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► To cite this version:

Solène Hameau, Barbara Köpke. Cross-language transfer for cognates in aphasia therapy with multilingual patients: a case study. *Aphasie und verwandte Gebiete (Internet)*, 2015, 3, pp.13-19. hal-01248395

HAL Id: hal-01248395

<https://hal.science/hal-01248395v1>

Submitted on 9 Nov 2016

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Originalbeitrag

Cross-language transfer for cognates in aphasia therapy with multilingual patients: a case study

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FR | Résumé

La question du transfert interlangues dans la thérapie d'aphasiques bilingues est controversée et les conditions dans lesquelles il y a transfert n'ont pas encore été élucidées. Le fait d'avoir davantage de représentations et de processus en commun dans les deux langues semble augmenter le transfert. Cette hypothèse a été mise à l'épreuve dans une étude de traitement basé sur des mots cognats chez un patient trilingue présentant une aphasie non fluente sévère, en phase chronique. Notre objectif était d'examiner le transfert des bénéfices de la thérapie d'une langue à l'autre, avec l'hypothèse d'une origine post-lexicale de l'effet cognat. Pendant 3 semaines, ce patient a reçu une prise en charge intensive en L3 impliquant cognats et non cognats. Un test de dénomination comprenant mots traités et non-traités a été effectué avant et après le traitement. Les résultats montrent des bénéfices au niveau des mots traités en L3 et à un moindre degré pour les mots non traités en L1 et L3. Cependant, aucun effet des cognats n'a été observé. Etant donné que le déficit du patient se situe au niveau post-lexical, les résultats semblent compatibles avec les modèles de production lexicale bilingue impliquant une forte interactivité des différents niveaux de représentation intra- et interlangues et postulant une origine postlexicale de l'effet cognat. D'un point de vue clinique, l'étude montre l'efficacité d'une thérapie de dénomination dans l'aphasie chronique et la transférabilité des bénéfices d'une langue à l'autre.

EN | Abstract

The issue of cross-language transfer (CLT) in aphasia therapy with bilingual patients is controversial and the conditions determining if there is transfer or not are not yet clear. A higher number of representations and processes shared by the two languages seem to increase transfer. We challenged this hypothesis through a treatment study focusing on cognates in a trilingual patient with chronic non fluent aphasia. Our aim was to investigate cross-language transfer of the benefits of therapy, building on the hypothesis of a post-lexical origin of the cognate effect. The patient received intensive therapy involving both cognates and non cognates in his L3 during 3 weeks with naming skills being assessed for treated and untreated words before and after. Results show benefits on the treated L3 words and also, albeit to a lesser degree, on the non-treated words in L1 and L3. However, no cognate effect was observed. Given that the patient's impairment can be located at the post-lexical level, the results are consistent with bilingual speech production models that postulate interactivity between levels of representation within and across languages, with cognate effects emerging at the post-lexical level. Within a clinical perspective, the study shows the efficiency of naming treatment in chronic aphasia, and that there may be cross-language transfer of therapy benefits in bilingual aphasia.

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1. Introduction

Given the difficulties associated with the setting up of aphasia therapy in the different languages of multilingual speakers, the question of possible cross-language transfer (CLT) of the therapy benefits from the treated to the untreated language(s) has received more and more attention in the last years. While the number of empirical studies devoted to this question is still small, a number of factors supposed to play a role in the arising of CLT have been proposed (for a recent review see Ansaldi & Ghazi Saidi, 2014). Among the most frequently mentioned factors is direction of transfer in relation to status of the treated language, i.e. stronger (or dominant, more proficient) or weaker (non dominant, less proficient) language. Edmonds & Kiran (2006), for instance, observe transfer from the weaker language to the more dominant language and conclude that CLT is more likely to occur in this direction or if the patient had very high pre-morbid proficiency levels in both languages. Miertsch et al. (2009) on the other side, observe transfer in a trilingual patient from the L3 to the L2 but not to the L1. A recent review on the issue of therapy transfer from L2 to L1 does not provide a clear answer either (Laganaro, 2014). In order to account for such differences, several authors have proposed that CLT is more likely to occur for structures that are shared by the different languages. The lexicon, supported by declarative memory for each of a multilingual's languages (in contrast to syntactic aspects), is supposed to be more sensitive to CLT (e.g. Ullman et al., 2005). One can infer that, in a therapy focusing on lexical aspects, typologically related languages (or languages that share structural and functional features) will show more sensitivity to CLT than more distant languages (Goral et al., 2007) and that the choice of the verbal material used for treatment will also influence whether there is CLT or not. Particularly, Kohnert (2004) observed CLT on cognate words (with similar meaning and form across languages such as Engl. rose and Span. rosa) following such a treatment in a Spanish-English bilingual with aphasia, but not on non-cognate words. However, Kurland & Falcon (2011) found inhibitory effects of cognates in lexical treatment in a case of bilingual aphasia.

This effect of cognates in bilingual aphasia treatment can be explained by the assumption that cognates have a specific place in the lexical representations of a multilingual, in particular during the production of single words (Costa, Santesteban, & Caño, 2005), due to a possible interaction between lexical and sublexical levels of representation, both within and across languages. Beneficial effects of cognates on naming abilities in bilinguals have been demonstrated, both on healthy (Costa,

Caramazza, & Sebastian-Galles, 2000) and aphasic subjects (Roberts & Deslauriers, 1999). In trilingual subjects, words that are cognates in three languages may show a larger «cognate effect» than cognates of two of the languages only (Dijkstra et al., 2010; Lemhöfer, Dijkstra & Michel, 2004).

The aim of the present study was to try to maximize the benefits of monolingual therapy taking into account the specificities of bilingual language processing with respect to cognate processing. In order to achieve this goal, we provided intensive monolingual language therapy with lexical-semantic focus – lexical-semantic approaches being more likely to favour CLT (Croft et al., 2011) – to a trilingual aphasic patient. Therapy was based on both cognates and non-cognates between the patient's languages in order to examine the cognate effect on the efficiency of naming in the treated language and the untreated language and to contribute to a better understanding of cognate effects.

2. Method

2.1. The patient

The patient, HVL, is a 71-year old right-handed male who suffered from a left sylvian ischaemic stroke with deep, cortico-subcortical lesion leading to severe non fluent aphasia, with apraxia of speech (assessed by clinical judgment). The initial speech pathology report described a relatively preserved comprehension, but very reduced spontaneous output, with a stereotypy, efficiency of phonological cueing in picture naming, with the frequent production of neologisms. Repetition was effortful with the production of neologisms. His L1 is German, he learned English from age 10 onwards at school and French informally upon his arrival in France in his late twenties. Before retirement he was working in a big company where English was the working language. At the time of this study, HVL is living in France and French is the language spoken at home with his spouse, and with friends. Moreover, the patient is benefitting from language therapy in French only, 4 times a week. The study is taking place 28 months post-onset, allowing for the separation of therapy effects from spontaneous recovery. HVL is highly educated and reported to have had very good oral and written proficiency in his three languages prior to the stroke. However, given the patient's present communication needs, it was decided to restrict language assessment to German and French in order to avoid fatigue.

2.2. Procedure

The study involved three steps: pre-treatment assessment, treatment and post-treatment assessment.

Originalbeitrag: Cross-language transfer for cognates in aphasia therapy with multilingual patients: a case study

1. Prior to treatment, general language assessment was conducted with an adapted version of the BAT (Paradis & Libben, 1987), in German by a bilingual researcher (L1 German), and in French by a speech pathologist (L1 French). The patient's naming skills were then assessed in both languages for the 50 words used for treatment and the 35 control words (see below). The words were dispatched in 6 blocks and naming was alternated between French and German in order to limit order effects.
2. Intensive language treatment was conducted in French by two French-speaking speech pathologists. Habitual language therapy was interrupted during this period. A total of 27 sessions, 45 minutes to 1h each, were provided over 3 weeks, five days a week, one to two times a day. Intensity of therapy has been shown to lead to better improvement in naming ability, especially at chronic stages of aphasia (Hinckley & Craig, 1998).
3. After treatment, a naming post-test identical to the pre-test was conducted and general language skills were assessed with the BAT in French and German.

2.3. Material

Treatment was based on a set of 50 French words including 15 French-German-English cognates, 15 French-German cognates, and 20 non cognates. Before and after treatment, the patient's naming skills were assessed for these 50 and an additional set of 35 non-treated words with similar composition in French, and for the German translation equivalents of these 85 words (see figure 1).

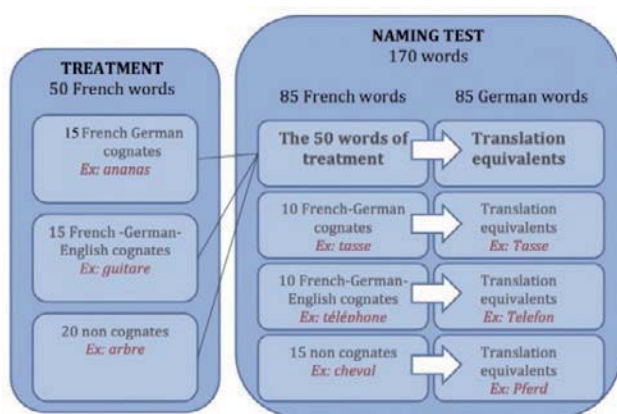


Figure 1. Material used in the naming task

All words were concrete, imageable words taken from two sets of pictures standardized for French (Alario & Ferrand, 1999; Bonin et al., 2003). Similarity between potential cognate pairs was based on cumulated phonological and orthographic similarity. For example, for the pair of French-German cognates «citron-Zitrone», the proportion of shared segments (letters / phonemes) was calculated between the two words. Citron (6 letters) and

Zitrone (7 letters) have five letters in common, in other words they respectively have 83 % and 71 % letters in common. These two percentages were averaged so that the orthographic similarity between these two words was 77 %. The same procedure was applied to the shared number of phonemes to calculate phonological similarity between cognate pairs. Finally, the shared letter and shared phonemes scores were combined, with a 7/3 ratio in favour of the phonological overlap (this choice was made because our study focuses on the spoken modality). Following this procedure, combined orthographic and phonological similarity of the cognate pair citron-Zitrone was 69 %. Treated and non-treated words were matched for degree of similarity following the procedure we just described, and word frequency was balanced across groups of stimuli. We were not able to establish full control of word complexity and length because of the small number of imageable cognate pairs we were able to find. But the effect of both length and complexity were analysed post-hoc.

The treatment material included pictures of the 50 words, written words, letter tiles, and sentences to complete. The activities consisted in repetition (in the presence of the picture), picture-naming with different levels of cueing, naming to definition, written picture naming using letter tiles, sentences to complete, picture/written word matching, and card games. These activities were chosen because evidence shows better transfer from the treated to the untreated language with tasks that target lexical-semantic processing compared to tasks that target phonological processing alone (e.g. Croft et al. 2011). Each of the 50 words had to be produced at least once by the patient during each session.

2.4. Scoring

Only the results of the naming task will be reported on here. For the scoring of this task, we adopted a cueing hierarchy and a phonemic accuracy scale in order to be able to document even slight improvements such as producing the words with less phonological errors or with less cueing from the examiner. Indeed, given the severity of his naming impairment, HVL could rarely produce a 100 % accurate response without any help. Scoring only correct responses without help and 100 % accuracy would not have allowed us to account for this patient's progress. Furthermore, naming 170 items without any help would have generated too much frustration in such a severely impaired patient. However, the method chosen was based on our clinical experience only and certainly needs improvement for the study of further cases of non fluent patients.

Originalbeitrag: Cross-language transfer for cognates in aphasia therapy with multilingual patients: a case study

With respect to the cueing scale, it was decided to provide cues in a pre-determined manner, each time the patient could not give the correct response. The first cues that were provided were semantic, indicating the category of the object, the actions associated or any kind of descriptive characteristics (e.g. for a cup: it's a container, it's used to drink tea or coffee, it has a handle...). Second an impulse sentence was provided (e.g., «Would you put a tea bag in my...»). Third the examiner showed the first labial movement, fourth, she produced the first phoneme, fifth the two first phonemes and so on, ending in providing the correct answer if no response was given by the participant. Spontaneous production of the expected word without any help was scored 10, if the examiner had to produce the full word, the patient was scored 0, the different steps in between received 9, 8, 7 points and so on.

We then also constructed a phonemic accuracy score, so that answers that were not correct but similar to the target word would be scored differently compared to completely unrelated or no response. Again, this was to account for potential differences in HVL's performance even when he still could not produce adequately the intended word. Starting from the phonemic transcription of the response, 1 point was given for each accurate phoneme and half point for each phoneme that differed only by 1 phonemic feature from the target. For added phonemes, half a point was subtracted. The obtained score was divided by the expected number of phonemes and multiplied by 10. For example *tup* for *cup* would result in a 83 % score.

Since the aim of the therapy was to enhance the ease of speech production, we combined the phonemic accuracy and «cueing» measure with a 1:3 ratio in order to give more weight to the patient's increasing autonomy and less to his phonemic accuracy, which was still very variable given the patient's difficulties at the post-lexical level.

2.5. Hypotheses

The study was based on two main hypotheses:

- 1) Transfer-of-treatment-effect hypothesis: Besides the expected treatment effect, we predicted CLT from the treated to the untreated language.
- 2) Cognate-advantage hypothesis: We postulated a) better overall performance for naming on cognates than on non cognates, and b) higher efficiency of treatment on cognates comparing to non cognates. This effect should be even stronger for words that are cognates in the three languages.

Taken together, these two hypotheses led us to formulate the following predictions with respect to the comparison of performance of the pre- and post-treatment naming task:

- improvement for all treated French words
- improvement for the German translation equivalents of the treated words which are cognates (with stronger effects for words which are cognates in the three languages)
- little improvement in German non cognate and non treated words and in French non treated words. In short, we expected better results on the words that have the most important degree of similarity across languages.

3. Results

The results of the pre- and post- naming tests, based on the combined measure of phonemic accuracy and facility of naming, are summarized in table 1.

With respect to hypothesis 1, a multivariate Anova with repeated measures shows a highly significant main effect of test-condition ($F(162) = 71,465$; $p < ,000$) illustrating the improvement between pre- and post-treatment testing. Considering the language of treatment, the results show that naming in French (the treated language) is all-over better than naming in German. However, this difference is significant for the post-test only ($t(162) = -1,755$; $p = ,0405$). This finding suggests an influence of the language of treatment in accordance with our predictions. The beneficial effect of treatment is furthermore clearly shown by the improvement between pre- and post-test for all categories of words, but it seems to be greatest for the treated words (25 % improvement), then for the L1 equivalents of the treated words (16 % improvement) and last by the control words (12 % improvement). These results illustrate that there is transfer from the treated French words to non treated French words, but also that there is CLT from the treated words to their translation equivalents in L1.

Originalbeitrag: Cross-language transfer for cognates in aphasia therapy with multilingual patients: a case study

		PRE-testing	POST-testing	% Improvement
Language	French (L3)	4,9	7,37	25 %
	German (L1)	4,08	5,44	14 %
Treatment status	Treated words (L3)	4,9	7,37	25 %
	Equivalents (L1)	4,64	6,2	16 %
	Control words	3,66	4,88	12 %
Cognate status	Cognates	4,46	6,09	16 %
	Non cognates	4,12	5,92	18 %

Table 1. Combined measure of response facility and phonemic accuracy in the pre- and post-treatment naming

With respect to cognate status, hypothesis 2 was not confirmed: although there seems to be a tendency for cognates to be slightly better named than non cognates, this difference is not significant, and it is the case both at the pre-test ($t(162) = .897, p = .1855$) and at the post-test ($t(162) = .446, p = .328$). No interaction between cognate and treatment status ($F(3,156) = .839, p = .475$) was found, showing that the efficiency of treatment was not better for cognate words compared to non cognates. Moreover, there was no difference between cognates of two or the three languages (all $p > .05$). Apart from these main results, the findings also showed highly significant effects of frequency, length and phonemic complexity of the target words. In addition, HVL would show a number of naming behaviours that could be attributed to difficulties occurring at the lexical-phonological level (namely phonemic paraphasias, and a great facilitation effect with phonological cueing). These, associated with the frequency effect, suggest that impaired word retrieval is to be attributed to a deficit in the phonological output lexicon. Finally, the major length effect and the presence of many phonemic paraphasias suggest a possible impairment of the phonological output buffer.

4. Discussion/conclusion

The discussion will focus on the absence of the expected cognate effect. Several possible explanations have been proposed in the literature to account for the cognate effect. We will discuss only those which are relevant with respect to our findings.

For instance, it has been claimed that the cognate effect has a conceptual origin since cognate translation pairs may share more conceptual features than pairs that are not cognates (Van Hell & de Groot, 1998). We believe that this hypothesis cannot account for our findings. HVL's conceptual level is not impaired as shown by his good results at the BAT subtests that target semantic proces-

sing and if the cognate effect was to be found at the conceptual level, our patient should have shown cognate effects.

The cognate effect may also have a lexical/morphological origin (Kirsner, Lalor & Hird, 1993). According to this vision, cognates would be seen as special cases of morphologically related words across languages. The advocates of this hypothesis locate the seat of the cognate effect between the conceptual/semantic and the lexical levels of representation or at the lexical level. HVL's impairment seems to be most severe after the stage of lexical retrieval. Consequently, if the cognate effect occurred at the lexical-morphological level, such an effect would have been expected in our patient, which was not the case.

These two first views account for the cognate/non-cognate distinction by postulating that cognates are represented «differently» than non-cognates. The following views see the cognate effect as a consequence of the dynamics of the language production system, rather than as a consequence of a different representational format. It has been proposed that the cognate effect may emerge at the sublexical level, due to the activation of phonological features of words in both languages during speech production (Costa, Caramazza & Sebastián-Gallés, 2000). Cognates share a lot of phonological features and should therefore be more strongly activated than non cognates, within and across languages when it is assumed that both languages are activated at that level.

Finally, Costa and colleagues (Costa, Santesteban & Caño, 2005) suggest that the cognate facilitation effect in naming can be viewed as a particular kind of phonological neighbourhood density effect. Phonological neighbours are words that sound similar to the target words. In that view, cognates are cross-language phonological neighbours. In monolinguals, words having many phonological neighbours are faster and more accurately named than words with few phonological neighbours (e.g., Vitkevitch, 2002). In bilinguals, phonological neighbours of both languages have been shown to facilitate speech production (Marian & Blumenfeld, 2006). It would be reasonable to infer that cross-language phonological neighbours also have a facilitating effect. This is because the phonological features of words that have many neighbours would be activated both by the target word and by this word's neighbours, and because there is interactivity between the lexical and the phonological levels of processing. Given that cognates also share meaning, the neighbourhood effect in the case of cognates would be magnified by the fact that the target's translation is not only activated by feedback from the phonological level, but also from the semantic level.

The latter two interpretations are particularly interes-

Originalbeitrag: Cross-language transfer for cognates in aphasia therapy with multilingual patients:
a case study

ting with respect to the case of HVL as it is likely that this patient's sublexical level of processing is severely impaired. It can further be assumed that disturbed activation of phonological features will also affect the activation of phonologically related words. Hence, a cognate effect would not to be expected in a patient with this specific impairment. On the other hand, following Costa and colleagues, in patients with more semantic impairments, cognate effects should arise and might facilitate CLT of therapy benefits. In any case, it is very likely that cognate effects depend on the type and severity of deficit. This may explain why the results of studies with bilingual aphasic patients are not homogenous with respect to cognate effects. For instance Kurland & Falcon (2011) observed inhibitory effects of cognates in lexical treatment in another case of severe non fluent bilingual aphasia.

The results of our study account for a language non specific lexical access in bilingual single word production. The study revealed CLT from the treated to the untreated language and demonstrates that the translation equivalents of the treated words were activated during processing, at least at the «word» level. It remains however difficult to draw any conclusions with respect to the status of the treated and non treated language as it is difficult to say which were HVL's premorbid stronger and weaker languages. As far as the cognate effect is concerned, our results are in favour of a sublexical origin of this phenomenon that implies interactivity between different levels of processing. HVL's impairment of the sublexical level did not allow for the cognate effect to occur.

Despite the absence of a cognate effect, the clinical implications of this study are still interesting. The results demonstrate the efficiency of naming treatment in bilingual aphasia, and the potential CLT to the non treated language. This case study accounts furthermore for the

efficiency of language therapy in chronic stages of aphasia.

Some aspects of this work would be interesting to consider for future research:

- First of all, to better understand the origin of the cognate effect, it would be interesting to propose the same experiment to aphasic patients whose sublexical level is differently impaired, in order to see whether the cognate effect can occur in patients with a different deficit as shown by other case studies of aphasic patients (Kohnert, 2004; Kurland & Falcon, 2011).
- Then, in order to go further into the analysis of CLT, since transfer did occur for translation pairs for our patient, it would be interesting to investigate the influence of semantic neighbourhood density in the rehabilitation process of bilinguals with aphasia. The influence of phonological neighbourhood density on the generalization effects within and across languages of a bilingual could also be investigated.
- Finally, HVL's speech production was very affected. We often had to provide him with cueing. We had to define a «cueing scale» and to take into account the phonemic accuracy of his production. It would be interesting to investigate the most accurate means of assessing improvements in naming when speech is still very disordered and when the patient still needs cueing.

5. Acknowledgements

We would like to thank the patient HVL and his family for participation in the study.

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Originalbeitrag: Cross-language transfer for cognates in aphasia therapy with multilingual patients:
a case study

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