Accent Attribution in Speakers with Foreign Accent Syndrome

Jo Verhoeven[1, 2], Guy De Pauw[3], Michèle Pettinato[4], Allen Hirson[2], John Van Borsel[7], Peter Mariën[1, 5, 6]

1. Flemish Academic Centre (Vlaams Academisch Centrum), Advanced Studies Institute of the Royal Flemish Academy of Belgium for Sciences and the Arts, Brussels, Belgium.

2. City University London, Department of Language and Communication Science, London, UK.

3. University of Antwerp, CLIPS, Computational Linguistics Group, Antwerp, Belgium.

4. University College London, Division of Psychology and Language Sciences, London, UK.

5. ZNA Middelheim General Hospital, Department of Neurology, Antwerp, Belgium

6. Vrije Universiteit Brussel, Department of Clinical and Experimental Neurolinguistics, Brussels, Belgium.

7. Ghent University, Department of Oto-rhino-laryngology and logopaedic-audiologic sciences, Ghent, Belgium and Veiga de Almeida University, Rio de Janeiro, Brazil.

Corresponding author:

Dr. J. Verhoeven
City University London
Department of Language and Communication Science
Northampton Square
London EC1V 0HB
United Kingdom

Tel. 020 7040 0148
Fax 020 7040 8577
Email jo.verhoeven@city.ac.uk

Abstract

Purpose: The main aim of this experiment was to establish the extent to which the impression of foreignness in speakers with Foreign Accent Syndrome (FAS) is in any way comparable to the impression of foreignness in speakers with a real foreign accent.

Method: Three groups of listeners attributed accents to conversational speech samples of 5 FAS speakers which were embedded amongst those of 5 speakers with a real foreign accent and 5 native speaker controls. The listener groups differed in their familiarity with foreign accented speech and speech pathology.

Results: The findings indicate that listerners' perceptual reactions to the three groups of speakers are essentially different at all levels of analysis. The native speaker controls are unequivocally considered as native speakers of Dutch while the speakers with a real foreign accent are very reliably assessed as non-native speakers. The speakers with Foreign Accent Syndrome, however, are in some sense perceived as foreign and in some sense as native by listeners, but not as foreign as speakers with a real foreign accent nor as native as real native speakers. This result may be accounted for in terms of the trigger-support model of foreign accent perception.

Conclusions: The findings of the experiment is consistent with the idea that the very nature of the foreign accent in different in both groups of speakers, although it cannot be fully excluded that the perceived foreignness in the two groups is one of degree.

1. Introduction

Foreign Accent Syndrome (FAS) is a motor speech disorder in which patients develop a speech accent which is notably different from their premorbid accent. Although it is the only motor speech disorder which is defined purely in terms of the perceptual impression it invokes in listeners, the systematic study of foreign accent perception in FAS speakers itself has received very little attention. The main focus has been on the incidental assessment of accents in FAS speakers in order to confirm investigators' impression of a foreign accent in these patients.

Foreign Accent Syndrome was first described more than 100 years ago by the French neurologist Pierre Marie (1907). He reported a change in regional accent in a patient after his recovery from anarthria following a subcortical left hemisphere stroke. The speaker from Paris had developed 'a noticeable Alsatian accent which he did not have before' (Marie 1907: 159 ; own translation). Since this statement about 50 cases have appeared in the literature (Dankovicova & Hunt, 2011) which have been classified by Verhoeven & Mariën (2010) into three distinct taxonomical types: neurogenic, psychogenic and mixed. In *neurogenic FAS* the accent change results from damage to the central nervous system. Besides an *acquired* type of neurogenic FAS, a *developmental* variant has recently been identified by Mariën, Verhoeven, Wackenier, Engelborghs, & De Deyn (2009) who described FAS in the context of developmental apraxia of speech and specific language impairment.

The second type of FAS is *psychogenic* in which there is no evidence of neurological damage and the accent change is rooted in psychological issues of the speaker. Verhoeven, Mariën, Engelborghs, D'Haenen, & De Deyn (2005), for instance, described a Dutch patient who in the context of a conversion disorder developed a strong French accent and severe gait impairments that emerged after having been involved in a near car accident.

The third FAS variant is mixed: initially the accent develops as a result of neurological damage. However, this accent change causes a strong feeling of loss of identity in the patient and the psychological effect of this is such that the patient seems to make a deliberate attempt to 'improve' the authenticity of the accent in order to create a more acceptable new identity (Laures-Gore, Contado Henson, Weismer, & Rambow, 2006).

From a perceptual point of view, it is remarkable that a motor speech disorder is perceived by listeners as a foreign accent and it has remained unclear which underlying mechanisms create this impression of foreignness. It has been hypothesized that the speech of patients with Foreign Accent Syndrome contains atypical speech characteristics which may lead to the perception of a 'generic' rather than a 'specific' foreign accent (Kurowski, Blumstein & Alexander 1996). FAS speech sounds generally foreign and any specific accent that is heard is assumed to depend on the experience listeners have had with foreign accents. Miller, Lowit & Sullivan (2006) point out that "Typically, accents heard are those within the experience of a listener or speech community. Parisians hear Alsatian; listeners in England hear a change to Welsh, Scots, French; Australians hear a Chinese/Japanese accent; a German accent is heard during the time of German occupation in Norway. Noticeably we do not hear of a British English speaker in England being described as developing an Ibo or Tagalog accent, even though their speech may contain features of these languages. In other words listeners focus on salient elements in speech, and these are interpreted through their experiental and attitudinal filters" (p. 404). This is to say that ultimately, the foreign accent does not reside in the speaker, but in the perception of the listener.

The perception of foreign accentedness in FAS was investigated in Di Dio, Schulz & Gurd (2006) and Dankovicova & Hunt (2011). Di Dio et al. (2006) studied the accent identification abilities of naïve judges concerning FAS speech samples and real foreign accented speech. For this purpose, an accent attribution experiment was carried out in which short speech samples of two English female FAS speakers were perceptually assessed by 52 naïve listeners. The foreign accents of these patients had previously been identified by an experienced phonetician as French and Scottish respectively. Speech samples of these patients were embedded amongst 6 samples of speakers with a natural foreign accent (3 French, 3 Scottish), who served as controls. In the experiment, listeners had to identify each accent and they were asked to give a confidence rating concerning their accent judgement on a 5-point scale ranging from 'very confident' to 'not confident at all'. The results of this experiment reveal that naïve listeners are generally more consistent and confident in assigning accents to the real foreign accents than to FAS speakers. In addition, there was inconclusive evidence that familiarity of listeners with

foreign accents plays a role in assessing the real foreign accents, but not so in the speakers with foreign accent syndrome.

The second study into the perception of FAS was carried out by Dankovicova & Hunt (2011) who investigated the impressions of foreignness and impairment in one single FAS patient whose speech was assessed in the context of speech samples of 2 native speaker controls and 3 speakers with a real foreign accent (French, Italian and Greek). The assessment was carried out by 10 native speakers of English who has to rate the speakers in terms of the degree of foreign accentedness and the degree of impairment. From the results it appears that the FAS speaker was considered as strongly foreign as the speakers with a real foreign accent. In terms of impairment, the FAS speaker was considered only very slightly impaired.

Although the results of Di Dio et al. (2006) and Dankovicova & Hunt (2011) are thought provoking, it has to be recognized that these experiments had several limitations, the first of which is that in both cases a very small number of FAS speakers were presented against the background of a highly restricted range of foreign accents. Furthermore, the listener panels were quite uniform in that they consisted of a single group of naïve listeners so that the results may not be generalizable to other groups of listeners with varying degrees of experience with foreign accents. Finally, the experimental design was such that no conclusive inferences can be made about the accuracy of the accent attributions. For these reasons, it was decided to carry out a more comprehensive perceptual study of FAS, the general aim of which was to investigate the foreign accent impression in FAS as compared to that in speakers with a real foreign accent.

2. Materials and methods

This study consists of an accent attribution experiment in which 123 native speakers of Dutch listened to the (foreign) accent and assessed the linguistic background of 5 speakers who had previously been diagnosed with FAS. Samples of these speakers' conversational speech were randomly incorporated within speech samples of 5 speakers with a real foreign accent and speech samples of 5 native speakers of Dutch with no trace of a foreign accent but with clearly identifiable regional accents. In addition to these

speaker differences, the listeners from the listener panel differed in their familiarity with foreign accented speech and with speech pathology.

2.1. Speech samples

The speech samples that were used in the experiment were obtained in informal interviews with the subjects. They were asked to speak freely about general topics such as their professional background, hobbies, holidays etc. These interviews were recorded by means of a Marantz Solid State Recorder (PMD660) and an AKG head-mounted condensor microphone (CL444). All the recordings were made in a quiet setting without contaminating background noise. From these recordings, one speech sample was selected for each speaker. From a content point of view, care was taken that these samples did not contain any indications about the speakers' professional background or medical history. In addition, care was taken to select the samples in such a way that they did not contain any indications of the speakers' nationality. Furthermore, they did not contain any grammatical/morphological errors of any kind and care was taken that they consisted of a complete and semantically coherent conversational topic. These selection criteria meant that there was variability in the duration of the individual samples, which ranged between 25 and 85 seconds. The speech samples were digitized with a sampling frequency of 44,100 Hz by means of the signal processing package PRAAT (Boersma & Weenink, 2007) prior to their perceptual assessment.

2.2. The speakers

The speech samples came from three groups of speakers. The first one consisted of 5 speakers who had previously been diagnosed with FAS. One speaker was male, the others female. A summary description of the speakers is given in table 1:

INSERT TABLE 1 ABOUT HERE

Several of these speakers were described in detail elsewhere, particularly FAS1 (Mariën et al 2006; Mariën & Verhoeven 2007, Verhoeven & Mariën 2010), FAS6 (Mariën & Verhoeven, 2007), FAS7 (Verhoeven, et al, 2005) and FAS10 (Mariën et al, 2009). In

terms of the FAS taxonomy that was discussed earlier, there were four speakers with neurogenic FAS (FAS1, FAS6, FAS10, FAS15) and one speaker with the psychogenic type (FAS7). They were all adults. Although the total number of FAS speakers in this experiment may seem quite small in real terms, it has to be emphasized that these 5 FAS speakers represent 10 % of the 50 FAS speakers which have been reported in the professional literature since the syndrome was mentioned for the first time by Marie in 1907 (Dankovicova & Hunt, 2011). Furthermore, this number represents the second largest group study on Foreign Accent Syndrome to date (Edwards et al., 2005).

The second group consisted of 5 non-native speakers of Dutch with a Real Foreign Accent (RFA). These speakers were matched for gender with the Foreign Accent Syndrome speakers, but no attempt was made to match the accents to those that had been informally reported for the FAS patients. The accents were selected to reflect differences in familiarity with these accents to native speakers of Belgian Dutch. From a Belgian perspective, an informal familiarity ranking is: French > German > Southern British English > Canadian English > Korean. A summary description of the RFA speakers' background is given in table 2:

INSERT TABLE 2 ABOUT HERE

The third group consisted of 5 native speaker controls who showed no trace of a foreign accent (NSC). All these speakers were secondary school teachers of Dutch and can thus be regarded as having a standard pronunciation which represents a reference norm. These speakers were chosen from a database of conversational speech samples of 160 native speakers of Dutch that were collected in the context of a project about pronunciation variation in Belgium and the Netherlands. The design of this corpus is described in detail in Verhoeven, De Pauw & Kloots (2004). These speakers were chosen to provide matches in terms of gender and regional accent: each FAS speaker was matched by a control speaker from exactly the same geographical region in Belgium or the Netherlands. The characteristics of these speakers are summarized in table 3:

INSERT TABLE 3 ABOUT HERE

2.3. The listener panel

The listener panel consisted of 123 listeners who were all native speakers of (Belgian) Dutch (Verhoeven, 2005). The panel comprised three subgroups on the basis of their familiarity with foreign accent/pathological speech. The participants in group 1 were professional listeners who were thoroughly familiar with the assessment of speech and language pathology: the 37 members of this group were advanced students in Speech and Language Pathology from Ghent University. Although the latter were trained to assess speech and language pathology, they had had only very limited training in dialectology or sociophonetics.

The listeners in group 2 were 42 advanced students in psychology from the Vrije Universiteit Brussel who had no experience in the formal assessment of foreign accents nor in assessing speech pathology. As students of a university in the capital city of Belgium, it should be conceded that they all may have had some informal exposure to foreign accents given the multilingual environment of modern day urban Belgium.

Group 3 consisted of 44 teachers of Dutch as a Foreign Language: as a result of their professional involvement with foreign language teaching, it is clear that they are highly familiar with hearing a wide range of foreign accents on a daily basis. Nevertheless, their familiarity with speech pathology can be assumed to be limited.

2.4. Materials

The speech samples of all the speakers were assembled on a digital tape. The sequential order of the samples was random. In order to give the listener panel enough time to complete an accent-assessment form for each speaker, each speech sample was repeated three times.

2.5. Speaker assessment

For each speaker, the listener panel was given a separate scoring sheet on which they had to freely attribute an accent to each speaker. In addition to accent identification, listeners had to rate the confidence in their own accent attributions on a 7-point scale between the extremes ‘very uncertain’ (1) and ‘very certain’ (7). Furthermore, they had to score each

speaker on a 7-point scale of nativity between the extremes ‘Definitely a non-native speaker of Dutch’ (1) and ‘Definitely a native speaker of Dutch’ (7).

2.6. Procedure

The speech samples were played to the listeners in open field at their respective institutions. First, the listeners read the instructions to the test and provided information about their sociological background on a questionnaire. Then participants heard two practice speech samples to familarize themselves with the task. Subsequently, the speech sample of each speaker was played to the listeners three times. Following this, listeners were given 3 minutes to complete the questionnaire for the corresponding speech sample.

3. Results

In the first instance, the results were analysed in terms of the accent attribution to the three groups of speakers.

3.1. Differences between speakers

In order to visualise the range of accents that were attributed to the different speakers in the experiment, a contingency table was compiled which lists the attributed accents for the different groups of speakers. This is illustrated in figure 1. Pearson ChiSquare was significant at $p < 0.0001$, indicating that the distribution of attributed accents in the three speaker groups was significantly different.

INSERT FIGURE 1 ABOUT HERE

Figure 1 clearly shows that the speakers with a real foreign accent as well as the FAS speakers were attributed a wide range of accents. In order to visualize the strength of the association between the three groups of speakers in the test and the attributed accents, a correspondence analysis was carried out (Clausen, 1998). Correspondence analysis is a technique which analyses ‘the association between two or more categorical variables by representing the categories of the variables as points in a low-dimensional space. Categories with similar distributions [are] represented as points that are close in the

space, and categories that have very dissimilar distributions [are] positioned far apart' (Clausen 1998: 2). In the present analysis the first categorical variable is constituted by the different speaker groups, while the second categorical variable represents the different accents attributed by the judges in the listener panel. The results of this analysis are given in figure 2:

INSERT FIGURE 2 ABOUT HERE

In figure 2, the horizontal axis (c2) separates the individual speakers, i.e. the further they are apart on the plot, the more dissimilar they are in terms of accent attribution. The vertical axis (c1) represents the different attributed accents. As a result of this, the distances between the different speakers (crosses) and the accents (squares) represent the strength of association between the speakers and the attributed accents.

The results of the correspondence analysis indicate that the speaker groups in the experiment cluster with different attributed accents. On the left hand side of figure 2, the analysis identifies two groups of native speaker controls (dashed circles). The left-most circle consists of speakers NSC2, NSC5 and NSC8, representing the native speaker controls with a Belgian Dutch accent. The lowest cluster is represented by speakers NSC3 and NSC9, i.e. the native speaker controls with a Holland Dutch accent.

On the extreme right-hand side of figure 2, the group of speakers with real foreign accents is represented by the dotted circle. The correspondence analysis indicates that speakers RFA11 and RFA12 are most strongly associated with a German accent, speaker RFA13 with an African accent, speaker RFA14 with an Eastern European accent and speaker RFA4 with a somewhat ambiguous English accent that is neither British nor North American.

The last group of speakers in the correspondence analysis consists of the speakers with Foreign Accent Syndrome: these are indicated in figure 2 by the solid circle. This group is situated mid-way between the RFA-group and the native speaker controls. Speakers FAS1, FAS7 and FAS10 are strongly correlated with a French accent and speaker FAS6 is most strongly associated with a Moroccan accent. It can be noted that FAS15 does not have strong associations with any particular accent, but the speaker also occupies an

intermediate position on the graph between the real foreign accent group and the Holland Dutch control speakers.

In addition, the nativity assessment was analysed for the three groups of speakers. This analysis was also done by means of correspondence analysis. In this case the different speaker groups constitute the first categorical variable, while the second one is made up of the nativity scores on the 7-point scale. The results of this analysis is given in figure 3:

INSERT FIGURE 3 ABOUT HERE

In figure 3 the crosses represent the different speaker groups, while the squares represent the different nativity ratings. From this graph it is clear that the native speaker control group (NSC) is (unsurprisingly) most strongly associated with the highest scores of nativity (i.e. score 7: 'definitely a native speaker'), while the speakers with a real foreign accent are most strongly associated with the lowest scores of nativity (i.e. score 1: 'definitely NOT a native speaker'). The FAS speakers most strongly associate with scores 3 and 4 on the 7-point scale which indicates doubt in the listening panel as to whether the FAS speakers are native speakers or not.

3.2. Differences between listeners

Differences in accent attribution between the listener groups were analysed by first compiling a contingency table which lists the different accents attributed by the three groups of listeners. This is illustrated in figure 4. Pearson ChiSquare indicates that the differences in accent attribution by the three groups are significant at $p < 0.0001$.

INSERT FIGURE 4 ABOUT HERE

The contingency table was further submitted to correspondence analysis, the result of which is illustrated in figure 5:

INSERT FIGURE 5 ABOUT HERE

From figure 5 it appears that the three groups of listeners are associated with different accents: the naïve listeners have the strongest association with a French accent, while the speech therapists' perceptual judgements are closest to Moroccan and German. Interestingly, the Teachers of Dutch as a Foreign Language are most strongly associated with a Belgian Dutch accent, i.e. this group attributed this accent more frequently than the other groups. In fact this applies particularly to the FAS speakers, who were attributed a Belgian Dutch accent by 33% of the TDFL (vs. NA=21%, ST=20%). In assessing the speakers with a real foreign accent, no such differences were found: TDFL= 25%, NA= 25%, ST = 23%). Furthermore, it can be noted in figure 5 that all the groups in the listener panel closely cluster around the more familiar accents, while the more 'exotic' accents are located on the periphery of the accent space.

In order to investigate how well the listeners of the listener panel agreed in attributing accents to the different speaker groups, Cohen's Kappa (Cohen, 1960) was calculated between each individual listener and the other listeners in the listener panel. This was done separately for the assessments of the three groups of speakers (NSC, RFA and FAS). These measures should provide an indication as to how consistent the members of the listener panel have been in attributing particular accents to groups of speakers. The mean Kappa scores for the three speaker groups are illustrated in figure 6:

INSERT FIGURE 6 ABOUT HERE

From figure 6, it is clear that inter-rater agreement in accent attribution is excellent for the native speaker controls (Overall mean = 0.93), substantially lower for the Real Foreign Accent speakers (Overall mean = 0.38), and lower still for the Foreign Accent Syndrome speakers (Overall mean = 0.26).

These measures were further analysed by means of a two-way ANOVA with LISTENER GROUP and SPEAKER GROUP as independent variables. From this analysis, it appears that inter-rater agreement is significantly different in both SPEAKER ($F(2, 7329) = 6589.80$, $p < 0.0001$) and LISTENER GROUPS ($F(2, 7329) = 13.0256$, $p < 0.0001$). Interactions were not significant. The variable SPEAKER GROUP was further analysed by means of a Tukey HSD with alpha level 0.050: this analysis indicates that inter-rater

agreement between the different groups of speakers was significantly different. A similar analysis for the LISTENER GROUPS reveals that the TDFL agreed significantly better (x = 54.03) than both the naïve listeners (x =52.71) and the speech therapists (x=51.03) although the differences are in fact small in real terms.

As part of the questionnaire, the listeners were asked to rate their confidence in accent assignment. Listeners' assessment was given on a 7-point rating scale between the extremes 'Very uncertain' (1) and 'Very certain' (7). The results are summarized in figure 7:

INSERT FIGURE 7 ABOUT HERE

Figure 7 indicates that the listener panel was extremely confident about rating the native speaker controls (x=6.68) and quite confident regarding the speakers with a real foreign accent (x=5.42). As far as the FAS speakers are concerned, the listener panel was least confident about their accent attributions (x=2.65).

In order to investigate any statistically significant differences in confidence judgements, two 2-way ANOVAs were carried out. Such analysis of variance was considered appropriate here since the level of measurement was ordinal with at least 20 possible values (Clark-Carter, 1997): the listeners assessed each patient group on five 7-point scales, which yields a total of 45 possible ordinal values.

In the first analysis, LISTENER GROUP was treated as a random variable, while SPEAKER GROUP was the fixed variable. The results of this analysis reveals a significant effect of SPEAKER GROUP ($F(2,360) = 2027.057$, $p < 0.0001$). In the second analysis, SPEAKER GROUP was treated as a random variable, while LISTENER GROUP was regarded as a fixed variable. This analysis also revealed a significant effect of SPEAKER GROUP ($F(2, 36) = 275.1404$), $p < 0.0001$). In neither of the analyses was the variable LISTENER GROUP significant, nor was the interaction between LISTENER GROUP and SPEAKER GROUP. Post-hoc investigation of the differences between the speaker groups by means of Tukey HSD reveals that each of the speaker groups differ statistically significantly from each other.

In order to assess whether this result is generalizable to new listener groups as well as new speaker groups, min F' was calculated[1] (Pring & Hunter, 1994). Min F' for the SPEAKER GROUP effect was found to be significant (min F' (2, 42) = 242.25779, $p < 0.0001$), whereas Min F' for the LISTENER GROUP was not significant. This indicates that the present results can be generalized to other groups of speakers for the same listeners.

4. Discussion

The findings from this accent attribution experiment can be looked at from the perspective of either speaker or a listener perspective. From a speaker group perspective there is little doubt about the mother tongue status of the native speaker control group. In the assessment of nativity, these speakers were most strongly regarded as 'Definitely a native speaker of Dutch', they were nearly unanimously attributed a Dutch accent (99 %) and their regional accents (Belgian vs. Holland Dutch) were identified with great accuracy (99 % correct). For these speakers there is the highest level of reported *self-confidence* in the attributed accents (6.68 on a scale of 7) and the highest agreement amongst the listeners as to the type of attributed accents (Kappa = 0.93).

Furthermore, there is little doubt about the foreign status of the speakers with a real foreign accent. These speakers were most strongly associated with the category 'Definitely NOT a native speaker of Dutch' in the nativity assessment and an overwhelming 97.2 % of the listeners attributed a foreign accent to these speakers, i.e. an accent which is not Holland or Belgian Dutch. For this group there is quite a high level of reported self-confidence in the accents attributed (5.42 on a scale of 7), although listeners did not agree very well on the type of accents attributed (Kappa = 0.38). So listeners have a very good intuition for real foreignness and are very accurate in their assessment of nativity. Even the foreign accents with which they are unlikely to be familiar with are interpreted as non-native. This is not to say, however, that listeners were accurate in

[1] Min F' is obtained using the following formula: $\min F'[i, j] = (F_1 \times F_2)/(F_1+F_2)$, where i and j are its degrees of freedom. If the degrees of freedom of F_1 are n and n_1 and of F_2 are n and n_2, then $i = n$ and j is the nearest integer to $j = (F_1 + F_2)^2/[(F_1^2/n_2) + (F_2^2/n_1)]$ (Pring & Hunter, 1997).

identifying the true linguistic background of the speakers involved: accuracy of identification ranged from 13 % (Korean) to 97 % (German).

Finally, it appears that the speakers with Foreign Accent Syndrome significantly deviated from the previous groups at all levels of analysis. In the correspondence analysis the FAS speakers were positioned between the speakers with a real foreign accent and the native speaker controls. Furthermore, the assessment of nativity revealed that FAS speakers were assessed approximately neutrally. In addition, it was observed that these speakers were attributed a foreign accent in many cases (mean = 75.27 %), but that they were also attributed a native Dutch accent (mean = 24.73 %). For this group both the levels of reported self confidence in the accents atrributed and agreement amongst the listeners in the accents assigned were the lowest of the three groups, i.e. 2.65 and Kappa = 0.26 respectively.

From these observations, it can be concluded that the listeners have been very successful in identifying the native speakers and almost equally successful in identifying the speakers with a real foreign accent as non-native (although the accuracy of accent identification may not have been high). FAS speakers, however, were not considered as native as the control native speakers and clearly not as foreign as the speakers with a real foreign accent: in other words they occupy an intermediate position. This finding is quite different from Dankovicova & Hunt (2011) who found their FAS patient to be assessed equally foreign as the speakers with a real foreign accent in the experiment.

The findings of this study are likely to be associated with the phonetic cues to foreignness/nativeness which are present in the speech of these groups of speakers. The perception results are consistent with the idea that in the speakers with a real foreign accent the speech markers of foreignness are frequent, strong, consistent and coherent enough to invoke the reliable identification of these speakers as non-native speakers. This does not seem to be the case in the speakers with foreign accent syndrome: the speech markers which could be interpreted as an indication of foreignness are probably not strong, consistent and coherent enough to be unequivocally interpreted as a foreign accent. This is clearly an area requiring further study. Nevertheless, the fact that FAS speech is identified as foreign by a very substantial proportion of the listener panel indicates that there must be cues in FAS speech which are suggestive of a foreign accent,

i.e. the impression of foreign accent is not entirely 'in the ear of the beholder' but is in fact to some extent inherent in the patient's vocalisations (Carbary, Patterson & Snyder 2000).

In terms of the types of accent attributed, the correspondence analysis revealed that FAS speakers are most strongly associated with French and Moroccan, while the speakers with a real foreign accent are mainly associated with –from a Belgian perspective- more exotic accents. In Belgium, French and Moroccan can be assumed to be the most familiar accents: 40% of the Belgian population is French-speaking and this accent is heard regularly on the radio and television news and current affairs programs. A Moroccan accent can also be assumed to be familiar to most of the listener panel since Belgium has a very substantial Moroccan immigrant population and this accent is heard frequently in the urban centres.

The fact that FAS speech in this experiment is more strongly associated with the more familiar accents is quite different from the results in Di Dio et al (2006) who did find an influence of accent familiarity, but only in the speakers with a real foreign accent, not in the FAS speakers. The fact that FAS is more strongly associated with the more familiar accents is consistent with the linguistic relative view of FAS (Di Dio et al, 2006) which holds that listeners identify the accents in FAS with the ones with which they are most familiar.

In a listener group perspective, very little difference was found in the perceptual judgements of the three participating listener groups. The main point that emerged from the correspondence analysis is that the naïve listeners are most strongly associated with a French accent, while the speech therapists were loosely associated with a Moroccan, and German accent. However, the Teachers of Dutch as a Foreign Language were most inclined to assign a Belgian Dutch accent, particularly to the FAS speakers. These findings also suggest an effect of listener familiarity with foreign accents: the listener group with the widest experience in assessing foreign accents, i.e. the Teachers of Dutch as a Foreign Language, were most inclined to recognise the FAS-speakers as native speakers of Dutch, not as real foreigners.

An appealing framework within which to account for the results obtained in this experiment is that of markers in speech (Laver & Trudgill 1979; Verhoeven 2002). This

framework is based on the idea that the speech of every individual contains a wide range of characteristics which - rather than being communicative - provide 'evidential' information. Laver & Trudgill (1979) distinguish between three taxonomical categories of such markers: *physical markers* are 'those that mark physical characteristics, such as age, sex, physique and state of health' (p 3), *psychological markers* which 'mark psychological characteristics of personality and affective state' (p 3) and *social markers* which 'mark social characteristics, such as regional affiliation, social status, educational status, occupation and social role' (p 3). As far as the attribution process is concerned, Laver & Trudgill (1979) make a distinction between actual markers and misinterpreted markers. The former 'accurately indicate a true characteristic of the speaker' (p. 20), while the latter 'are mistakingly interpreted by the listener as signalling a particular characteristic of the speaker when in fact the speaker is not actually thus characterizable' (p. 26-27). In this perceptual experiment, listeners were near-perfect in correctly identifying the regional affiliation of the native speakers, i.e. the social markers in native speech were accurately interpreted by the listener panel. This also applied to the listener's assessment of the real foreign accents: the collection of actual social markers in real foreign accented speech are so numerous, coherent and systematic that almost all listeners correctly consider these speech samples as foreign accented speech, even those accents with which listeners are unlikely to be familiar. Consistent with this framework was the finding that the Korean speech sample was regarded as an instance of real foreign accented speech by 99 % of the listeners in the listener panel. In addition, the listeners felt quite confident that their attributions were correct.

Foreign accent syndrome speech, however, can be assumed to contain a wide range of physical markers that are actually informative of the speaker's physical state (i.e. motor speech disorder). A misinterpretation has then taken place: some of the physical markers which are actually informative of the speaker's physical state (motor speech disorder) are misinterpreted as social markers that are then mistakingly taken to be cues of the speaker's regional affiation (regional or foreign accent) with which the listener has some familiarity. Interestingly, the process is clearly not triggered in all listeners since th FAS speakers are frequently perceived correctly as native speakers of Belgian Dutch. More concretely, apraxia of speech is characterized by state markers such as the inconsistent

stopping of fricatives. As it happens the stopping of fricatives (particularly the voiced velar fricative [ʏ]) is a well-known characteristic of French speakers of Dutch and familiarity with this feature may trigger the misinterpretation process in which the speech impairment is considered as a foreign accent. In this misinterpretation process, listener familiarity with specific social markers suggesting foreign accent is crucial. Once this misinterpretation has taken place, it seems likely that other speech characteristics which existed before the occurrence of speech pathology may provide general support for a specific foreign accent interpretation (Verhoeven & Mariën, 2010). In some of the FAS speakers in this experiment the regionally-determined lack of a qualitative distinction between the high front vowels [i] and [ɪ] in the Brabantine regional variant of Standard Dutch (Verhoeven, 2005) provides general support for perceiving a French accent after it was triggered by the stopping of the velar fricative [ʏ] because this is also characteristic of the French vowel system. As a result of this *trigger-support model* a pattern of foreignness may be invoked in listeners which is in fact more apparent than real and which is essentially based on a misinterpretation of speech pathology features.

5. Conclusion

The results of this accent attribution experiment indicate that FAS speakers are assessed differently from speakers with a real foreign accent. This applies to all levels of analysis which indicates that FAS speakers are not perceived as foreign as speakers with a real foreign accent, while they are not perceived as equivalent to unimpaired native speakers. This may indicate that the impression of foreignness in FAS is fundamentally different from the impression of foreignness in real foreign accents and this can be accounted for by the trigger-support model of foreign accent perception in FAS.

6. References

Boersma, P., Weeninck, D. (2007). PRAAT. Doing Phonetics by Computer. Computer Program.

Carbary, T.J., Patterson, J.P., Snyder, P.J. (2000). Foreign Accent Syndrome following a Catastrophic Second Injury: MRI Correlates, Linguistic and Voice Pattern Analysis. *Brain and Cognition*, 43, 78-85.

Clark-Carter, D. (1997). *Doing Quantitative Psychological Research. From Design to Report*. Hove: Psychology Press.

Clausen, S. (1998). *Applied Correspondence Analysis: An Introduction*. London: Sage.

Cohen, D.A., Kurowski, K., Steven, M.S., Blumstein, S.E., Pascual-Leone, A. (2009). Paradoxical facilitation: the resolution of foreign accent syndrome after cerebellar stroke. *Neurology*, 73, 566-567.

Cole M. (1971). Dysprosody due to posterior fossa lesions. *Transactions of the American Neurological Society*, 96, 151-154.

Dankovicova, J., Gurd, J.M., Marshall, J.C., Mac~Mahon, M.K.C., Stuart-Smith, J., Coleman, J.S. (2001). Aspects of non-native pronunciation in a case of altered accent following stroke. *Clinical Linguistics & Phonetics*, 15, 195-218.

Dankovicova, J., Hunt, C. (2011). Perception of foreign accent syndrome speech and its relation to segmental characteristics. *Clinical Linguistics & Phonetics*, 25, 85-120.

Di Dio, C., Schulz, J., Gurd, J. (2006). Foreign Accent Syndrome: In the ear of the beholder ? *Aphasiology*, 20, 951-962.

Edwards, R. J., Patel, N.K., Pople, I.K. (2005). Foreign Accent following Brain Injury: Syndrome or Epiphenomenon ? *European Neurology*, 53, 87-91.

Haley, K. L., Roth, H., Helm-Estabrooks, N. & Thiessen, A. (2009). Foreign accent syndrome due to conversion disorder: phonetic analyses and clinical course. *Journal of Neurolinguistics*, 23, 1-16.

Kurowski, K.M., Blumstein, S.A., Alexander, M. (1996). The Foreign Accent Syndrome: a Reconsideration. *Brain and Language*, 54, 1-25.

Laures-Gore, J., Contado Henson, J., Weismer, G., Rambow, M. (2006). Two cases of foreign accent syndrome: An acoustic-phonetic description. *Clinical Linguistics & Phonetics*, 20, 781-790.

Marie, P. (1907). Présentation de malades atteints d'anarthrie par lésion de l'hémisphère guache du cerveau. *Bulletins et Mémoires de la Soc. Méd. Des Hôpitaux*, 1, 158-160.

Mariën, P., Verhoeven, J., Engelborghs, S., Rooker, S., Pickut, B., De Deyn, P. (2006). A role for the cerebellum in motor speech planning: Evidence from foreign accent syndrome. *Clinical Neurology and Neurosurgery*, 108, 518-522.

Mariën, P., Verhoeven, J. (2007). Cerebellar Involvement in Motor Speech Planning: Some Further Evidence from Foreign Accent Syndrome. *Folia Phoniatrica et Logopaedica*, 59, 210-217.

Mariën, P., Verhoeven, J., Wackenier, P., Engelborghs, S., De Deyn, P.P. (2009). Foreign accent syndrome as a developmental motor speech disorder. *Cortex*, 45, 870-878.

Miller, N., Lowit, A., Sullivan, H. (2006). What makes acquired foreign accent syndrome foreign ? *Journal of Neurolinguistics*, 19, 385-409.

Pring, T. R., Hunter, L. (1994). Speakers and listeners: some problems of generalising from a common speech pathology research design. *European Journal of Disorders of Communication*, 29, 51-59.

Tsuruga, K., Kobayashi, T., Hirai, N., Koto, S. (2008). Foreign Accent Syndrome in a Case of Dissociative (Conversion) Disorder. *Seishin Shinkeigaku Zasshi*, 110, 79-87.

Van Borsel, J., Janssens, L., Santens, P. (2005). Foreign Accent syndrome: an organic disorder? *Journal of Communication Disorders*, 38, 421-429.

Verhoeven, J., De Pauw, G., Kloots, H. (2004). Speech rate in a pluricentric language situation. A comparison between Dutch in Belgium and the Netherlands. *Language and Speech*, 47, 297-308.

Verhoeven, J. (2005). Illustrations of the IPA: Belgian Dutch. *Journal of the International Phonetic Association*, 35, 243-247.

Verhoeven, J., Mariën, P., Engelborghs, S., D'Haenen, H., De Deyn, P. (2005). A foreign speech accent in a case of conversion disorder. *Behavioural Neurology*, 16, 225-232.

Verhoeven, J., Mariën, P. (2007). Foreign Accent Syndrome: segmentele en prosodische kenmerken. *Stem-, Spraak- en Taalpathologie*, 15:3, 208-228.

Verhoeven, J., Mariën, P. (2010). Neurogenic foreign accent syndrome: Articulatory setting, segments and prosody in a Dutch speaker. *Journal of Neurolinguistics*, 23, 599-614.

Whitaker H. (1982). Levels of impairment in disorders of speech. In R.N. Malatesha, & L.C. Hartlage (Eds.), *Neuropsychology and Cognition (volume 1)* (pp. 194-207). The Hague: Martinus Nijhoff.