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THE PARASITIC MODEL OF L2 AND L3 VOCABULARY ACQUISITION: EVIDENCE FROM NATURALISTIC AND EXPERIMENTAL STUDIES

O MODELO PARASITA DA AQUISIÇÃO DO VOCABULÁRIO DE L2 E L3: EVIDÊNCIA DE ESTUDOS NATURAIS E EXPERIMENTAIS

EL MODELO PARASITARIO DE ADQUISICIÓN DEL VOCABULARIO DE L2 Y L3: EVIDENCIA DE ESTUDIOS NATURALISTAS Y EXPERIMENTALES

Peter Ecke[*]
University of Arizona, US

Christopher J. Hall
York St John University, US

RESUMO: Este estudo apresenta, de forma breve, evidências obtidas a partir do Modelo Parasita de Aquisição de Vocabulário para aprendizes de segundas e terceiras línguas/falantes multilíngues em desenvolvimento. Primeiro, descrevem-se as proposições do modelo sobre as falhas dos processos, fundamentados na detecção e no uso das semelhanças entre as três etapas envolvidas no desenvolvimento de itens lexicais individualmente: (1) o desenvolvimento ou criação de uma forma de representação, (2) a construção de conexões com a estrutura sintática e a automatização das representações dos conceitos, e (3) o reforço e a automatização de representações e rotas de acesso. Em seguida, sintetizam-se evidências referentes aos resultados dos experimentos realizados nestas três etapas. Por fim, propõem-se uma discussão a partir dos resultados obtidos e apontam-se propostas para investigações futuras na área.

PALAVRAS-CHAVE: aquisição de vocabulário; desenvolvimento léxica;, multilíngue; terceira língua; Modelo Parasitório; influência trasnlexical.

RESUMEN: En este trabajo, brevemente, son presentadas evidencias para el Modelo Parasitario de la Adquisición del Vocabulario para aprendices de segundas y terceras lenguas/hablantes multilingües en desarrollo. Primero, se describen las predicciones del modelo sobre procesos por defecto, basados en la detección y el uso de semejanzas en las tres etapas involucradas en el desarrollo de componentes individuales del léxico: (1) la creación de una representación de forma, (2) la construcción de conexiones al marco sintáctico y la representación conceptual y (3) el reforzamiento y la automatización de representaciones y rutas de acceso. Después, se sintetizan evidencias referentes a los resultados de los experimentos realizados en estas tres etapas. Finalmente, se disertan asuntos no resueltos y áreas con potencial para investigaciones futuras.

PALABRAS CLAVE: adquisición del vocabulario; desarrollo léxico; multilingüe; tercera lengua; Modelo Parasitario; influencia transléxica.

ABSTRACT: This paper reviews evidence for the Parasitic Model of Vocabulary Acquisition for second and third language learners/developing multilinguals. It first describes the model's predictions about default processes based on the detection and use of similarity at the three stages involved in the development of individual lexical items: (1) the establishing of a form representation, (2) the building of connections to syntactic frame and concept representations, and (3) the strengthening and automatization of representations and access routes. The paper then summarizes both naturalistic and experimental evidence for processes involved at these three stages. Finally it discusses open issues and potential areas for future investigation.

KEYWORDS: vocabulary acquisition; lexical development; multilingual; third language; Parasitic Model; cross-linguistic influence.

1 INTRODUCTION

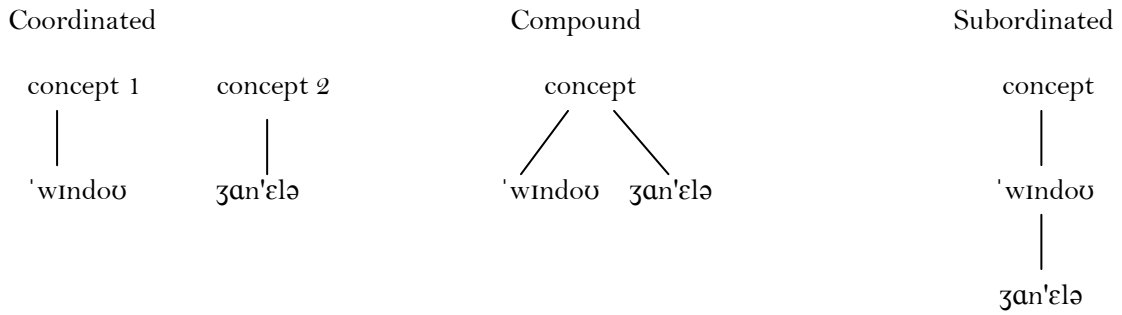
A speaker's first language (L1) and other acquired languages (L2) will affect the rate and the way in which a subsequent (third or additional) language (L3) is learned. For the lexical level, much research has demonstrated that a speaker's L1 words affect the way in which new (L2 or L3) words are learned and integrated into the speaker's lexical network(s). In practical language learning, this is reflected in lexical 'errors' (or, better, 'deviations' from the native-speaker norm) produced by the learner in speech. These deviations regularly show attributes that are similar to lexical equivalents from the L1. Newly learned vocabulary of learners at low proficiency levels appears to be more affected by L1 vocabulary than the vocabulary of learners at more advanced levels. There are more deviations produced by beginning learners

[*] Email: eckep@email.arizona.edu.

compared to advanced learners. This has led to suggestions about how lexical representations of beginning learners may differ from those of more advanced learners or fluent bilinguals.

Most of these suggestions have their basis in an early conception of different possibilities for bilingual mental representations made by Weinreich (1953). Weinreich distinguished between a (nonverbal) conceptual level and a lexical level of representation and outlined three ways in which these levels may be connected with each other: in *coordinated*, *compound*, and *subordinated* fashion (see figure 1). The *coordinate* form of bilingualism is characterized by different conceptual representations and links from each concept to the corresponding lexical representation in the L1 and the L2. For example, a speaker may have two different concepts of what represents a window in the US and what is a typical window in Brazil. Accordingly s/he would connect these different concepts with the different lexical forms of *window* or *janela*. On the other hand, *compound* bilingual representations share a common concept (e.g., a window with its characteristic features) which is connected to a lexical representation in the L1 and which is connected additionally and independently to a lexical representation in the L2. The third form, *subordinate* bilingualism, is characterized again by a common conceptual representation (the typical features of a window) and only one connection from the concept to the L1 lexical representation. A novel L2 lexical form is 'added on', i.e., connected to the L1 lexical representation, which serves as a mediating link to access the concept in L2 comprehension and the lexical form in L2 production.

Figure 1 - Possibilities of bilingual representations according to Weinreich (1953)



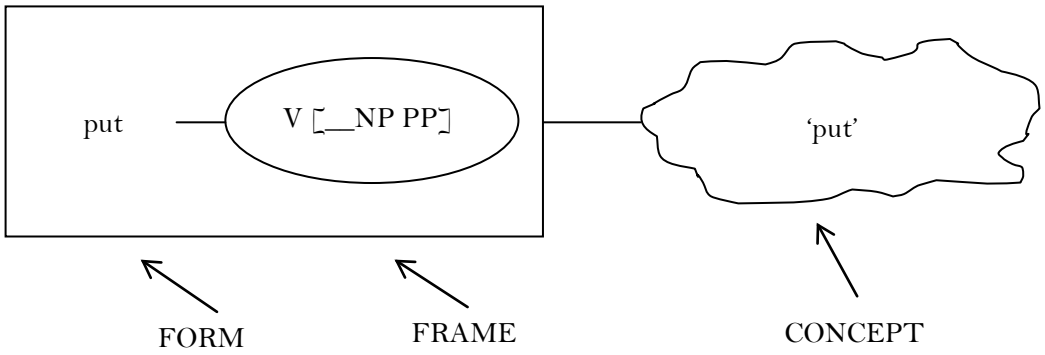
Weinreich already assumed that a bilingual speaker's lexicon may consist of a mixture of different representational types depending on the circumstances and levels of acquisition. More recent models of lexical development have assumed that the L2 vocabulary in less proficient learners is represented mostly in subordinate fashion, whereas the vocabulary of more advanced learners is represented mostly in compound fashion. The processing of subordinate structures has also been called *lexical association* whereas the processing of compound structures has been called *concept mediation* (CHEN; LEUNG, 1989; DUFOUR; KROLL, 1995; POTTER; SO; VON ECKARDT; FELDMAN, 1984). Mediating *lexical links* and direct *conceptual links* (ALTARRIBA; MATHIS, 1997; KROLL; STEWART, 1994) are other terms for compound and subordinate configurations in the lexicon. Most researchers nowadays seem to agree that in early acquisition stages, learners will connect new lexical items to already established structures in the lexicon, which will result in some kind of lexical connection (association/link) between the L2 items and the L1 items.

2 THE PARASITIC MODEL OF VOCABULARY AQUISITION

Hall (1993) assumed that these lexical connections are the result of a default cognitive process (a 'parasitic learning strategy') that is based on the learners' drive to reduce the complexity of the learning task by detecting and using similarity between novel and already represented structures. The Parasitic Model (PM) of vocabulary acquisition that he developed made specific predictions about the vocabulary learning process including the involved representational levels and acquisition stages (HALL; SCHULTZ, 1994). Unlike Weinreich and others who only focused on form-meaning levels and connections between them, Hall assumed three main levels of representation that together make up 'lexical triads': The first level is lexical form (the phonological and orthographic representation of a lexical item), the second level is its syntactic frame (or grammatical specification, such as word class, grammatical gender, subcategorization frames) and the third (nonverbal) level is the item's concept or meaning (see also JACKENDOFF, 1997;

LEVELT; ROELOFS; MEYER, 1999 for similar conceptions of the lexical architecture). Figure 2 illustrates the levels for the lexical item *put*, a verb (V) that subcategorizes a noun phrase (NP) and a prepositional phrase (PP).

Figure 2 - The lexical triad (adapted from HALL et al., 2009, p. 160)



The most recent version of the PM (HALL; ECKE, 2003) attempts to explain not only the acquisition of L2 words, but also L3 words, taking into account the important role that previously acquired vocabulary of other foreign/second languages (L2s) plays in the learning of new words (e.g., RINGBOM, 2007). Notice that the PM makes assumptions about the development of individual lexical items, not the lexicon as a whole. Individual lexical items will be at different acquisition stages over time, displaying different kinds of configurations and different degrees of automatization in their processing (for comprehension or production). The model's assumptions will be presented here as they appeared in the 2003 formulation (HALL; ECKE, 2003, p. 78-79). Subsequently, data will be reviewed from naturalistic and experimental studies that are consistent with the model's claims.

The Parasitic Model: Stages of vocabulary acquisition (from HALL; ECKE, 2003, p. 78-79)

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 neighbours. (This is difficult and not always achieved, leading to fossilisation 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 automatisation 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 fossilisation, 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 automatised.

Hall and Ecke (2003) added that parasitic connections are modulated by numerous lexicon-external factors. These can be grouped into *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 etc. (HALL; ECKE, 2003, p. 73). In spite of the numerous modulating factors (see also ECKE, 2014; GARCÍA-MAYO, 2012; TEIXEIRA; SOARES, 2012), parasitism should be detectable in naturalistic and experimentally elicited data. The following part of the paper will discuss evidence for parasitism at stages A, B, and C. It will also discuss some relevant findings with respect to modulating factors.

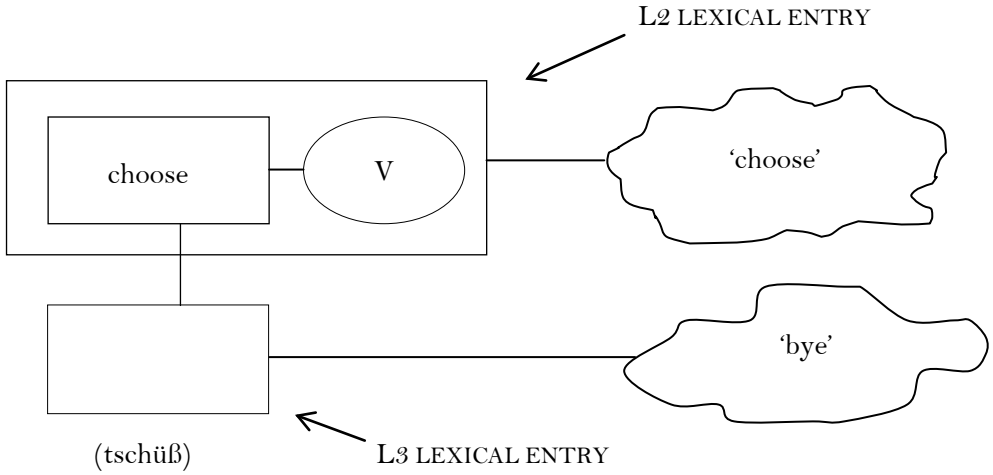
3 EVIDENCE FOR PARASITISM IN THE LEXICON OF L2 AND L3 LEARNERS

3.1 Evidence for stage A: Establishing a form representation

A learner's initial focus to establish and integrate a novel word form into a network of existing lexical triads will frequently result in form-based 'errors' when the learner attempts to use the novel word form. The PM assumes that the production of form-based deviations (as with other types) will often be the result of an initial pattern-matching process in which the learner connects a novel item to a similar-sounding, but different structure so that it can be stored and accessed quickly in the lexical network. Hall and Ecke (2003) called this first kind of cross-lexical influence (CLI) Acquisition-CLI (ACLI). The German target word *tschüß* [ʧyeˑ] may be perceived initially by a learner as the (somewhat) similar-sounding English word, *choose*. S/he will create a parasitic connection between the new form and the English item so that it can be anchored rapidly and effectively in the lexicon (see figure 3).

If the initial representation/connection is not revised with time and additional input, it will be strengthened (and fossilize) through repeated use, and the connection will continue to result in persistent deviations. If the item needs to be retrieved, it will be produced as the similar-sounding English word form, *choose*, resulting in a non-target deviation. This kind of CLI was called Competence-CLI (CCLI) since it is the result of a mentally represented item that is part of the learner's lexical competence. A third possibility of parasitism is Performance-CLI (PCLI). In this case, a novel form may have been perceived correctly and may have been integrated in the lexicon.

Figure 3 – Parasitic connection at the form level



However, since access routes (the form-frame-concept connections) of novel and infrequently used words are weak, they will often be subject to word retrieval failure and interference from related words (neighbors), such as translation equivalents, but also other words related to the target in form and/or meaning. Tip of the tongue states are such temporary word finding problems (see e.g., ECKE, 2009). In these cases, the speaker knows a certain word, but access to its form is temporarily impaired. The following examples from Ecke (2001) show form-related associations produced during tip of the tongue (TOT) states elicited in translation tasks from Spanish L1 to German L3 in Mexican learners of English L2 at the intermediate/advanced level and German L3 at the novice level (see table 1).

Table 1 - Form-related associations (intrusions) during TOT states with L3 words

Word association (intrusion)	Source language	L3 target word
René [name]	L1	*Taschenrechner* [pocket calculator]
fence	L2	*Fenster* [window]
Fleisch [meat]	L3	*Flasche* [bottle]
Fernsehe(r) [TV-set]	L3	*Fenster* [window]

Form-related deviations or intrusions also occur in spontaneous speech and writing. Table 2 illustrates examples of lexical 'errors' that are phonologically or orthographically similar to the target word. They stem from the corpora of Ecke and Hall (2000) and Hall and Ecke (2003), again with productions of Mexican learners of German L3.

Table 2 - Form-related 'errors' (intrusions) in L3 learners' spontaneous speech

Lexical 'error' (intrusion)	Source language	L3 target word
cómod(o) [comfortable]	L1	*Komode* [chest of drawers]
programación [programming]	L1	*Programmieren* [programming]
espagueti [spaghetti]	L1	*Spagetti* [spaghetti]
choose	L2	*Tschüss* [bye]
exams	L2	*examen* [exam]
drink	L2	*trinke* [I drink]
zwei [two]	L3	*weiss* [white]
*Kuchen*schreiber [cake pen]	L3	*Kugel*schreiber [ball point pen]
Hotel und *Gastwissenschaft* [hotel and restaurant science]	L3	Hotel und *Gastwirtschaft* [hotel and restaurant management]

These examples of intrusions as 'errors' and word associations during TOT states suggest that learners form parasitic connections between novel words (here from an L3) with already known words at the level of lexical form. They demonstrate that, in principle, forms of any language may serve as sources for ACLI and thus provide anchors for novel word forms in the phonological/orthographic lexicon.

An experimental study conducted by González Alonso (2012) attempted to test assumptions made about stage A of the PM and the hypothesized parasitic connections at the form level. González Alonso designed a primed picture-naming task in which learners of Russian L3 were tested for parasitic connections between Russian L3 words and related words in their L1 and L2. The participants were Polish L1 speakers, who were highly proficient in English L2 and who at the time of study were learning Russian L3. In the task, they were asked to name pictures in their L3 Russian. Before they had to name a picture, they briefly heard a word from either the L1 or the L2. Some of the L1 and L2 words were related phonologically to the L3 targets, but none of the words were translation equivalents. González Alonso assumed that these primes (form-related words presented prior to picture naming) were host representations that the L3 learners had used parasitically in the acquisition process to anchor the novel words to the existing form representations. He predicted that naming L3 target words after hearing form-related primes would be faster than after hearing unrelated words. González Alonso found strong CLI effects of form-related L1 and L2 primes on L3 word naming, reflected in enhanced retrieval speeds. After the L3 learners heard an L2 or L1 word that was phonologically related to the L3 target word, they were faster in naming the picture compared to naming it in a task in which the prime was not related to the target word. He concluded that the L3 learners' word retrieval was enhanced by connections that the learners had established between the novel L3 words and similar-sounding host representations from the L1 and the L2, as predicted by the PM.

3.2 Evidence for stage B: Building connections to frame and concept representations

L2 learners' tendency to automatically connect syntactic frames of L1 words to novel L2 word forms was the core claim of the early version of the PM (HALL, 1992; HALL; SCHULZ, 1994). The assumption derived from the analysis of errors in writing samples collected from L2 learners. Hall and colleagues observed, for example, that Mexican learners of English used the English verb *like* in the thematic frame of the Spanish translation equivalent *gustar*, which resulted in 'errors' such as: **Acapulco likes me* instead of the intended *I like Acapulco* (HALL; NEWBRAND; ECKE; SPERR; MARCHAND; HAYES, 2009). The L2 learners used the verb *like* with a preceding NP in a theme role and a following NP in an experiencer role. The syntactic frame of the L1 equivalent *gustar* specifies this order, whereas the frame of *like* specifies the opposite. The written and spoken productions of L3 learners show similar instances of CLI at the frame level, reflected in non-native grammatical/syntactic use of L3 target words. Table 3 illustrates examples of 'errors' that are a consequence of learners' assumption of frame equivalence. The learners of German L3 had assumed that a new L3 word form could be used syntactically like an equivalent L1 or L2 item and had connected the novel form to an existing syntactic frame that is different from the one yet to be learned for the L3 target word.

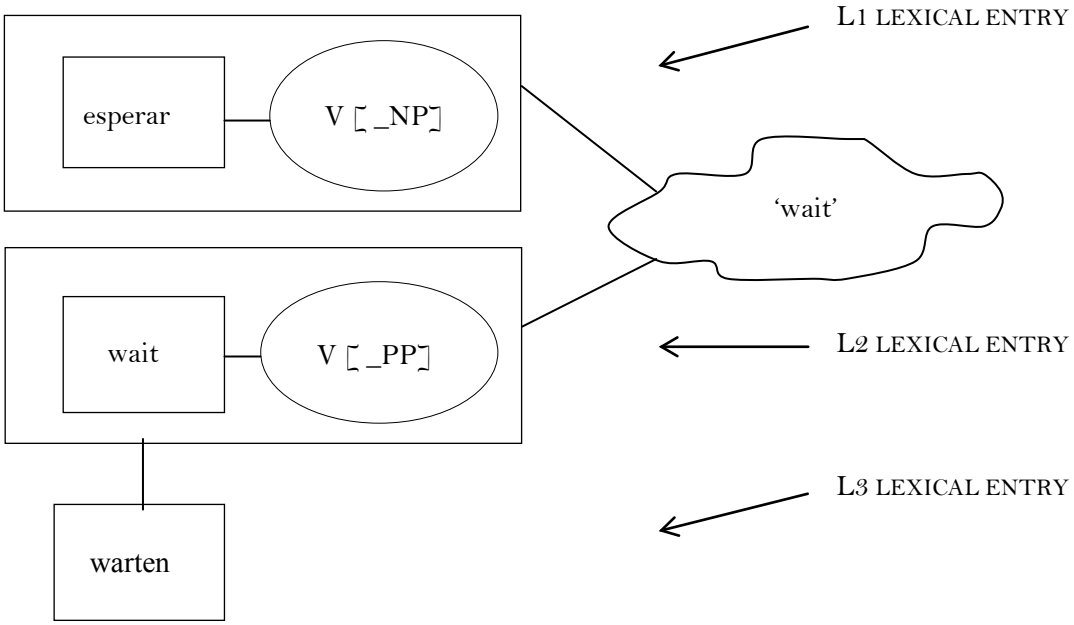
Table 3 - CLI at the syntactic frame level

Lexical 'error' (frame)	Source language(s) & structure(s)	L3 target structure
**max ist schlafen* ⌜Max is sleep(ing)⌝	L1: *Max está dormido* L2: *Max is sleeping*	*Max schläft* (no progressive) ⌜Max sleeps.⌝
**alles schports* ⌜all sports⌝	L2: *all sports* (plural)	*Sport* (singular only)
**warten für…* ⌜wait for⌝	L2: *wait for*	*warten* + *auf* ⌜wait + on⌝

Figure 4 illustrates the parasitic connection between the novel L3 verb *warten* ⌜wait⌝ and the form representation of the English L2 equivalent *wait*. Both verbs subcategorize prepositional phrases. However, they use different prepositions. The English verb requires the preposition *for* whereas the German verb

uses *auf* [on]. The orthographic similarity (similar initial letters) may have contributed to the learner's assumption of frame equivalence that led to the 'error': *Ich kann warten nicht *für mein Reise* ['I can't wait for my trip']. Similar deviations of the syntactic frames of new words produced by learners of other languages have been reported as instances of 'lemma copying' (JIANG, 2000) and 'lemma transfer' (WEI, 2006).

Figure 4 – Parasitic connections at the form and frame levels



At least two studies have shown that if learners detect form similarity (i.e. phonological or orthographical similarity) between a novel word and an existing item, they are more likely to connect the novel forms with existing forms, frames, and concepts than words that do not show any form overlap with previously learned words.

In an experiment with pseudocognates, Hall (2002) presented visually a list of English pseudowords to Spanish L1-speaking learners of English L2. Half of the stimuli were pseudocognates (non-words that were similar in form to words in the L1) and pseudowords that did not resemble L1 words. Examples of orthographically related pseudowords were: *pulge* derived from *pulga* [flea], *recort* from *recortar* [cut], and *campanary* from *campanario* [bell tower]. Nonrelated pseudowords included items, such as, *tarm*, *purtent*, and *muttlement* (p. 84). The 95 Mexican participants were asked to perform two tasks based on the stimuli: They were instructed to (1) record whether or not they had seen the word before and (2) write down what they thought could be the Spanish word that is closest in meaning to the presented English word. Hall then analyzed to what extent cognate and noncognate pseudowords were reported as previously seen and the extent to which provided translation equivalents varied for cognate and noncognate pseudowords.

Results showed the following: Whereas only 6% of participants reported to have seen the noncognate pseudowords, over 40% reported to have seen the cognate pseudowords (across items). This clearly shows that participants felt that they were more familiar with the cognate pseudowords and that they more frequently detected similarity between these items and existing cognates in their L1. As far as provided translations are concerned, the following was found: Across participants, a mean number of 41 (different) translations were provided for noncognate pseudowords whereas a mean number of 14 translations were provided for the cognate pseudowords. In other words, there were many more translations given for the noncognate stimuli compared to the cognate ones. Moreover, for the noncognate items, 14% of participants provided the one most frequently chosen translation equivalent, whereas 57% of participants provided the most frequent common translation for the cognate stimuli. Translated items in the noncognate condition shared the initial letter with the noncognate stimuli in 49% of cases and the first three consonants in 17% of cases. Translations of the cognate condition shared the initial letter 78% of the time, and the first three consonants 75% of the time. These findings show that the participants' translations of the cognate pseudowords coincide more frequently and that they are more frequently similar to the meanings of the

activated L1 items similar in form compared to the noncognate pseudowords. However, to some extent learners also use form similarity (particularly initial letters) to assign meanings to noncognate pseudowords which suggests that they detect and use similarities that have not been realized by the experimenter.

Hall's findings provide evidence that the L2 learners frequently assume translation equivalence with an L1 word that is similar in form to the new word, even if they do not receive any cues about the word's meaning. In other words, once learners (unconsciously) recognize that a novel word is phonologically or orthographically similar to an existing L1 equivalent (and in the absence of any salient cues related to the potential meaning of the new form), they will most likely automatically (and economically) connect it to the established similar form as a host, through which it will inherit the already existing links to frame and concept. Form-based 'errors' including frequently reported 'errors' with partial and false cognates are a reflection of this process in L2 and L3 production (ECKE, 2003). Analogous 'errors', in which learners 'confuse' meanings based on formally similar neighbors, have been reported for comprehension as well (LAUFER, 1991).

In another study, Hall et al. (2009) were interested in the question of the extent to which form similarity may affect L3 learners' initial assumptions about the syntactic frames of recently encountered L3 words. They designed an experiment in which beginning learners of German L3 and beginning learners of French L3 were presented with new words in their L3. The new words had either a cognate in the L1 (the SpaCog condition), a cognate in the L2 (the EngCog condition) or they had two non-cognate equivalents in the L1 and the L2 (the NoCog condition). Hall et al. hypothesized that when an L3 word was cognate only with a word in one of the other languages, the learners would tend to assume that the new word is used in the frame of the cognate and not of the non-cognate equivalent. This hypothesis stems from the PM's prediction that a learner will assume frame equivalence upon the initial detection of form similarity between a new word and a known word (as illustrated in figure 3). In the experiment, the learners were presented with new L3 words that they were asked to learn. The words were centered on a large screen for seven seconds each. After two seconds, the Spanish L1 and English L2 translation equivalents appeared below. The presentation session was followed by an immediate testing session (two minutes after the presentation session) and a delayed testing session (one week later). In these testing sessions, the new words appeared in two short sentences that only differed in an aspect of syntactic frame information (the verb's reflexivity or the use of a prepositional complement). One sentence was constructed according to the requirements of the verbal frame of the L1 equivalent, and the other sentence was constructed according to the grammaticality of the frame of the L2 equivalent. The learners had to make forced choices to indicate which sentence they believed sounded correct.

Hall et al. did indeed find support for the cognate effect: The highest rate of Spanish frame selection was obtained in the SpaCog condition. It was significantly higher than in the EngCog and NoCog conditions. English frame selection was also higher for the EngCog condition than for the SpaCog condition, but it was unexpectedly high in the NoCog condition. Hence the study also found evidence for a modulating L2 status effect: Under the NoCog condition, syntactic frames from the L2 were preferably selected by the learners of both German and French L3. There was also some indication of a contributing language typology effect: Participants selected English L2 frames more frequently for typologically closer German words than for French words. Learners of French, on the other hand, adopted more frequently frames from cognates in the typologically closer Spanish L1 than from cognates in English L2. In sum, Hall et al.'s findings provided support for the claim that learners frequently make frame and meaning selections (connections) based on initially detected form similarity, but they also provided evidence for a combined effect that includes parasitism and the modulating factors of L2 status (BARDEL; FALK, 2012) and typological proximity (ROTHMAN, 2013).

3.3 Evidence for stage C: Strengthening and automatization of representations and access routes

For stage C, the PM holds that initially established connections with other representations are revised, bypassed or severed, when warranted by further exposure. In practice, mediating connections to host forms may be abandoned if the new lexical forms become more stable with use and new access routes are established that directly connect new forms with frames and concepts (as predicted by other models, such as the Revised Hierarchical Model: KROLL; STEWART, 1994; KROLL; MICHAEL; TOKOWICZ; DUFOUR, 2002). In these cases, more autonomous triads are created that no longer rely on lexical

mediation (CHEN; LEUNG, 1989). This, however, is not always achieved, particularly if practice or use of the target language is infrequent or in decline. In this case, parasitic connections will remain in place and host representations will continue to serve as mediators in the processing of L2 items (see also JIANG, 2000). One can conceive such mediation as a kind of fossilization of structures in the lexical network. It is also possible that once-autonomous lexical triads will turn to, and increasingly rely on, mediation through parasitic connections in cases of non-pathological language attrition, when the frequency of use of words from a target L1, L2 or L3 decreases considerably (ECKE, 2004, p. 335; ECKE; HALL, 2013; SILLS; HALL, 2005). Parasitic connections reflected in cross-linguistic influence in lexical production of a multilingual aphasic have also been reported in a case of pathological language loss (GORAL; LEVY; OBLER; COHEN, 2006).

A number of naturalistic language usage patterns are consistent with the assumed restructuring of lexical representations and changes in access routes with increases in language proficiency over time. These data, taken together, seem to suggest that at early proficiency levels, learners process much of their vocabulary through lexical mediation, i.e. through parasitic connections between novel forms and similar-sounding host forms in the L1 or other languages.

One set of data that reflect such changes in lexical development comes from word associations. Form-related word associations (phonologically related interlopers or intrusions) have been reported to occur more frequently in TOT states (extended word searches) with novel L2 and L3 target words compared to less recently acquired L1 words, which more frequently involve semantically related associations (CAMPAÑA RUBIO; ECKE, 2001; ECKE, 1997, 2001). Form-related responses are also particularly frequent in free-word association experiments with novel and unfamiliar L1 words as stimuli (CHAFFIN, 1997) and free-word association experiments with L2 words in less proficient learners, compared to more proficient learners (MEARA, 1978; SÖDERMAN, 1993; WOLTER, 2001; ZAREVA, 2007).

Another set of data comes from lexical errors made by L2 and L3 learners at various proficiency levels. Proportionally, learners at low proficiency levels have been shown to produce more 'errors' that are phonologically or orthographically related to the target words (SÁNCHEZ, 2014) whereas learners at higher proficiency levels produce more 'errors' that are related semantically to the substituted target word (HENNING, 1969; TALAMAS; KROLL; DUFOUR, 1999). A similar pattern has been found for comprehension 'errors' or 'confusions'. Confusions between phonologically and orthographically similar words are particularly frequent in learners at low proficiency levels whereas confusions between semantically related words are more frequent in learners at higher proficiency levels (LAUFER, 1991). Form-related errors and associations are reflections of parasitic connections at the form level. With increased proficiency some of these connections of lexical forms are abandoned in favor of direct form-frame-meaning connections.

Experimental studies have provided evidence for restructured representations and access routes in relation to changes in learners' proficiency levels. The latter can be assumed to correlate with the stability and depth of integration of individual lexical items in the lexicon. 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 primes. The interference effects were reflected in longer recognition times. Sunderman and Kroll (2006) replicated the findings showing again that form-related primes had a detrimental effect on translation recognition in L2 learners at low proficiency levels, but not in L2 learners at high proficiency levels. Meaning-related primes, on the other hand, caused similar rates of interference in both groups of learners.

In the earlier mentioned primed word-naming experiment, González Alonso (2012) found that a group of relatively low-proficiency learners of L3 Russian was more influenced by form priming through a previously-presented similar L2 or L1 word than a group of relatively high-proficiency learners. Word naming speed was enhanced more after L1 and L2 form primes in the low-proficiency group than word naming speed in the high-proficiency group, whose retrieval speed was less affected by the form primes. The finding suggests that learners at low-proficiency levels more frequently use form-related hosts from L1 and L2 as mediators to access L3 forms for production, whereas learners at high-proficiency levels may have bypassed or abandoned mediated access through host representations from L1 or L2.

De Groot and Hoecks (1995) conducted a translation production task in which Dutch L1 speakers were asked to translate (concrete and abstract) L1 words into their highly developed L2 English and into their

less developed L3 French. The authors reasoned that concrete words would be translated faster than abstract words, but only if the translation was conceptually mediated, i.e., if learners mentally translated the L1 form via the shared concept and not via direct lexical links between L1 and L2 forms and L1 and L3 forms. De Groot and Hoecks found that translation times were significantly faster for concrete words than for abstract words, but only when participants translated into the highly proficient L2 (English). The authors argued that word association is the preferred means of access in a less developed L3 lexicon whereas concept mediation is the preferred means of access in the lexicon of a more developed L2. This interpretation is consistent with the assumed form-based parasitic connections between novel and established lexical forms at stages A and B of the PM and the acknowledged possible revision and bypassing of connections between lexical forms described at stage C of the PM.

Two studies on the PM have investigated potential differences in learners' reliance on mediating syntactic frames as a function of their overall proficiency level in the target language. A study by Hall and Reyes Durán (2009) reported clear differences in syntactic frame representations in three groups of Spanish-speaking learners of English L2 at different proficiency levels. The authors found that with increasing proficiency levels, L2 learners become less reliant on the syntactic frames of L1 translation equivalents, independently of word novelty. This suggests that learners are likely to revise and bypass initially constructed form-frame connections not only as a result of new evidence in the input, but also as a result of continuous use of the target language. Another study that focused on developmental changes in syntactic frame representations was conducted by Sills and Hall (2005). The authors predicted lexical changes in a bilingual community in Mexico who spoke Spanish and Veneto, a dialect of Italian brought to the country in the 19th century. They compared a group of young bilinguals with a group of older bilinguals who used Spanish L2 less frequently. Focusing on reflexivity and subcategorized prepositions, Sills and Hall found that young bilinguals used Veneto verbs in the syntactic frames of Spanish translation equivalents much more frequently than older bilinguals, revealing their increasing adoption of parasitic links from the less dominant to the more dominant language. The finding suggests that parasitic connections do not only play a role in early acquisition contexts, but also in contexts of lexical attrition when an L2 vocabulary becomes increasingly dominant, affecting representations and access routes of vocabulary from the minority L1.

Studies into word associations during TOT states have also shown a relation between L2 proficiency and cross-linguistic influence during lexical search in speakers' L1. Ecke's (2008) study with Spanish-speaking learners of English L2 demonstrated that developing bilinguals' proficiency level in the L2 was related to the rate of CLI experienced by the bilinguals during extensive searches for L1 words that were on the tip of their tongues. In a longitudinal case study, Ecke and Hall (2013) found that the kind and amount of CLI experienced during lexical search in TOT states in the speaker's L1 and L2s was affected not only by proficiency level, but also by typological relatedness and dynamic changes in the multilingual speaker's language systems and patterns of use. Parasitic connections can be assumed to be a main cause of CLI affecting lexical retrieval in L3, L2, and L1. Stage C of the PM can thus be understood as a process of continuous development and change (DE BOT; LOWIE; VERSPOOR, 2007, JESSNER, 2008), in which representations and access routes are revised, bypassed or severed. The process does not necessarily lead to an emancipation of representations. In the case of language attrition, it can also lead to regression and fall-back to increased mediation via parasitic connections.

4 CONCLUSIONS

This paper has presented the Parasitic Model of Vocabulary Acquisition (HALL; ECKE, 2003), a developmental account of stages and default processes that determine how novel structures are integrated and processed in the mental lexicon of multilingual speakers/second language learners. The model highlights learners' detection and use of similarity between novel structures and information already represented in the lexicon, following general principles of economy and least effort.

When learners encounter new words, they make use of similarity that is detected in structures from any source language (the L1, L2, or the L3) and at any representational level (form, frame or concept/meaning). This paper has reviewed evidence in support of the PM from both naturalistic and experimental research. The reported findings suggests that parasitic connections are psychologically real and frequent, particularly at early stages of vocabulary development, although they may also be instrumental mediators in cases of individual and inter-generational lexical attrition (SILLS; HALL, 2005). It was noted that

learners' productive use of novel word structures is affected by lexicon-external factors that modulate parasitism. The L2-status effect and typological distance between target language and other known languages are two modulating factors that turned out to be particularly significant in the data from L3 learners reviewed here.

It is hoped that this paper has acquainted readers with the key assertions of the PM and that it will stimulate more research that will test the claims made by the model. Of importance for future research will be the search for, and application of, more fine-grained methodologies that can filter out parasitic learning processes from lexicon-external factors, which together affect how a learner acquires and uses new words.

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