

The background of the slide is a light gray gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

WORD FREQUENCY PREDICTS ASYMMETRY OF LEXICAL ACCESS.

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FREQUENCY EFFECT IN LEXICAL ACCESS

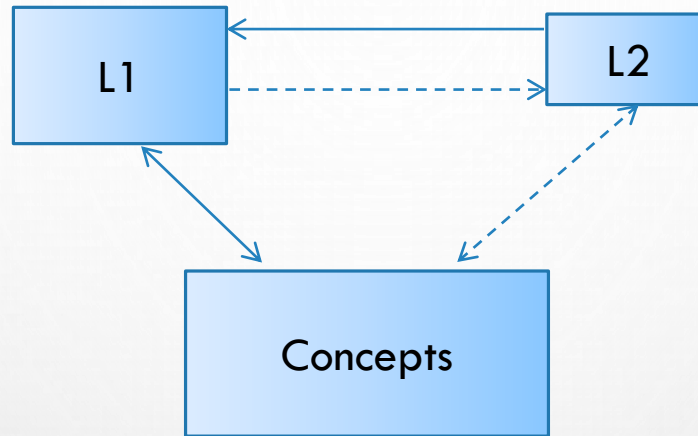
1. In code switching, bilinguals replace constructions of the base language by their equivalents in another language (Aparicio & Lavaur, 2014; Kheder & Kaan, 2016; Rodriguez-Fornells et al., 2012) due to the latter being more readily available at that time.
2. Effect of frequency of use is reliable in both monolingual and bilingual formats (Basnight-Brown & Altarriba, 2007; Sunderman & Priya, 2012);
3. Frequent words (HF) are accessed and processed faster than less frequent (LF) ones (Oldfield & Wingfield, 1965; Paap et al., 1987);
4. Processing of HF words is more robust to processing interference (Bangert et al., 2012; Michael & Gollan, 2005). Interference disrupts processing of LF words more than HF words.

In bilingualism, faster access to HF (L1) and less sensitivity to processing interference (e.g., semantic categorisation) is often represented within an architecture of the RHM (Kroll & Stewart, 1994).

K&S reported that L1-dominant bilinguals translated faster into L1 than L2. L2→L1 translations are also less sensitive (immune) to semantic categorisation, while L1→L2 translations are sensitive to it.

BILINGUAL ASYMMETRIES

THE REVISED HIERARCHICAL MODEL (RHM) (KROLL & STEWART, 1994).



Lexical route in backward translation L2→L1;

Semantic route in forward translation L1→L2.

The model is developmental. The strengths of links develop over time depending on proficiency and instruction (Poarch et al., 2015).

BILINGUAL ASYMMETRIES.

Research is inconsistent in support of the RHM (Brysbaert & Duyck, 2010; Kroll et al., 2010)

- Semantic processing for L2 words (Dimitropoulou et al., 2011; Duyck & Warlop, 2009; Schoonbaert et al., 2009; Perea et al., 2008).
- Functional language non-selectivity (Spivey & Marian, 1999; Van Heuven et al., 1998).
- Integrated lexicon is proposed as a shared system where L1 and L2 items are governed by shared processing principles (Indefrey, 2006; Moon & Jiang, 2012 etc).

We attempt to account for these asymmetries by taking lexical non-selectivity evidence and a single lexicon proposal into consideration.

BILINGUALISM OR FREQUENCY EFFECT?

Hypothesis:

Translation asymmetry is due to the frequency imbalance between L1 and L2 forms in a bilingual speaker (not unique to bilingualism): may be observed within a language and across two languages.

To test this proposal, we present a series of word production experiments that model translation performance in monolingual and bilingual formats. If lexico-semantic processing is essentially the same (governed by frequency of use), same/similar asymmetries will be observed within a language or across two languages.

Predictions:

1. Within-language “translation” of a HF word into its LF synonym ($L1 \rightarrow L2$) to be slower than a LF word into its HF synonym ($L2 \rightarrow L1$). **General translation asymmetry in a single lexicon. (Expt. 1).**
2. Within-language “translations” $HF \rightarrow LF$ will be affected by semantic categorisation, whereas $LF \rightarrow HF$ will be immune to it. **Asymmetric semantic sensitivity in a single lexicon (Expt. 2).**
3. Translation asymmetry in L2-dominant bilinguals will be faster in $L1 \rightarrow L2$. This direction to be immune to categorisation conditions, while $L2 \rightarrow L1$ is predicted to be sensitive to them. **Reversed asymmetry as function on frequency of use. (Expt. 3).**

EXPERIMENT 1. SYNONYM TRANSLATION IN MONOLINGUALS

PARTICIPANTS AND MATERIALS.

32 British English monolingual university students.

28 English synonymous pairs of common nouns were used. Controlled for:

- Synonymy: Longmann synonym dictionary.
- Frequency contrasted: HF↔LF (*e.g.*, *Car* ↔ *Automobile*) BNC ipm: *HF* 111(26) *vs.* *LF* 21 (4).
- Word length: comparable HF 6 (.3) *vs.* LF 5 (.4)
- Pairs piloted for bidirectionality, *e.g.*, *Forest* ↔ *Woods*.
- Pairs piloted for concreteness. Concrete / Abstract – balanced

EXPERIMENT 1. ASYMMETRY IN WITHIN-LANGUAGE TRANSLATION

Procedure

- Participants “translated” a word they saw on the screen into its HF synonym (and vice versa)

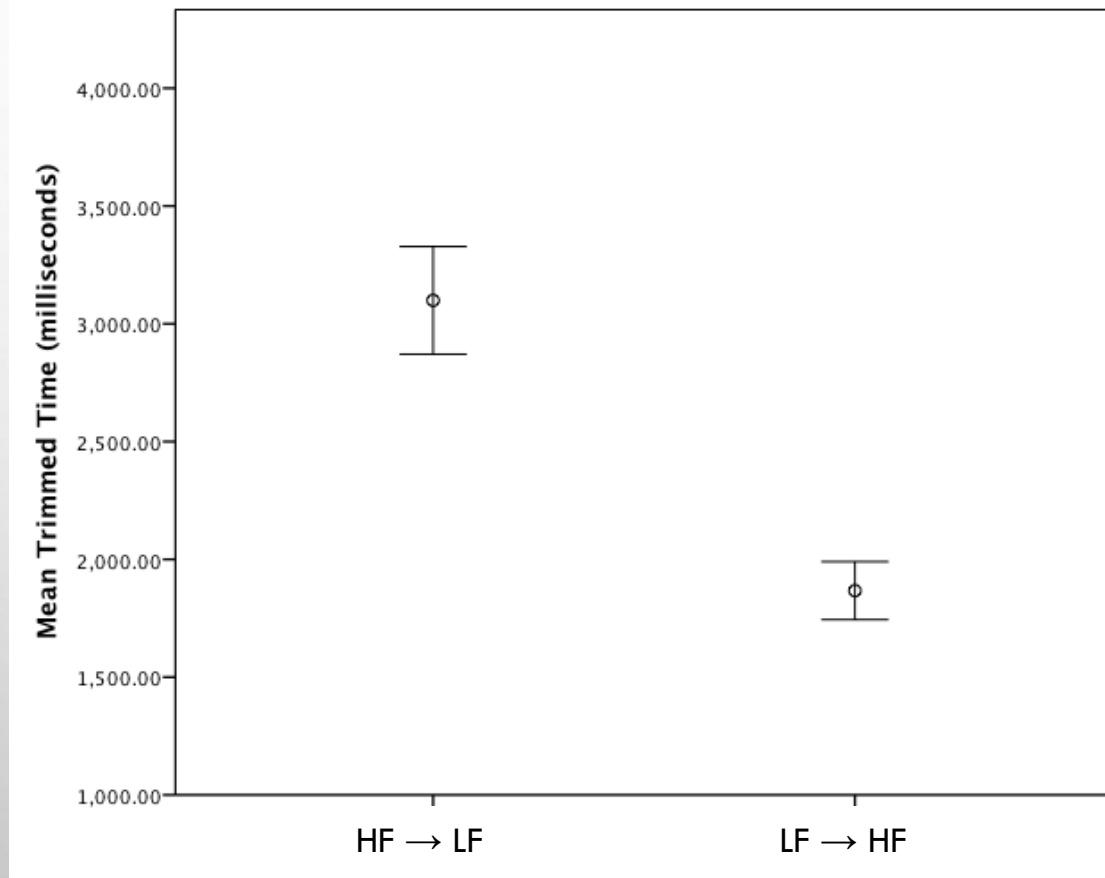
e.g. Enemy ↔ Foe

- Stimuli presented in DMDX. RTs and responses recorded.
- Explanation of synonymy and examples were given in the instructions.

EXPERIMENT 1 RESULTS

A response was discarded if:

a) it was not a synonym; b) non-target noise. c) outside of 2 SD of the mean.



Mean Response Times and 95% confidence intervals of synonym production in HF → LF and LF → HF frequency contours.

Frequency contour effect is significant ($p < .001$).

Frequency imbalance results in translation asymmetry in a single lexicon.

EXPERIMENT 2. CATEGORISATION EFFECTS IN WITHIN-LANGUAGE TRANSLATION

QUESTIONS FOR EXPERIMENT 2:

1. Would semantic manipulation of the stimuli replicate the “bilingual” categorisation interference effect within a language (in a single lexicon)?
2. Does the noise effect disappear when the direction is flipped to LF→HF?
3. Is this asymmetry semantic in its nature, or is it reduced to greater sensitivity to interference in the direction of HF→LF?

EXPERIMENT 2A. HF→LF

Participants and materials

- 30 university students (monolingual British English native speakers).

Three lists of 25 English HF common nouns.

Random; Semantic (*emotions; crimes; jobs; vehicles*); Form-based (*pro-; con -; for-; pa-*)

- Frequency: Stimulus vs. Target contrasted;
- Word length: roughly matched
- Response predictable: lists piloted to predict low frequency responses
- Lists piloted for concreteness: 9 concrete and 16 abstract nouns.

EXPERIMENT 2A. HF→LF

Procedure:

Stimuli presentation and data capture is identical to Expt. 1.

Stimuli example:

Random List

Woman → Lady

Potato → Spud

Car → Automobile

Semantic List

Lift → Elevator

Bus → Coach

Plane → Jet

Form-related List

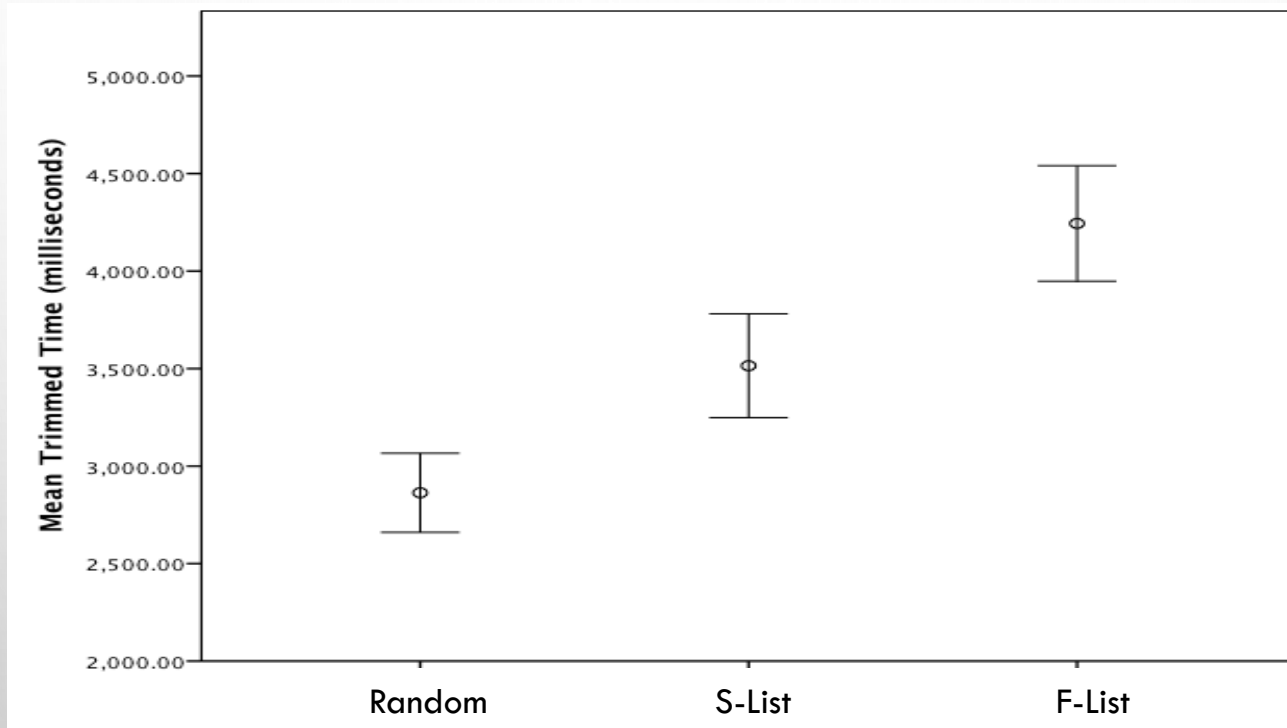
Paint → Emulsion

Pavement → Sidewalk

Page → Sheet

EXPERIMENT 2A HF→LF. RESULTS.

Sig. List Type: $p < .001$. All List Type means are different: $p < .05$ (Bonferroni corrected) for all three comparisons.



HF → LF. Means and 95% CIs for synonym production RTs as a function of List Type

Categorisation (S- and Form-) interference effects are present in
access to LF forms within a language

Participants and Materials.

- 29 university students (monolingual British English native speakers).

Three lists of 25 English LF common nouns

Random; S-list (*emotions; jobs; vehicles*) and F-list (*con-; pro-; car-; la*)

- Frequency: Stimulus vs. Target contrasted;
- Word length: comparable;
- Synonymy: Longmann synonym dictionary;
- Response predictable;
- Lists piloted for concreteness. 10 concrete and 15 abstract nouns.

Experiment 2B. LF→HF.

Procedure:

- Same procedure as in 2A but with the synonym translation in the opposite frequency contour.
- **Stimuli example:**

Random List

Jail → Prison

Spud → Potato

Automobile → Car

Semantic List

Ferry → Boat

Jet → Plane

Elevator → Lift

Form-related List

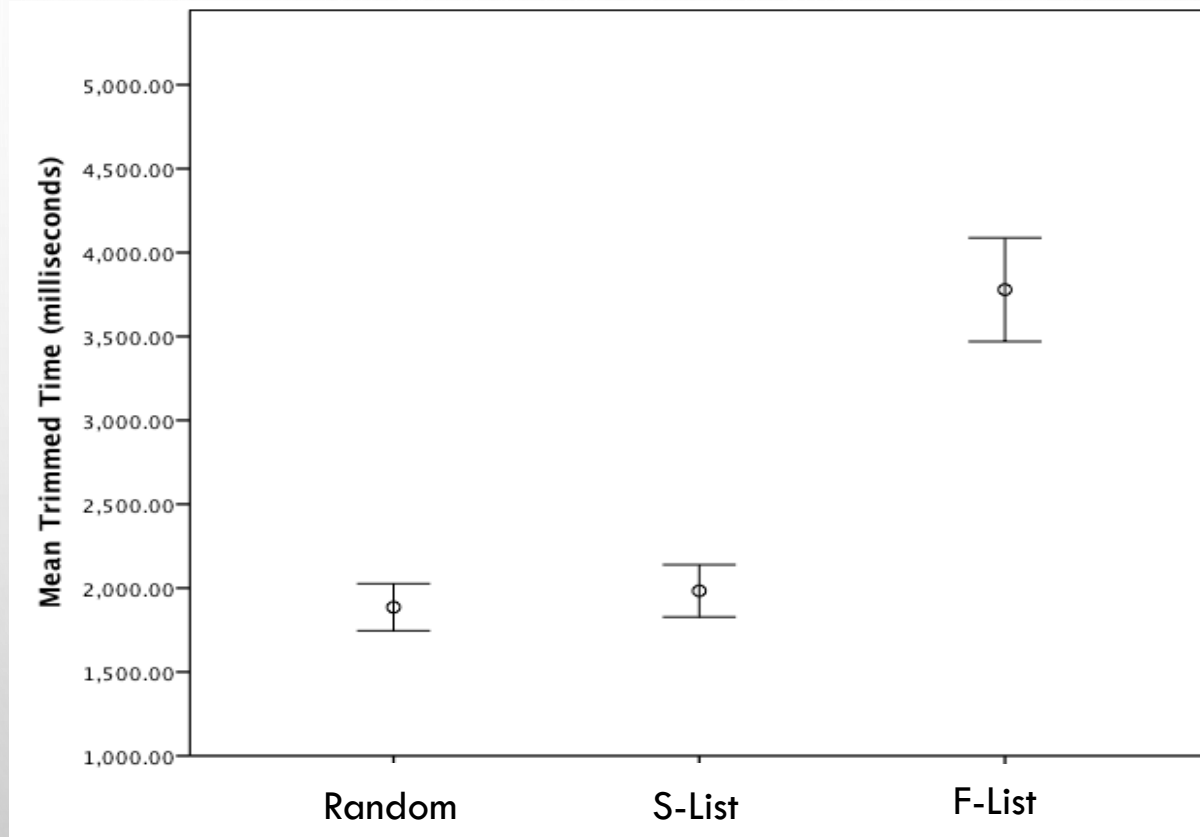
Lane → Path

Ladle → Spoon

Lady → Woman

EXPERIMENT 2B. LF→HF.

Significant effect of List Type: $p < .001$. R-List and S-List no difference: $p > .05$. R-List was faster than F-List: $p < .001$; S-List was faster than F-List: $p < .001$. (*Bonferroni corrected*).



LF→HF Means and 95% CIs for synonym production RTs as a function of List type.

Semantic relatedness effect present in access to lower frequency forms, is overridden when high frequency forms are accessed.

Form relatedness effect remained strong despite the frequency contour change.

MONOLINGUAL RESULTS

- Access to HF words in a “translation” task was faster and more resilient to processing interference (categorisation) than access to LF words.
- Bilingual translation asymmetry is modelled within a single lexicon, with no possible account of varied conceptual processing demands between 2 lexicons.

Our findings provide initial support to frequency of use-related explanation of bilingual asymmetries in lexical access.

Considering bilingual case: question for Experiment 3.

- Will bilingual translation asymmetry be reversed with the reversal of frequency of use (language dominance)? Such reversal has already been reported in some studies (Basnight-Brown & Altarriba, 2007; Sunderman & Pryia, 2012).

EXPERIMENT 3. FREQUENCY EFFECT IN BILINGUAL TRANSLATION

Materials

Three lists of 24 English→Russian translation noun pairs.

Random; S-List (**time; clothes; literature**); F-List (output) (**ob-; pri-; do-**).

Three lists of 24 Russian→English translation pairs

Random; S-List (**emotions; jobs; weather**) and F-Lists (**he-; de-; be-**).

- Frequency (Sharoff, 2006) and Word Length: matched across and within lists;
- Translation predictability (separate pilot);
- Concreteness (separate pilot): each list 15 abstract 9 concrete nouns.

PARTICIPANTS AND PROCEDURE

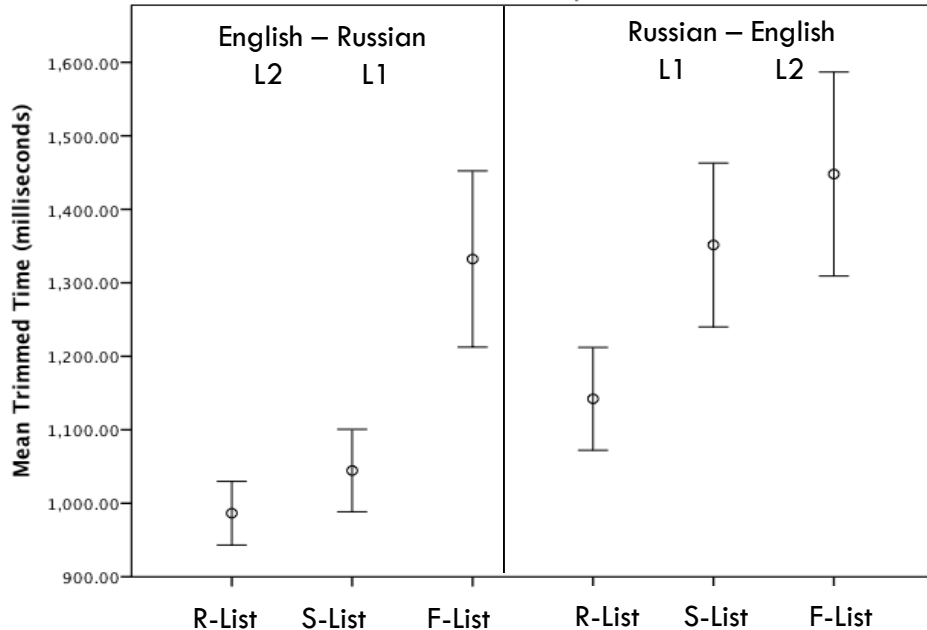
- Participants: 40 Russian (native)-English, UK resident, highly proficient bilingual adults. All started learning English as a second language in secondary education in Russia/Soviet Union
- 20 adults self-assigned to Russian Dominant (RusDom) and 20 to English Dominant (EngDom) groups (4 males + 16 females in each group).
- Participants performed a traditional translation task.
- Stimulus presentation and recording was identical to Expts. 1 & 2.

EXPERIMENT 3. RESULTS

Significant interaction of Group x Direction x List Type: $p < .05$.

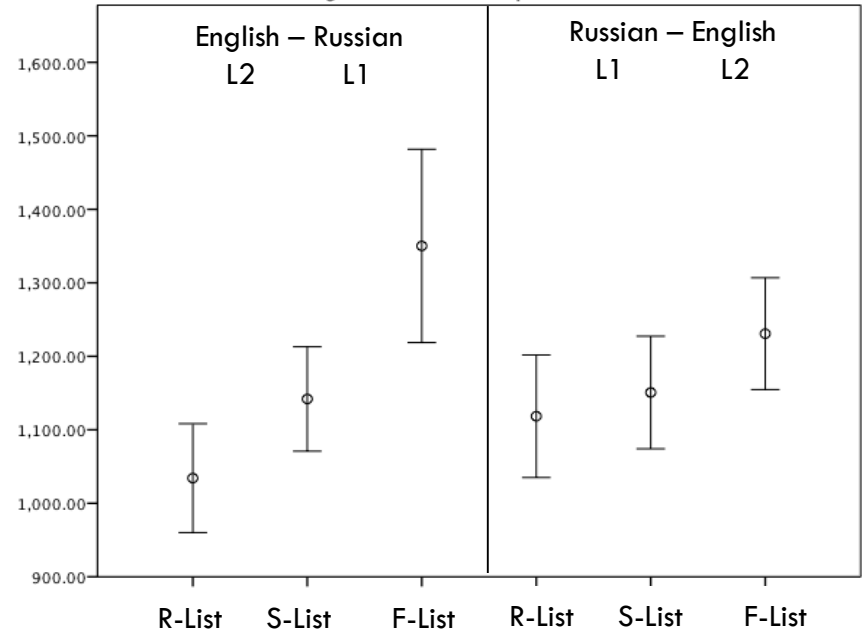
Russian Dominant Group sig. effects

Direction; List Type and Direction X List Type:



English Dominant Group sig. effects

List Type and Direction X List Type



Means and 95% CIs as a function of List Type and Direction.

The R-List faster than the S-List: $p < .001$; R-List and S-List faster than the F-List: $p < .001$ and $p = .005$. (Bonferroni corrected).

R-List faster than S-List: $p = .006$, but to a lesser extent than in the Russian → English direction. R-List and S-List were faster than the F-List: $p < .001$ and $p < .001$. (Bonferroni corrected).

R-List faster than S-List: $p < .001$, and F-List: $p < .001$. S-List was translated faster than the F-List: $p < .001$ (Bonferroni corrected).

R-List and S-List RTs no difference: $F > 1$; $p > .05$. R-List and S-List faster than F-List: $p < .001$ and $p < .001$ (Bonferroni corrected).

SUMMARY

- Translation asymmetry is observed in a context where there is no possibility of different processing (within-language asymmetry).
- HF items are produced faster and are more resilient to processing interference than LF item regardless of language tags (L1 /L2).
- Asymmetry is dynamic and may be reversed depending on language dominance (frequency contour).
- Results are consistent with integrated lexicon and underpinned by shared processing principles for L1 and L2 words.
- In code-switching case: a more frequently used lexical item is a more accessible lexical item. System is “blind” to L1 /L2 tags in terms of word retrieval. The system is dynamic, so switching patterns are likely to be affected if the frequency of use of an item changes due to linguistic environment.

BIBLIOGRAPHY

- Aparicio, X., & Lavaur, J.M. (2014). Recognising words in three languages: effects of language dominance and language switching. *International Journal of Multilingualism*, 11(2), 164-181.
- Bangert, A. S., Abrams, R. A., & Balota, D. A. (2012). Reaching for words and nonwords: Interactive effects of word frequency and stimulus quality on the characteristics of reaching movements. *Psychonomic bulletin & review*, 19(3), 513-520.
- Basnight-Brown, D., Altarriba, J. (2007). Differences in semantic and translation priming across languages: The role of language direction and language dominance. *Memory & Cognition*, 35, 953-965.
- British National Corpus (n.d.) Retrieved January, 20, 2015, from <http://bncweb.lancs.ac.uk>
- Brysbaert, M., Duyck, W. (2010). Is it time to leave behind the revised hierarchical model of language processing after 15 years of service? Research note. *Bilingualism: language and cognition*, 13(3). 359-371.
- Dimitropoulou, M., Duñabeitia, J. A., & Carreiras, M. (2011). Two words, one meaning: Evidence of automatic co-activation of translation equivalents. *Frontiers in Psychology*, 2, 188
- Duyck, W., & Warlop, N. (2009). Translation priming between the native language and a second language: New evidence from Dutch-French bilinguals. *Experimental Psychology*, 56(3), 173-179
- Indefrey, P. (2006). A Meta-analysis of Hemodynamic Studies on First and Second Language Processing: Which Suggested Differences Can We Trust and What Do They Mean?. *Language Learning*, 56(s1), 279-304.
- Kheder, S., & Kaan, E. (2016). Processing Code-Switching in Algerian Bilinguals: Effects of Language Use and Semantic Expectancy. *Frontiers in Psychology*, 7, 248.
- Kroll, J., Stewart, E. (1994). Category interference in translation and picture naming: evidence for asymmetric connections between bilingual memory representations. *Journal of memory and language*. 33. 149-174.

BIBLIOGRAPHY

- Kroll, J. F., Van Hell, J. G., Tokowicz, N., & Green, D. W. (2010). The Revised Hierarchical Model: A critical review and assessment. *Bilingualism: Language and Cognition*, 13, 373–381.
- Michael, E., Gollan, T. (2005). Being and becoming bilingual: individual differences and consequences for language production. In J. Kroll and De Groot, A. (Eds.), *Handbook of bilingualism: psycholinguistic approaches*. Oxford: OUP.
- Moon, J., & Jiang, N. (2012). Non-selective lexical access in different-script bilinguals. *Bilingualism: Language and Cognition*, 15(01), 173-180.
- Oldfield, R. C., & Wingfield, A. (1965). Response latencies in naming objects. *Quarterly Journal of Experimental Psychology*, 17(4), 273-281.
- Poarch, G. J., Van Hell, J. G., & Kroll, J. F. (2015). Accessing word meaning in beginning second language learners: Lexical or conceptual mediation?. *Bilingualism: Language and Cognition*, 18(03), 357-371.
- Rodriguez-Fornells, A., Krämer, U. M., Lorenzo-Seva, U., Festman, J., & Münte, T. F. (2012). Self-assessment of individual differences in language switching. *Bilingualism and cognitive control*, 123.
- Sharoff, S. (2006). Open-source corpora: using the net to fish for linguistic data. *International Journal of Corpus Linguistics*, 11(4), 435-462.
- Spivey, m., Marian, V. (1999). Cross talk between native and second languages: partial activation of the irrelevant lexicon. *Psychological science*. 10 (3), 281-284.
- Sunderman G., Priya, K. (2012). Translation recognition in highly proficient Hindi–English bilinguals: The influence of different scripts but connectable phonologies. *Language and Cognitive Processes*, 27(9), 1265-1285.
- Paap, K. R., McDonald, J. E., Schvaneveldt, R. W., Noel, R. W. (1987). Frequency and pronounceability in visually presented naming and lexical decision tasks. In M. Coltheart (Ed.), *Attention and performance XII: The psychology of reading* (pp. 221-243). Hillsdale, NJ: Erlbaum.
- Thierry, G., Wu, Y. J. (2007). Brain potentials reveal unconscious translation during foreign language comprehension. *Proceedings of national Academy of Sciences*, 104, 12530-12535.