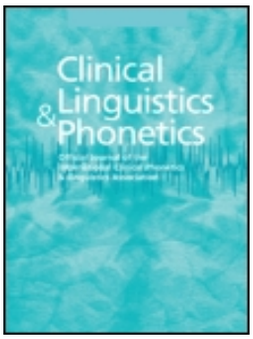

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A follow-up case study of transitory developmental apraxia of speech: 'L'enfant à voyelles'

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Abstract

It is well known that the acquisition of consonants can be a more difficult developmental process than of vowels. In this study the authors describe a case of 'transitory developmental apraxia of speech' (TDAS) in which a French-speaking child, although he acquired the whole vowel system, showed a significant delay in consonant acquisition and usage. The results of systematic observations and assessments of general cognitive and specific language functioning cover a period of 4 years (age 3:8 to 7:11), from first clinical assessment to evidence of a good academic achievement. It is argued that this case demonstrates an unusual example of TDAS. The language deficits observed could not be attributed to oromotor, neurological, cognitive or intellectual deficits. The findings here also raise crucial questions concerning the origins of such a speech disorder and why it is transient in nature.

Key words: Phonologic-syntactic disorder, developmental apraxia, disfluencies, follow-up study.

Introduction

If a child begins to talk at the stage of meaningful speech without the use of any consonants, as was observed in the case reported here, two questions must be addressed: (1) how can such a speech disorder be explained and, (2) will such a pattern be persistent or transient during childhood?

Since Jakobson's seminal paper (1941), researchers in child phonology have attempted to determine whether or not some regularities in the order of acquisition of vowels and consonants are found among individuals and across cultures. Frequent and careful observations, mostly on English-speaking children during their early phonological development, have shown the following usual patterns:

1. The first vowel is [a], followed later by [i] and [u]; with low vowels tend to be acquired before high ones.
2. The first consonants are labials, most commonly [p] or [m]; these are followed by [t] and later [k]. Labial consonants occur before lingual ones, stops tending to be acquired before fricatives, and non-glottalized before glottalized.
3. Semivowels occur before liquids.

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Recent research on phonological development, however, has also emphasized individual variation. In particular, Jakobson's theory has been criticized for failing to capture the differences among children acquiring the same language (Ferguson and Farewell, 1975; Macken and Ferguson, 1983; Menn, 1971, 1983; Vihman and Greenlee, 1987).

Concerning phonotactic structures, the usual pattern described in the early words has generally emphasized a constraint of a consonant–vowel (CV) combination (Stoel-Gammon, 1983). The question whether normal speech might occur even when this previous pattern of CV combination has not taken place, has received no attention in clinical research to date.

On the other hand, empirical studies of speech development in normal children have revealed that the most common 'error patterns' are consonant or syllable omissions and substitutions. These errors do not merely reflect random errors but rather the phonological developmental process itself (Ingram, 1976; Hodson, 1980; Hodson and Paden, 1981; Shriberg, Kwiatkowski and Hoffman, 1984; Shriberg and Kwiatkowski, 1980, 1988; Weiner, 1979).

Similarly, empirical data from France (Chevrie and Le Breton, 1973; Chevrie, Simon, Florentin and Olivier, 1973) have shown that, when French children start to talk they may also delete initial syllables, e.g. [lapɛ̃] (*lapin* 'rabbit') produced as [pɛ́]; delete initial or final consonants, e.g. [lapɛ̃] produced as [apɛ̃]; [banan] (*banane* 'banana') produced as [bana]; delete consonants from clusters e.g. [stilo] (*stylo*, 'pen'); produced as [tilo]; or substitute consonants with other consonants, e.g. [buʒi] (*bougie* 'candle') produce as [buzi]; [buʃɔ̃] (*bouchon*, 'cork') produced as [busɔ̃].

With regard to the developmental outcomes of children with speech and language problems, ever since the publication of Weiner's thoughtful review (1975) of 17 follow-up studies of such children, three major results have been typically reported in the literature:

1. Clinically significant proportion of children with early language involvement continue to have problems in academic areas (Silva, Justin, McGee and Williams, 1984; Formsby, Lougeay-Mottinger, Maxfield and Frield-Patti, 1985).
2. Intelligence seems to be an important influence on eventual good outcome for heterogeneous groups of children with early identified language problems (Bishop and Edmundson, 1987; Klackenberg, 1980; Schery, 1985).
3. Children with errors of articulation only, i.e. no language involvement, are the least at risk for long-term clinically significant deficits (Hall and Tomblin, 1978; Tyler and Edwards, 1986).

In this paper longitudinal data are presented from the speech development of a French boy who showed no cognitive, hearing, neurological or oromotor deficits but did display a very unusual early pattern of speech acquisition and production. Unusual phonological behaviour has been described in both young, normally developing children and in specifically language-impaired children. For example, Leonard and Brown (1984); Leonard and Schwartz (1985); Leonard, Schwartz, Swanson and Loeb (1987) reported cases where the 'sound changes' for consonants were considered as 'unusual', but no studies have reported cases with virtually no consonants at the first stage of language production.

The purpose of this case report is threefold: (1) to describe the developmental stages of this child's speech–sound system (vowels and consonant acquisition); (2)

to provide empirical evidence of an unexpectedly good outcome in speech, concomitant with satisfactory adjustment in a regular school; (3) to propose that what was observed could best be called a 'transitory developmental apraxia of speech' (TDAS).

Early clinical history

The child, F.E., first seen at age 3:8, was referred for evaluation of severely limited speech production to the Salpêtrière Hospital in Paris. The history given by his mother indicated that he was born by caesarean section and had suffered 'mild' asphyxia at birth, which resulted in admission for 2 days to an intensive care unit for resuscitation. She reported identifying 'speech' problems quite early on in his development. She also reported him as being left-handed, and this was confirmed by direct observation of his behaviour. He was the second of three children, and his younger sister later also showed a delay in language acquisition. When he was 2 years old he fell from a wall, but no neurological sequelae were reported. His milestones in motor development were normal; for instance, he walked at 17 months. Hearing was normal, as confirmed by audiological assessment. There were no anatomical abnormalities of the oral cavity. Simple voluntary movement of the lips, tongue, palate and velar motricity were normal. His mother also reported that babbling development did not reduplicate CV syllables but that sentence-like intonational patterns occurred around 10 months. The first meaningful speech also followed the same unusual manner of development. The only reduplicated CV syllables found were when the child started to produce three intelligible words (*papa, maman, bébé*, 'daddy, mummy, baby') at about 24 months. Since that time, the most salient characteristic of his speech had been very poor intelligibility in word production, essentially characterized by his using only vowels. Only his parents were able to recognize his 'sentences' due to his using relatively correct syllabic and intonational pattern in relation to context. Communicative intentions were generally well established, but F.E. was unable to produce verbal forms other than essentially syllabic shapes without consonants. Some examples of this are:

1. [ma-mɑ̃-va-a-ʃ-te-yn-vwa-tyr-a-mwa] (*maman va acheter une voiture à moi*, 'Mummy is going to buy a car for me') produced as [mɑ̃-mɑ̃-a-e a-y a-a].
2. [mø-sjø-va-a-le-ɑ̃-o] (*monsieur va aller en haut*, 'the gentleman is going upstairs', produced as [a-ø a-e ɑ̃-o].
3. [sɛ-l-mɛm] (*c'est le même*, 'it is the same') produced as [a-ɛ].
4. [pa-pa-a-ʃ-te-sa] (*papa acheter ça*, 'daddy bought that') produced as [pa-pa-a-e-a].
5. [a-ʃ-te-sa-pa-pa] (*acheter ça papa*, 'buy that daddy') produced as [a-e-a-pa-pa].

F.E. showed some behaviour problems which might be the result of his frustration over being unable to communicate verbally in a way commensurate with his cognitive development. He received a 4-year intensive training course in speech therapy (three times a week), in which emphasis was placed on teaching him how to use consonants appropriately.

Methods

F.E. was assessed seven times between the ages of 3:8 and 7:11, using two kinds of methods: (1) formal testing, including a series of standardized general cognitive,

language and academic tests; and (2) systematic observation of language usage during standardized play sessions, each lasting 20 minutes. The complete range of tests and the play sessions were not used at each age level, since F.E. could attend for only relatively short assessment periods. Thus, the most appropriate expressive tests and/or play sessions were selected at each examination (see Table 1). All play sessions were both videotaped and audiotaped. All testing sessions took place in the same room, which was a video-room at the Salpêtrière Hospital. Equipment and material for a session was placed in this room in advance.

Assessment procedures

Formal tests

Standardized tests of cognitive functioning. The following standardized tests of cognitive functioning were administered to F.E.: (1) Leiter International Performance Scale (Leiter, 1948), at age 4:0; (2) Developmental Psychomotor Scale (Brunet and Lézine, 1981), at age 5:5; (3) Goodenough–Harris 'Draw-a-Man' Test (Harris, 1963), at age 4:9 and 6:2; and (4) the Wechsler Intelligence Scale for Children–Revised (WISC-R, Performance Scale only, Wechsler, 1981) at age 7:11. (5) Standardized and grade-appropriate reading and spelling tests, namely the *Tests de Lecture pour le Cours Préparatoire* (TLCP, Pasquier, 1979), were administered at ages 7:3 and 7:11.

Auditory memory was assessed, through tests of digit and rhythm reproduction, administered at age 6:2 and 7:3 (Chevrie-Muller, Simon and Decante, 1981).

Standardized tests of receptive language. These comprised: (1) six subtests from a language examination test (Chevrie-Muller *et al.*, 1981, Chevrie-Muller, Simon, Le Normand and Fournier, 1988), administered between ages 3:8 and 7:3; and (2) 20 items from the French adaptation of the Northwestern Syntax Screening Test (NSST) (Weil-Halpern, Chevrie-Muller, Simon and Guidet, 1983) administered at age 7:11.

Standardized tests of expressive language. Expressive language was assessed using: (1) three subtests assessing articulatory phonological and picture-naming tasks (Chevrie-Muller *et al.*, 1988), given at ages 3:8 and 4:0 and a syllable repetition task at age 4:9, 5:5, 6:2 and 7:3 (Chevrie-Muller *et al.*, 1981); (2) three subtests assessing lexical and syntactic aspects of language, namely a picture-naming task, a picture story-telling task and 20 items from the French adaptation of the NSST (Weil-Halpern *et al.*, 1983), administered at age 7:11.

Systematic observation of language usage during standardized play sessions

A systematic observation of language usage during standardized play sessions (Le Normand, 1986) was made at ages 3:8, 4:0, 4:9, and 5:5 in order to assess as far as possible the productivity of language. Specifically, this involved measuring: number of utterances, number of different words, number of flexions, mean length of syllables/utterance (MLSU), mean length of utterances (MLU), all according to the general rules for counting French morphemes found in Rondal, Bachelet and Pérée (1985).

Table 1. *Distribution of assessment procedures across seven sessions.*

Stage	*Stage I*		*Stage II*			*Stage III*	
Age	*3:8*	*4:0*	*4:9*	*5:5*	*6:2*	*7:3*	*7:11*
Intellectual and visuospatial skills							
Cognitive functions							
Developmental Psychomotor scale (Brunet and Lézine, 1981)				×			
Leiter International Performance Scale (Leiter, 1948)		×	×				
Draw-a-Man test (Harris, 1958)			×	×			
Rey-Osterrieth Complex Figure (Rey, 1959)					×	×	×
Wechsler Performance Intelligence Scale (Wechsler, 1981)							×
Academic tests							
Reading (TLCP, Pasquier, 1979)						×	×
Spelling (TLCP, Pasquier, 1979)						×	×
Auditory memory							
Digit reproduction (Chevrie-Muller, Simon and Decante, 1981)				×	×	×	
Rhythm reproduction (Chevrie-Muller *et al.*, 1981)				×	×	×	
Language functions							
Receptive language							
Difference (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Similarities (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Answering Questions (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Prepositions (Chevrie-Muller, Simon, Le Normand and Fournier, 1988)	×	×					
Picture designation (Chevrie-Muller *et al.*, 1981)	×	×	×	×	×	×	
Syntax comprehension (Weil-Halpern, Chevrie-Muller, Simon and Guidet, 1983)							×
Expressive language							
Articulatory and Phonological aspect							
Syllables repetition (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Picture Naming (list 1, or list 2) (Chevrie-Muller *et al.*, 1981)	×	×	×	×	×	×	
Repetition of words (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Lexical & syntactic aspect							
Picture Naming (list 3) (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Picture Story Telling (Chevrie-Muller *et al.*, 1981)			×	×	×	×	
Syntax Expression (Weil-Halpern *et al.*, 1983)							×
Production (play, Le Normand, 1986)							
Number of utterances	×	×	×	×			
Number of different words	×	×	×	×			
Number of flexions	×	×	×	×			
Mean length of syllables utterances (MLSU)	×	×					
Mean length of utterances (MLU)			×	×			

Transcription and analysis of data

For standardized tests of cognitive and receptive language, analyses were carried out in the standard way given in the manuals. For expressive language assessment, from age 3:8 to 6:2, the general rules outlined by Chevrie-Muller *et al.* (1981, 1988) and by Le Normand (1986) were followed, but with the following modifications. The video- and audiotapes were used to facilitate phonetic transcriptions of the child's production. Independent transcriptions of all tapes were done by three trained transcribers, using the International Phonetic Alphabet (IPA). Subsequently, the transcriptions were compared, and disagreements were independently checked by repeated monitoring of the tapes. Finally, a single transcription was arrived at by including only those phonetic features that were agreed upon by all the transcribers.

Distributional analysis
The percentage vowels correct were recorded at ages 3:8 and 4:0, and the percentage consonants correct (PCC) were recorded between ages 4:9 and 7:3.

Feature analysis
Consonant sounds included a 33-word list and total number of different word types produced in the play were classified in terms of distinctive features to allow precise assessment of F.E.'s developmental use of a consonantal system, as follows:

(a) place of articulation of labials: /p, b, f, v, m/ and linguals: /t, k, d, g, s, ʃ, z, ʒ, l, r, n/;
(b) manner of articulation of stops: /p, t, k, b, d, g/, and fricatives: /f, s, ʃ, v, z, ʒ/; and,
(c) voicing contrasts voiced consonants: /b, d, g, v, z, ʒ, m, n, ŋ, l, r, and voiceless consonants: p, t, k, f, s, ʃ/.

Results

It was considered most convenient for the purposes of this study to divide F.E.'s speech acquisition into three stages, each marked by the appearance of some developmental change in his speech production. The results for each of these three stages are presented below.

Stage 1: a period without consonants (ages 3:8 and 4:0)

Cognitive skills
On the Leiter International Performance scale, administered at age 4:0, F.E.'s I.Q. was 118.

Receptive language skills
The results of standardized tests at ages 3:8 and 4:0 (prepositions and picture designation, Chevrie *et al.*, 1988) placed F.E. at the mean for children of his chronological age.

Expressive language skills

Productivity of language. During the first 4 months of work with F.E., his productivity of language in play sessions did not increase: 55 utterances were collected

with a mean length of 2.09 syllables (MLSU) at age 3:8 and a mean of 2.57 syllables at age 4. His vocabulary included 20 different identified 'words' at age 3:8 and 29 different 'words' at age 4:0. All his sentences during this period were based on the basic syllabic vowel pattern, with a range of 1 to 6 syllables in length of utterance (SLU).

His connected speech started with an unstabilized word order, as shown by the following example: [lø-mø-sjø-va-ʃɛʀ-ʃe-sa-vwa-tyʀ-o-ga-ʀaʒ] (*le monsieur va chercher sa voiture au garage*, 'the gentleman is going to look for the car at the garage') produced either as [a-ø-a-y-a-a] or [a-ø-a-a-a-y].

It was striking to find that all the strings of words making connected sentences started with the repetition of the same syllable [a], as if the child marked syllable boundaries by putting words together. However, an exception of two utterances eliciting an emerging syntax was found, as follows:

1. [a-le-o-li] (*allez au lit*, 'go to bed') produced as [a-e-o-i].
2. [dɑ̃-la-mɛ-zɔ̃-lø-mø-sjø] (*dans la maison le monsieur*, 'in the house the gentleman') produced as [ɑ̃-a-ɔ̃-a-ø-ø].

Vowel acquisition—monosyllabic words. At age 3:8, in the test situation, the list of monosyllabic words produced with the expected correct vowels by the child were [u] for [ru] (*roue*, 'wheel'), [ø] for [flør] (*fleur*, 'flower') and [a] for [gla] (*glace*, 'mirror'). At age 4:0 [e] for [kle] (*clé*, 'key') occurred.

In the play situation, the vowels [ɛ] for [lɛ] (*lait*, 'milk') and [i] for [li] (*lit*, 'bed') were already produced at age 3:8 followed by [ɛ̃] for [ʃjɛ̃] (*chien*, 'dog') and [rjɛ̃] (*rien*, 'nothing') at age 4:0. This suggests that the play situation allowed the expression of a greater variety of vowel sounds than did the formal testing situation.

Vowel acquisition—bisyllabic and multisyllabic words. In the test situation, the vowels produced were [a-o] for [ʃa-po] (*chapeau*, 'hat'), and [pja-no] (*piano*, 'piano'); [a-u] for [ja-uʀt] (*yaourt*, 'yogourt'), [a-é] for [la-pɛ̃] (*lapin*, 'rabbit'), [a-a] for [gaʀaz] (*garage*, 'garage'); [a-ɔ̃] for (a-vjɔ̃) (*avion*, 'aeroplane'); and [a-a-i] for [pa-ʀa-plwi] (*parapluie*, 'umbrella'). In the play situation the different correct vowels produced by the child in bisyllabic words in the play situation were [a-e] for [ka-ʃe] (*caché*, 'hidden') and [a-le] (*aller*, 'to go'), [a-o] for [ɑ̃-o] (*en haut*, 'up') and [a-a] for [ʃ-val] (*cheval*, 'horse') at age 3:8; and [a-i] for [ta-pi] 'tapis' (carpet) at age 4:0.

It is interesting to note that, in both situations, the onset of the initial syllable was frequently produced by the child using the inappropriate back vowel [a].

The contrasting assessment of F.E.'s vocalic system was therefore considered at that stage as complete and was verified by the sonagram given in Figure 1. Mac Speech lab II displayed waveform and spectogram of the following words (*joli*, 'beautiful'; *clé*, 'key'; *voiture*, 'car'; *feu*, 'fire'; *fleurs*, 'flowers'; *chapeau*, 'hat'; *roue*, 'wheel') which shows F.E.'s formant frequencies of vowels /i/, /e/, /y/, /ø/, /oe/, /a/, /o/, /u/ within the range of average formant frequencies of these vowels by a French child of the same age (Chevrie-Muller, 1967).

Correctly produced vowels were significantly more frequent in monosyllabic words (72·73%) than in bisyllabic words (60·70%) or multisyllabic words (0%) at the age 3:8 $\chi^2 = 13{\cdot}14$; d.f. = 2; $p < 0{\cdot}001$) (total number of words = 76).

Similar findings occurred at age 4:0 with 100% for the monosyllabic words, 67·69% for the bisyllabic words and 44·44% for the multisyllabic words.

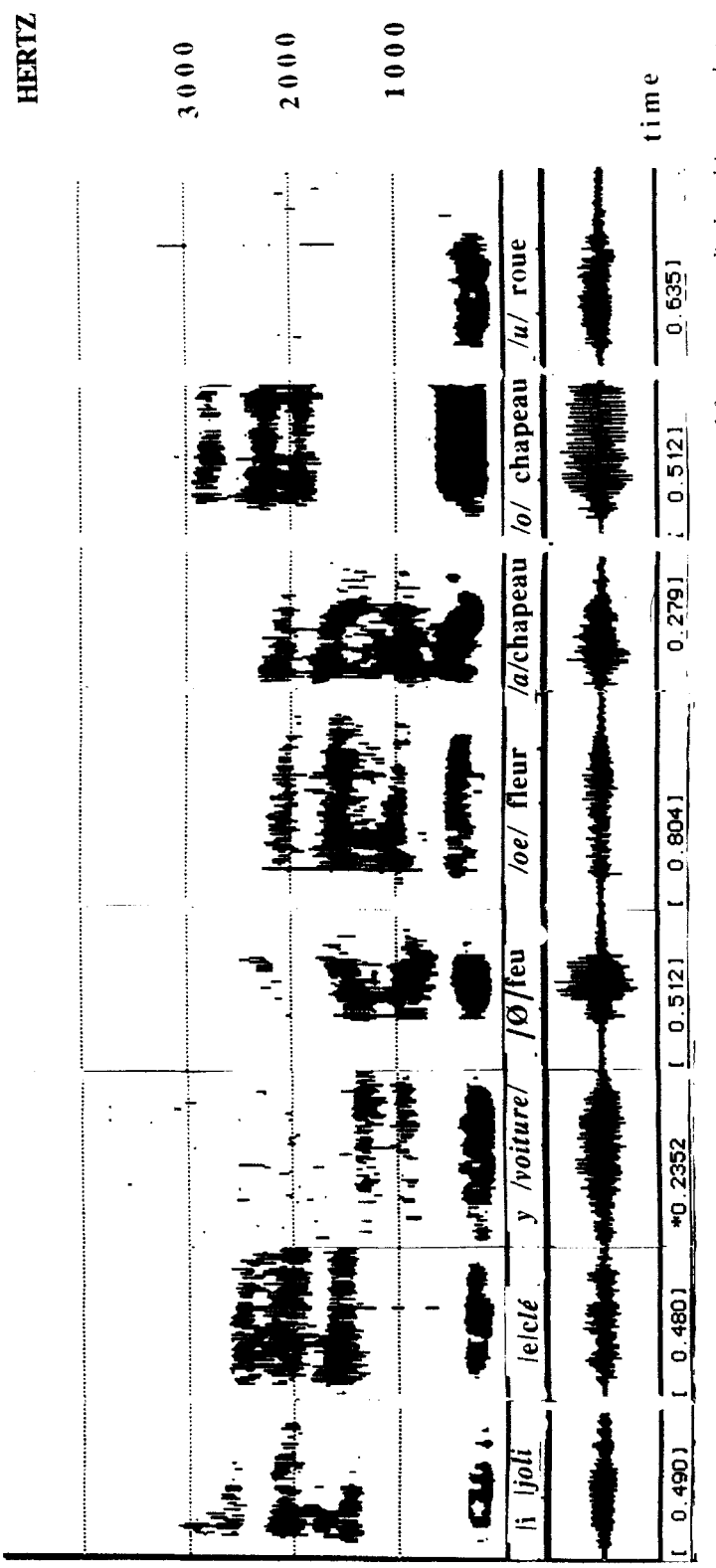

Figure 1. *Spectogram- (Mac Speech Lab II display of waveform) F.E.'s vocalic system at age 3:8 (time and frequency are displayed in areas between panels).*

Vowels correctly produced were less frequent in the initial position (35·29%) compared with the final position of a word (71·43%), $\chi^2 = 9.92$, d.f. = 1; $p < 0{\cdot}001$) at age 3:8. Similar results were found at age 4:0 with 53·85% in initial position, and 83·33% in final position, ($\chi^2 = 8{\cdot}93$, d.f. = 1, $p < 0{\cdot}003$).

When comparing the percentages of correct vowels among the total vowels in both the test and the play situations, significant differences were found across situations: at age 3:8, 80% for the play sessions vs 34·15% for the test session ($\chi^2 = 16{\cdot}05$; d.f. = 1; $p < 0{\cdot}001$); at age 4:0, 82·98% for the play sessions vs 55% for the test sessions ($\chi^2 = 8{\cdot}073$; d.f. = 1; $p < 0{\cdot}004$).

Stage 2: emergence of CV stage and development of consonant speech sounds (ages 4:9, 5:5 and 6:2) with transitory disfluency period (age 4:9)

Cognitive and auditory memory skills

F.E. scored within the normal range on the Draw-a-Man test at ages 4:9 and 6:2, on the Developmental Psychomotor Scale, Developmental Quotient (DQ) = 103 (Brunet and Lézine, 1981) administered at age 5:5 and on the two auditory memory subtests administered at age 6:2. Some difficulties were observed, however, in the visual perception and memory test administered at 6:2. Thus, the Rey–Osterrieth Complex Figure (Rey, 1959) assigned him a score just at the limit of the −1 standard deviation (SD) below the mean of his age.

Receptive language skills

F.E. scored within the normal range on all subtests assessing receptive language, (four subtests) at age 4:9, 5:5, 6:2 and 7:3.

Expressive language skills

The emergence and development of morphosyntax (4:9 and 5:5). At the point F.E. succeeded in producing recognizable patterns of sentences, it was possible to determine his morphosyntactic limitations by comparing him with mean and standard deviation of a control group aged 2:0–4:0 (Le Normand, forthcoming). Mean length of utterances (MLU) and the number of different flexions (gender markers and verb inflections) from the spontaneous speech sample were calculated for the two play sessions at age 4:9 and 5:5.

F.E.'s MLU scores derived from his utterance sample of 100 utterances at age 4:9 and 87 utterances at age 5:5 were 3.49 at 4:9 (with 63 different flexions) and 4.20 at age 5:5 (with 82 different flexions). Such results demonstrated F.E. was evidently morphosyntactically impaired, and assigned him a score at 2 SD below the mean of children of age 2:9 when he was 4:9 and also 2 SD below the mean of children of age 3:6 when he was 5:5.

Despite the delay of 2 years in morphosyntax, qualitative analysis demonstrates the beginning of gradual organization of F.E.'s grammar in revealing that F.E. correctly used: (1) definite articles *le*, *la*, *les*, 'the'; *du*, 'of'; *des* including cliticized forms *l'* at age 4:9 followed by indefinite articles *un*, *une*, 'a'; *au* at age 5:5 (2) personal pronouns *moi*, 'me' at age 4:9 followed by *je*, 'I'; *tu*, *toi*, *il*, 'he'; *elle*, 'she'; *se*, 'himself, herself' at age 5:5 and (3) prepositions: *dans*, 'in' at age 4:9 followed

by *à côté*, 'next to'; *devant*, 'in front of'; *derrière*, 'behind'; *de*, 'of'; *pour*, 'for' at age 5 : 5.

Transitory speech disfluency. F.E. showed a short period of speech disfluency around age 4 : 9. Some illustrative speech samples from this disfluency stage are given in table 2. What is observed here is F.E.'s difficulty in producing syntactic units, such as (*parce que*, 'because') and functional words such as the preposition (*avec*, 'with'). Speech acoustic signal from the Soundedit software given in figure 2 showed empirical evidence of F.E.'s transitory speech disfluency at age 4 : 9 in the production of these two expected utterances elicited from a picture story-telling task: Figure 2a (*a plein de terre*, 'a lot of mud', produced as [ap-ap-at-at-ap-a-kɛ-to-tɛ]; and Figure 2b (*il se regarde dans la glance*, 'he looks at himself in the mirror') produced as [ãk-ãk-ãk-kɛ-ak-kɛ-kɛ-tak-kla]; this figure shows in both examples five and six successive attempts to produce the expected sentence after short pauses such as breathing in Figure 2 a. The two picture stimuli are given in Figure 3a and Figure 3b. Speech disfluency completely disappeared at age 5 : 5.

The construction of a consonant system (ages 4 : 9 and 5 : 5). As expressive language skills could still not be assessed by standardized testing, the percentage of errors in producing consonants was therefore calculated using the test and play situations. An inventory of F.E.'s actual consonant system was compared with the target consonants expected. This provided a paradigm of developmental changes in the consonant system. Because of the small speech sample, only two consonant positions could be assessed, namely the initial consonant and medial consonant.

At age 4 : 9, distributional analysis given in Table 3 showed that consonants were correct in 55 cases (55%): initial consonant positions were correct in 32 cases (63%), medial consonants were correct in 23 cases (47%). Consonants such as [p] [t] [m] were 100% correctly produced, while [n] and [b] were correctly produced 80% of the time. Among stops, [k] and [d] were correctly produced for 77% and 66% of

Table 2. *Connected speech sample collected in a picture story telling task (age 4 : 9) (disfluency stage).*

Questions from the adult			*Child's responses*	
(3b)	**Q:**	*Le garçon est-il content? Pourquoi?* 'Is the boy happy? Why?'	**R:**	*parcequ'il est tombé* 'because he fell down' [pars-ki-lɛ-tɔ̃-be]→ [pak-pak-pak-i-lɛ-tɔ̃-be]
(4a)	**Q:**	*Avec quoi le garçon se lave-t-il?* 'With what does the boy wash himself?'	**R:**	*avec un gant* 'with a face flannel' [a-vɛk-ɛ̃-gɑ̃]→[a-a-a-a-ɛ-a-kɑ̃]
(5b)	**Q:**	*Pourquoi est-il content?* 'Why is he happy?'	**R:**	*parce qu'il est allé dans sa maison* 'because he went to his house' [pars-kil-ɛ-a-le-dɑ̃-sa-mɛ-zɔ̃]→ [pak-pak-pak-a-te-a-mɛ-ɔ̃]
(5d)	**Q:**	*Pourquoi se tient-il comme ça sur la pointe des pieds?* 'Why does he stand up like that on tiptoe?'	**R:**	*parce qu'il est tombé* 'because he fell down' [pars-ki-lɛ-tɔ̃-be]→ [pak-pak-pak-pak-pak-i-lɛ-tɔ̃-be]

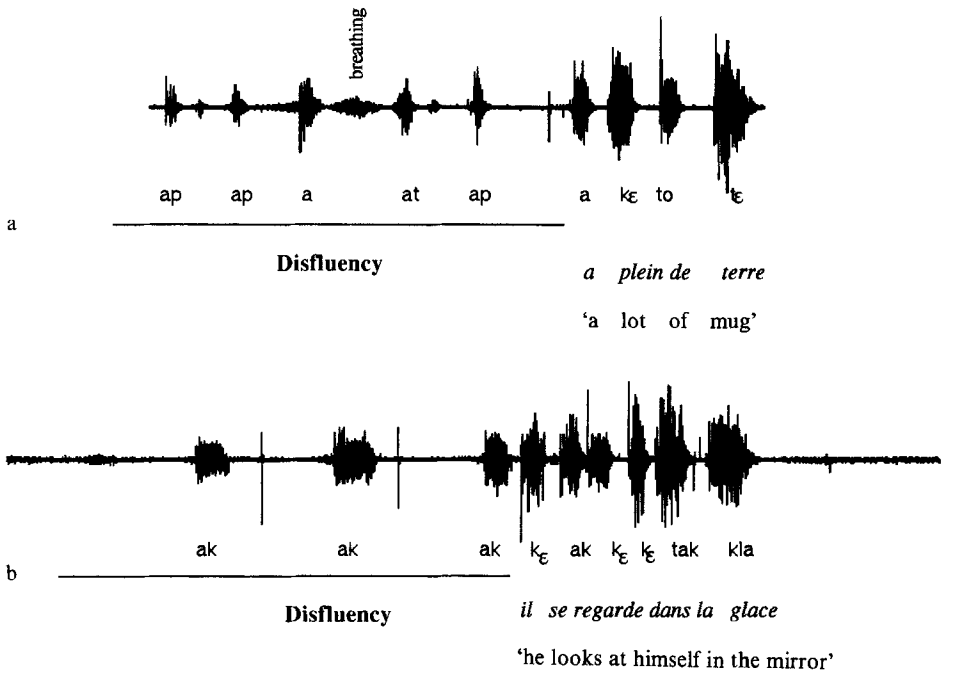

Figure 2. *Speech acoustic signal, F.E.'s disfluency period at age 4:9: story-telling task (Chevrie-Muller et al.*, 1981).

the time respectively. Among fricatives, only [v] began to emerge (33%). Substitutions were still frequent, particularly among stops: [k] for [g] in [gɔm] (*gomme*, 'rubber') and [g] for [d] in [dwa] (*doigt*, 'finger'). Fricatives were almost lacking for F.E. at that time, and were therefore replaced by stops.

At age 5:5, consonants were correct in 97 cases (82%), consonant initial position correct in 53 cases (81%) and medial position was correct in 44 cases (83%), but incorrect in 9 cases (16%). Eight consonants, [p], [t], [k], [b], [f], [v], [m], [n], were 100% correctly produced, and [s] was 91% correctly produced, followed by [l] (83%), [r] (80%), [d] (66%) and [g] and [z] (50%). The confusions were still persistent among the following fricatives: [s] for [ʃ] in [buõ] (*bouchon*, 'cork') and [ʃɛz] (*chaise*, 'chair'); [ʃ] for [ʒ] in [frɔmaʒ] (*fromage*, 'cheese'); [z] for [ʃ] for [buʒi] in (*bougie*, 'candle') and [ʒɑ̃bɔ] (*jambon*, 'ham').

Developmental pattern for consonants. Percentages of errors in three classes of consonants, (labials vs linguals, stops vs fricatives, voiced vs voiceless), were compared. Separate chi-square (χ^2) tests were applied at 4:9, 5:5 and 6:2.

1. *Place of articulation: labials vs linguals.* At age 4:9 the total percentage of consonant errors remained too large, preventing any analysis of the use of labials and linguals in both the naming task and the standardized play situation. However, a significant difference was found in a more restricting task with no problem of recall such as a repetition task ($\chi^2 = 13{\cdot}25$; d.f. = 1; $p < 0{\cdot}001$).

   It is apparent from an inspection of Table 4 that labials were almost all acquired at age 5:5. Significant differences were clearly found in all tasks at

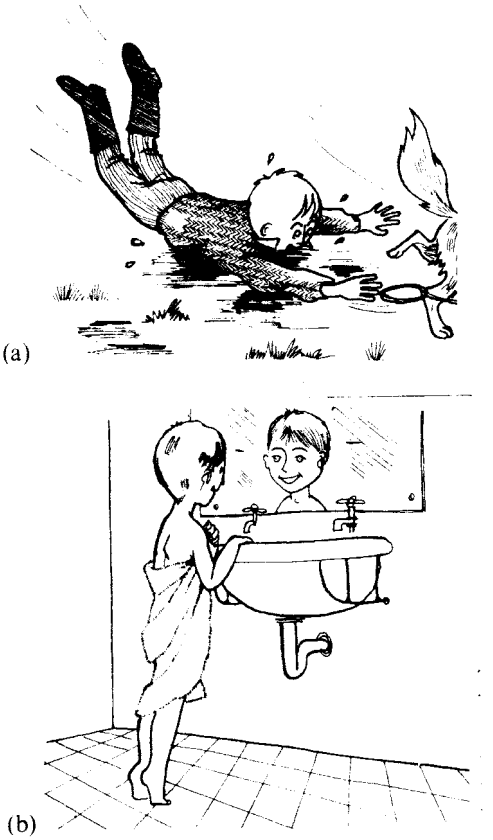

Figure 3.

that age (picture-naming test: $\chi^2 = 10{\cdot}52$; d.f. = 1; $p < 0{\cdot}001$; repetition test: $\chi^2 = 4.45$; d.f. = 1; $p < 0{\cdot}05$; spontaneous play: $\chi^2 = 10{\cdot}17$; d.f. = 1; $p < 0{\cdot}001$). However, linguals were not mastered at this age.

The percentage of correct linguals increased dramatically by age 6 : 2 so that F.E.'s levels of labials and linguals were basically the same (see Table 4).

2. *Manner of articulation: Stops vs fricatives.* At age 4 : 9 the rate of correct fricatives was generally low, contrasting significantly with that of stops in all tasks (picture-naming task: $\chi^2 = 6{\cdot}62$, d.f. = 1; $p < 0{\cdot}01$; repetition task: $\chi^2 = 11{\cdot}80$, d.f. = 1; $p < 0{\cdot}001$; spontaneous play: $\chi^2 = 18{\cdot}78$, d.f. = 1; $p < 0{\cdot}001$). Higher scores were, however, noticed for stops in spontaneous play than in formal testing.

Significant differences were also found at age 5 : 5 in the picture-naming test: $\chi^2 = 3{\cdot}66$, d.f. = 1; $p < 0{\cdot}05$; and in spontaneous play: $\chi^2 = 4{\cdot}14$, d.f. = 1; $p < 0{\cdot}05$).

A regular pattern was found only at age 6 : 2 between fricatives and stops in formal testing. (Table 5).

3. *Voicing.* When comparing voiceless to voiced consonants it was usual to find that F.E. produced voiceless consonants more correctly than voiced consonants in all situations. No significant differences were, however, found at any age and in any tasks. (Table 6).

Table 3. *Inventory of consonants correctly produced in initial and medial positions in F.E.'s speech sample (test and play situations) during stage II (consonant acquisition).*

	4:9					*5:5*				
	Initial		*Medial*		*PCC*	*Initial*		*Medial*		*PCC*
	t	*pr*	*t*	*pr*		*t*	*pr*	*t*	*pr*	
Stops										
[p]	5	5	3	3	100	7	7	3	3	100
[t]	2	2	6	6	100	4	4	5	5	100
[k]	7	6	2	1	77	5	5	3	3	100
[b]	6	6	5	3	81	6	6	3	3	100
[d]	2	1	1	1	66	4	3	2	1	66
[g]	3	2	1	0	50	1	0	1	1	50
Fricatives										
[f]	1	0	1	0	—	5	5	1	1	100
[s]	3	0	4	0	—	7	6	5	5	91
[ʃ]	3	0	3	0	—	7	0	3	0	—
[v]	5	1	1	1	33	5	5	6	6	100
[z]	1	0	3	0	—	0	0	4	2	50
[ʒ]	2	0	2	0	—	2	0	3	0	—
Others										
[l]	1	1	4	2	60	2	2	4	3	83
[r]	2	0	5	0	—	3	3	2	1	80
[m]	7	7	3	3	100	6	6	5	5	100
[n]	1	1	4	3	80	1	1	5	5	100
Total	51	32	48	23	55 (55)	65	53	53	44	82 (97)

t = French target consonant, pr = child's production, PCC = percentage of correct consonants.

Table 4. *Subject's percentage of errors in the place of articulation (labials vs linguals) at age 4:9, 5:5 and 6:2 in the test situation and at age 4:9 and 5:5 in spontaneous play.*

	4:9		*5:5*		*6:2*	
	Labials	*Linguals*	*Labials*	*Linguals*	*Labials*	*Linguals*
Picture-naming test						
Expected consonants (*n*)	12	38	12	38	12	38
Correct	58·33%	28·95%	100%	47·37%[b]	100%	89·47%
Incorrect	41·67%	71·05%	0%	52·63%*	0%	10·53%
Repetition test						
Expected consonants (*n*)	12	38	12	38	12	38
Correct	91·67%	31·58%[a]	100%	71·05%[c]	100%	84·21%
Incorrect	8·33%	68·42%	0%	28·95%*	0%	15·79%
Play						
Expected consonants (*n*)	27	35	37	59		
Correct	55·56%	40·00%	97·30%	71·19%[d]	—	—
Incorrect	44·44%	60·00%	2·70%	28·81%	—	—

[a] $\chi^2 = 13{\cdot}25$, $p < 0{\cdot}001$; [b] $\chi^2 = 10{\cdot}52$, $p < 0{\cdot}001$; [c] $\chi^2 = 4{\cdot}45$, $p < 0{\cdot}05$; [d] $\chi^2 = 10{\cdot}17$, $p < 0{\cdot}001$.

Table 5. *Subject's percentage of errors in the manner of articulation (stops vs fricatives) at age 4:9, 5:5 and 6:2 in the test situation and at age 4:9 and 5:5 in play sessions.*

	4:9		*5:5*		*6:2*	
	Stops	*Fricatives*	*Stops*	*Fricatives*	*Stops*	*Fricatives*
Picture-naming test						
Expected consonants (*n*)	24	13	24	13	24	13
Correct	50·00%	07·69%[a]	70·83%	38·46%[d]	95·83%	92·31%
Incorrect	50·00%	92·31%	29·17%	61·54%	4·17%	7·69%
Repetition test						
Expected consonants (*n*)	24	13	24	13	24	13
Correct	66·67%	07·69%[b]	83·33%	69·23%	91·67%	92·31%
Incorrect	33·33%	92·31%	16·67%	30·77%	8·33%	7·69%
Play						
Expected consonants (*n*)	22	23	27	43		
Correct	77·27%	13·04%[c]	92·00%	67·74%[e]	—	—
Incorrect	22·73%	86·96%	8·00%	32·26%	—	—

[a] $\chi^2 = 6{\cdot}62$, $p < 0{\cdot}01$; [b] $\chi^2 = 11{\cdot}80$, $p < 0{\cdot}001$; [c] $\chi^2 = 18{\cdot}78$, $p < 0{\cdot}001$; [d] $\chi^2 = 3{\cdot}66$, $p < 0{\cdot}05$; [e] $\chi^2 = 4{\cdot}14$, $p < 0{\cdot}05$.

Table 6. *Subject's percentage of errors in voicing at age 4:9, 5:5 and 6:2 in the test situation and at age 4:9 and 5:5 in spontaneous play.*

	4:9		*5:5*		*6:2*	
	Voiceless	*Voiced*	*Voiceless*	*Voiced*	*Voiceless*	*Voiced*
Picture-naming test						
Expected consonants (*n*)	21	16	21	16	21	16
Correct	38·10%	31·25%	61·90%	56·25%	100%	87·50%
Incorrect:61·90%	61·90%	68·75%	38·10%	43·75%	0%	12·50%
Repetition test						
Expected consonants (*n*)	21	16	21	16	21	16
Correct	52·38%	37·50%	85·71%	68·75%	95·24%	87·50%
Incorrect	47·62%	62·50%	14·29%	31·25%	4·76%	12·50%
Play						
Expected consonants (*n*)	28	18	45	24		
Correct	46·43%	44·44%	73·33%	79·27%	—	—
Incorrect	53·57%	55·56%	26·67%	20·73%	—	—

Stage III: a final good outcome (ages 7:3 and 7:11)

Receptive and expressive language skills

F.E. obtained an average level of performance for his age on all subtests administered at the final assessment of his receptive and expressive language, at age 7:3, indicating the child's normalization in all components of language (phonology, lexicon and morphosyntax).

Cognitive skills
On the WISC-R at age 7:11 F.E. had an IQ of 134. Perception and memory for complex visuospatial information were again assessed at age 7:11 by the Rey-Osterrieth Complex Figure, resulting in a score more than one standard deviation below the mean for his age.

Academic achievement
Academic achievement test results, as measured by the TLCP for reading and for spelling, showed better performances in reading than in spelling at age 7:3 and 7:11. At these ages F.E. was in regular school classes, with a high level of academic achievement (highest marks in class in mathematics, highest overall average).

Discussion

The case reported here is of a child (F.E.) with a language disorder so called in French 'l'enfant à voyelles' (child who uses a predominantly correct vowel system in meaningful speech, but used virtually no consonants). F.E. initially presented at age 3:8, with a severe developmental speech disorder, but without any auditory, oromotor, motor oropharyngeal, verbal receptive or cognitive deficits. The results presented above facilitate the exploration of, at least, the two important questions, raised in the introduction: (1) How can a specific developmental difficulty in acquiring the correct usage of consonants be explained particularly in the context of the use of meaningful 'vocalic' language, as in the case of F.E.? (2) Will such a pattern be a good or poor prognosis?

In the case of F.E. it is important that oropharyngeal motricity in all other functions, besides consonant usage, was normal, as was hearing. Thus, the cause of the observed speech disorder cannot be explained at a primary sensorimotor level. Considering that F.E. had acquired the syllabic structures, used meaningful combinatorial speech, had a normal comprehension of words and sentences, by age 4:0 and because of the later successful development of F.E.'s consonant system, this virtually excludes an explanation of his problems in terms of perception and discrimination difficulties with speech sounds. A very plausible explanation for his problems may lie in an impairment of ability to plan and organize the coordinated sequences of the oropharyngeal movements that are necessary for complex speech production. It is known that the movements for consonant production need to be more precise and faster than those used for vowels (Mlcoch and Square, 1984). A reasonable hypothesis which might be made here is that F.E. suffered from a transitory inability to produce any consonants, which can be interpreted as a maturational lag in speech 'praxic abilities'. For F.E. the correct production of vowels was found more in monosyllabic than in bisyllabic and plurisyllabic words, and, more in final than in initial syllables. This transitory apraxia of speech includes symptoms which have been described in disorders of adults' use of previously acquired consonants (Mlcoch and Square, 1984) and also during normal consonant acquisition by children (Guyette and Diedrich, 1981).

F.E.'s *disfluency* at age 4:9 in two specific tasks, story-telling and answering questions, demonstrates the transitory disfluency phenomenon associated with the emergence of the use of consonants. The disfluency represents, in F.E.'s case, the effort necessary to process the sentences and articulate syntactic units. This disfluency is particularly marked at the beginning of words including a syntactic unit, and

never at the end. This brings to mind an observation made by many authors, but particularly by Bloodstein and Gantwerk, 1967; Bloodstein, 1974; Bloodstein and Grossman, 1981) that repetition or prolongation of sounds or syllables occurs at the beginning of the words in most cases and almost never at the end of a word. Stromata (1986) uses the term 'coarticulation' to refer to the transition between sounds and syllables, and also states that this process allows adjacent sounds to overlap so that the articulator movements necessary for different sounds meld together, or occur simultaneously. This transitory disfluency hypothesis, proposed here, implies that language disfluencies, in the early stages, are due to some type of difficulty in the execution of whole utterances and their component phrase structures. Thus, when most of the stop consonants had been mastered at age 5:5, F.E. was completely fluent. This is in accordance with most studies which report a gradual decline in disfluencies as age increases, particularly between the ages of 2 and 4 years (Yairi, 1981, 1982, 1983; Wexler and Mysak, 1982).

With regard to the classification of the disorder at the 'vocalic stage' (assessment at age 3:8 and 4:0), the analysis of test results and of spontaneous speech samples, from play sessions, leads us to consider the impairment as a rather general expressive one. It was true that F.E. started his connected speech at age 3:8 and 4:0, but MLU in morphemes could not be calculated because of the difficulties in recognizing and interpreting word boundaries, and the overuse of the vowel [a] as the initial syllable in bisyllabic and multisyllabic words. It was nevertheless striking to find that F.E. was able to control suprasegmental factors using a predominantly vocalic system, especially the syllabic structure of language and, probably, the duration of the vocalic sequence, incorporating both in emerging meaningful speech. Such a finding is consistent with those theories of phonological speech acquisition that posit the child as an active rather than passive learner (Kiparsky and Menn, 1977; Macken, 1979; Macken and Ferguson, 1983).

In the case reported here, F.E. overcame the usual constraint of CV use. At that stage the case might nevertheless be classified, because of the low MLU and the lack of morphemes, as a 'phonologic–syntactic' disorder (Rapin, 1983).

The process of acquiring the consonantal system between age 4:9 and 7:3 allows the diagnosis to be made that F.E. had a severely delayed speech disorder. But when the phonological aspect of F.E.'s consonantal stages of development are considered, (Ingram, 1976; Crystal, 1980; Grunwell, 1981; Edwards, 1983; Camarata and Gandour, 1984; Leonard and Brown, 1984), a striking number of similarities is seen with the usual process of acquisition of speech sounds; especially for the reduction of clusters of consonants particularly in spontaneous speech, the deletion of final consonants, fricatives made into stops and substitutions with fricatives; examples of substitution are of palatal voiceless [ʃ] for palatal voiced [ʒ], and alveolar voiceless [s] for alveolar voiced [z]. The findings that the voiced fricatives and some consonant clusters, the last acquired by French children (Chevrie-Muller and Le Breton, 1973; Chevrie-Muller *et al.*, 1973), were the only sounds which were consistently misarticulated by the child up to 7:3, pointed to the conclusion that no particular part of the articulatory apparatus can be implicated. At age 7:3 F.E. can be considered as suffering from a 'usual' but severe developmental language delay at the phonological level.

It became obvious, as the child's language developed, that he should be considered more as having a speech impairment than a language one, and classified as showing an almost pure phonological disorder. Netteblatt (1987) and Bishop and Edmundson

(1987) have emphasized this possibility of profile change in classification of developmental language impairment.

With regard to the problem of prognosis, it is well known, from longitudinal studies, that preschool language delay is a significant risk factor for later language and learning problems. This has been demonstrated equally well from 'non-screened groups' (i.e. a group of children with language delays, for example Aram and Nation, 1980; Aram, Ekelman and Nation, 1984; Bishop and Edmundson, 1987; Tallal, 1988) as from screened populations of preschool children (Stevenson, 1984; Silva, McGee and Williams, 1983; Silva, Williams and McGee, 1987). But claiming that language-delayed children are 'at risk' for further oral and written language abilities does not mean that all delayed children will be impaired at school age. Several authors have argued that there is better psycholinguistic and academic prognosis for children with normal non-verbal intelligence such as F.E. For example, Bishop and Edmundson (1987) found only 11% of children with cognitive impairment had a good language outcome by 5:6 compared with 44% of children with normal non-verbal cognitive performance.

Moreover, a number of studies have suggested that children with isolated articulation and speech problems have a better outcome in terms of reading and educational attainment than do children with language disorders (Stevenson, 1984; Hall and Tomblin, 1978; Bishop and Edmundson, 1987). One should emphasize that in the earliest stages of F.E.'s language acquisition, the speech delay was so severe that the actual language abilities may well have been concealed; the child having no means of demonstrating his lexical and morphosyntactic expressive abilities with such a reduced vowel system. The progressive and favourable modification of the 'language profile' offers some support for such an hypothesis.

Finally, one may conclude from this case report that there is a strong need for longitudinal studies in order to differentiate both usual and unusual language disorders. This would help to make more precise and refine the classification of childhood language disorders by stating a clear differential prognosis, which may occur during unusual language development because of the opportunity to follow 'changes of language profile' over time.

References

ARAM, D. M. and NATION, J. E. (1980) Preschool language disorders and subsequent language and academic difficulties. *Journal of Communication Disorders*, **13,** 159–170.

ARAM, D. M., EKELMAN, B. L. and NATION, J. E. (1984) Preschoolers with language disorders: 10 years later. *Journal of Speech and Hearing Research*, **27,** 232–244.

BISHOP, D. V. M. and EDMUNDSON, A. (1987) Language-impaired 4-year-olds: distinguishing transient from persistent impairment. *Journal of Speech and Hearing Disorders*, **52,** 156–173.

BLOODSTEIN, O. and GANTWERK, B. F. (1967) Grammatical function in relation to stuttering in young children. *Journal of Speech and Hearing Research*, **10,** 786–789.

BLOODSTEIN, O. (1974) The rules of early stuttering. *Journal of Speech and Hearing Disorders*, **39,** 379–394.

BLOODSTEIN, O. and GROSSMAN, M. (1981) Early disfluency: some aspects of their form and distribution. *Journal of Speech and Hearing Research*, **24,** 298–302.

BRUNET, O. and LÉZINE, I. (1981) *Echelle de développement de la première enfance*. II. Echelle complémentaire (Issy-les-Moulineaux: Editions Scientifiques et Psychologiques).

CAMARATA, S. and GANDOUR, J. (1984) On describing idiosyncratic phonologic systems. *Journal of Speech and Hearing Disorders*, **49,** 262–266.

CHEVRIE-MULLER, C. (1967) *Etude comparée de la réalisation phonétique chez un enfant de 4 ans et chez un adulte. Intérêt des techniques oscillographiques et spectographiques.* Mémoire présenté à l'Institut Phonétique de la Faculté des Lettres de l'Université de Paris.

CHEVRIE-MULLER, C. and LE BRETON, M. T. (1973) Etude de la réalisation des consonnes au cours d'une épreuve de répétition des mots sur des groupes d'enfants de 3 ans et 5 ans 1/2. *Revue de Laryngologie*, **94,** 109–152.

CHEVRIE-MULLER, C., SIMON, A. M., FLORENTIN, F. and OLIVIER, M. (1973) Epreuves destinés à apprécier le niveau phonologique de l'enfant. Etalonnage sur les classes d'âge 5 et 6 ans. Etude comparative des performances au cours des épreuves de répétition et de dénomination spontanée. *Revue de Neuro Psychiatrie Infantile*, **21,** 593–610.

CHEVRIE-MULLER, C., SIMON, A. M. and DECANTE, P. (1981) *Epreuves pour l'examen du langage* (Paris: Editions du CPA).

CHEVRIE-MULLER, C., SIMON, A. M., LE NORMAND, M. T. and FOURNIER, S. (1988) *Batterie d'évaluation psycholinguistique de l'enfant à 3 et 4 ans.* (BEPL) (Paris: Editions du CPA).

CRYSTAL, D. (1980) *Clinical Linguistics* (New York: Springer-Verlag).

EDWARDS, M. (1983) Disordered phonological systems: evidence from a case study. *Topics of Language Disorders*, **3,** 51–61.

FERGUSON, C. A. and FAREWELL, C. (1975) Words and sounds in early language. *Acquisition of Language*, **5,** 419–439.

FORMSBY, E. S., LOUGEAY-MOTTINGER, J. W., MAXFIELD, K. M. and FRIELD-PATTI, S. (1985) A follow-up study of language-impaired preschoolers. Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Washington D.C.

GRUNWELL, P. (1981) *The Nature of Phonological Disability in Children* (New York: Academic Press).

GUYETTE, T. W. and DIEDRICH, W. M. (1981) A critical view of apraxia in speech. In N. Lass (Ed.), *Speech and Language Advances in Basic Research and Practice*, Vol. 16 (New York: Academic Press), pp. 1–49.

HALL, P. K. and TOMBLIN, J. B. (1978) A follow-up study of children with articulation and language disorders. *Journal of Speech and Hearing Disorders*, **43,** 227–241.

HARRIS, B. (1963) *Children's Drawings as Measures of Intellectual Maturity: a revision and extension of the Goodenough Draw-a-Man test* (New York: Harcourt, Brace & World).

HODSON, B. W. (1980) *The Assessment of Phonological Processes* (Danville, Ill.: Interstate Printers and Publishers).

HODSON, B.W. and PADEN, E. P. (1981) Phonological processes which characterize unintelligible and intelligible speech in early childhood. *Journal of Speech and Hearing Disorders*, **46,** 369–373.

INGRAM, D. (1976). *Phonological Disability in Children* (New York: Elsevier).

JAKOBSON, R. (1941) *Kindersprache, Aphasie und allgemeine lautgesetre* (Langage enfantin et aphasie, translated by J. P. Boons and Radmida Zygouris, Arguments, 42 (Paris: Minuit, 1969).

KIPARKY, P. and MENN, L. (1977) On the acquisition of phonology. In J. Macnamara (Ed.), *Language Learning and Thought* (New York, Academic Press).

KLACKENBERG, G. (1980) What happens to children with retarded speech at 3? *Acta Paediatrica Scandinavica*, **69,** 681–685.

LE NORMAND, M. T. (1986) A developmental exploration of language used to accompany symbolic play in young, normal children (2–4 years old). *Child: Care, Health and Development*, **12,** 121–34.

LE NORMAND, M. T. (forthcoming) Language abilities in young, normal French speaking-children (2–4 years old): a psycholinguistic analysis.

LEITER, R. (1948) *The Leiter International Performances Scale*, (Chicago, Ill.: Stoetling).

LEONARD, L. B. and BROWN, B. L. (1984) Nature and boundaries of phonologic categories: A case study of an unusual phonologic pattern in a language-impaired child. *Journal of Speech and Hearing Disorders*, **49,** 419–428.

LEONARD, L. B. and SCHWARTZ, R. G. (1985) Early linguistic development of children with specific language impairment, In K. E. Nelson (Ed.), *Children's Language*, Vol. 5 (Hillsdale, NJ: Erlbaum), pp. 291–318.

LEONARD, L. B., SCHWARTZ, R. G., SWANSON, L. A. and LOEB, D. M. F. (1987) Some conditions that promote unusual phonological behaviour in children. *Clinical Linguistics and Phonetics*, **1**, 23–34.

MACKEN, M. A. (1979) Developmental reorganization of phonology: A hierarchy of basic units of acquisition. *Lingua*, **49**, 11–49.

MACKEN, M. A. and FERGUSON, C. (1983) Cognitive aspects of phonological development: Mode, evidence, and issues. In K. E. Nelson (Ed.) *Children's Language*, Vol. 4 (Hillsdale, NJ: Erlbaum), pp. 256–282.

MENN, L. (1971) Phonotactic rules in beginning speech. *Lingua*, **26**, 225–251.

MENN, L. (1983) Development of articulatory, phonetic and phonological capabilities. In B. Butterworth (Ed.), *Language Production: Development, Writing and Other Language Processes*, Vol. 2 (New York: Academic Press), pp. 3–50.

MLCOCH, A. and SQUARE, P. A. (1984) Apraxia of speech: articulatory and perceptual factors. *Speech and Language*, **10**, 1–57.

NETTELBLATT, U. (1983) *Developmental Studies of Dysphonology in Children* (Lund: CWK Gleerup).

PASQUIER, D. (1979) *Test de Lecture pour le Cours Préparatoire (TLCP), (Issy-les-Moulineaux: Editions Scientifiques et Psychotechniques).*

RAPIN, I. (1983) Developmental language disorders: nosologic considerations. In U. Kirk (Ed.), *Neuropsychology of Language, Reading and Spelling* (New York: Academic Press), pp. 155–184.

REY, A. (1959) *Test de copie d'une figure complexe* (Paris: Centre de psychologie appliquée).

RONDAL, J. A., BACHELET, J. F. and PÉRÉE, F. (1985) Analyse du langage et des intéractions verbales adulte-enfant. *Bulletin d'audiophonologie*, **5/6**, 507–536.

SCHERY, T. K. (1985) Correlates of language development in language-disordered children. *Journal of Speech and Hearing Disorders*, **50**, 73–83.

SCHRIBERG, L. D. and KWIATKOWSKI, J. A. (1980) *Natural Process Analysis: A procedure for phonological analysis of continuous speech* (New York: John Wiley & Sons).

SHRIBERG, L. D. and KWIATKOWSKI, J. A. (1988) A follow-up study of children with phonologic disorders of unknown origin. *Journal of Speech and Hearing Disorders*, **53**, 144–155.

SILVA, P. A., MCGEE, R. O. and WILLIAMS, S. (1983) Developmental language delay from three to seven years and its significance for low intelligence and reading difficulties at age seven. *Developmental Medicine and Child Neurology*, **25**, 783–793.

SILVA, P. A., JUSTIN, C., MCGEE, R. O. and WILLIAMS, S. (1984) Some developmental and behavioral characteristics of seven-year-old children with delayed speech development. *British Journal of Disorders of Communication*, **19**, 147–154.

SILVA, P. A., WILLIAM, S. and MCGEE, R. O. (1987) A longitudinal study of children with developmental language delay at age three: later intelligence, reading and behaviour problems. *Developmental Medicine and Child Neurology*, **29**, 630–640.

STEVENSON, J. (1984) Predictive value of speech and language screening. *Developmental Medicine and Child Neurology*, **26**, 528–538.

STOEL-GAMMON, C. (1983) Constraints on consonant vowel sequences in early words. *Journal of Child Language*, **10**, 455–457.

STROMATA, C. (1986) *Elements of Stutterings* (Ostemo, Mich: Atsmorts Publishing).

TALLAL, P. (1988) Developmental language disorders. In J. F. Kavanaugh and T. J. Truss, Jr (Eds), *Learning Disabilities: Proceedings of the National Conference* (Parkton, MD: York Press).

TYLER, A. and EDWARDS, M. L. (1986) Phonologically disordered preschoolers: At risk for later learning problems? Paper presented at the Annual Convention of the American Speech-Language-Hearing Association, Detroit.

VIHMAN, M. M. and GREENLEE, M. (1987) Individual differences in phonological development: ages one and three years. *Journal of Speech and Hearing Research*, **30**, 503–521.

WECHSLER, D. (1981) *Echelle d'intelligence de Wechsler pour enfants*, forme révisée. WISC. (Paris: Editions du centre de Psychologie appliquée).

WEIL-HALPERN, F., CHEVRIE-MULLER, C., SIMON, A. M. and GUIDET, C. (1983) *Evaluation des aptitudes syntaxiques chez l'enfant*, (Issy-les-Moulineaux: Editions Scientifiques et Psychologiques).

WEINER, P. (1975) The value of follow-up studies. *Topics in Language Disorders*, **5**, 78–82.

WEINER, F. F. (1979) *Phonological Process Analysis* (Baltimore: University Park Press).
WEXLER, K. and MYSAK, E. (1982) Disfluency characteristics of 2-, 4- and 6-year old males. *Journal of Fluency Disorders*, **7**, 37–46.
YAIRI, E. (1981) Disfluencies of normally speaking two-year-old children. *Journal of Speech and Hearing Research*, **24**, 490–495.
YAIRI, E. (1982) Longitudinal studies of disfluencies in two-year-old children. *Journal of Speech and Hearing Research*, **25**, 155–160.
YAIRI, E. (1983) The onset of disfluency in two- and three-year old children, a preliminary report. *Journal of Speech and Hearing Disorders*, **6**, 283–298.