Language Variation and Change, **12** (2000), 295–319. Printed in the U.S.A.
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Developmental data on a French sociolinguistic variable: Post-consonantal word-final /R/

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ABSTRACT

To begin, we review three theoretical problem areas in the field of research into phonological variation in children. Next, we present the results of a cross-sectional study of two groups of children, aged 6 to 7 years and 10 to 12 years, relating to the deletion of post-consonantal word-final /R/ in French (production and judgments of acceptability). In an experimental study, we then examine the mechanism involved in the learning of words with a variable /R/. Finally, the interpretation of the results within the framework of a cognitive conception of variation leads us to four conclusions: (i) children have a tendency to copy adult surface forms rather than to encode a variable rule; (ii) orthography causes the late encoding of certain variable /R/s; (iii) the establishment of linguistic factors precedes that of social factors; and (iv) age-related changes are not guided by the sociolinguistic value that groups consciously attribute to the variables.

Phonological variation has been the object of many studies in the field of sociolinguistic research. Despite undeniable advances based on the observation of adults and adolescents, developmental approaches to variation remain rare. This state of affairs is particularly marked in France, where variationist sociolinguistics is almost nonexistent (Gadet, 1996). Within this context, our contribution takes two directions. First, the observation of studies devoted to phonological variation in English-speaking children enables us to define three developmental issues that structure this field.[1] Second, the report of a survey and an experiment into the deletion of post-consonantal word-final /R/ in French children aged 6 to 12 years supplies data that can help us shed light on some of these issues.

THREE DEVELOPMENTAL ISSUES

The age of appearance of sociolinguistic patterns in their adult form

The age of appearance of sociolinguistic patterns in their adult form has been discussed by a number of researchers over the last three decades (e.g., Labov,

https://doi.org/10.1017/S095439450012304X Published online by Cambridge University Press

1964; Patterson, 1992; Reid, 1978; Roberts, 1994, 1997b; Romaine, 1984), although no consensus has been reached. For example, according to Roberts (1997b), the phonological and grammatical constraints of (t, d) deletion are acquired around 3 to 4 years of age, whereas Patterson (1992) argued that these same constraints do not influence the (ing) variable before the age of 6 to 7 years. We have two reasons for thinking that these attempts at age attribution are extremely risky. First, the age at which the sociolinguistic patterns for one phonological variable are established probably depends on the perceptual salience of the variants in question, their articulatory complexity, and their sociolinguistic value in a given community. Second, the way in which the question is posed is highly adultocentric (Patterson, 1992). Researchers are only interested in the regularities in children's variations (i.e., the age at which they take the same form as is found in adults). However, questions about the age of appearance of sociolinguistic patterns become more heuristic if they are reformulated in terms of the order of acquisition. Indeed, the question of whether the establishment of social factors precedes or follows that of linguistic factors is crucial if we are to understand the dynamics of development.

Developmental variation and sociolinguistic variation

Psycholinguistic studies of phonological development emphasize the very great intra-individual variability observed in the form of children's words. Gerken (1994) stressed the desire to treat this variability as a reflection of children's phonological representations rather than as a noise to be eliminated. Menn and Matthei (1992) surveyed the various sources of this variability: more detailed specification of the forms children reproduce through immediate imitation; fluctuations in attention; temporary alternation between an old form and a recently acquired form; effect of the insertion of the word in a linguistic context; competition between two simplification processes that apply to the same word; and different ways of mapping certain adult words into the canonical form. Before taking a developmental approach to variation patterns, it would seem necessary to consider the relationship between this developmental variation and the phonological variables of interest to sociolinguists. While pointing out the existence of partial similarities between children's variants and certain sociolinguistic variables, Ingram, Pittam, and Newman (1985) assumed that residual variation inherited from the period of acquisition is recycled as part of stylistic change. An early variability, which probably results from articulatory or cognitive factors, would partially escape such conditioning and would gradually be placed in the service of social goals (Chevrot, 1994; Romaine, 1984). This hypothesis is strengthened by the results reported by Patterson (1992), who observed that the range of variants of (ing) is broader and more dependent on coarticulation in children than in their mothers.

The developmental dynamics

The last issue requires us to consider learning modes and developmental change. Attention was first drawn to this issue in the form of a debate on age-linked de-

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velopment in the frequency of nonstandard variants (Romaine, 1984). It would appear that this question has been poorly formulated. Researchers have not considered that the use of nonstandard variants might change only in certain categories of young speakers or in certain types of interaction. In the final analysis, the major question is to identify not how the overall mass of nonstandard variants develops, but rather how their usage changes in each situation and for each category of speakers. To what extent do divergent developments account for the appearance of social differences during development? Once this distraction has been eliminated, we need to answer four questions concerning the dynamics of development.

The first question relates to the mechanism by means of which children encode variable units within their emergent phonological skills. In accordance with the position of Labov (1989), Roberts (1997b) suggested that 3- to 4-year-old children learn a variable deletion rule for (t, d) rather than limit themselves to case-by-case copying of adults' surface forms. Conversely, Wolfram (1989), in a study of children of the same age, found that variation in certain word-final nasals is subject to lexical conditioning, which is incompatible with the generalization implied by the rule. This debate is subject to important theoretical questions in psycholinguistics. Indeed, certain proposals emphasize children's ability to extract probabilistic constraints from the linguistic environment and to generalize these constraints, without it being necessary to postulate rule building in order to explain these generalizations (Plunkett, 1995; Seidenberg, 1997). These conceptions raise problems for both defenders of variable rules and their detractors, who doubt that the human mind is able to internalize probabilities.

The second question relates to the acquisition of the linguistic conditioning of phonological variations. Are we dealing with the learning of dialect features through the intermediary of the child's linguistic environment or with the emergence of universal articulatory and cognitive tendencies? Here, Roberts's data converge with Labov's arguments in support of the hypothesis of dialectal learning. This position leads Roberts (1997b) to accept that some of the phonological constraints that influence (t, d) deletion might be due to learning and not to the emergence of a universal articulatory tendency. As we shall see, our own data do not confirm these conclusions.

The third question relates to the establishment of the social factors of variation. According to Labov's hypothesis (1964, 1976), the tendency to limit the selection of nonstandard variants in formal situations does not appear until adolescence, when young speakers, exposed to a wide variety of usages, discover the social meaning of linguistic forms. This supposition is contradicted by studies showing that certain stylistic adaptations are acquired at the age of 3 or 4 years (Patterson, 1992; Roberts, 1994). Moreover, the hypothesis is largely incompatible with what is known about metalinguistic development. At the age of 3 or 4 years, children are capable of modulating certain aspects of their utterances as a function of the situation, even if these adjustments are simply the verbal facet of global behavioral modifications, which are largely unconscious and automatically associated with certain situations (Gombert, 1990). In short, it is probable that stylistic skills precede stylistic awareness of the social meaning of variants and situations (Patterson, 1992).

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The fourth question relates to the role of contact with written word forms as a developmental factor influencing the learning of variable phonological units and the establishment of sociolinguistic patterns. Even though there have been very few systematic studies of this point, a number of arguments have confirmed this hypothesis. Many historical linguistic studies have provided indications that diachronic changes and synchronic variations are influenced by spelling (Bright & Ramanujan, 1962; Levitt, 1978). We also know that children in the first years of primary school make spelling mistakes that transcribe dialect features (Labov, 1978; Treiman, Goswami, Tincoff, & Leevers, 1997). This tendency to reduce the difference between the phonological representation and the orthographical representation of the same word may also act in the opposite direction. In this case, children and adults tend to modify the phonological representation in order to harmonize it with the orthographical representation (Chevrot & Malderez, 1999).

Finally, this brief overview of sociolinguistic research into phonological variations in children suggests that there have been changes in the problem areas under consideration. During the 1960s and 1970s, the main issue was to determine the age at which the adult sociolinguistic patterns were established. During a second era, which started in the 1990s, certain studies (Foulkes, Docherty, & Watt, 1999; Patterson, 1992; Roberts, 1994, 1997b; Roberts & Labov, 1995) explored the question of developmental dynamism and proposed hypotheses concerning learning mechanisms. Thus, their objectives coincided with those of psycholinguistic approaches to phonological development. It would appear appropriate to compare sociolinguistic studies with research into phonological development conducted within a psycholinguistic framework. Our contribution is based on observations of the deletion of post-consonantal word-final /R/.

POST-CONSONANTAL WORD-FINAL /R/: A SOCIOLINGUISTIC MARKER

There are a number of facts to suggest that the deletion of post-consonantal word-final /R/—henceforth, (CR#)—has the function of a sociolinguistic marker. For centuries, notes on linguistic habits have attested to the existence of this variation and its social value. For example, according to Bourciez and Bourciez (1982:185), in the seventeenth century the pronunciation *suc(re)*, *vinaig(re)*, *coff(re)* was considered "vulgar." (CR#) deletion appears to belong to the category of variation that persists over centuries without undergoing any diachronic change (Kemp, Pupier, & Yeager, 1980; Labov, 1989). This type of variation favors a developmental approach because differences between age groups cannot be attributed to any diachronic change (Patterson, 1992). Studies conducted among adults have shown that the deletion of (CR#) is still relevant (Léon & Tennant, 1988).

Three studies of this variable relate specifically to adolescents and children. Laks (1980, 1983) observed /R/ variation in a variety of phonological contexts in a group of 6 adolescents (aged 14 to 15 years). The second study was an extensive study of 30 girls and 30 boys (aged 8 to 18 years), all speakers of Ontarian French (Thomas, 1986). The third study (Chevrot, 1996) provided a

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more specific description of the influence of reading aloud on the production and evaluation of (CR#) deletion in French children (aged 10 to 12 years). A number of points arise from these studies. First, in the two varieties of French considered here, the presence of a consonant at the start of the following word favors (CR#) deletion. Second, both in France and in Ontario, a comparison of reading and conversational situations shows that this deletion is sensitive to the communication situation. Third, the variation reacts to certain social factors: the status of the parents in France, sex, and place of residence in Ontario. Finally, little information is available at the developmental level. At most, we are able to state that the effects of right-hand context, social environment, and reading situation are already established at adolescence.

In the light of these results, our own study takes two different directions. A cross-sectional study investigates the developmental changes before the onset of adolescence. This study examines the production of (CR#) in two age groups: 6 to 7 years and 10 to 12 years. These data are complemented by a study of judgments of acceptability of the two variants. Special attention is given to the interactions between age and three factors: right-hand phonological context, context of communication, and social status of the parents. The last section breaks with the methodological habits currently employed in the sociolinguistic field. Using an experiment involving the learning of pseudowords containing (CR#) by 9-year-old children, we explore how the variable units are acquired as well as the impact of literacy on the acquisition process.

PRODUCTION: CROSS-SECTIONAL OBSERVATION

Method

The sample taken for the cross-sectional study consisted of 60 children, all attending the fifth year (10 to 12 years) or the first year (6 to 7 years) of primary school and living in a rural valley of the French Alps. Random sampling was performed in such a way that the speakers were equally distributed in terms of sex and two social environments, defined by a combination of the professions of the two parents. In the "worker" environment, one parent was a manual worker, without any managerial responsibility, while the other had a similar profession or no profession. In the "manager" environment, one parent held a group 3 profession (managers and high-level intellectual professions), as defined by the National Institute for Statistics and Economic Studies, while the other practiced a profession in the same group, a profession of groups 4 or 5 (intermediary professions), or no profession. Each environment was represented by 9 girls and 9 boys among the 36 children aged 10 to 12 and by 6 girls and 6 boys among the 24 children aged 6 to 7 years.

The utterances were recorded in two situations designed to elicit the use of words containing (CR#). The first situation can be defined as a dialogue about a task between the child and the researcher. The task consisted of identifying the missing elements (*fenêtre* 'window', *soixante-quatre* 'sixty-four', *poutre* 'beam', *lettre* 'letter', *quatre* 'four', *feutre* 'felt pen', *livre* 'book') in a series

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TABLE 1. *Formality of research situations*

	Dialogue about a task (informal)	School exercise (formal)
Presentation of situation	presented as a game	presented as a task
Turn to speak	negotiated	imposed by instructions
Researcher's attitude	relaxed (treats, etc.)	distanced
Aim of messages	to transmit content	to reproduce a model
Syntactical/lexical	elaborated by the child	imposed by the instructions

of 20 pictures with reference to a model that contained all of these elements. Moreover, the pictures were designed so that the items were associated with a qualifying adjective that started with either a vowel or a consonant. As a result the children produced words including (CR#) in different phonological environments. For example, where the missing element was an open window, the statement was *Sur ce dessin, il manque une fenêtre ouverte* 'There's an open window missing in this picture'. In this case, the variable /R/ was followed by a vowel. If the missing element was a closed window, then the variable /R/ was followed by a consonant (*fenêtre fermée*). The second task can be defined as a school exercise. The researcher presented the pictures used in the first situation one by one and asked the children to enter the name of the drawn object in a predefined sentence: "This is a . . . ." Even though these two situations belong to the formal part of the stylistic range, six differences allow us to assert that the style is more formal in the school exercise than in the dialogue about a task (see Table 1).

In fact, the young speakers sometimes dissociated the word-final /R/ from the following adjective. This could be done by interposing a pause between the noun and the adjective or by omitting the adjective itself. The data we gathered therefore contain a non-negligible number of /R/s followed by a pause.

Using this protocol, we were able to gather a set of 6,854 possible occurrences[2] of (CR#), all of which were transcribed and classified in one of three categories: certainty of deletion, certainty of conservation, or indecision (this last class represented less than 2% of the total). Two phoneticians who were independent of the research listened to the recordings of two young speakers selected at random. Their task was to assign the possible occurrences of (CR#) to one of these three categories. The percentage agreement between the judges' transcriptions and our own ranged between 85% and 88%.

We decided to group /R/ preceding a vowel together with /R/ preceding a pause in the same category for two reasons. First, deletions are approximately 6 times less frequent before a pause and before a vowel than before a consonant. Second, the phonological mechanisms are different. Approximately 70% of the /R/ conservations before a consonant are accompanied by the insertion of a [ə] (e.g., [fənɛtRəfɛRme]). Conservation of the /R/ in this phonological context involves the maintenance not only of a segment, but also the addition, in the

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TABLE 2. *Interaction of situation, age, and right-hand phonological context*

	6–7 years		10–12 years	
	Dialogue	Exercise	Dialogue	Exercise
C-#C	51.1	59.0	55.1	22.2
C-#V, C-#§	7.6	12.4	7.6	8.3

spoken word chain, of the syllable, the nucleus of which is the [ə]. We therefore decided to categorize the observed variants into two phonological contexts: on the one hand, cases in which the word containing the variable precedes a consonant-initial word, irrespective of whether (CR#) is followed by a [ə], and, on the other hand, cases in which the word containing the variable precedes a pause or a vowel-initial word. After performing this categorization, we calculated an /R/ deletion score[3] for each speaker in each context (consonant vs. vowel or pause) and for each situation (dialogue vs. exercise). These data were analyzed using analysis of variance (ANOVA). In cases where the conditions guaranteeing the validity of this method were not satisfied, we used a nonparametric test.[4]

Two stages are involved in the analysis of the results. First, we examine how the effect of style and the effect of right-hand phonological context develop with age. This developmental perspective helps us to identify a general acquisition pattern. Next, we consider whether the different social groups differ or resemble one another in the general developmental tendency.

A general acquisition pattern

The ANOVA shows that the three factors have a significant effect on the deletion scores. Deletions are globally more frequent in the younger than in the older subjects, more frequent in the dialogue situation than in the exercise situation, and more frequent before a consonant than before a vowel or a pause. Moreover, an evaluation of the strength of the simple effects using the R^2 coefficient (Abdi, 1987) shows that the variability due to phonological context ranges between 21% and 57% of the total variability ($p < .01$), that due to situation ranges between 1% and 12%, and that due to age ranges between 3% and 19%. The effect of phonological context on (CR#) deletion is therefore greater than the effect of situation or age. Moreover, the three-variable interaction is significant. We break down this interaction using post-hoc pairwise comparisons[5] (Table 2).

The effect of phonological context persists whatever the age or the situation: at 6 to 7 years, as at 10 to 12 years, whether as part of a dialogue or part of an exercise, the /R/ is more frequently deleted before a consonant than before a vowel or a pause. The effect of situation is significant only in the 10- to 12-year-old group when the /R/ precedes a consonant. The mean of the deletion rates then falls from 55.1 in the dialogue situation to 22.2 in the exercise situation. In the

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TABLE 3. *Developmental pattern in each social environment, C-#C context*

	6–7 years		10–12 years	
	Dialogue	Exercise	Dialogue	Exercise
Worker environment	65.3	59.7	65.7	27.8
Manager environment	37.0	58.3	44.6	16.7

other three cases, the differences between the two styles are not significant. The effect of age can be observed by means of four pairwise comparisons (51.1 vs. 55.1; 59 vs. 22.2; 7.6 vs. 7.6; and 12.4 vs. 8.3). Among these four comparisons, the only significant difference appears in the exercise situation when the /R/ precedes a consonant. In this case, deletions are more frequent in the 6- to 7-year-old group ($M = 59$) than in the 10- to 12-year-old group ($M = 22.2$).

Finally, we see a coherent developmental pattern emerge. The impact of phonological context is the strongest and appears to be independent of age and style. Since it has already been established at 6 to 7 years, it is also earlier to emerge than the effect of style. Between 6 to 7 years and 10 to 12 years, children learn to reduce the frequency of deletions, but only in the more formal of the two situations and when the /R/ precedes a consonant. This learning is exhibited in the appearance, in the older subjects, of a stylistic adaptation, which is not present in the younger subjects.

Changes in the general pattern as a function of social environment

We now consider whether this general pattern is shared by the two social environments. First, we examine the case in which the /R/ precedes a consonant (Table 3). An ANOVA performed on the data for the worker environment shows that the interaction between age and situation is significant. In the dialogue situation, the means of the deletion rate do not change between 6 to 7 years (65.3) and 10 to 12 years (65.7). In the exercise situation, however, deletions are significantly less frequent at 10 to 12 years (27.8) than at 6 to 7 years (59.7). This age-related development is manifested, at 10 to 12 years, by the appearance of situation-dependent adaptations that do not exist at 6 to 7 years (the difference between 65.7 and 27.8 is statistically significant, whereas the difference between 65.3 and 59.7 is not). In the manager environment, the breakdown of a significant interaction between age and situation possesses a somewhat similar organization. In the dialogue situation, the mean at 6 to 7 years (37.0) is not significantly different from the mean at 10 to 12 years (44.6). In contrast, in the exercise situation, deletions are less frequent in the older subjects (16.7) than in the younger subjects (58.3). If we consider the effect of situation in each age group, we observe an unexpected result. At 6 to 7 years, the deletion of the /R/ is significantly more frequent in the exercise situation (thought to be more formal) than in

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TABLE 4. *Developmental pattern in each social environment, C-#V or C-#§ context*

	6–7 years		10–12 years	
	Dialogue	Exercise	Dialogue	Exercise
Worker environment	11.2	14.2	12.9	15.4
Manager environment	4.0	10.7	2.3	1.1

the dialogue situation (thought to be less formal). However, at 10 to 12 years, the pattern conforms to the results habitually observed in adults, with deletions being more frequent in the dialogue situation.

To summarize, when the word-final /R/ precedes a consonant, the general developmental pattern seems to be the same in the two social environments. Both among the children of managers and those of workers, a similar tendency to limit the frequency of deletions in the more formal of the two situations is established between 6 to 7 years and 10 to 12 years. This similarity of the acquisition pattern in the two environments also leads to the reproduction, at 10 to 12 years, of social differences already established at 6 to 7 years. On the one hand, the social differences are only significant in the less formal of the two situations, in which deletions are more frequent in workers' children than in managers' children. On the other hand, this organization remains identical at both ages considered.

We now examine the case in which the right-hand context of (CR#) is a vowel or a pause (Table 4). An ANOVA performed on the data for the worker environment shows that the simple effects of age and situation and the interaction between these two factors are not significant. In the C#V or the C-#§ context, the children in this environment do not react to the situation, whatever their age, and there is no difference between older and younger subjects. A similar analysis conducted on the data for the manager environment yields different results. In the dialogue situation, the means of the deletion rate cannot be considered different at 6 to 7 years (4.0) than at 10 to 12 years (2.3). In contrast, in the exercise situation, this mean value falls significantly from 6 to 7 years (10.7) to 10 to 12 years (1.1). This fall-off results from an age-related change in situational adaptation in children from the manager environment. At 6 to 7 years, they exhibit the same inverse reaction as in the C-#C context, since deletions are more frequent in the more formal situation (10.7) than in the less formal situation (4.0). However, this unexpected organization disappears in the 10- to 12-year-old group, where the two scores (2.3 and 1.1) are low and equivalent in both situations.

In brief, in contrast to the observations made in the C-#C context, the general acquisition pattern is not shared by the two social environments when the (CR#) precedes a vowel or a pause. Between the ages of 6 to 7 years and 10 to 12 years, only the children from the manager environment learn to limit the frequency of deletions in the more formal of the situations. This developmental change, which is limited to only one of the social environments, also leads to the appearance of

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social differences that do not exist in the 6- to 7-year-old group. Despite the small difference between the mean values for the two social classes in the dialogue situation (4.0 and 11.2), the effect of social environment is not significant in either of the two situations in the 6- to 7-year-old group. In contrast, at 10 to 12 years, this influence is exhibited tendentially ($p < .10$) in the dialogue situation, and its impact becomes significant in the exercise situation.

JUDGMENTS OF ACCEPTABILITY: CROSS-SECTIONAL OBSERVATION

Awareness of the sociolinguistic value of the variants is one explanation for the apparent control of variability in the older subjects. We therefore investigated the way in which children aged 6 to 7 and 10 to 12 judge the acceptability of variants representing conservation and deletion.

Method

The sample of children involved in the study of judgments of acceptability of the variants included 24 children aged 10 to 12 and 24 children aged 6 to 7, divided between the two social environments (worker and managerial) and the two sexes.

With the 10- to 12-year-old group, we used the matched guise method. The recorded utterances presented to the children for judgment simulated a conversation between a teacher and a pupil during a mathematics lesson. The recording had been made using the voices of two 11-year-old boys, two girls of the same age, and one adult. The four young helpers had been informed of the nature of the variation and were able to produce conservations on request. They recorded 12 possible occurrences of (CR#) in the word *quatre* 'four', which appeared in 12 short replies: in 4 occurrences it preceded a pause, in 4 occurrences it preceded a vowel, and in 4 occurrences it preceded a consonant. In each group, there were 2 conservations and 2 deletions.[6] In the data gathered as part of the cross-sectional study of productions, 70% of the /R/ conservations in the C-#C context were accompanied by a [ə]. We considered the insertion of a [ə] to be typical of /R/ conservation in this context, and we respected this tendency in the variants proposed for children's judgments.

At the start of each session, the following verbal instruction was given to each child: "You are going to hear discussions between a teacher and his pupils recorded in the classroom. For each pupil, you must say whether he or she tends to speak well or badly." All of the listeners wrote their judgments on a response sheet by circling one of the two options: speaks quite well/speaks quite badly. Each judgment was made while listening to the same sequence twice in succession.

In the case of the 6- to 7-year-old group, it proved impossible to use the matched guise method. The task of judging recorded words rather than a flesh-and-blood speaker confused the younger subjects, and we had to adopt a different approach. During an initial training phase, the researcher told the children that they were about to take part in a game during which he would deliberately pronounce cer-

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TABLE 5. *Favorable judgments of conservations and deletions of* [R]

	6–7 years		10–12 years	
Position of /R/	Conserved	Deleted	Conserved	Deleted
C-#C	96%	79%	69%	67%
C-#V	79%	58%	71%	21%
C-#§	83%	12%	80%	39%

tain words badly, and that it was their task to identify when the adult had "spoken well" and when he had "spoken badly." The researcher spoke the names of objects present in the room, while pointing at them with his finger, and on occasion deformed their pronunciation. More precisely, the deformations were either syllabic permutations of bisyllabic words or substitutions for initial or internal syllable onsets. These were mixed with correct pronunciations. The purpose of the training phase was to transform a task that might be unsettling for younger children (i.e., to correct the pronunciation of an adult) into a game. At the end of the training phase, the researcher proceeded with the actual experimental pass. He pronounced, in a random order, 6 occurrences of (CR#) in the word *fenêtre*: in 2 occurrences it preceded a consonant (*une fenêtre fermée* 'a closed window'), in 2 occurrences it preceded a vowel (*une fenêtre ouverte* 'an open window'), and in 2 occurrences it was at the end of the utterance (*ferme la fenêtre!* 'Shut the window!'). For each pair, the /R/ was conserved in one of the utterances and deleted in the other. In each case, the child had to judge whether the researcher had spoken well or badly.

Results

For each speaker and for each of the three contexts (C-#C, C-#V, C-#§), we counted the number of favorable responses ("well spoken") as a function of whether [R] was present or deleted in the heard utterances. The percentages of favorable responses are recorded in Table 5. An ANOVA conducted for each age group establishes the following results. For the 6- to 7-year-old children, conservations and deletions of /R/ are not judged differently when the phoneme is followed by a consonant or a vowel. In these two contexts, favorable judgments are equally frequent, whatever the status of the /R/ in the recorded utterances: the difference between 96% and 79%, on the one hand, and 79% and 58%, on the other hand, is not statistically significant. In contrast, when the /R/ occurs before a pause, favorable judgments are significantly more numerous when it is conserved (83%) than when it is deleted (12%). For the 10- to 12-year-old children, the judgments also depend on the right-hand phonological context. Before a consonant, judgments do not differ as a function of whether the /R/ is conserved (69%) or deleted (67%). In contrast, they are more favorable to the conservation

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of /R/ when the phoneme precedes a vowel or when it precedes a pause. The value 71 is significantly different from 21, as is the value 80 from 39. Finally, the effect of social environment is not significant in either age group. The absence of this effect remains stable, whatever the phonological context to the right of the word-final /R/. It would appear that, as of 6 to 7 years, (CR#) exhibits one of the stable tendencies revealed by the study of variation: convergence of the evaluation norms despite the diversity of usage (Labov, 1976).

The changes observed between the age groups relate to the phonological contexts in which the deletion of the /R/ is both perceived and judged. At age 6 to 7 years, identification of the variants is only possible when the /R/ stands at the end of the utterance. At 10 to 12 years, this possibility extends to the case in which the /R/ precedes a vowel. When the /R/ precedes a consonant (i.e., the context in which deletion is most likely), judgments do not distinguish between the two variants, whatever the age. It should be noted that a conserved /R/ followed by a [ə] in the C-#C context results in a [CRV] surface sequence (i.e., [CRə]) identical to that produced by its conservation in the C-#V context. The fact that judgments at 10 to 12 years differ for the two contexts suggests that at this age listeners are influenced not by the surface sequences but by the phonological environments.

DISCUSSION: RETURNING TO THE DEVELOPMENT-RELATED ISSUES

To conclude this cross-sectional investigation (production and judgments of acceptability), we discuss the results in relation to some of the issues presented earlier. With regard to the order of appearance of the variation patterns, two indications suggest, though without providing irrefutable proof, that the effect of phonological context precedes the establishment of social factors. First, the effect of phonological context is greater, in terms of the amount of variance it accounts for, than the effect of situation. Second, the analysis of the general pattern shows that the effect of phonological context is present in both situations at the age of 6 to 7 years, and that it undergoes no change between then and 10 to 12 years. The same is not true for the influence of situation and social environment, which develops with age and depends on phonological context at 10 to 12 years. This configuration is compatible with the hypothesis that social factors are superimposed on an already established phonological conditioning, presumably the manifestation of general articulatory constraints.

When applied to the question of developmental dynamics, the results illustrate the role of adaptation to the situation. It is very clear that the acquisition of an ability to limit the frequency of (CR#) deletions in the more formal situation is responsible for all the changes between 6 to 7 years and 10 to 12 years. If this acquisition is shared by the two social environments, as is the case before a consonant, then the social differences in place at 6 to 7 years would be transposed to the 10- to 12-year-old group. Conversely, if this acquisition is limited to children of the more privileged social environment, as is observed before a vowel or a

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pause, then the social differences would appear during the course of development. Moreover, two results suggest that the age-related progress in stylistic adaptation does not depend on an improvement in the ability to formulate judgments of acceptability concerning the variants. First, at 10 to 12 years, the speakers show adult-like situational adaptation in the C-#C context, whereas their judgments fail to differentiate between the two variants in this phonological context. Second, the developmental changes found in the acceptability test consist of an extension of the phonological contexts in which the judgments are normative: before a pause at 6 to 7 years and before a pause and a vowel at 10 to 12 years. We have observed that this extension is shared by children from both social environments, whereas the age-related limitation of deletions before a vowel or a pause in the more formal situation is observed only in the more privileged social environment.

Finally, two factors may account for the inverse stylistic reaction of the youngest subjects and the emergence of an adult-like situational adaptation: on the one hand, modifications in the categorization of situations and interactions as a function of their formality, and, on the other hand, changes in attentional control.[7] Our observation procedure does not permit us to arrive at any definitive conclusion on this point.

Since most of its progress has been based on surveys performed in ordinary speaker environments, variationist sociolinguistics has placed the focus on the external validity of its results. This methodological choice comes up against certain limits when verification of precise hypotheses makes it necessary to control the variables more closely. Thus, Labov (1976) or Dressler and Wodak (1982) used experimental data to prove the role of attention and auditory feedback in the selection of variants. The influence of spelling in the learning of variable phonological units also numbers among the questions that require observational procedures, which guarantee a high level of internal validity. The experimental procedure that we present here tests a number of hypotheses relating to the learning of (CR#).

THE LEARNING OF (CR#) AND THE INFLUENCE OF SPELLING: AN EXPERIMENT

A series of results (Chevrot, 1998) suggest that learning the written form of the conjunction *parce que* 'because' leads young speakers (around 8 years) to add an /R/ to its phonological representation. This fact is corroborated by historical data: the forms of *parce que* have lost their original etymological [R] in the majority of French dialects, which are largely or entirely unwritten.

There is an explanation for this relationship between knowing the spelling of a word and updating its phonological representation. In effect, a number of studies involving both adolescents and adults have shown that the [R] is deleted in most occurrences of *parce que* (Léon & Tennant, 1988; Thomas, 1986). This high frequency of deletion might explain why young children do not perceive the presence of an [R] in forms of the conjunction encountered during early linguistic

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exchanges. Only contact with the letter *r* in the orthographic representation of *parce que* and its processing in reading or copying would lead them to encode a variable /R/ in the phonological representation of *parce que* around the age of 8. However coherent this explanation might be, it is nevertheless the case that the correlations issuing from the research can be interpreted in a variety of ways and are not able to prove a causal link between two developmental events that have been shown to occur at a similar stage of development. Experimental verification based on the learning of pseudowords should therefore corroborate the interpretations from the survey-like observation.

Hypotheses

Our experiment was designed to test three hypotheses. According to the first hypothesis, learning and using the written form of certain words should allow young speakers to update their incomplete phonological representations in which a phoneme that is very often deleted in the linguistic environment is missing. According to the second hypothesis, infrequent words learned through exposure to written material (reading, writing) should be pronounced differently from words acquired through contact with the spoken language. Since the phonological representation of these words is deduced from an orthographic representation, their pronunciation should be more stable and the phonemic deletions less frequent, quite independently of the sociolinguistic, articulatory, or perceptual factors that otherwise encourage variation. Finally, as this experiment is based on learning of pseudowords that contain (CR#), it should provide us with information about the way in which the mechanism responsible for the variation processes new words. The key question is, does this mechanism generalize the variability to a completely new lexical item including (CR#)?

Method

Children in the third year of primary school (8 to 9 years), randomly distributed into three groups, learned three pseudowords designating imaginary animals, which were represented by pictures. The written forms of the pseudowords were *quaçontre*, *bydeincre*, and *maullopre*; they were pronounced, respectively, as [kasɔ̃tR], [bidɛ̃kR], and [molɔpR]. Each pseudoword consisted of 9 letters and possessed a spoken syllabic structure of the CVCVCC type. They included a (CR#), which was preceded by a voiceless obstruent: /t/, /k/, or /p/.

The learning of pseudowords, performed individually over four sessions distributed across four successive half-days, took different forms in the three groups of children. The “oral” group learned the pseudowords in the oral mode only; they listened to two types of recording. In the first type of recording, the heard statements described a landscape drawn on a poster in which the imaginary animals were placed within a medieval environment. These statements were of the form *Près du château, il y a un bydeincre blanc. A côté de la princesse, il y a un maullopre bleu*, etc. ‘Next to the castle, there is a white bydeincre. Next to the princess there is a blue maullopre’, etc. In the second type of recording, the children looked at cards representing each of the imaginary animals, and at the same

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time they heard a recorded statement naming each of the animals: *un bydeincre blanc, un maullopre bleu,* etc. 'a white bydeincre, a blue maullopre', etc. In the recordings, each pseudoword was presented with the /R/ conserved in a quarter of the occurrences and deleted in the remainder. The subjects in the "oral–written" group learned the pseudowords in both the oral and written modes. They listened to the same recordings as the oral group did during the first two learning sessions. In the third session, this experience was complemented by contact with the written form of the pseudowords, which evidently contained the letter *r,* as part of copying and silent reading exercises. The subjects in the "written" group learned the words in the written mode only. As of the very first session, they processed the written form of the words through copying and silent reading tasks. It should be emphasized that the written statements that were read or copied by the children were the orthographic transcriptions of the heard statements. Moreover, every occurrence of the (CR#) in the pseudowords was in the C-#C phonological context, and the first consonant of the following adjective was /b/: *bydeincre blanc/bleu* 'white/blue bydeincre'. When the /R/ was conserved in the recordings heard by the oral group and the oral–written group, the /R/ was accompanied by a [ə]. Precautions were taken to ensure that each child came into contact with each pseudoword the same number of times: eight contacts in each of the four learning sessions.

At the end of each training session, each group was asked to perform two oral production tasks. These tasks were intended to record the progress made in learning the lexical representations of the pseudowords, and as such they should favor the surface presence of the underlying phonological units, a condition most frequently fulfilled in formal situations. Initially, the children had to produce 16 occurrences of each pseudoword through the oral naming of the pictures. The occurrences for production were inserted in a phonological environment identical to the one the children experienced during the training session (i.e., C-#C with a /b/ as the right-hand consonant). In a second task, each child had to syllabify each pseudoword twice.[8] This task not only required sustained attention to the phonological material, but also limited the effect of articulatory constraints, which may result in the nonrealization of a phonological unit. In both the naming and syllabification tasks, the pictures representing the animals were presented to the children in a random order.

The protocol was presented in full to a sample of 48 children (16 per group). The oral data obtained from the 192 recordings were transcribed into IPA. A set of conventions was drawn up in order to standardize the decisions taken by the different transcribers.

Results

Two scores were calculated in order to quantify the data from the two production tasks. For the naming task, we calculated an individual conservation percentage, which represented the number of forms produced with a word-final [R] as a proportion of the total number of forms produced (Table 6). This percentage, which was calculated for each pseudoword and for the naming sessions following the

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TABLE 6. *Naming task: mean of the individual /R/ conservation percentages*

	Oral Group			Oral–written Group			Written Group		
	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4
quaçontre	48%	49%	45%	34%	85%	84%	91%	94%	87%
maullopre	37%	37%	45%	12%	69%	71%	83%	92%	93%
bydeincre	58%	66%	58%	35%	81%	82%	91%	91%	94%

TABLE 7. *Syllabification task: mean of the individual /R/ conservation scores*

	Oral Group			Oral–written Group			Written Group		
	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4
quaçontre	0.47	0.56	0.67	0.43	0.93	0.87	0.87	0.88	0.88
maullopre	0.44	0.38	0.44	0.06	0.81	0.69	0.87	0.94	0.94
bydeincre	0.73	0.75	0.69	0.43	0.93	0.81	0.93	0.93	0.94

last three training sessions, was evaluated in each case on the basis of 16 occurrences per subject. For the syllabification task, which made explicit the entire set of phonemes present in the phonological representation, we calculated an individual score for each word and for each test following the last three training sessions. To do so, we used the following criterion: 1, if at least one of the syllabified forms out of the two contained an [R]; 0, if not (Table 7).

The use of nonparametric tests reveals the following tendencies. The expected equivalence between the oral group and the oral–written group after the first two sessions is not observed, even though the subjects were randomly assigned to these groups and neither of the groups had had contact with the written word at this stage of the protocol. In effect, at the end of session 2, the /R/ in the item *maullopre* is conserved significantly less frequently by the subjects of the oral–written group than by those of the oral group, both in oral production (37% and 12% in Table 6) and in syllabification (0.44 and 0.06 in Table 7). This fact, which is undoubtedly the result of a sampling bias, makes between-group comparisons difficult. However, it does not stop us from observing the degree of learning within each group.

For both the oral group and the written group, the scores indicating the presence of an [R] in the naming task and the syllabification task undergo no significant change between session 2 and session 4, whatever the pseudoword under consideration. In contrast, for the oral–written group, the values increase from session 2 to session 3 (during which the written form is introduced) and then level off between session 3 and session 4. Friedman's test shows this change to be statistically significant for each of the three pseudowords, both in naming and in syllabification. As of session 2, the scores obtained by the written group are very close to the maximum value of 100 for naming and 1 for syllabification. Specifically, of the nine mean percentages for conservation obtained from this group in the naming task (Table 6), eight are greater than or equal to 87%, whereas none of the means of the oral group or oral–written group reach this value. We observe an analogous tendency in connection with the means for the syllabification task.

In brief, only the oral–written group makes any advance when faced with the written form of a word. If the written group fails to make progress, it is because this group has already achieved maximum performance in session 2. As for the oral group, its means in sessions 3 and 4 remain close to the values obtained in session 2.

This calculation of the mean conservation rates during the naming task (Table 6) masks a question of crucial importance raised by the following alternative interpretation: namely, these means might be the result of individual conservation percentages which generally differ from 0 and 100. If this is the case, we must accept that the speakers have encoded a variable /R/ in their lexical representations during the course of learning. Alternatively, these means might be the result of individual percentages which are generally equal to 0 or 100. In this case, we must conclude that the speakers have learned one of two phonetic variants: the one with an [R] or the one without. We consider this question on the basis of the

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data presented in Table 8, in which the number of speakers achieving a score of 0 or 100 or an intermediate score is presented by word, group, and session.

Clearly, the general tendency is to memorize one of the heard pronunciation variants rather than to encode the variability in the lexical representation during learning. Even though the children in the oral and oral–written groups have heard the variant with [R] and the variant without [R] for each of the three pseudowords, their conservation percentages per item are equal to 0 or 100 in approximately 81% of the cases presented in Table 8. In the remaining 19%, the speakers have directly encoded a variable /R/ in their lexical representation during learning. For their part, the children in the written group have had contact only with the written form of the pseudowords (where the letter *r* is stable). Even though they have never perceived a variable auditory input, a small minority of them do succeed in producing *quaçontre, bydeincre*, and *maullopre* variably with and without [R].

DISCUSSION: RETURNING TO THE HYPOTHESES

The main tendencies are compatible with the hypotheses relating to the influence of spelling on the variation of /R/. The results for the written group indicate that a pronunciation deduced from a stable orthographic representation tends towards a stability that corresponds to the nonvariability of phonemes that can be deleted in other words in the language with the same articulatory configuration and the same sociolinguistic value. As Chevrot and Malderez (1999) suggested, the interactive activation relations established between phonological units and orthographic units in the course of learning the spelling of a word contribute to the stability of the phonological coding mechanisms[9] during the word's oral production. This result provides an answer to the questions posed by Dell (1982) concerning the learnability of lexical exceptions to the optional deletion rule. In effect, a child who hears a word in which the /R/ is conserved is unable to decide whether this represents the ordinary nonapplication of an optional rule or whether it is a specific manifestation of the word's status as an exception. It is probable that infrequent words, which are precisely those that form exceptions to the deletion rule, are primarily encountered in their written form. This fact alone would be sufficient to explain their specificity, without it being necessary to postulate that children identify and memorize a list of exceptions.

The results relating to the oral–written group suggest that late learning of the orthographic representation of a word allows young speakers to complement the phonological representation with a phoneme that is often deleted in the linguistic environment. It is important to note that orthographic influence on phonology acts immediately as soon as learning of the written form commences (session 3).

The last result relates to children's tendency to favor one of the two heard variants rather than to encode a variable /R/ in their phonological representation. The results of the cross-sectional survey showed that, as of 6 or 7 years, children's language skills contain a mechanism, which may take the form of a rule or some other form, that results in the deletion of word-final /R/. It is therefore certain

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TABLE 8. *Number of speakers by percentage of conservation: 0, 100, other value*

	Oral Group			Oral–written Group			Written Group		
	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4	Session 2	Session 3	Session 4
quaçontre									
0	8	7	4	7	2	2	1	1	2
100	6	5	6	3	11	12	13	15	14
Other	2	4	5	3	3	1	1	0	0
maullopre									
0	9	8	7	14	3	4	2	0	1
100	4	4	5	1	7	9	9	12	13
Other	3	4	4	1	6	3	4	4	2
bydeincre									
0	6	4	6	8	2	2	1	1	1
100	9	8	9	4	10	12	12	13	14
Other	1	4	1	3	3	2	2	2	1

that the 48 children, aged 8 to 9, who took part in the experiment possessed such a mechanism, even before learning the pseudowords. Thus, the experiment does not claim to simulate the period during which such a mechanism is constructed. Instead, it reproduces the situation in which new words are presented as input to a mechanism that is already in place. The fact is, this mechanism is unaware of these new items in a majority of children, whose behavior can be summarized as follows: either they have not encoded the /R/ in the phonological representation, in which case it clearly never appears in their utterances, or they have encoded it, in which case it is categorically present in the productions. It appears unlikely that, in these children, the mechanism in question can be represented by a rule that is regularly applied to an independent lexicon. Rather, the tendency to conserve the encoded /R/ in newly acquired words suggests that the potential for variation is a lexical property. It remains the case that this mechanism possesses a limited capacity for generalization, as indicated by the minority of cases where the variable segment was encoded or by the existence of variation in certain children in the written group who had not heard the new words. This means that some children processed pseudowords that they had just learned by means of analogy to words with a variable /R/ that they already knew.

Finally, these results lead us to make two conclusions with regard to the encoding of variable units. First, it appears that encoding continues up to a relatively advanced age, and that it occurs in response to the written forms of words. Second, our data cast doubt on the position of Roberts (1997b), who argued that 3- to 4-year-old children directly acquire a variable rule in response to a variable input. In effect, it is unlikely that at the age of 3 to 4 years a mechanism that is still being constructed possesses the fully developed properties of lexical generalization, given that these properties are still far from perfect at the age of 8 to 9 when this mechanism is already in place.

GENERAL DISCUSSION

By way of conclusion, we would like to present our general conception of phonological variation and then use this framework to propose a more coherent interpretation of the results. Our general conception requires us to adopt a cognitive point of view concerning the facts of phonological variation (Chevrot, 1994).

Sociolinguistic approaches to variation have produced numerous results at the level of linguistic description as well as in regard to the relationship between language and society. In contrast, little attention has been paid to the cognitive processing involved in the selection of the variants. One way to approach this subject is to ask: what knowledge do speakers have that permits variation and promotes the emergence of its most regular aspects? An initial response has prompted us to distinguish four levels of knowledge (for details, see Chevrot, 1994).

The first level involves the encoding of the potentiality for variation. What are the locus and nature of the mechanism that specifies the phonological units ca-

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pable of variation as well as the possible variants? Given the growing importance attributed to lexical representations within the framework of phonology, we are inclined to locate this variability within the lexical knowledge internalized for each word. The second level concerns the cognitive automatisms involved in speech planning. In our opinion, these automatisms draw on a variability encoded at the lexical level in order to satisfy articulatory or cognitive constraints. For example, the deletion of a word-final consonant can help simplify a complex articulatory sequence, balance rhythmic intervals, or accelerate speech rate. The third level addresses the relationships between phonological variation and social context. This level consists of verbalizable knowledge about the acceptability of the variants, the effect that their production can induce in the listener (distance, complicity), and the probabilistic relationship linking them with sociological characteristics of speakers and with certain types of interaction. The fourth level concerns the mechanism that controls variant selection in real time during speaking. This mechanism is simply a specific instantiation of a multipurpose, self-monitoring system for verbal production, which has been brought to light by psycholinguistic research into spontaneous self-repairs (Levelt, Roelofs, & Meyer, 1999). When phonological variants are selected, this control can, a priori, operate in two different ways: either through a global intensification of the articulatory activity that produces hyperarticulation and unconscious selection of the standard variant, or through a sporadic consciousness of a variable and an intentional selection of the variant judged to be correct in the situation. Following Labov (1976:159–161) and Dressler and Wodak (1982), we wish to add that the mobilization of this control mechanism depends on the degree to which the attentional resources are focused on the speech activity. As a result, this mechanism is the channel through which high-level social knowledge about situations or variants might be able to modulate the impact of speech planning automatisms on variant selection. This conception allows us to draw together two opposing tendencies that have divided sociolinguistic approaches to variation: an interactional approach, which supposes that speakers are free to manipulate variants in order to achieve communicative aims, versus a variationist approach, which supposes that speakers' linguistic behavior is constrained by linguistic and sociological factors. Rather than considering it necessary to choose between the alternative of freedom or constraint, we prefer the idea of a control that is undoubtedly effective but necessarily fallible, because it impinges on highly automated articulatory processes and because it is subject to the limited nature of attentional resources.

At the level of acquisition, this conception unifies a number of developmental hypotheses that are compatible with our results. The low lexical generalization capacities of the mechanism responsible for the variation of (CR#), which is revealed by the experimental learning of pseudowords, suggests that it is the word that is the unit for the encoding and implementation of variable phonological material. When faced with words containing variable /R/ in the linguistic input, young speakers appear to start by encoding one of the two variants. Children's general tendency to simplify obstruent–liquid clusters—a phenomenon that has been identified in young French speakers aged 2 to 6 (Aicart de Falco &

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Vion, 1987)—suggests that the variant without [R] is encoded first. As they gain linguistic experience, children learn to encode a variable /R/ in their lexical representations as a result of having heard both variants of each word. Finally, in the case of a few items, updating lexical representation appears to be a late phenomenon, occurring at the point when written word forms are manipulated as part of school exercises.

At an early age, lexically encoded variability seems to be used by the mechanisms responsible for speech production. The tendency to delete (CR#) more frequently before a consonant is already present at the age of 6 to 7 years. This tendency is strong and does not change with either age or style. All of these reasons lead us to think that this tendency derives from a very general articulatory mechanism that is learned at a young age: the use of the variability of (CR#) in order to avoid a sequence of three consonantal articulations in the C-#C context.

It is likely that acquisition of stylistic adaptation can take one of two courses. It is possible, as Patterson (1992) suggested, that children aged 3 to 4 years learn to associate the standard variants automatically and unconsciously with certain types of interactions within the family environment. However, it is also probable that young speakers acquire a hyperarticulatory ability, which comes to the fore when attentional resources are directed towards speech. The data we have obtained suggest that stylistic adaptation does not appear until some point between the ages of 6 to 7 and 10 to 12. It is therefore not as early as the automatic variant–situation associations posited by Patterson, and it probably operates through a global intensification of the speech activity. One key fact is that learning this control conflicts with the articulatory mechanism for avoiding [CRC] sequences in the C-#C context. As a result, it is established at a relatively advanced age and is limited in its efficiency, allowing the persistence of numerous deletions.[10] Finally, it seems that the appearance of this type of control is independent of the developmental changes that relate to judgments of acceptability of the variants. It is precisely in the C-#C context, in which stylistic acquisition is extremely clear-cut and shared, that judgments of acceptability do not distinguish between conservation and deletion. In these conditions, it is unlikely that control is motivated by the aim of avoiding a variant judged to be nonstandard. Instead, hyperarticulation results from a global mobilization in the face of a situation experienced as formal by the subject; conservation of the /R/ is one component of this global response.

If we consider the social differences, the conclusions just presented suggest that these have three origins. First, if early encoding of the variable /R/ in lexical representations depends on encounters with each word, then the lexical variability that characterizes the /R/ in any given child can be influenced at an early age by the relative frequency of the two variants of a given word in the input. Second, it is likely that learning a stylistic adaptation, based on the automatic association of standard variants with certain types of family interaction (Patterson, 1992), is also responsible for early social differentiations. For instance, situations such as reading stories aloud might not be practiced with the same regularity by parents in every social environment. Third, social differences may emerge later because

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of inter-individual differences in the acquisition of a control by hyperarticulation in response to situations perceived as formal. The establishment of this type of control requires, at the very least, that children be capable of perceiving the formality of a situation in a manner congruent with adult norms.

There are two cases to consider when we investigate social differences in light of the (CR#) data. When the /R/ precedes a consonant, the social differences in place at 6 to 7 years are also observed among 10- to 12-year-old subjects. When it precedes a vowel or a pause, they appear between the ages of 6 to 7 and 10 to 12, as a result of disparities in the way each social environment adapts to the situation. The first case suggests the existence of early social differences which result from lexical encoding of variability or from automatic associations made between variants and interactions. In contrast, the second case suggests that disparities in the ability to mobilize control by hyperarticulation appear gradually. It is therefore probable that a combination of developmental causes contributes to the progressive emergence of the regular social differences observed in adults.

Finally, we note that the core elements of the sociolinguistic patterns relating to (CR#) could be established without the developmental changes being guided by the sociolinguistic value that different social groups consciously attribute to the variants. The interaction of lexical and articulatory factors and the reaction of social groups to certain communication situations would be enough to provoke, at the macrosocietal level, probabilistic associations between variants, groups, and situations. Later, when subjects' metaphonological abilities permit a clearer awareness of the phonological units, these associations are interpreted, and the variants can then be thought of and deliberately used as markers of social identity.

NOTES

1. We have limited this review to studies designed to observe the development of sociolinguistic patterns during the acquisition of the first dialect. We have not included recent work into the link between language acquisition and linguistic change or into the acquisition of a second dialect (Chambers, 1992; Kerswill, 1996; Kerswill & Williams, 2000; Labov, 1994; Roberts, 1997a).

2. The data files that are the basis for the statistical analyses contained in this article can be obtained on request from the first-named author (jpchevrot@wanadoo.fr).

3. This score was calculated as follows. We awarded 1 point for each obvious deletion, 0.5 points for each case of indecision, and 0 points for each obvious conservation. This way of handling cases of indecision as intermediates between conservations and deletions is supported by electropalatographic data (Wright & Kerswill, 1989), which indicate the existence of initiated articulatory movements corresponding to the variably perceived segments.

4. Given the well-known difficulty of applying analyses of variance to variation data (Rousseau & Sankoff, 1978), we adopted the following procedure for the work presented in this article. First, in the event of a violation of the postulate of the homogeneity of variances, the values were transformed using the arcsine function (Myers, 1972); if the heterogeneity persisted, we used a nonparametric test (Kruskall–Wallis test for independent samples; Wilcoxon test or Friedman test for matched samples) or decided to ignore the effect of one of the factors in order to increase the number of cases per cell. Second, when the dependent variable ranged over a number of possible values less than 5 (as was the case for judgments of acceptability), the results of the analysis of variance were verified using nonparametric tests.

5. The pairwise comparisons were corrected using the Tukey test.

6. Two non-specialist adults listened to a tape to check the audibility of the variants. They had previously been told that some of the children in the recording "did not pronounce the /R/ in 'quatre'." The 48 evaluations gathered during two successive play-throughs of the tape fully agreed with

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the variants actually recorded, which were therefore perfectly audible for anybody whose attention was focused on distinguishing between them.

7. We know that deletion of the word-final /R/ increases with a high speech rate (Mathy, 1996), and that attention on the articulatory activity compensates for the effects of rate on the selection of variants (Dressler & Wodak, 1982). We might therefore imagine that children aged 6 to 7 would not be able to perform this compensation, whereas the very simple task presented to them (which is similar to a naming task) in the more formal situation might encourage an accelerated speech rate. This would explain their inverse reaction to the situation.

8. Syllabification is an exercise practiced by French children as of the first year of primary school. Furthermore, syllabification is one of the first manifestations of phonological awareness (Gombert, 1990). The instruction required subjects to perform syllabification and therefore posed no problems.

9. By phonological coding mechanisms, we mean the mental processes that permit the retrieval from memory of phonological information during lexical access and the correlation of this information with the context (resyllabification, sandhi phenomena).

10. The (unpublished) detailed analysis of the relations between /R/ and /ə/ in the C-#C context shows that this control is essentially due to the production of /R/ followed by the insertion of a /ə/. This configuration, which makes it possible to conserve the /R/ and to avoid a [CRC] sequence, is the vector for stylistic adaptations and developmental modifications. In effect, the number of [R]s produced with a /ə/ increases between the ages of 6 to 7 and 10 to 12 in the most formal situation, whereas the number of [R]s without /ə/ remains stable.

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