Title	An evaluation of combined effects of semantic priming and semantic features analysis on treatment of anomia in Chinese
Other Contributor(s)	University of Hong Kong.
Author(s)	Sung, Hoi-yan, Florence; 宋凱茵
Citation	
Issued Date	2004
URL	http://hdl.handle.net/10722/48790
Rights	Creative Commons: Attribution 3.0 Hong Kong License

An evaluation of combined effects of semantic priming and semantic features analysis on treatment of anomia in Chinese

Sung Hoi Yan, Florence

A dissertation submitted in partial fulfillment of the requirements for the Bachelor of Science (Speech and Hearing Sciences), The University of Hong Kong, May 7, 2004.

Abstract

This paper reported a single-case study of a Cantonese-speaking anomic patient, investigating the combined effect of two semantically based treatments: semantic priming and semantic feature analysis (SFA). According to the connectionist model, it was hypothesized that by adding extra semantic stimulation to the semantic networks, the word-retrieval ability would be enhanced. The results showed that 1) the combined treatment was effective in improving word-retrieval ability on trained items. 2) Generalization to untrained items was present and the effect was non-category specific. 3) Familiarity effect was present for generalization items and the treatment effect was able to maintain for at least one month after the end of treatment.

Introduction

Anomia is one of the most common symptoms in aphasic patients. Most of the aphasic patients suffered from different degrees of word-finding difficulties. Among various word classes, content words, including nouns and verbs, were the most vulnerable categories to anomic patients. (Goodglass, H. & Kaplan, E., 1983)

Based on the cognitive neuropsychological approach, word retrieval requires successful access from the semantic system to the phonological output lexicon. The logogen model in Figure 1, which is adopted from Lesser and Coltheart (1992), demonstrates the pathway of word retrieval in confrontation naming. Any disruption along this pathway would lead to word-finding difficulty.

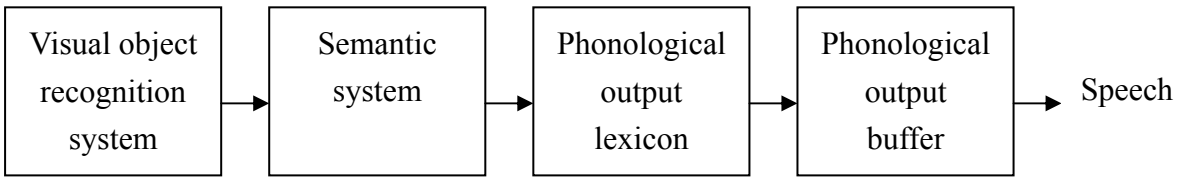

Figure 1. Logogen model on confrontation naming

Another more recent theory of lexical retrieval is the connectionist model. In this model, lexical nodes, semantic features and the phonological network are interconnected and the connections are interactive instead of uni-directional in nature. Successful word retrieval required both the activation of semantic and phonological networks, while the activation can spread along the connections, that means the lexical units which are either phonologically or semantically similar to the target words will also be activated. The stronger the connections,

the faster the spreading of the activation is. (Harley, 1993)

No matter which model is being adopted, treatments of word-finding difficulties are mainly divided into two main approaches: semantic and phonological. There are many different types of treatments reported in the literature. As reviewed by Nickels (2002), phonological treatments, including repetition of the target names, phonological/phonemic cueing in picture naming, rhyme judgment and phoneme segmentation tasks have been used for patients with impairments in retrieving phonological information. Nickels (2002) summarized the results of various phonological treatment researches and concluded that most phonological treatments had immediate effect and were likely to be item-specific.

On the contrary, semantic treatments were reported to be more durable and have better generalization effect (Nickels, 2002). Aiming at strengthening the activation of semantic information in word retrieval, Drew and Thompson (1999) reported the effectiveness of the model-based semantic treatment, including word/picture matching task, sorting task and definition-to-picture match task on four patients who had semantic-level deficit and two of them were responsive to the semantic treatment. Another treatment method named circumlocution-induced naming (CIN), was suggested by Francis, Clark and Humphreys (2002). This treatment targeted at patients with impaired link between semantics and phonology. They hypothesized that by ‘‘talking-around’’ the target pictures (circumlocution) until the patients successfully retrieved the name could rebuild or reinforce the impaired link.

The treatment results were encouraging. Generalization to untrained items had also been noted.

Apart from the treatments mentioned above, there are still many studies that have investigated the effect of different treatment approaches, but all of these studies were targeted at English-speaking population. There has been relatively little research involving Cantonese-speaking anomic patients. The aim of this study was to investigate whether semantic treatments can be beneficial to these patients.

Semantic treatment was selected because its effect was found to be more long-lasting compared to phonological treatment and had better generalization to semantically-related items in English-speaking population (Nickels, 2002). Therefore, through this study, it was hoped to find out whether the same treatments, when applied to Cantonese-speaking patients, would have the same effect as those on English-speaking patients.

This study combined two existing semantic treatments - semantic feature analysis (SFA) (Boyle and Coelho, 1995; Conley & Coelho, 2003) and semantic priming (Martin & Laine, 2000; Renvall, K., Laine, M., Laakso, M. & Martin, N., 2003). Both of the treatments were found to be useful in facilitating word retrieval in English-speaking anomic patients.

The method of SFA was similar to that of CIN. Both of them encourage patients to verbalize the features around the targets. However, instead of letting the patients circumlocute freely as done in CIN, SFA focus on six semantic features for patients to

describe for each target picture, including ‘group’, ‘use’, ‘action’, ‘properties’, ‘location’ and ‘association’. The primary theory behind it is that by encouraging the patients to verbalize the semantic features of the target, “the semantic network surrounding the target can be activated above its threshold; the likelihood to retrieve the word successfully will be increased as the target had been activated above the threshold level” (Boyle & Coelho, 1995, p.94). This treatment has been proven to be effective in improving patients’ naming difficulties in both treatment and control items and the effect was able to last for two months after the treatment ended. (Boyle & Coelho, 1995)

The second treatment applied in this study was semantic priming. Martin and Laine (2000) and Renvall et al. (2003) investigated the effect of semantic priming and phonological priming on anomic patients. Sets of five pictures, which were either semantically or phonologically related, were presented to the patients, and they were required to repeat after the examiners if they failed in spontaneous naming attempts. This cycle was repeated throughout the treatment period. Progress was noted on treatment items in both conditions, but generalization only occurred in semantic priming. Its primary principle is that by eliciting stimulus, activation will spread amongst the semantically-related items, bringing them closer to the selection threshold, so pictures in a related set are easier to name than those in an unrelated set (Renvall et al, 2003).

Since both semantic priming and SFA were aimed at activating the semantic network

of the target pictures, thus, by combining the two treatments, both the semantically related features and items can be activated. By providing more activation to the semantic network, the patient's word retrieval ability is believed to be more efficient. It is also possible that the technique used in SFA could be developed into a self-cueing strategy for the patient to overcome the word-retrieval difficulty in the daily conversations.

In the original studies of semantic priming and SFA, the familiarity effect was not investigated; however, it is believed to be one of the important variables affecting word retrieval (Cuetos, F., Aguado, G., Izura, C & Ellis, A.W., 2002). In the connectionist model, the activation level in the semantic and phonological network must reach the threshold for successful word retrieval (Harley, 1993). It is hypothesized that the higher the familiarity of the target names, the lower the threshold is and therefore easier to be selected for production. Thus, another aim of this study was to investigate if the familiarity effect was present in this combined treatment program. The outcomes of this investigation would have important clinical implications in managing anomic patients.

The research questions in this study included: 1) Was the combined treatment of semantic priming and semantic feature analysis effective on facilitating oral naming? 2) Was there any generalization to untreated items? 3) Would the treatment effect (if any) last beyond the treatment period and was there any familiarity effect for the proposed treatment?

Method

Subject

MTK, a 39-year-old male was recruited as the participant in this anomic treatment research. He was a right-handed native Cantonese speaker. His education level was Form 3. He suffered from traumatic brain injury and was diagnosed to have left parietal epidural haematoma in 1994. According to the results of the Western Aphasia Battery (Cantonese Version) (CAB) (Yiu, 1992), he was classified as having Broca's aphasia. He had achieved 28.3% accuracy in the object-naming task in CAB. Apraxic elements were found in the subject's speech.

To identify the underlying deficit of MTK's naming problem, the Pyramid and Palm Tree Test (PPT) (Howard & Patterson, 1992) as well as the Associative Match test in the Birmingham Object Recognition Battery (BORB) (Riddoch & Humphreys, 1993) were administered. He had attained 94.59% and 95.65% accuracy respectively, indicating that his semantic system was relatively intact. Therefore, based on the logogen model, his naming difficulty was due to deficits at the phonological output lexicon and/or the access to it.

Materials

The original set of stimuli consisted of 256 line drawings and was divided into 18 semantic categories. The picture set included 158 from a standardized picture set by Snodgrass and Vanderwart (1980), 39 from Aphasia Rehabilitation: a clinical and home therapy outcome (Jipson, 1987), 36 from the British Picture Vocabulary Scale (Dunn, 1982),

12 from the Boston Naming Test (Goodglass and Kaplan, 1983) and 11 from Picture Please! A Language Supplement (Abbate & Lachappelle, 1997).

Naming agreement, familiarity and visual complexity were obtained by asking five native Cantonese-speaking male to name and rate the stimuli once. Their average age was 39.20 years old. Four of them had education level of Form three and one had Form five. The summary of the normal data was attached in the Appendix A. Visual complexity was found to be comparable across categories in the original set.

Pictures would be removed if the naming agreement was less than 75% (three out of five normal subjects or more had named them differently or were unable to recognize the pictures) and if the names were monosyllabic in length. Monosyllabic names were excluded so that the examiner could judge the subject's responses more easily and to avoid the ambiguity due to the subject's articulatory errors. A total of 233 pictures were used in obtaining the baseline performance of MTK.

Treatment program

A multiple baseline research design was used to evaluate treatment efficacy. Three types of stimuli were used in the treatment, including treatment items, generalization items and control items. Corrective feedbacks were only given to the treatment items. In order to prove that the improvement in the naming ability was due to the treatment effect, but not the general improvement of the patient, a control task, which should not involve the word

retrieval mechanism, was used. Auditory sequential digit span (forward), which was used to assess the functioning of short-term memory, was selected as the control task.

The treatment program was divided into four phases.

Baseline phase

This phase consisted of three sessions and was carried out in one week. The aims of this phase were to establish the baseline performance of MTK and for assignment of stimuli. In each session of this phase, MTK was asked to name the 233 pictures once. The order of presenting pictures was randomized every session. Twenty-three pictures, which he was able to name in 15 seconds in two out of three sessions, had been removed from the original set. Items that were used in the treatment program were selected from the remaining 210 pictures.

The 18 categories were then arranged in descending order of familiarity. The first three categories (fruit and vegetable, clothing and kitchen items) were selected for Phase one. For each category, the ten items with highest familiarity ratings were assigned as high familiarity treatment and generalization items for Phase I. The last three categories (four-legged animals, birds and insects) were selected for Phase II. Due to the insufficient items in low familiarity categories, the category of ‘birds’ and ‘insects’ were combined to form a new category of ‘non-four-leg animals’. Fifteen items with lowest familiarity in the category ‘four-leg animals’ and 14 items in ‘non-four-leg animals’ were assigned as low familiarity treatment and generalization items. Four control categories were also selected, two with high

familiarities ratings (stationery and transportation Means) and two with low familiarities ratings (musical instruments and recreational Items). Five items were selected according to their familiarity from each control category

In order to ensure that there were familiarity contrasts between the high and low familiarity categories, independent t-tests were administered to compare the familiarity values of all treatment, generalization and control items. The results indicated all the comparisons were significantly different (high familiarity treatment items versus low familiarity treatment items [$t = 11.90$, $p = 0.00$]; high familiarity generalization items versus low familiarity generalization items [$t = 11.58$, $p = 0.00$]; high familiarity control items versus low familiarity control items [$t = 12.83$, $p = 0.00$]).

To summarize, there were 30 treatment items, 29 generalization items and 20 control items. The total number of stimuli was 79.

The control task was carried out in each of three baseline sessions.

Phase I – High familiarity categories

In this phase, two sessions a week with a total number of ten sessions were conducted. In each session, pre-treatment probing was obtained by asking the subject to name all stimuli. The order of picture presentation was randomized every time. During the treatment, pictures of treatment items in the same semantic category were presented to the subject while he was required to name them spontaneously. The order of presenting the semantic categories was

rotated every session to prevent the fatigue effect of the subject on particular categories.

Regardless of his ability to name the target item, he was required to describe the target item according to the parameters and procedure in the SFA. He needed to verbalize the six semantic features of the target, the experimenter then wrote the appropriate features on a chart (as shown in Appendix B) afterwards. If he was unable to provide the features, the experimenter would provide them orally and visually by writing on the chart. After these procedures, he was required to name the picture again. If he was still unable to name in 15 seconds, the experimenter would provide the correct name and the subject was required to repeat.

In order to proceed to Phase II, the subject was required to attain at least 85% accuracy (13/15 correct) on treatment items in the pre-treatment baseline over three consecutive sessions.

Phase II – Low familiarity categories

There were totally six sessions in this phase. Due to the Chinese New Year Holidays, the first two sessions in phase two were conducted weekly, the next four sessions were carried out twice a week. The procedures and the passing criteria were exactly the same as in Phase I.

Maintenance phase

This phase consisted of four weekly sessions.. The aim of this period was to see if the

treatment effect maintain beyond the treatment period, and the pattern of regression (if any) of the subject's performance. This phrase started two weeks after the last treatment session. The subject's performance on naming as well as on the control task was recorded.

Scoring of responses

All the subject's responses were scored as correct or incorrect. All normal responses and those with articulatory errors, such as distortion of phonemes due to apraxia, were counted as correct responses. Five types of errors were classified as incorrect responses. 1) 'no response'. 2) 'incomplete response', in which the subject's response contained only a part of the word, e.g. 馬騮 (monkey) → 騮. 3) 'semantic error', defined as a complete naming response and semantically related to the target objects, e.g. 裙(dress) → 長褲(trousers). Another type of 'semantic error' defined as the subject's production of the superordinate of the target objects instead, e.g. 涼鞋(sandal) → 鞋(shoe) 4) 'phonological error', characterized by the substitution of phoneme and 50% or more syllables in the target words were correct, e.g. 犀/sai1/牛(rhinoceros) → 山/san1/牛 and 'non-target responses', which contained the correct meaning but the response name was uncommon and was different from the norm data, e.g. 猩猩(chimpanzee) → king kong. All sessions were tape-recorded by using a mini-disc recorder. The subject's processing time had also been marked by using a timer.

Statistic comparisons

In order to evaluate the subject's performance statistically, several comparisons were

made. Firstly, to evaluate the performance of treatment items, the subject's best performance in the baseline phase and the best performance in the corresponding treatment phase (i.e. Phase I for high familiarity treatment items and Phase II for low familiarity treatment items) were compared. Secondly, to evaluate the performance of generalization items and control items, the subject's best performance in the baseline phase and the best performance in the whole treatment phase were used for comparsion. Finally, to investigate the familiarity effect on generalization items and control items, the subject's best performance of high familiarity categories and that of low familiarity categories in the whole treatment phase were compared by using the chi-square test.

Results

MTK made good progress on treatment items of both high and low familiarity categories. For high familiarity treatment items, the subject made steady improvement throughout Phase I. His best performance in baseline phase was 20% (session B3) and rose up to 93% (session T7) in Phase I [McNemar $z = 3.32$, $p<0.05$]. His performance on these items was maintained throughout Phase II as well as the whole maintenance phase. Followed by Phase I, the subject received treatment on low familiarity items in Phase II. Figure 2 reveals that his performance on low familiarity treatment items was improving during Phase I even without intervention. His best performance of low familiarity treatment items in Phase I was 80% (session T7). If compared it with the best performance in the baseline phase

(session B3), significant difference was found [McNemar z = 5.14, p<0.05]. At Phase II, MTK's best performance was 100% (session T14) while the best performance in the baseline phase was 33% (session B3) [McNamar z = 3.16, p<0.05].

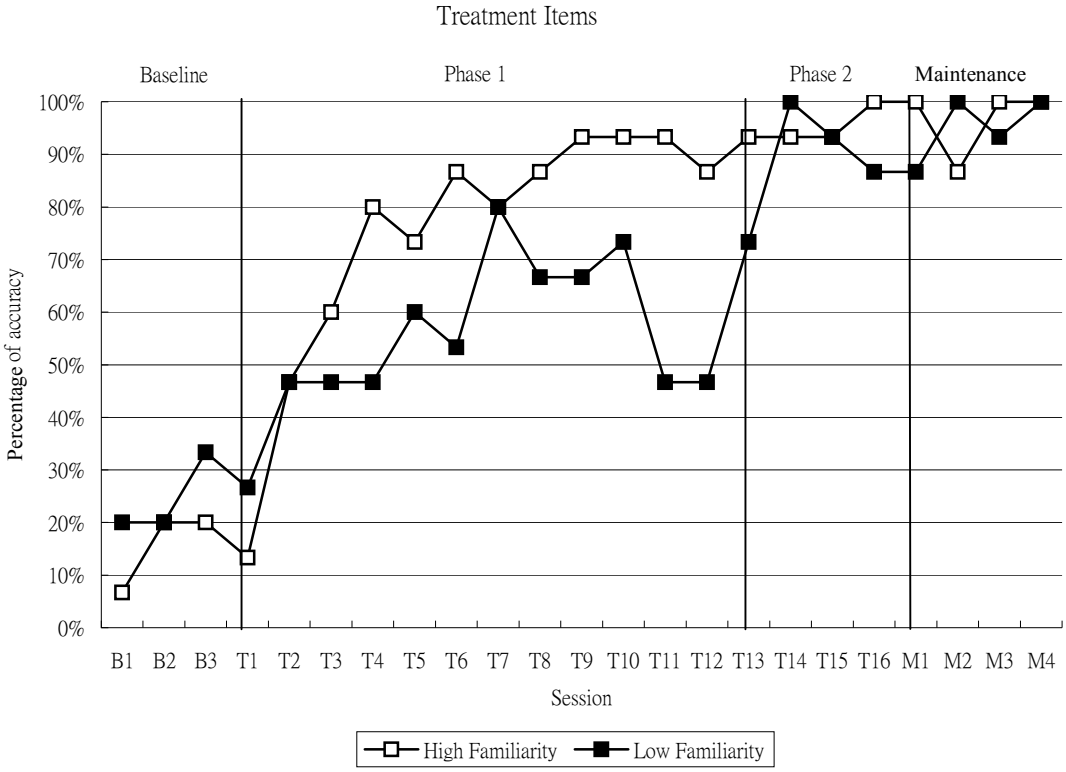

Figure 2. Percentage of accuracy of treatment items

Figure 3 shows the subject's progress on generalization items of both high and low familiarity. For high familiarity items, there was a steady improvement when compared with the baseline performance. The best performance in treatment phase was 60% (session T14) while it was 13% (session B2) in the baseline phase. The change was significant statistically [McNemar z = 5.14, p < 0.05]. For low familiarity items, the subject's performance was similar throughout the whole treatment phase. The change was insignificant [McNemar z =

0.25, p = 0.62], with his best baseline performance at 7% (session B3) and rose to 21% (session T16) in Phase II.

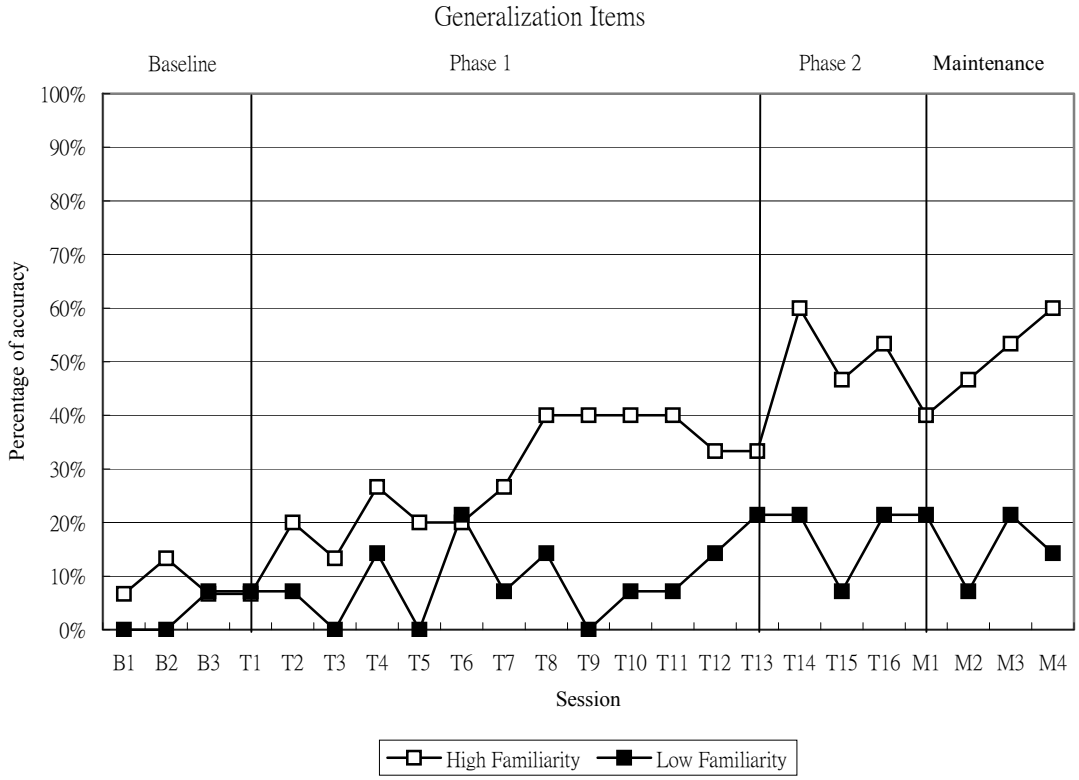

Figure 3. Percentage of accuracy of generalization items

MTK showed steady progress on control items as revealed in Figure 4. Due to the small number of control items, only the overall performance could be compared statistically. By comparing the subject's best performance in the baseline phase with that in the whole treatment period, the percentage of accuracy has risen from 5% (session B3) to 60% (session T13) [McNemar z = 9.09, p<0.05]. In addition, his performance was able to maintain throughout the maintenance phase. For the control task (sequential digit span) performance, three data points were taken in the baseline phase, the average span range was 5.3, while four

data points were taken in the maintenance phase and the average digit span was 5.0.

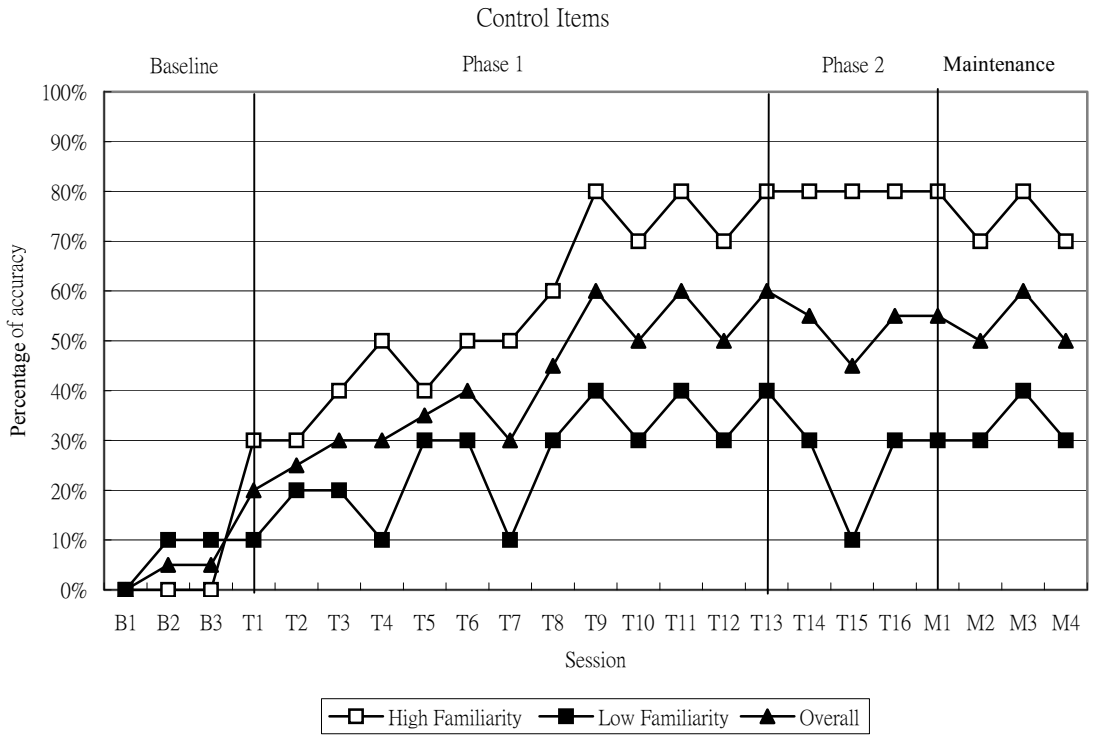

Figure 4. Percentage of accuracy of control items

Familiarity effect was investigated by comparing the subject's performance on treatment, generalization and control items across familiarity levels. No significant difference was found between high familiarity and low familiarity treatment items because both of them had reached 100% in the treatment program. However, significant differences were found for both generalization and control items, ([$\chi^2 = 4.44$, $p<0.05$] for generalization items and [$\chi^2 = 3.33$, $p<0.05$] for control items). In both cases, MTK's performance on high familiarity items was significantly better than that on low familiarity items.

Error analysis

Figure 5 reveals that MTK's errors were dominated by omission. Its percentage was

highest in the first session of baseline phase at 79%. It declined gradually since then. For the other error types, the numbers of errors were in general low as each of them were less than 10% throughout the treatment program. There was a slight increase in the number of semantic errors across the period.

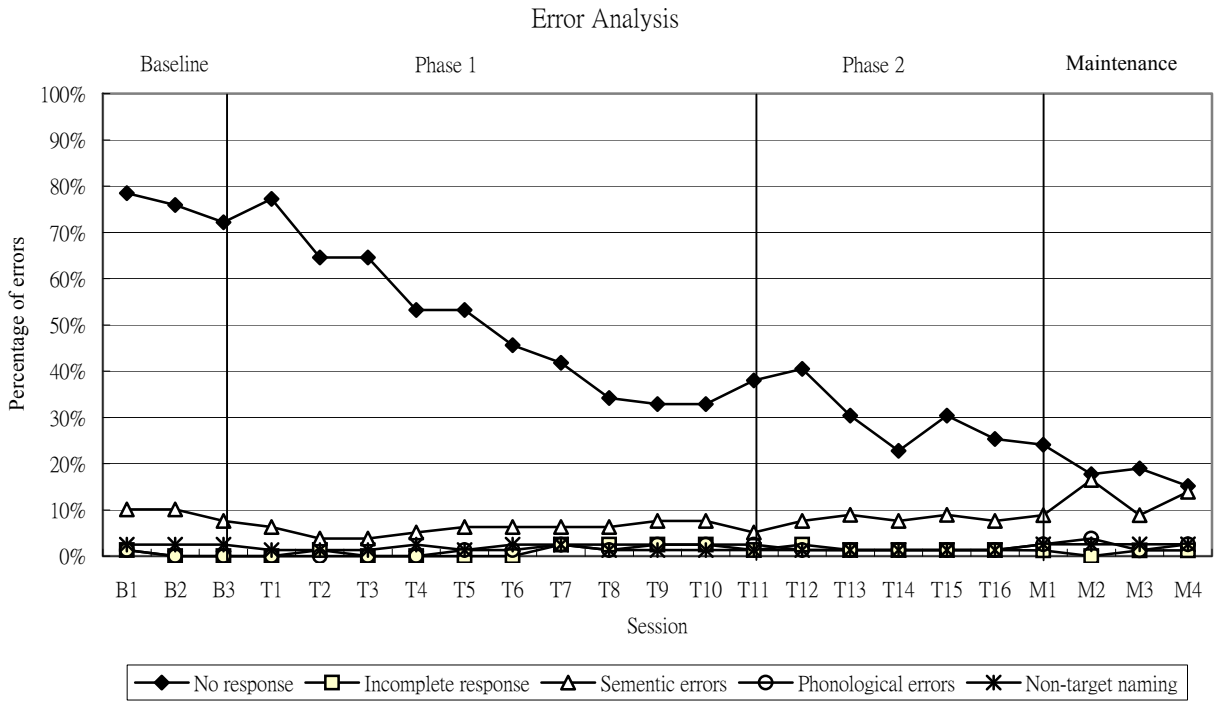

Figure 5. Percentage of different types of error across sessions

Summary

The combined treatment of SFA and semantic priming was effective in aiding word retrieval and its effect was able to maintain for one month after the last treatment session. Generalization was only noted in high familiarity generalization items. In addition, significant improvement was also noted in control categories. Finally, familiarity effect was evident for both generalization and control items.

Discussion

Based on the results that the subject could achieve nearly perfect performance on both high familiarity and low familiarity treatment items, the combined treatment of semantic priming and SFA was proved to be effective in improving word retrieval ability. This conclusion was supported by MTK's constant performance in the control task (sequential digit span), indicating that his improvement in naming was due to specific treatment effect. The finding was consistent with previous studies of these two treatment approaches (Boyle and Coelho, 1995; Martin & Laine, 2000; Conley & Coelho, 2003; Renvall, K., et al., 2003). To explain the treatment results in the connectionist model, the effectiveness of the combined treatment indicated that the extra semantic stimulation was successful in bringing the activation closer to the threshold level. In addition, to implement the combined treatment successfully, the information provided in the six semantic features should be very distinctive. The more specific the semantic features, the more activation can be given to the semantic networks, the easier it is to retrieve the words.

Another evidence on treatment success was the change in the error pattern. Although MTK's errors were dominated by omissions, there was a slight increase in the number of semantic errors at the end of the treatment period, as indicated in Figure 5. This phenomenon could be explained by the connectionist model as well. As the subject received continuous stimulation to the semantic network, the activation levels of the target words as well as those

closed to the target words were raised accordingly. Consequently, more semantic errors appeared in the subject's production.

Previous studies of semantic priming and SFA had already demonstrated that the two treatments had good generalization effect to untrained items (Boyle & Coelho, 1995; Martin & Laine, 2000; Conley & Coelho, 2003; Renvall, K., et al., 2003). In this study, more detailed investigations were conducted and two more conclusions could be made beyond the previous work. Firstly, the generalization effect was not category-specific. This was indicated by the significant improvement of the control items. Secondly, the generalization effect was restricted by familiarity. In both generalization and control items, better performance was found for high familiarity items. These results supported the hypothesis mentioned before that high familiarity items were easier to be retrieved, as their threshold levels were believed to be lower when compared with low familiarity items.

However, Cuetos, et al. in 2002 investigated the effect of different factors, including familiarity, visual complexity, age of acquisition and word frequency, on naming performance of anomic patients. They found that object familiarity and age of acquisition were the most important factors influencing the naming performance. In order to find out which factor(s) were indeed affecting MTK's performance on high and low familiarity generalization and control items, a survey on age of acquisition was carried out. Five normal subjects were asked to fill in the survey forms, estimating their age of acquisition on all

stimuli. A correlation analysis was done to see if familiarity and age of acquisition were related to each other. The result indicated that there was a significant negative correlation [$r = -0.25$, $p<0.05$], implying that the younger a person acquires a word, the higher the familiarity of the object is. However, the strength of this relationship was not strong as indicated by the small correlation coefficient.

Since a weak correlation had been found between familiarity and age of acquisition, independent t-tests were administered to see if there was any discrepancy in term of age of acquisition between high and low familiarity categories. The results indicated that there was no significant difference between high and low familiarity treatment items [$t = -1.22$, $p = 0.23$] as well as between high and low familiarity generalization items [$t = -1.94$, $p = 0.06$]. However, the age of acquisition between high and low familiarity control items was significantly different [$t = -5.00$, $p = 0.00$]. The results showed that for both treatment and generalization items, the age of acquisition in high and low familiarity categories were actually comparable, implying that this factor did not actually affect the subject's naming performance. On the other hand, since there was significant difference in control items, apart from familiarity, age of acquisition might have attributed to the discrepancy in the subject's performance between high and low familiarity control items.

In addition to the treatment effect, several self-cueing strategies employed by MTK observed during the probing at the beginning of each session, might have contributed to his

good progress. At the initial stage of the treatment, it was already noted that MTK would verbalize very simple semantic features of the target pictures [e.g. ‘好靚嘅…’(beautiful…) for the target word ‘孔雀’(bird of juno)] when he encountered naming difficulties. This self-developed cueing strategies was similar to the techniques mentioned in CIN, in which the patients are encouraged to verbalize any features about the target pictures. (Francis, et al., 2002). However, this self-cueing strategy was not successful in helping MTK to retrieve the target words, the main reason was the semantic features he could provide were too simple and not distinctive. At the later stage of treatment, it was observed that MTK made use of the technique of SFA during the probing. This technique appeared in untrained items as well but with less detailed descriptions. This clearly indicated that MTK was not only able to apply SFA as a kind of self-cueing strategy, but he could also generalize the skills to other contexts.

Another self-cueing strategy observed was related to semantic priming. MTK would cue himself by recalling items of the same category. This strategy appeared in trained items only and it was highly successful. It indicated that semantic priming was effective in improving the subject's word retrieval ability. The last self-cueing strategy observed was in term of writing. Occasionally, when MTK encountered word-finding difficulty, he would finger trace the word and was able to produce the correct names afterwards. According to the logogen model (Lesser & Coltheart, 1992), this strategy was actually bypassing the impaired link between the semantic system and the phonological output lexicon. Instead, MTK was able to

visualize the orthography of the words by finger tracing so he actually made use of the direct route from the orthographic input to the phonological output lexicon.

One interesting finding was noted in this study. As shown in Figure 2, MTK's performance on low familiarity treatment items improved steadily in the baseline phase as well as in Phase I. This result was unexpected as it was assumed that there should be no progress or only little progress when no intervention was given directly to those items. There were several explanations towards this result. First of all, according to Nickels (2002), repeated attempt to name the target pictures would improve the word retrieval ability of an individual even if no feedback or error correction were provided. However, if repeated attempt alone could improve naming performance, then one should expect progress for all untrained items, but that was not the case for the low familiarity generalization items and control items. Thus, the effect of repeated attempts might at best have attributed to MTK's modest progress on low familiarity treatment items but it could not fully explain the whole data pattern.

Another possible reason was familiarity. Familiarity could vary from person to person, although the 'animals' categories were rated as low familiarity by the normal subjects, MTK's wife reported that MTK liked to watch documentaries about animals. Thus, the familiarity of the selected 'animals' items might be higher for MTK than for the normal subjects. Since the higher the familiarity, the easier it would be to retrieve the words, MTK's

performance on these items were likely to be better than expected. Nevertheless, this reason could not fully explain the current finding as the generalization items of the 'animals' categories had limited improvement throughout the treatment. If the suggested reason was the sole cause of this finding, one would expect that the same improvement could be observed in the generalization items as well.

Finally, at least one drawback was recognized in this study. The two low familiarity categories belonged to a more general category: 'animals'. As a result, the varieties of low familiarity items were very limited. Therefore, the subject's bias on particular categories could not be revealed. On the other hand, if the categories were semantically unrelated, even if the subject was highly familiar with one of the categories, we could still compare the results of the categories in order to evaluate the effect of the subject's bias. In addition, using similar categories was not representative since it was difficult to make the conclusion that the treatment was effective for different low familiarity categories.

The present study only examined the effectiveness of the combined treatment of semantic priming and SFA; it remained unknown whether the combined effect was more beneficial to anomic patients when compared to the two treatments individually. Therefore, in order to find out whether the combined treatment is more effective than the two individual treatments, it is necessary to conduct another single-case study for this investigation. For instance, one may select three semantically unrelated categories with comparable familiarity

as the stimuli and then apply SFA, semantic priming and the combined treatment on each category. Unrelated categories are chosen in this proposed study so as to avoid the priming effect across categories. Finally, compare the results across categories to see if there is any discrepancy on the treatment outcomes.

Another possible investigation is to compare the combined treatment effect on patients with different functional lesions. Such an experiment would help find out the suitability of semantically based treatment for anomic patients in general. In this study, the word-finding difficulties of MTK had a mainly phonological origin, it would be interesting to see if the same results could be obtained by applying the treatment on another type of anomic patients (e.g., with impaired semantic system).

With respect to clinical implication, the most important one in this study was that the semantically based treatments seem to be beneficial for Cantonese anomic patients. Moreover, MTK's self-cueing strategies indicated that the combined treatment has good potential to generalize across contexts and develops into a self-cueing strategy in daily conversation. More importantly, the treatment effect seemed to be relatively long-lasting.

Conclusions

The results of this study showed that the combined treatment of semantic priming and SFA was effective in improving the word retrieval ability of a Cantonese-speaking anomic

patient. It also suggested that this combined treatment had good generalization effect to untrained item and its effect could be maintained at least one month beyond the treatment period. Generalization effect was found to be better in high familiarity categories.

Acknowledgement

I would like to express my sincere gratitude to my dissertation supervisor, Dr. Law Sam Po, for her unconditional support and advices.

I would also like to thank Jess, who prepared the original picture set and exchange so many ideas with me.

Last but not the least, thanks my dear classmates for their encouragement and comments on this study.

References:

Abbate, M.S. & Lachappelle, N.B. (1979). *Pictures please! a language supplement.* Communication Skill Builders.

Boyle, M. & Coelho, C.A. (1995). Application of semantic feature analysis as a treatment for aphasic dysnomia. *American journal of speech-language pathology*, 4, 94-98.

Conley, A. & Coelho, C.A. (2003). Treatment of word retrieval impairment in chronic Broca's aphasia. *Aphasiology*, 17 (3), 203-211.

Cuetos, F., Aguado, G., Izura, C., Ellis, A.W. (2002). Aphasic naming in Spanish:predictors and errors. *Brain and language*, 82, 344-365

Drew, R.L., & Thompson, C.K. (1999). Model-based semantic treatment for naming deficits in aphasia. *Journal of speech, language and hearing research*, 42, 972-989

Dunn, L.M. (1982). *British picture vocabulary scale*. Windsor, Berks.: Nfer-Nelson Publishing Co. Ltd.

Francis, D.R., Clark, N. & Humphreys, G.W. (2002). Circumlocution-induced naming (CIN): a treatment for effecting generalization in anomia?. *Aphasiology*, 16 (3), 243-259

Goodglass, H., & Kaplan, E. (1983). *Boston naming test*. Philadelphia: Lea & Febiger.

Goodglass, H., & Kaplan, E. (1983). *The assessment of aphasia and related disorders (2nd ed.)*. Philadelphia Lea & Febiger.

Harley, T.A. (1993). Connectionist approaches to language disorders. Aphasialogy, 7(3) 221-249.

Howard, D., & Patterson, K. (1992). *Pyramids and palm trees test*. Edmunds, UK: Thames Valley Test Company.

Jipson, T.W. (1987). *Aphasia rehabilitation: a clinical and home therapy program.* Modern Education Corporation.

Kay, J., Lesser, R., & Coltheart, M. (1992). *PALPA: Psycholinguistic assessments of language processing in aphasia.* Hove, UK: Lawrence Erlbaum Association Ltd.

Martin, N. & Laine, M. (2000). Effects of contextual priming on impaired word retrieval. *Aphasiology,* 14(1). 53-70.

Martin, N., Laine, M., Renvall, K. & Laakso, M. (2003). Anomia treatment with contextual priming: a case study. *Aphasiology*, 17(3), 305-328.

Nickels, L. (2002). Therapy for naming disorders: revisiting, revising, and reviewing. Aphasiology, 16(10/11), 935-979.

Nickels, L. (2002). Improving word finding: Practice makes (closer to) perfect? *Aphasiology*, 16 (10/11), 1047-1060

Riddoch, M.J., & Humphrey, G.W. (1993). *Birmingham object recognition battery*. Hove, UK: Lawrence Erlbaum Associates.

Snodgrass, J.G., & Vanderwart, M. (1980). A standardized set of 260 pictures: norms for naming agreement, image agreement, familiarity, and complexity. *Journal of experimental psychology: human learning and memory*, 6, 174-215.

Yiu, M-L. (1992). Linguistic assessment of Chinese-speaking aphasics: development of a cantonese aphasia battery. *Journal of Neurolinguistics*, 7(4), 379-424.

Appendix A

Norm data of the original picture set

Category	Naming Agreement					Visual Complexity (Average)	Familiarity (Average)
	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5		
Household items	垃圾鏟	垃圾鏟	鏟	垃圾鏟	垃圾鏟	1.6	5.0
	枕頭	枕頭	枕頭	枕頭	枕頭套	2.2	5.0
	電制	燈制	開關電制	電開關制	燈制	1.6	5.0
	電燈泡	燈泡	燈膽	燈膽	燈膽	1.2	5.0
	插蘇	插蘇	插蘇頭	插蘇	插蘇頭	1.4	5.0
	燙衫板	燙衫板	燙衫板	燙衫板	摺板	1.4	5.0
	衣架	衣架	衣架	衣架	衫架	1.0	5.0
	門鎖	印	門鎖	門鎖	門鎖	1.6	5.0
	電筒	電筒	電筒	電筒	電筒	2.2	4.8
	衣架	掠衫架	掠衫架	掠衫架	衣架	2.2	4.8
	花樽	花瓶	花樽	花樽	花瓶	2.2	4.8
	鞋架	鞋架	鞋架	鞋架	NR	2.8	4.6
	衫夾	衫夾	衣夾	衫夾	衫夾	2.0	4.6
	蠟燭	蠟燭	蠟燭	蠟燭	蠟燭	1.0	4.6
	掃把	掃把	掃把	掃把	掃把	2.0	4.6
	拖把	地拖	拖地棍	地拖	地拖	1.8	4.4
	垃圾桶	垃圾桶	垃圾桶	垃圾桶	垃圾桶	1.8	4.2
	指甲挫	指甲挫	開信刀	指甲挫	指甲挫	1.8	4.2
	花灑	NR	花灑	水壺	花灑	1.6	3.6
Kitchen items	洗碗盤	洗碗盤	廁盤	洗碗盤	廚櫃	3.0	5.0
	水煲	茶煲	水煲	水煲	水煲	2.0	5.0
	匙羹	匙羹	匙羹	匙羹	匙羹	1.2	5.0
	杯	茶杯	杯	茶杯	茶杯	1.8	5.0
	水杯	杯	水杯	水杯	水杯	1.2	5.0
	酒杯	杯	水杯	酒杯	酒杯	1.2	5.0
	胡椒粉樽	胡椒樽	胡椒樽	胡椒粉樽	胡椒粉樽	1.8	5.0
	煎 pan	煎 pan	平底鑊	煎 pan	煎 pan	1.4	5.0
	筲箕	NR	筲箕	筲箕	筲箕	3.4	4.8
	水桶	水桶	水桶	量桶	水桶	1.4	4.8

	水殼	煲	煲	水殼	煲	1.4	4.8
	冰夾	冰鉗	方糖夾	方糖夾	鉗	1.4	4.4
	熱水壺	保暖壺	熱水壺	暖杯	熱水壺	2.4	3.8
Recreation items	乒乓波拍	乒乓波拍	乒乓波拍	波板	乒乓波拍	1.4	4.8
	滑梯	滑梯	滑梯	滑梯	滑梯	2.4	4.8
	網球拍	網球拍	壁球拍	網球拍	網球拍	2.2	4.8
	氣球	氣球	氣球	氣球	氣球	1.0	4.8
	跳繩	跳繩	跳繩	跳繩	跳繩	1.4	4.6
	滑板	滑板	滑板	滑板	滑板	1.8	4.6
	保齡球	保齡球	保齡球	保齡球	保齡球	1.4	4.6
	韆鞦	韆鞦	韆鞦架	韆鞦架	韆鞦	1.4	4.6
	搖搖	搖搖	搖搖	搖搖	搖搖	1.4	4.4
	棒球棍	雷球棍	棒球棍	棒球棍	雷球棍	1.6	4.4
	bear bear 熊	玩具熊	熊人公仔	玩具熊	玩具熊	3.6	4.2
	魚竿	魚竿	魚竿	魚竿	魚竿	2.8	4.0
	滾軸溜冰鞋	溜冰鞋	滾軸溜冰鞋	滾軸溜冰鞋	溜冰鞋	3.0	3.8
	紙鳶	風箏	風箏	紙鳶	紙鳶	1.8	3.8
	飛標	飛標	飛標	飛標	飛標	2.4	3.6
	欖球	欖球	欖球	欖球	美式足球	1.4	3.6
	牌九	天九	骰仔	天九	天九	1.6	3.2
	波子機	彈波子機	波子機	波子機	波子機	3.2	3.2
	陀螺	陀螺	陀螺	陀螺	陀螺	1.6	2.8
Transportation means	巴士	巴士	雙層巴士	雙層巴士	巴士	3.0	5.0
	貨車	車	拖頭	貨車	貨車	1.8	5.0
	電單車	電單車	電單車	電單車	電單車	3.2	5.0
	私家車	車	私家車	私家車	汽車	2.4	5.0
	旅遊巴	巴士	巴士	巴士	巴士	2.0	5.0
	單車	單車	單車	單車	單車	2.8	5.0
	救護車	救護車	救護車	救護車	救護車	2.4	4.8
	垃圾車	垃圾車	垃圾車	垃圾車	垃圾車	2.6	4.8
	泥頭車	泥車	泥頭車	泥頭車	泥頭車	2.8	4.8
	拖車	拖車	拖車	拖車	拖車	3.0	4.8
	飛機	飛機	飛機	飛機	飛機	2.4	4.4

	火車	火車	火車	火車	火車	3.4	4.2
	直昇機	直昇機	直昇機	直昇機	直昇機	2.6	4.2
	快艇	快艇	快艇	摩打船	船	3.0	3.6
	帆船	帆船	帆船	帆船	帆船	2.8	3.6
	艇仔	舢舨	舢舨	艇仔	划艇	2.8	3.4
	火箭	火箭	火箭	火箭	火箭	2.8	2.2
Stationery	較剪	較剪	較剪	較剪	較剪	1.8	5.0
	間尺	尺	間尺	間尺	間尺	1.0	5.0
	原子筆	筆	原子筆	原子筆	原子筆	2.0	5.0
	鉛筆	鉛筆	鉛筆	鉛筆	鉛筆	1.6	5.0
	信封	信封	信封	信封	信封	1.2	5.0
	地球儀	地球儀	地球儀	地球儀	地球儀	2.0	4.4
	水彩筆	毛筆	畫筆	畫筆	毛筆	2.2	4.2
	打字機	打字機	打字機	打字機	打字機	3.6	3.8
	蠟筆	顏色筆	蠟筆	顏色筆	蠟筆	1.2	3.6
	畫板	NR	畫板	畫板	NR	1.4	3.4
	圓規	圓規	圓規	圓規	圓規	3.0	3.4
	算盤	算盤	算盤	算盤	算盤	2.4	3.2
Furniture	書枱	枱	書枱	書枱	書枱	1.4	5.0
	梳化	梳化	梳化	梳化	梳化	1.8	5.0
	衣櫃	衣櫃	衣櫃	衣櫃	鞋櫃	2.2	4.8
	櫈仔	櫈	櫈	櫈仔	櫈仔	1.4	4.6
	搖椅	安樂椅	安樂椅	安樂椅	櫈	3.0	4.2
Toiletry	浴缸	浴缸	浴缸	浴缸	浴缸	2.0	5.0
	馬桶	馬桶	坐廁	坐廁	坐廁	2.6	5.0
	牙膏	牙膏	牙膏	牙膏	牙膏	2.2	5.0
	鬚刨	鬚刨	鬚刨	鬚刨	鬚刨	1.8	5.0
	水龍頭	水龍頭	水龍頭	水龍頭	水龍頭	2.6	5.0
	牙刷	牙刷	牙刷	牙刷	牙刷	1.6	5.0
	番梘	番梘	番梘	番梘	番梘	2.0	4.8
	毛巾	毛巾	毛巾	毛巾	毛巾	1.2	4.4
Electrical appliances	洗衣機	洗衣機	洗衣機	洗衣機	洗衣機	2.6	5.0
	吸塵機	吸塵機	吸塵機	吸塵機	吸塵機	2.6	5.0
	電話	電話	電話	電話	電話	2.6	5.0
	雪櫃	雪櫃	雪櫃	雪櫃	雪櫃	1.6	5.0

	燙斗	燙斗	燙斗	燙斗	燙斗	1.8	4.8
	多士爐	多士爐	多士爐	多士爐	多士爐	2.6	4.6
	枱燈	枱燈	枱燈	床頭燈	床頭燈	2.0	4.6
	電視機	電視機	電視機	電視機	電視機	2.4	4.4
	收音機	收音機	收音機	收音機	卡式收音機	4.0	4.2
	衣車	衣車	車衣機	衣車	車衣機	3.4	4.0
	發蛋器	攪拌器	攪拌機	攪拌機	攪拌器	2.8	3.6
	唱機	唱機	唱盤	唱機	唱機	2.4	2.8
Personal belongings	銀包	銀包	銀包	銀包	銀包	1.8	5.0
	鈪	鈪	介子	手鈪	手鈪	3.0	5.0
	鎖匙	鎖匙	鎖匙	鎖匙	鎖匙	1.2	5.0
	手袋	書包	手袋	揹袋	袋	1.8	5.0
	手錶	手錶	手錶	手錶	手錶	2.2	5.0
	介指	介指	介指	介指	介指	1.8	4.8
	眼鏡	眼鏡	眼鏡	眼鏡	眼鏡	2.2	4.8
	鍊咀	鍊咀	頸鍊	吊嘴	吊嘴	3.8	4.6
	行李唒	行李箱	行李	皮唒	行李唒	2.4	4.6
	珠鍊	頸鍊	頸鍊	頸鍊	頸鍊	3.0	3.8
	雪加	雪加	雪加	雪加	雪加	2.2	3.8
	銀包	銀包	銀包	銀包	散紙包	2.2	3.6
	煙斗	煙斗	煙斗	煙斗	煙斗	1.4	3.6
Fruits & Vegetables	馬鈴薯	蒜茸包	馬鈴薯	薯仔	薯仔	1.2	5.0
	蕃茄	蕃茄	南瓜	蕃茄	蕃茄	1.8	5.0
	洋蔥	洋蔥	洋蔥	洋蔥	洋蔥	1.6	5.0
	青椒	燈籠椒	青瓜	燈籠椒	西椒	1.4	5.0
	芹菜	西芹	芹菜	西芹	西芹	3.2	5.0
	紅蘿蔔	紅蘿蔔	蘿蔔	蘿蔔	紅蘿蔔	1.6	5.0
	香蕉	香蕉	香蕉	香蕉	香蕉	2.0	5.0
	草菇	蘑菇	冬菇	冬菇	磨菇	2.0	4.8
	粟米	粟米	粟米	粟米	粟米	2.6	4.8
	蘋果	蘋果	蘋果	蘋果	蘋果	1.0	4.8
	車厘子	車厘子	車厘子	車厘子	櫻桃	1.2	4.8
	提子	葡提子	葡提子	提子	提子	2.8	4.8
	西瓜	西瓜	西瓜	西瓜	西瓜	1.8	4.8
	椰菜	椰菜花	生菜	生菜	生菜	2.8	4.6

	南瓜	南瓜	南瓜	南瓜	南瓜	1.4	4.6
	檸檬	檸檬	檸檬	檸檬	檸檬	1.0	4.6
	菠蘿	菠蘿	菠蘿	菠蘿	菠蘿	3.4	4.6
	梨	蜜桃	蜜桃	桃	桃駁李	1.0	4.4
	露筍	筍	NA	露筍	露筍	2.2	4.2
Food	雪糕	雪糕	雪糕	雪糕	雪糕	2.2	5.0
	肉腸	香腸	香腸	香腸	香腸	1.4	5.0
	漢堡飽	漢堡飽	漢堡飽	漢堡飽	漢堡飽	2.4	5.0
	麵包	麵包	麵包	方包	麵包	1.4	5.0
	熱狗	熱狗	熱狗	熱狗	熱狗	2.4	4.8
	啫喱	啫喱	啫喱	啫喱	啫喱	2.6	4.8
	蛋糕	蛋糕	蛋糕	蛋糕	蛋糕	1.8	4.8
	三文治	三文治	三文治	三文治	三文治	2.8	4.8
	花生	花生	花生	花生	花生	2.0	4.8
	餅乾	杏仁餅	餅乾	餅	餅乾	2.8	4.4
	朱古力	朱古力	朱古力	朱古力	朱古力	2.4	4.4
Four-legged animals	青蛙	青蛙	青蛙	青蛙	青蛙	2.0	4.4
	烏龜	烏龜	龜	烏龜	烏龜	2.6	4.2
	兔仔	白兔	兔仔	白兔	白兔	2.2	4.0
	蜥蜴	蜥蜴	蜥蜴	蜥蜴	蜥蜴	3.4	3.8
	老鼠	老鼠	老鼠	老鼠	老鼠	2.2	3.4
	馬騮	馬騮	馬騮	猴子	馬騮	3.4	3.2
	猩猩	猩猩	猩猩	猩猩	猩猩	2.6	3.0
	駱駝	駱駝	駱駝	駱駝	駱駝	2.2	2.8
	犀牛	犀牛	犀牛	犀牛	犀牛	2.4	2.2
	斑馬	斑馬	斑馬	斑馬	斑馬	3.0	2.2
	松鼠	NR	松鼠	松鼠	松鼠	2.8	2.0
	山羊	羊	山羊	山羊	山羊	2.4	2.0
	大笨象	大笨象	大笨象	大象	大笨象	3.0	2.0
	果子狸	狐狸	果子狸	果子狸	狐狸	3.2	1.8
	長頸鹿	長頸鹿	長頸鹿	長頸鹿	長頸鹿	3.6	1.8
	箭豬	箭豬	箭豬	箭豬	箭豬	4.8	1.6
	老虎	老虎	老虎	老虎	老虎	3.4	1.6
	獅子	獅子	獅子	獅子	獅子	3.4	1.4
	袋鼠	袋鼠	袋鼠	袋鼠	袋鼠	3.0	1.4

	狐狸	狐狸	狐狸	狐狸	狼	2.2	1.4
	北極熊	北極熊	熊	熊	北極熊	2.4	1.4
	鱷魚	鱷魚	鱷魚	鱷魚	鱷魚	3.4	1.2
Birds	公雞	雞	公雞	雄雞	公雞	3.0	4.8
	麻雀	麻雀	麻雀	雀仔	雀仔	2.4	4.6
	雞仔	雞仔	雞仔	雞仔	雞仔	2.2	4.0
	火雞	火鳥	火雞	火雞	火雞	2.4	3.6
	天鵝	鴨	鵝	天鵝	天鵝	3.0	3.6
	駝鳥	駝鳥	駝鳥	駝鳥	駝鳥	2.4	3.2
	啄木鳥	啄木鳥	啄木鳥	啄木鳥	啄木鳥	2.8	3.0
	鸚鵡	鸚鵡	鸚鵡	鸚鵡	鸚鵡	3.4	3.0
	孔雀	孔雀	孔雀	孔雀	孔雀	3.8	2.4
	貓頭鷹	貓頭鷹	貓頭鷹	貓頭鷹	貓頭鷹	3.6	2.2
	企鵝	企鵝	企鵝	企鵝	企鵝	1.8	1.6
Insects	烏蠅	倉蠅	蜜蜂	蜜蜂	蜜蜂	3.2	4.6
	蝴蝶	蝴蝶	蝴蝶	蝴蝶	蝴蝶	3.0	4.4
	蜘蛛	蜘蛛	蜘蛛	蜘蛛	蜘蛛	3.0	4.0
	烏蠅	倉蠅	烏蠅	烏蠅	倉蠅	3.6	4.0
	甲蟲	NR	NR	甲蟲	甲蟲	3.6	3.4
	草猛	草猛	草猛	草猛	草猛	3.2	3.2
	蝸牛	蝸牛	蝸牛	蝸牛	蝸牛	2.0	2.8
	蝎子	蝎子	蝎子	蝎子	蝎子	3.0	2.6
	毛蟲	毛蟲	毛蟲	毛蟲	毛蟲	2.4	2.6
Clothings	涼鞋	涼鞋	涼鞋	涼鞋	涼鞋	2.4	5.0
	皮帶	皮帶	皮帶	皮帶	皮帶	1.2	5.0
	袍衫	袍衫	袍衫	袍衫	袍衫	2.2	5.0
	皮鞋	鞋	鞋	鞋	鞋	2.2	5.0
	西褲	西褲	長西褲	西褲	西褲	1.4	5.0
	頸巾	頸巾	頸巾	冷頸巾	頸巾	2.4	4.8
	大褸	西裝	褸	外套	外套	1.8	4.8
	冷帽	冷帽	冷帽	冷帽	聖誕帽	2	4.6
	女裝袍衫	女裝袍衫	袍衫	衫	袍衫	1.8	4.6
	裙	裙	裙	裙	裙	1.2	4.6
	冷衫	冷外套	冷衫	外套	冷衫	3.6	4.4
	領呔	領呔	領呔	領呔	領呔	1.6	4.4

	泳衣	泳衣	泳衣	泳衣	泳衣	2.0	4.2
	手套	手襪	手套	手套	手襪	2.4	4.0
	牛仔褲	工人褲	牛仔褲	工人褲	工人褲	2.8	4.0
	背心	NR	衫	背心	背心	2.4	3.8
	手套	手襪	隔熱手套	手套	手套	1.8	3.6
Body Parts	膊頭	肩膊	膊頭	膊頭	肩膊	1.2	5.0
	皺紋	皺紋	皺紋	皺紋	火車軌	1.4	5.0
	頭髮尾	後尾枕	髮尾	頭髮	頭髮	2.8	5.0
	耳仔	耳朵	耳仔	耳仔	耳朵	1.6	5.0
	腳趾公	腳趾	腳趾	腳趾	腳趾	1.6	5.0
	手指公	手指	手指公	手指公	手指公	1.6	5.0
	嘴唇	口唇	口唇	嘴唇	嘴	1.2	5.0
	頭髮	頭髮	NR	頭髮	頭髮	1.4	5.0
	手指	手指	手指	手指	手指	2.4	5.0
	鬍鬚	鬍鬚	鬍鬚	鬚	鬍鬚	3.6	4.8
Musical Instruments	口琴	口琴	口琴	口琴	口琴	3.0	3.8
	結他	結他	結他	結他	結他	2.8	3.6
	小提琴	小提琴	小提琴	小提琴	小提琴	2.8	3.6
	鋼琴	鋼琴	鋼琴	三角琴	鋼琴	3.2	3.2
	喇叭	喇叭	喇叭	喇叭	NR	3.0	2.8
	豎琴	風琴	豎琴	豎琴	\	2.8	2.6
	手風琴	風琴	風琴	手風琴	風琴	3.2	2.2
Tools	鎚仔	鎚	鎚仔	鎚仔	鎚仔	1.8	5.0
	螺絲批	螺絲批	螺絲批	螺絲批	螺絲批	1.8	5.0
	螺絲釘	螺絲	螺絲	螺絲	螺絲	1.8	4.8
	士巴拿	士巴拿	士巴拿	緊頭	士巴拿	1.4	4.8
	齒輪	齒輪	齒輪	齒輪	齒輪	2.0	4.2
	士巴拿	鉗	鉗仔	鯉魚鉗	鉗	1.8	4.0
	螺絲帽	絲帽	絲帽	絲帽	絲帽	1.4	4.0
	斧頭	斧頭	斧頭	斧頭	斧頭	1.4	3.2
	手拉車	手推車	手推車	手拖車	車	2.4	3.0

Appendix B

Chart used in Semantic Feature Analysis (SFA)