial output during retrieval failure have been used to infer the processing stages and time-course involved in lexical production (Garrett, 1993) as well as the sources and directions of CLI in the case of bilingual or multilingual retrieval (Ringbom, 1987). In this essay, I review and discuss what studies into lexical retrieval failure and CLI have contributed to our understanding of lexical production in multilingual speakers and argue that adopting an acquisition or developmental point of view may help explain aspects of CLI in multilingual lexical production. I will first review research related to a debate on whether typological similarity and/or L2 status can be conceived of as primary factors that determine the functioning of CLI in L3 production. I will then present a model of vocabulary acquisition and use it as an explanatory framework to discuss factors that influence lexical development, production and its occasional failure in the dynamically unfolding multilingual.

I should stress that this review focuses on automatic word retrieval and its failure, reflected in or accompanied by unintended intrusions of various kinds. It will leave aside a substantial body of L3 research that investigates intentional switches, such as affective or metacognitive comments, and appeals for help that are part of the speaker’s communication strategy repertoire (e.g., Gabryś-Barker, 2006). These reflect a different level of awareness (Cenoz, 2003a) and deliberateness, and tell us little about the cognitive mechanism underlying lexical retrieval (Poullisse & Bongarts, 1994).

Stages in L3 speech production

Most research into L3 lexical production has dealt with issues of CLI (de Angelis & Dewaele, 2009; Jarvis & Pavlenko, 2010). Whereas second language acquisition

has been concerned almost exclusively with CLI from the L1, researchers who have investigated L3 acquisition noticed early that L3 production was affected not only by L1, but also, and often to a greater degree, by one or more L2 (Vildomec, 1963). Most studies to date have focused on the prominent negative transfer (interference) of another language in L3 production, although the positive effects of CLI will usually outweigh the negative ones (Ringbom, 2001).

I will adopt here a three-stage view of lexical production based on triads of lexical form, (syntactic) frame, and links to corresponding conceptual representations (Hall & Ecke, 2003; Hall & Schulz, 1994; Jackendoff, 1997; Levelt, Roelofs & Meyer, 1999). In an attempt to produce a word, a trilingual speaker will have to map a chosen *concept* (meaning) onto a lexical form of a chosen language through access to its *syntactic frame* or *lemma* (Levelt et al., 1999) (which specifies the item’s word class, sub-categorization scheme, etc.) and the subsequent retrieval of the corresponding phonological or orthographic *form*, which can then be processed for articulation or written production. Non-target retrieval can occur at any of the three representational levels, as the following examples of ‘errors’ made by Spanish (L1) speaking learners of German (L3) with English (L2) illustrate.

- (1) *CLI at the meaning level*
 - a. *Ich practice Fussball* (target: *spiele*)
[I practice soccer] (target: play)
L2 source: *practice*; L1 source: *practicar*
 - b. *eine Tisch, nein eine Stuhl* (target: *stuhl*)
[a (fem.) table, no a (fem.) chair] (target: chair)
L3 source: *tisch* (table)
- (2) *CLI at the frame level*
 - a. *Ich kann warten nicht für mein Reise* (target: *warten + auf*)
[I cannot wait for my trip] (target: *wait + on*)
L2 source: *wait for*
 - b. *Der Bleistift bricht sich in zwei* (target: *bricht*)
[The pen breaks + refl. in two] (target: *break - refl.*)
L1 source: *romperse* [break + refl.]
- (3) *CLI at the form level*
 - a. *essen, ah soap, ein soap, Rindersteak* (target: *Suppe*)
[food, ah, soap, a soap, beef steak] (target: soup)
L2 source: *soap*
 - b. *der Kuchenschreiber* (target: *Kugelschreiber*)
[the cake pen] (target: ball point pen)
L3 source: *kuchen* [cake]

In examples 1a and 1b, the learner selected inappropriate concepts, which resulted in productions semantically related to the target. In examples 2a and 2b,

non-native syntactic frames were selected, a subcategorized preposition in 2a having its origin in an English L2 equivalent, and a reflexive marker in 2b influenced by an L1 equivalent. The non-native productions in 3 are form-based, 3a being apparently influenced by a similar L2 form, while 3b had its origin in an interfering form from within the L3. Note that in several of these examples, various representational levels are affected. Based on 'error' data of this kind, researchers developed a number of hypotheses that were meant to account for preferred patterns and sources of CLI in L3 production.

The tangle of typological distance and L2 status effects

Theoretical considerations within a generative framework of the study of language acquisition and the observation that L2 structures frequently affected L3 use resulted in the assumption of a FOREIGN LANGUAGE EFFECT (Meisel, 1983), later also referred to as the L2 STATUS FACTOR (Williams & Hammarberg, 1998). The assumption has been that the L1 acquired in childhood held a special status (Corder, 1983) with respect to the L2 acquired later (after infancy), which would be represented and processed qualitatively differently from the L1. Due to assumed differences in L1 vs. L2 learning and representation, it would be expected that the more similar representation and processing routes of two or more L2s affect each other more than the (qualitatively different) representation and access routes of the L1. Both Paradis (2009) and Ullman (2001) make a case for such differences in their discussions of procedural-based learning (prevalent in childhood) and declarative-based learning (in adulthood). In a recent contribution, Bardel and Falk (2012) discuss how these learning and knowledge types may relate to the L2 status effect.

Another early observation was that typologically more similar languages or languages that are perceived to be more similar by the learner (Odlin, 1989; Singleton, 1987) had a greater impact on CLI than typologically distant languages. It has also been pointed out that similarity of structures in two or more languages would often collectively contribute to CLI in the L3 (Selinker & Lakshmanan, 1993; Vildomec, 1963). Kellerman's (1977, 1983) concept of PSYCHOTYPOLOGY – the speaker's subjective perception of similarity and differences between languages – has had a great impact on how CLI patterns in L3 production have been interpreted. Learners' psychotypological perceptions will often, but not always, coincide with the typological and historical relatedness of language pairs described by linguists (Hall, Newbrand, Ecke, Sperr, Marchard & Hayes, 2009; Singleton, 2012).

Stedje's (1977) and Ringbom's (1987) research in Finland showed that the typologically very different

Finnish language contributed little to CLI at the form level in L3 German and L3 English use, compared to the typologically related Swedish language. Ringbom studied both L1 Finnish speakers (with Swedish L2) and L1 Swedish speakers (with Finnish L2) and found very little influence of Finnish in the L3 learners' writings, regardless of whether it functioned as L1 or L2 (also Jarvis & Odlin, 2000). In a longitudinal study with school children in the Basque country, Cenoz (2003b) reported CLI in L3 (English) to be more affected by L2 (Spanish) than by the typologically distant L1 (Basque). The thirteen studies with the pattern [L2, L3] [L1] listed in the Appendix all report a strong influence of a typologically similar L2 on L3 use, while the typologically distant L1 exercises relatively little CLI.

Most studies on L3 production investigated the learning and use of an L3 after the acquisition of an L2 that is closer to the L3 than the L1, but with all three languages belonging to the same (e.g., Indo-European) language family. A good number of studies have investigated how previously learned Germanic L2s affected the learning and use of Germanic L3s by L1 speakers of Romance languages (Bouvy, 2000; Ecke, 2001; Ecke & Hall, 2000; Hall & Ecke, 2003; Hall et al., 2009; Michiels, 1999; Sánchez, this volume). Another group of studies explored the effects of previously learned Romance L2s on the learning and use of Romance L3s in speakers of Germanic L1s (Bardel & Lindqvist, 2007; de Angelis, 2005b; de Angelis & Selinker, 2001; Möhle, 1989; Müller-Lancé, 2003; Singleton, 1987). The 22 studies with the pattern [[L2, L3] L1] in the Appendix reported relatively strong effects of the more similar L2 on CLI in L3 production compared to the somewhat more distant L1. Unfortunately, the prevailing combination of a relatively distant L1 and more closely related L2 and L3 pairs in these studies did not make it possible to separate the two factors and determine the potential PRIMACY of one or the other factor's effect on CLI. The frequently observed influence of a typologically more related L2 on L3 use leaves open the question of whether the effect was primarily a result of typological similarity, L2 status, or a combination of both (or even more) factors.

A few studies tried to disentangle the combined effects of language similarity and L2 status. Cenoz (2001), while reporting a strong overall effect of CLI from the typologically more similar Spanish language, pointed out that L3 English learners with Spanish L1 and Basque L2 transferred less Spanish than speakers of Basque L1 with Spanish L2. In other words, the learners' L3 was more subject to CLI if the more similar Spanish language was an L2 and not an L1, a finding that suggests that L2 status has a clear additive effect on CLI besides constraints of typological similarity.

Research into CLI in L3 production with typologically related triples of languages has shed more light on the

potential primacy of the L2 status factor. A number of studies were carried out with related Germanic L1s, L2s, and L3s (Voorwinde, 1981; Dentler, 1998; Herwig, 2001; Williams & Hammarberg, 1998) and related Romance language triples (de Angelis, 2005a, b) (see the studies under [L1, L2, L3] in the Appendix). These studies did, indeed, show strong L2 effects, but usually also some degree of CLI from the L1. In an influential case study of a multilingual, Williams and Hammarberg (1998) reported that (unintentional) CLI in L3 (Swedish) production was strongest from one L2 (German), which they labeled “default supplier”, (p. 295) compared to the speaker’s L1 (English) and other less-developed L2s.

Analyses of production errors made with triple cognates (phonologically and semantically similar word equivalents from three relatively close languages) also provided evidence for modulated L2 status effects. Ecke and Hall (2000, 2011) reported that the written and spoken lexical deviations produced by L3 learners of German with cognates consisted mostly of intrusions from the L2 (English), even though the L1 (Spanish) equivalents were often phonologically and orthographically more similar to the L3 target than the L2 (English) cognate. Others have also reported the lack of interfering L1 cognates in L3 speech, while L2 cognates frequently appear as substitutions of L3 target items (Ringbom, 1986; Sánchez, this volume).

Hall et al. (2009) found differences in the strength of the L2 status effect and the typological similarity effect depending on the word types that learners were given in a forced-choice test, assigning syntactic frames (either from a known L1 or L2 word equivalent) to new L3 word forms. For Spanish–French cognates, they reported strong Spanish L1 influence (and weaker English L2 influence) when L3 learners had to assign syntactic frames, such as subcategorized prepositions or reflexives, to new L3 verbs. A similar, albeit weaker, effect was obtained for Spanish–German cognates, again showing strong CLI from Spanish L1 in the syntactic frame assignments to new L3 German verbs. In the case of non-cognates, however, L3 learners of both French and German were more influenced by English L2 words than Spanish L1 equivalents. This is most noteworthy for the French L3 learning condition since, in this case, L2 status overrode the typological similarity effect.

Probably the strongest argument for an L2 status effect is made by studies that report strong CLI from L2s that are typologically more distant from relatively similar L3 and L1 pairs. One such study was reported by Bono (2011). According to the author, 63% of unintended lexical intrusions in French L1 speakers’ productions of Spanish L3 showed traces of L2 influence, mostly from English L2 and occasionally from German L2. However, in this as well as the Hall et al. (2009) study reported above, (psycho)typological similarity effects cannot be excluded

completely, given the large overlap of French and English lexis.

CLI from typologically more distant L2s on L3 use by learners with less distant L1s is relatively rare, although some anecdotal and diary reports contain instances. CLI from distant L2s has been reported in two case studies with multilinguals who were already functional in several L2s and in the process of learning an L3. Schmidt and Frota (1986) reported instances of Arabic L2 influence in an English L1 speaker’s production of Portuguese L3, while Selinker and Baumgartner-Cohen (1995) reported French L2 and Hebrew L2 intrusions in an English L1 speakers’ production of German L3. The latter study, in particular, showed clear traces of phonological similarity of intruding items with the substituted target. An example is the replacement of German *du hast...* with the French structure *tu as (mein Fax bekommen)* [Did you get my fax?] (p. 117). In other words, psychotypological similarity of specific lexical items (from two genetically distinct languages) seems to have affected these cases of CLI, at least in part.

The L2 status effect on CLI in L3 production would, in general, be in line with predictions made by Green’s (1986, 1998) model of inhibitory control (IC). This model assumes stronger activation levels in highly proficient languages (usually L1s) and lower activation levels for less developed languages. Retrieving lexical items in the less developed language(s) would require the inhibition of the stronger language(s), but see also de Bot (2004), who notes that deactivation may be sufficient. If cognitive resources are used to inhibit the strongest competing language, then (non-inhibited) L2s may be in a better position to compete and interfere with L3 production. A prediction of the IC model is that switching from a less developed L2 to the dominant L1 would take more time than switching from the L1 to an L2. Such a switching cost effect has, indeed, been reported (e.g., Costa, Santesteban & Ivanova, 2006; Meuter & Allport, 1999).

One study on switching costs, reported by Linck, Schwieter and Sunderman (2012), involved trilingual speakers of English L1 who learned French L2 and Spanish L3. The researchers did not explicitly postulate an L2 status effect, but their findings may be consistent with it. They designed a multilingual switching experiment in which the learners of L2 French and L3 Spanish had to name pictures alternating in L1, L2, and L3. In some cases, the task followed a naming trial in the same language, in others, a switch into one of the other languages was necessary. The researchers observed larger costs of switching into the more dominant L1 and L2 than into the L3, which is partially consistent with the IC model. (Given L1–L2 proficiency differences, however, one would also have expected switch costs into the L1 to be higher than into the L2.) The authors also reported that the trilinguals needed more time switching into the L3

after L1 word naming than after L2 word naming, a finding which they interpreted as evidence for increased inhibition needed to switch out of the L1, the language which needs to be suppressed the most. As with the naturalistic studies, however, the typological relatedness of the L2 (French) and L3 (Spanish) may also have affected the results. It is quite possible that these two lexical subsets share more information than either shares with the L1, and that activation of one subset may have also primed or activated the other (cf. Paradis, 2004). In addition, it is possible that lexical connections at the form level affected the outcome, even though no translation equivalents were involved in the switching task (González Alonso, 2012, and discussion below).

What can we conclude from the review so far with respect to the potential primacy of the L2 status factor and typological similarity effects? Most L3 researchers appear to judge (psycho)typological similarity the most important factor in determining the strength and sources of lexical CLI: “language closeness is probably a privileged factor in interlanguage transfer” (de Angelis & Selinker, 2001, p. 55) and “. . . linguistic distance is a stronger predictor of cross-linguistic influence than L2 status” (Cenoz, 2001, p. 18). For Jarvis and Odlin (2000), it is typological similarity between languages that determines CLI in the first place, regardless of L1/L2 status. Singleton (2012, p. 108) concludes that “. . . where psychotypological considerations are not weighted in the direction of any particular pairing it appears that, for example, L3–L2 interactivity is more in evidence than L3–L1 interactivity”. This review suggests that both typological similarity and L2 status appear to come into play in a combined fashion in the majority of studies summarized in the Appendix. In what follows, I will suggest that the apparent effects of typological similarity on CLI in L3 use have their origins, at least partially, in what Hall (2002) called a PARASITIC learning mechanism for word learning.

Lexical CLI as a consequence of parasitic vocabulary acquisition

Most psycholinguistic attempts to explain CLI have been based on non-developmental models of lexical production (de Bot, 2004; Poulisse & Bongaerts, 1994) and activation (Dewaele, 2001; Green, 1998; Paradis, 2004), essentially describing lexical processing during production. These models spell out the processing stages involved in lexical production, and how (where and when) particular target word forms are selected or activated after competing with other activated (or inhibited) forms. They also attempt to explain how speaking in a monolingual mode (adhering to just one target language) and speaking in a bilingual mode (switching voluntarily or involuntarily between languages) is possible (Grosjean, 2001).

I will take a different perspective here, arguing that much CLI in the lexicon can be explained as a consequence of a default cognitive process for word learning, a process that Hall referred to as PARASITISM in the mental lexicon (e.g., Hall, 2002). Hall and colleagues argue that the learners’ search for, detection, and use of similarity between new information and already represented information is a general cognitive principle that they use to integrate novel word structures into a network of stable representations and access routes. The process heavily constrains L2 and L3 word learning, including the establishment of lexical connections, representations, and processing routes, particularly at the initial stages of word learning, although fossilized configurations may stay intact permanently. Hall and Ecke (2003, pp. 78–79) outlined a model of vocabulary acquisition that describes three stages involved in the learner’s attempt to create triads of lexical FORM, FRAME, and connections to the corresponding CONCEPT. Note that the model’s assumptions apply item-by-item, allowing for different words in the emerging lexicon to be at different stages simultaneously. The model will be stated here in its original form and serve as a framework for the subsequent discussion.

The Parasitic Model: Stages of vocabulary acquisition

A Establishing a form representation

- A1 The L3 word form is registered in STM and the closest matches (if there are any) in L3, L2, or L1 are activated, based on salient form attributes (cf. Ecke, 2001).
- A2 The L3 form is connected to a host representation (normally the most highly activated related L3, L2, or L1 form, where some threshold level of similarity between them is met) and is established in LTM in distributed fashion (activating the same nodes in the network as the host form).
- A3 Difference(s) between L3 form and host representation are detected, new patterns are rehearsed and the representation is revised with respect to the attributes that distinguish it from the host and/or other consolidated neighbors. (This is difficult and not always achieved, leading to fossilization of the interlanguage configuration.)
- A4 If no matching form representation is activated sufficiently, the L3 form is connected to the frame of the nearest conceptual (translation) equivalent (as in B2 below).

B Building connections to frame and concept representations.

- B1 The frame of the form-related host is adopted for deployment of the L3 form (cf. Hall &

Schultz, 1994). It is retained while contextual cues confirm the inference, and is used as a link to the corresponding conceptual representation (cf. Hall, 2002).

- B2 If subsequent context contradicts information in the frame and conceptual representation inferred from the form-related host, another perceived conceptual (translation) equivalent from L1 or L2 is activated and its frame adopted.
- B3 If no translation equivalent can be identified, a provisional frame (based on a variety of distributional and morphological cues) is constructed and connected directly to a conceptual representation. (This, we believe, will be a very rare case at initial stages of exposure and use.)
- C Strengthening and automatization of representations and access routes
 - C1 Initially established connections with other L1, L2, or L3 representations are revised, bypassed, or severed, to establish a more autonomous triad responding to new cues in the input. (This, again, is not always achieved, leading to fossilization, cf. Jiang, 2000.)
 - C2 Autonomous connections between L3 form, mediating frame and concept are strengthened and the representations themselves refined, with increased frequency of exposure and use.
 - C3 Access routes between elements of the L3 triad are automatized.

Notice that the model bears similarity to other models of vocabulary acquisition that presuppose an initial subordinate-type structure of the developing lexicon (Weinreich, 1953). Kröll and Stewart's (2004) well-known Revised Hierarchical Model assumes (mediating) lexical links at early stages and conceptual links at later stages (aspects of A and C in the model above). Both Jiang (2000) and Wei (2006) focus on the learner's tendency to "copy" or "transfer" lemmas (i.e., connections made at and via the syntactic frame, level B above). The Parasitic Model, however, makes claims about the creation, revision, and abandonment of connections at all three representational levels. These connections will, for the most part, enhance learning by making use of what is already in the lexical network (Dijkstra, 2003, on recognition), but they will also lead to occasional lapses and productions that are deviant from the target norm, if the preliminary representations remain underspecified and mediating access routes are not refined.

The Parasitic Model was originally developed to account for the large variety of observed CLI phenomena, hence its prediction that learners initially connect new

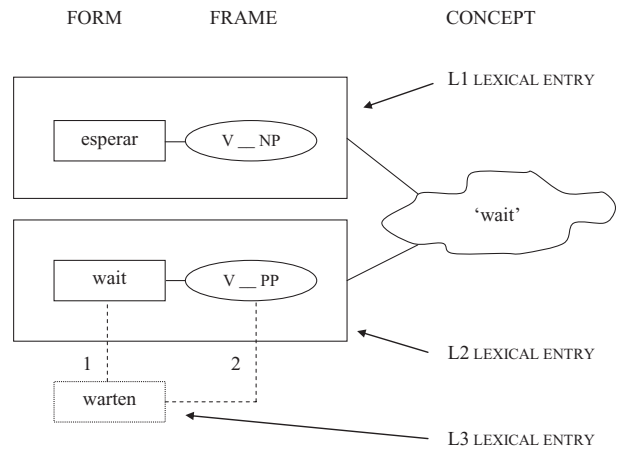


Figure 1. Example of lexical triads and hypothetical parasitic connections (1) between L3 form and L2 form and (2) between L3 form and L2 frame

word forms with existing representations wherever similarity is detected. The connection can be made with forms of the L1 or L2, or forms from within the L3, and at any of the three representational levels (form, frame, and concept). Figure 1 illustrates such hypothetical connections and the lexical configuration for the L3 verb *warten* [wait] inferred from the 'error' in example 2a. The configuration is shown as lexical triads consisting of form, syntactic frame, and conceptual representation as well as potential parasitic connections between L3 and L2 representations.

In the case of example 2a, two kinds of connections are possible: one between the phonological or orthographic forms *warten* and *wait* if the learner recognizes the form similarity and uses the existing form parasitically (connection 1 in Figure 1). In that case, the connected new form is likely to also be linked via the L2 frame to the concept. Another option is that the L3 form will be connected to the L2 frame initially (connection 2 in Figure 1) and linked that way to the concept if the learner did not realize the form similarity.

The occurrence of form, frame, and meaning-based 'error' types in various corpora (Ecke, 2001; Ecke & Hall, 2000; Hall & Ecke, 2003; Hall & Schulz, 1994) and in many of the studies in the Appendix suggests that such connections are psychologically real and quite frequent. However, different rates of error types and CLI sources make it clear that parasitic connections are modulated by numerous lexicon-external factors. These include LEARNER FACTORS (e.g., psychotypology and metalinguistic awareness), LEARNING FACTORS (e.g., L2 status, proficiency in each language, order of acquisition), LANGUAGE FACTORS (e.g., typological distance, degree of contact), EVENT FACTORS (e.g., language mode,

task, style, interlocutor), and WORD FACTORS (e.g., degree of form/frame/concept similarity with competitors, number of form/frame/concept competitors, abstractness vs. concreteness, frequency, frequency of competitors (see Hall & Ecke, 2003, p. 73).

Experimental data has provided evidence for subcomponents of parasitism. In an experiment with pseudocognates, Hall (2002) demonstrated that in the absence of any semantic cues, L2 learners automatically assume translation equivalence with an L1 word that is similar in form to the new word. In other words, once a learner recognizes that the novel word is phonologically or orthographically similar to an existing L1 equivalent, he will automatically (and economically) connect it to the established form and use it as a host, including its already existing connections to frame and concept. Form-based ‘errors’ such as examples 1a and 1b, including frequently reported ‘errors’ with partial cognates and false friends, are a reflection of this process in L2 and L3 production, and analogous ‘errors’ can be observed in comprehension as well (Laufer, 1991).

In the aforementioned Hall et al. (2009) study, the researchers were interested in L3 learners’ initial assignments of syntactic frames (stage B in the model) and whether these were affected by form similarity. They examined whether the learners would automatically assume that newly presented verbs shared syntactic frames with cognate and non-cognate equivalent forms from the L1 and the L2. The findings provided general support for the hypothesis that learners would make frame selections based on form similarity (probably via connections of type 1 in Figure 1), but also for modulating typological proximity and L2 status effects.

González Alonso (2012) designed a primed picture-naming task and tested assumptions made about stage A (and connections of type 1) in the Parasitic Model. Participants were Polish L1 speakers, highly proficient in English L2, who had learned Russian L3 at different stages. They had to name pictures in the L3 after hearing words in the L1 or L2. Some of the L1 and L2 words were related in form (phonology) to the L3 targets, but were not translation equivalents. These words were hypothesized to be host representations used by the L3 learners to anchor the new L3 words to the existing form representations. The prediction was that retrieving L3 targets after hearing the form-related hosts would be faster than after hearing unrelated words. González Alonso found strong CLI effects of form-related L1 and L2 primes on Russian L3 word naming, reflected in enhanced retrieval times. He concluded that the L3 learners’ word retrieval was enhanced by connections that the learners had established between the new L3 words and similar hosts from L1 and L2 at the form level, as predicted by the Parasitic Model.

CLI and developmental changes of individual lexical configurations

The Parasitic Model’s stage A (establishing a form representation) and stage B (building form–frame–concept connections) focus on the initial state and early stages of L3 word learning. Stage C (the strengthening and automatization of representations and access routes) is an ongoing process that will often include the revision of initial representations, the bypassing of hosts, and the creation of more autonomous triads. Again, lexicon-external factors will affect how long it will take the L3 learner (and whether he will be successful at all) in his attempts to develop independent, autonomous triads that are more reliable and resistant to CLI than representations and access routes based on host representations and mediated access routes.

Research into CLI involving learners of typologically different languages suggests that learners’ interim representations (especially at the frame level) will often fossilize and never reach native-like autonomy (Jiang, 2000; Wei, 2006). An interesting study of an aphasic patient also suggests that parasitic structures can be very durable. Goral, Levy, Obler & Cohen (2006), after finding strong CLI between the L2 English and the L3 French in an aphasic patient with Hebrew as L1, conclude that the “... results lead us to suggest that a third language (L3) may be learned in connection with a previously learned non-native language (L2), and thus develop strong lexical connections with that language. These connections can be detected even in the presence of a language deficit ... resulting from aphasia” (p. 244–245). While parasitic configurations can be durable, changes are likely for many lexical triads as learners advance in proficiency (Hall & Reyes Durán, 2009). They become less prone to CLI and exercise more control over the L3, and CLI patterns and sources may change.

Form-based, frame-based, and meaning-based CLI

Learners’ initial focus on establishing and integrating a novel form representation into a network of existing triads will result in disproportionately high rates of form-based ‘errors’ when they attempt to use the new word forms. Error analyses often claim that L2 and L3 learners at low proficiency levels tend to produce proportionally more form-related errors than learners at higher proficiency levels, who produce more meaning-related errors (Henning, 1973; Ringbom, 2007).

L2 learners’ performance in word association tests and their word associations during TOT states reflect similar patterns. Meara (1978) showed that L2 learners produced more sound-related (clang) responses than L1 speakers, who predominantly generated meaning-related responses. In a similar study, Söderman (1993) found that

low-proficiency L2 learners produced more clang responses than high-proficiency L2 learners, who generated more meaning-related associations. Ecke's (1997) analysis of word associations in TOT states with L2 words and L1 words revealed that retrieval failures with L2 words more frequently included form-related associations than TOT states with L1 words, which more frequently involved meaning-related associations. The observed differences in lexical retrieval between learners at lower proficiency levels and those at higher proficiency levels or native speakers do not imply qualitative differences between the L2/L3 lexicons and the L1 lexicon; they merely reflect different stages of integration of individual items in the lexical network and quantitative differences in its configuration (Hulstijn & Tangelder, 1993; Singleton, 1999; Söderman, 1993). Research by Wolter (2001), Zareva (2007), and Zareva and Wolter (2012) demonstrated that these observations are largely attributable to variable word familiarity rather than inherently different network structures in L1 and L2 lexicons. Low familiarity and usage frequency of stimulus words and target words will result in higher rates of form-related productions. The claim made here is that these form-related associations are partially the result of lexical connections at the form level, needed to help anchor new or unstable word forms (whether in the L1, L2, or L3) in the lexicon.

It is therefore not a surprise that instances of form-based CLI continue to affect production in relatively advanced L3 users, albeit less frequently than in beginning learners. Lindqvist (2010) reported that an unusually high level (46%) of the lexical 'errors' produced by advanced French L3 learners were related in form to the target, while 54% were related in meaning. Advanced learners continue to acquire new word forms parasitically. They are subject to the same acquisition stages A, B, and C, outlined in the model. Until the word forms stabilize and emancipate themselves from host representations, they will be susceptible to CLI. The overall larger vocabulary and the relatively stable and automatized access routes for much of the advanced learner's vocabulary, however, make form-based 'errors' appear less frequently than in learners at lower proficiency levels, who proportionally depend more on parasitic connections to anchor a good portion of their word stock in the lexicon.

Results of experimental studies appear to corroborate the patterns found in naturalistic data. A finding with relevance to L3 learners' proficiency differences was reported in the aforementioned study on form-priming in an L3 picture-naming experiment. González Alonso (2012) found that learners of L3 Russian at a lower proficiency level were more affected by form-priming (through a previously presented similar L2 or L1 word) than those at higher proficiency levels. Word-naming speed was more enhanced through L1 and L2 form primes in the low-proficiency group than in the high-proficiency

group, whose retrieval speed was less affected. The finding suggests that form-related L1 and L2 hosts as mediators were used more frequently by learners at lower levels than learners at higher levels, who have emancipated or bypassed access routes from former or potential host representations.

Another experimental study is worth mentioning in this context. De Groot and Hoecks (1995) conducted a translation production task in which Dutch L1 speakers translated (concrete and abstract) L1 words into their highly fluent L2 (English) and into their less developed L3 (French). Their reasoning was that concrete words would be translated faster than abstract words, but only if the translation was conceptually mediated, that is, if learners mentally translated the L1 form via the shared concept and not via direct lexical connections between L1 and L2 forms and L1 and L3 forms. The data revealed significantly faster translation times for concrete words than abstract words, but only when participants translated into the highly proficient L2 (English). The authors interpreted the finding as evidence for a preference for word association (lexical connections) in the processing of the less developed L3 and a preference for concept mediation in the processing of the more developed L2, an interpretation that, again, is consistent with the assumption of form-based parasitic connections at the early stages of the integration of individual words into the lexical network. At later stages, learners frequently bypass lexical connections and translate via the common concept.

Similar evidence has been presented in studies on translation recognition. Talamas, Kroll and Dufour (1999) demonstrated that less proficient L2 learners were more affected by form-related primes in a translation recognition task than more proficient L2 learners, who experienced more interference from meaning-related words. The interference effects were reflected in longer reaction times. As in natural learning environments, beginning learners of an L2 are more prone to interference from phonologically and orthographically similar words (Laufer, 1991). In a later study, Sunderman and Kroll (2006) replicated the finding, showing again that form-related neighbors negatively affected translation recognition in less proficient L2 learners, but not in highly proficient L2 learners, whereas both groups experienced similar rates of interference from meaning-related neighbors.

To my knowledge, no experimental data is available on developmental changes in L3 learner's syntactic frame representations, but see Hall and Reyes Durán (2009), whose study documents clear differences in frame representations in three groups of English L2 learners at different proficiency levels. With increasing proficiency levels, L2 learners become less reliant on L1 for frame information.

While proficiency in the target L3 certainly has an impact on the strength and kind of CLI patterns experienced, other aspects of the multilingual's proficiency must be considered as well. One such aspect is the level of proficiency in the non-target L2(s). There is evidence from studies into lexical 'errors' that CLI can be traced most of the time to structures from the learner's most developed languages (Singleton, 1987; Williams & Hammarberg, 1989). Likewise, Ecke & Hall's (2013) analysis of a multilingual's TOT states revealed that, overall, most CLI (reflected in across-language word associations during extensive word search) came from the most developed/stable L1 (German) and L2 (English), whereas CLI from other less stable L2 (Spanish and Russian) was rare. In another study on word associations in TOT states with three groups of Spanish-speaking learners of English (L2), Ecke (2008) found clear L2 proficiency effects on CLI in L1 word search. While the search for L1 words was almost never affected by L2 word associations in the beginning L2 learners, it occasionally showed traces of CLI in intermediate L2 learners, and was frequently affected by the L2 in the fluent Spanish–English bilinguals. In timed word association experiments with trilinguals, Van Hell and Dijkstra (2002) provided evidence for CLI from L2 (English) and L3 (French) cognates on the retrieval of Dutch L1 equivalents, but only if proficiency in the L2 and L3 was relatively high.

Researchers disagree to what extent a high proficiency (or certain threshold) level of an L2 is needed for it to influence L3 production. Schmidt and Frota (1986) argue that CLI from L2 is only possible if the speaker is highly proficient in the L2. Singleton (1987) reports a case of an L3 learner of French who was mostly affected by CLI from L2 Spanish, the L2 that the learner was most proficient in and that he had learned most recently (unlike Latin and other L2s). Jarvis (2009) and Ringbom (2007) restrict the claim that a high proficiency is needed for CLI to occur to the meaning level. They both argue that a more narrowly defined kind of meaning-based errors, such as calques and semantic extensions, always involves the L1 or another highly proficient language. Others argue that a high proficiency level in the background L2 is not a prerequisite for it to function as a source for CLI (Bardel & Lindqvist, 2007; de Angelis, 2005a; de Angelis & Selinker, 2001; Möhle, 1989). These researchers report errors that can be traced to CLI from rudimentarily developed L2s as source languages. Most of these errors, however, appear to involve some kind of influence at the form level. The Parasitic Model would allow for the possibility that structures of a less developed L2 can influence the establishment and use of novel L3 forms. If the learner detects similarity between a new L3 form and an already represented form of the L2, parasitic connections are to be expected.

An interesting claim related to proficiency effects is made by Bardel and Lindqvist (2007). They suggest that if a learners' L3 proficiency level is low, a low-proficiency L2 is likely to influence L3 retrieval. If, on the other hand, a learner's L3 proficiency is high, a high-proficiency L2 or the L1 is expected to be the main source language for CLI. The proposal is based on observations from a longitudinal case study of a developing multilingual who displayed high rates of CLI from an unstable L2 (Spanish) on L3 (Italian) at the initial stage of learning, but increasing influence of another, more developed, L2 (French) at a later stage when the L3 was much stronger (also Lindqvist, 2010, 2009).

Falk and Bardel (2010) make another claim related to proficiency and the L2 status factor. They point out that a well-mastered L2 may "... lose its L2 status and its influential role in the L3 acquisition process" (p. 197) and behave more like a stable L1. It seems that such hypotheses are compatible with the assumptions mentioned earlier about inhibitory control (Green, 1998). Using a less developed L3 would require a large effort to suppress highly developed L1 and L2, while other less developed (but not suppressed) L2 may surge and interfere with L3 production. On the other hand, a highly developed L3 will require less inhibition of strong L1 and L2.

Changes in speed and automatized access routes

Stage C of the Parasitic Model stresses the need to strengthen representations and automatize access routes if words are to be used reliably and efficiently in everyday communication. Slow and unstable retrieval routes are easily affected by CLI in the form of lexical intrusions in production (Poulisse & Bongaerts, 1994) as well as confusions in comprehension (Laufer, 1991). An extensive body of research has demonstrated that dominance or proficiency in a language correlates with the time the speaker needs to retrieve words in the language. Experiments that measure speakers' reaction times in tasks such as timed translation recognition, translation production, picture naming, and semantic categorization have shown that words of more dominant/more developed languages are accessed faster than words of less dominant/less developed languages (Kohnert, Bates & Hernandez, 1999; Kroll, Michael, Tokowicz & Dufour, 2002; McElree, Jia & Litvak, 2000; Sunderman & Kroll, 2006). This also holds for trilinguals, who have been shown to be fastest in their dominant L1, relatively fast in their strongest L2, and slowest in their weakest L2 (Abunuwara, 1992; De Groot & Hoecks, 1995; Horwinski Healy & McDonald, 2008) although language dominance can change over time (Mägiste, 1979).

Bilinguals, in general, are reported to be at a disadvantage to monolinguals when they have to name pictures as quickly as possible or when they have to

produce as many related words as possible in one language in a limited time. Even in their dominant language, they are normally slower than monolinguals in word naming and fluency tasks (e.g., Gollan, Montoya & Werner, 2002; Kroll & Gollan, 2014, for a review). There is some evidence that trilinguals are slower in word retrieval tasks than bilinguals. In two studies, Mägiste (1979, 1984) compared Swedish monolinguals, Swedish–German bilinguals, and Swedish–German trilinguals who spoke an additional language with at least one parent at home. Mean reaction times in object naming tasks (in Swedish and German) were shorter in monolingual controls than in the bilinguals and were longest for the trilinguals. The finding, however, needs to be interpreted with caution because typological distance of some of the trilinguals' L1 may have affected the results. In Mägiste's (1979) study, eight of the 24 trilingual participants spoke a non-Indo-European language (Finnish, Hungarian, Estonian, or Japanese) at home, and five used non-Germanic languages (French, Italian, Romanian, Polish, and Bulgarian) with a parent. Mägiste did not provide information on the L1 of the trilinguals in the 1984 study, but mentioned that some of them had Finnish as L1. These learners clearly were at a disadvantage learning and performing in the tested Germanic languages.

We do not know whether adding more languages to a multilingual's repertoire inevitably leads to even lower retrieval speeds. It is an empirical question whether a simple linear relationship between number of languages spoken and word retrieval speed can be found. A recent study by Cedden and Sağın Şimşek (published online September 12, 2012) reported that a group of highly proficient Turkish–German–English trilinguals displayed advantages over a group of highly proficient bilinguals in an oral interview task that required participants to speak freely and to switch frequently between the three or two languages at certain points. It turned out that the trilinguals switched more effortlessly when required and controlled CLI more effectively than the bilinguals. While this finding does not rule out the possibility that multilinguals are slower at lexical access than bilinguals, it does suggest that they may be superior in controlling language selection and in compensating for a potential slowdown in retrieval speed (Bialystok, 2009).

The complexity and non-linearity of multilingual lexical retrieval

The discussion of language proficiency and its relation to changes in lexical representation and processing as well as CLI has already hinted at the immense complexity and dynamism of multilingual learning and use. The Parasitic Model sketches out a path to lexical growth, refinement, and automatized access, and acknowledges the possibility of fossilization of structures and access

routes. However, multilinguals' access to vocabularies will fluctuate over time and inevitably include periods of stagnation, re-learning, and attrition of L2/L3 as well as L1 lexis. While we know that the lexicon is among the first language structures to be affected under conditions of attrition (Ecke, 2004; Schmid & Köpke, 2008) and that CLI plays an important role in this, we know little about how the multilingual's network is being reconfigured when form–frame–concept connections weaken due to lack of use. A study by Sills and Hall (2005) on lexical changes in a bilingual Veneto–Spanish community in Mexico suggests that parasitism does not only play a role in acquisition contexts but also in contexts of lexical attrition when an increasingly dominant L2 replaces a minority L1. Sills and Hall found that the syntactic frames of Veneto verbs (specifically reflexivity and subcategorized prepositions) displayed parasitic connections to L2 hosts more often in a group of young bilinguals than in a group of older bilinguals who used Spanish L2 less often than the younger bilinguals. Although incomplete acquisition cannot be excluded as a contributing factor in a cross-sectional study of attrition, the proposal that once independent and automatically accessible lexical triads might reconfigure in reverse, with degrading forms being (re)connected to increasingly dominant representations, is promising and should be investigated further.

There are a number of interesting questions to explore in future research into multilingual lexical development and productive use. One issue is how life-changing events and periods of abrupt change in the multilingual's language learning and use patterns affect lexical representations and access routes. The case studies earlier mentioned by Selinker and Baumgartner-Cohen (1995) and Schmidt and Frota (1989) seem to deal with learners who go through such life-changing events in which the language system has come out of balance and is challenged by the task of integrating, processing, and retrieving new forms while maintaining or even suppressing others.

In a recent study, Opitz (2013) adopted a dynamic systems approach (Jessner, 2008b) to study the development of multiple languages in expatriates. She documented how changes in multilinguals' acquisition and maintenance efforts after migration to an English L2 environment led to a period of instability (characterized by temporary "cognitive and emotional overload") and a subsequent period of stabilization. She reported that the proficiency gains in English L2 after about 18–24 months of intensive acquisition coincided with noticeable decreases in fluency and increases in CLI in the production of the participants' L1 (German) and their less maintained L2s. The decrease in L1 proficiency and fluency, however, appeared to level off after a few years and was followed by a perceived improvement of L1 skills

for at least some of the participants, while L2s were less often maintained successfully.

Mägiste's (1979) research on German–Swedish bilinguals and trilinguals' fluency development after migration to Sweden showed comparable results, although her study used a cross-sectional design in which immigrants differing in length of residence were compared with respect to fluency in L1 and L2. While fluency in object naming decreased in the L1 with longer length of residence in the new country, it increased in the L2 (Swedish). After about six years, Swedish became the faster language, surpassing retrieval speed in the L1. After about 14 years of residence in the L2 environment, the L1 appeared to have re-stabilized, as word naming in the L1 became faster again, but not as fast as in the L2.

Word retrieval speed also appears to be highly variable and affected by frequency of use in the short term, including by relatively brief periods of interrupted use or changing usage patterns. De Bot and Lowie (2010) showed that this is especially the case for L2/L3. Even a few days of no use of a language can significantly increase word retrieval times in that language.

In a longitudinal case study on dynamic changes of CLI and word retrieval failure in a multilingual, Ecke and Hall (2013) tracked TOT states that Ecke had experienced in four languages over a period of ten years living in the US, Mexico, and the US again. The study's objective was to learn about the different languages' vitality and susceptibility to CLI and attrition over time. In particular, the speaker's L1 production was expected to become increasingly vulnerable to attrition given its relatively infrequent use in English-speaking and Spanish-speaking environments. Contrary to expectation, the longitudinal data suggested that the speaker's L1 was stabilizing over time, after a period of relative instability in which a highly developed L2, two recently learned L2s and a reactivated L2 competed for maintenance and cognitive resources. Compared to the most frequently used L2s, the L1 turned out over time to be less vulnerable to lexical retrieval failure, was more frequently the source of CLI in other language TOT states, and more resistant to CLI in L1 word retrieval attempts.

Investigating multilinguals' language acquisition, maintenance and loss over time is much more difficult in controlled experimental settings that rely on groups of relatively homogenous speakers. Case studies, including learner error analyses, think-aloud protocols, and word association analyses will most probably continue to have a place in L3 research in spite of their methodological limitations. Unlike other

methods, they allow for a focus on the individual learner, developmental patterns, including variation as an essential part of the acquisition process, and the interaction of internal learning mechanisms with external variables, such as "language-related major life events" (de Bot, 2007).

Conclusion

This paper started out by examining typological similarity and L2 status as main determinants of CLI in multilingual lexical production. The review of a substantial number of studies showed that most research involved L3 learners with language constellations that could only suggest combined effects of typological similarity and L2 status, and that did not allow the primacy of one or the other factor to be filtered out. Having the identification of a single source for CLI as an objective might not be realistic in any case. Odlin (1989) pointed out some time ago that a speaker's knowledge of three or more languages may be affected by CLI from three or more source languages and that "pinning down the exact influences . . . is often hard" (p. 27). It seems that most L3 researchers nowadays acknowledge that typological similarity, L2 status, proficiency, and usage frequency of interacting languages are the factors that minimally need to be taken into account in explaining CLI patterns in lexical production (de Angelis, 2007; Falk & Bardel, 2010).

The second part of the paper presented a model of vocabulary acquisition as a framework for the explanation of CLI at form, (syntactic) frame, and meaning levels as well as some of the developmental changes that have been reported for CLI patterns in relation to L3 learners' proficiency. It was suggested that these patterns can be related to default processes and stages involved in the acquisition of individual word forms and their integration into networks of existing lexical triads, as described in Hall's Parasitic Model of vocabulary acquisition (Hall, 2002; Hall & Ecke, 2003).

The third part of the paper went beyond the hypothesized acquisition stages of the Parasitic Model and pointed to studies that reflect the immense complexity and non-linearity of multilingual lexical development and the need to learn more about these dynamic aspects. This review was necessarily selective. It addressed effects of typological relatedness, L2 status, proficiency, and usage frequency of languages on multilingual lexical retrieval and CLI, but highlighted the impact of parasitism (as a default learning process) and stages of individual word learning on CLI and lexical production.

Appendix. List of studies on cross-linguistic influence (CLI) in L3 production

Typological relations and main source of CLI				
	Main CLI effect and language combinations	Affected level	Study method	Reference
[[L2, L3] [L1]	<i>L2 effect from a (psycho)typologically similar L2 with very different L1</i>			
	Swedish L2 on German L3 with Finnish L1	FO/ME	E	Stedje (1977)
	Swedish L2 on English L3 with Finnish L1	FO/ME	E	Sjöholm (1979)
	English L2 on French L3 with Igbo L1		E	Ahukanna et al. (1981)
	English L2 on French L3 with Ngemba & Yoruba L1	FO, PR	E	Chumbow (1981)
	Swedish L2 on English L3 with Finnish L1	FO/ME	E	Ringbom (1987)
	Spanish L2 on English L3 with Yaqui L1	FR/ME	E	Bartelt (1989)
	English L2 on German L3 with various Non-Indo-European L1		E	Hufeisen (1991)
	English L2 on German L3 with Chinese L1		E	Vogel (1992)
	French L2 on English L3 with Kirundi L1	FO/ME	E	Sikogukira (1993)
	Spanish L2 on English L3 with Basque L1		E	Cenoz (2001, 2003b)
	Japanese L2 on Korean L3/L5 with English L1		E	Fouser (2001)
	English L2 on French L3 with Hebrew L1	FO/ME	E-AP	Goral et al. (2006)
	English L2 on German L3 with Chinese L1	FR/ME	E	Wei (2006)
[[[L2, L3] L1]	<i>L2 effect from a (psycho)typologically more similar L2 than L1</i>			
	English L2 on German L3 with Hindi L1		E	Chandrasekhar (1978)
	English L2 on French L3 with Hindi L1		E	Singh & Carroll (1979)
	French & Italian L2 on Spanish L3 with English L1		E	Rivers (1979)
	French L2 on Portuguese L3 with English L1 & German L2		E	Schmidt & Frota (1986)
	Spanish L2 on French L3 with English L1 (Latin & Irish L2)	FO	E	Singleton (1987)
	French L2 on Spanish L3 with German L1 & English L2	FO/ME	TRA	Möhle (1989)
	Dutch L2 on German L3 with French L1		E	Michiels (1999)
	Germanic L2s on English L3 with French L1	FO/FR/ME	E	Bouvy (2000)
	English L2 on German L3 with Spanish L1	FO/ME	E	Ecker & Hall (2000)
	English L2 on German L3 with Spanish L1	FO/ME	TOT	Ecker (2001)
	Dutch & Swedish L2 on German L3 with English L1	FO/ME	TRA	Herwig (2001)
	Dutch & German L2 on Swedish L3 with English L1	FO/ME	TRA	Herwig (2001)
	Spanish L2 on Italian L3 with French L1 or English L1	FO/ME	E	De Angelis & Selinker (2001)
	English L2 on German L3 with Spanish L1	FO/ME	E	Hall & Ecker (2003)
	Romance L2 on Spanish L3 and Italian L3 with German L1	FO/ME	E	Müller-Lancé (2003)

Appendix. Continued

Typological relations and main source of CLI				
	Main CLI effect and language combinations	Affected level	Study method	Reference
	Spanish L2 on Italian L3 with English L1	FO/ME	TRA	De Angelis (2005b)
	Spanish L2 and French L2 on Italian L3 with Swedish L1	FO/ME	E	Bardel & Lindqvist (2007)
	English L2 on French L3 with German L1		PN-SW	Festman (2008)
	English L2 on German L3 with Spanish L1 for non-cognates	FR/ME	FC	Hall et al. (2009)
	English L2 on French L3 with Irish L1	FO/ME	E	Laoire & Singleton (2009)
	English L2 on French L3 with Swedish L1	FO/ME	E	Lindqvist (2010)
	German L2 on English L3 with Spanish & Catalan L1	FO/FR	E	Sánchez (this volume)
<i>[L1, L2, L3]</i>	<i>L2 effect in (psycho)typologically (roughly) similar languages (or triple cognates) (of same subgroup in a language family)</i>			
	English L2 on German L3 with Dutch L1	FO/ME	E	Voorwinde (1981)
	English L2 on German L3 with Swedish L1	FO/ME	E	Dentler (1998)
	English L2 on French L3 with Dutch L1	FO/FR	E	Dewaele (1998)
	German L2 on Swedish L3 with English L1	FO/ME	E	Williams & Hammarberg (1998)
	English L2 on German L3 with Spanish L1 for triple cognates	FO/ME	E	Ecke & Hall (2000, 2011)
	French L2 on Italian L3 with Spanish L1 for function words	FO/FR	E	De Angelis (2005a)
	Spanish L2 on Italian L3 with French L1	FO/ME	E, TRA	De Angelis (2005b)
<i>[[L1, L2], L3]</i>	English L2 on Spanish L3 with German L1 & Russian L2	FO/ME	TOT	Ecke & Hall (2013)
<i>[[L1, L3], L2]</i>	<i>L2 effect from a (psycho)typologically more distant L2 than L1</i>			
	Arabic L2 on Portuguese L3 with English L1 & German L2	FO	E	Schmidt & Frota (1986)
	French & Hebrew L2 on German L3 with English L1	FO	E	Selinker & Baumgartner-C (1995)
	German L2 on Spanish L3 with English L1	FO/ME	E	Rivers (1979)
	English L2 on French L3 with Spanish L1 for non-cognates	FO/FR/ME	FC	Hall et al. (2009)
	English L2 (& German L2) on Spanish L3 with French L1	FO/ME	E	Bono (2011)
	English L2 on Russian L3 with Polish L1	FO	PPN	González Alonso (2012)

Appendix. Continued

Typological relations and main source of CLI				
	Main CLI effect and language combinations	Affected level	Study method	Reference
[[L1, L3], L2]	<i>L1 effect from a typologically more similar L1</i>			
	Swedish L1 on English L3 with Finnish L2	FO/ME	E	Sjöholm (1979)
	Swedish L1 on English L3 with Finnish L2	FO/ME	E	Ringbom (1987)
	More Spanish L1 on English L3 than Basque L1 on English L3	FO/ME	E	Cenoz (2003a)
	English L1 on French L3 with Irish L2	FO/ME	E	Ó Laoire & Singleton (2009)
	Spanish L1 on French L3 with English L2 for cognates	FO/FR	FC	Hall et al. (2009)
	German L1 on English L3 with Spanish L2 & Russian L2	FO/ME	TOT	Ecker & Hall (2013)
	Polish L1 on Russian L3 with English L2	FO	PPN	González Alonso (2012)
<i>L1 effect in typologically roughly similar languages</i>				
[L1, L2, L3]	Swedish L1 on German L3 with English L2	FO/ME	E	Dentler (1998)
[[L1, L2], L3]	German L1 on French L3 with English L2		PN-SW	Festman (2008)
[[L2, L3], L1]	<i>L1 effect from a typologically more distant L1</i>			
	English L1 on Portuguese L3 with French L2 (& German L2)	FO/ME	E	Schmidt & Frota (1986)
	English L1 on French L3 with Spanish L2, (& Latin & Irish L2)	FO	E	Singleton (1987)
	Dutch L1 on French L3 with English L2	FO	E	Dewaele (1998)
	Swedish L1 on French L3 with English/Spanish/Italian L2	ME	E	Bardel & Lindqvist (2007)
	Swedish L1 on French L3 with English L2 (& other L2)	FO/ME	E	Lindqvist (2009)
	Swedish L1 on French L3 with English L2 (& other L2)	ME	E	Lindqvist (2010)

Note. This scheme is necessarily a simplification, illustrating findings of main source of CLI in L3 production. Many of the studies also report CLI of lesser degree from other source languages. If CLI was substantial from two source languages, the study is listed twice. L1 = first language, L2 = any second/background language, L3 = the target language potentially influenced by L1 and L2. Study methods: AP = aphasic case study, E = error analysis, FC = forced choice task, PN = picture naming, PPN = primed picture naming, SW = switching task, TOT = tip-of-the-tongue state analysis, TRA = translation task.

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