

## Role and Properties of Rhythm in French Intonation

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### ABSTRACT

The current study considers that the distinctive acoustic properties and variations in the closed plateau are realized by four different pitch accents (/Hi\* \_ H\*/ or /Hi\* \_ h\*\_i for an emphatic phrase and /hi \_ H\*/ for a neutral phrase ) in an intermediate phrase in the French intonational structure. Thus, an attempt is made to define the acoustic property of the CP in the ip according to the duration time and pitch range, while different combinations of the four pitch accents of the CP are used to explain the way a speaker will highlight. The duration time of the CP was measured at about 0.67 sec. for males and 0.75 sec. for females. The duration properties of the plateau in the CP were found to control the pitch range based on two different prominent pitch accents, which appeared in more than two APs. Therefore, the ip was identified as having a hierarchical level in the French intonational structure, along with the AP and IP. In addition, the CP in the ip was used as a specific location to explain the pragmatic meaning of the rhythm using the two acoustic factors and different combinations of the four pitch accents.

**Keywords:** intonational rhythm, Plateaus: OP(Open Plateau), CP(Closed Plateau, PP (Parenthesis Plateau), two acoustic factors(duration time, pitch range)

### 1. Introduction

The Accentual Phrase (AP) is essentially where the rhythm shape starts, while the Intonational Phrase (IP) is where the type of rhythm is reflected in the French intonational structure. 'The accent, which is closely correlated with the rhythm, is an indispensable element as regards the rhythm composition (A. Lacheret-Dujour & F. Beaugendre 1999: 33-34), because 'the syntagmatic operation between the accented and deaccented organizes the rhythm pattern'(F. Dell 1984 : 135). As such, these remarks highlight the importance of rhythm in the study of French intonation. Furthermore, the intermediate phrase (ip) must be analyzed as the place where the rhythm, including the property of 'a variable yet

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repeated duration', is realized. According to Yuh & LEE(2003), the AP, IP, and ip including rhythm, all have a hierarchical durational property. In particular, the advantage of the ip is that it makes the AP and IP harmonize in an intonational contour. The ip is higher hierarchically than the AP, because the rhythm is organized with the pitch accent occurring in more than two APs. If two pitch accents occur in two APs, then a closed plateau is realized, if one pitch accent occurs, an opened plateau is realized, while if no pitch accent occurs, then a parenthesis plateau is realized. Accordingly, the rhythm can not be realized as a CP in an AP, as it is hidden between the AP and IP overlapping each one. Meanwhile, the ip is lower hierarchically than the IP, because the IP includes one or two rhythms with the boundary tone. Therefore, the ip is also hierarchically lower than the IP as regards the form and meaning.

The hierarchical level of the ip is not considered to have an inherent element and pattern, as the ip is specified according to the pitch accent realized in the AP, then takes a concrete shape in the IP. Therefore, the property of the ip is different from the inherent property of the AP and IP. Nonetheless, the rhythm, the concrete shape of the ip, is produced by each prominent pitch accent realized in more than one AP. The prominent pitch accent based on the relative interval with the speaker's speech rate ensures the pattern of the ip. Accordingly, the role and property of the ip, obtained by combining the property of the AP and then reflecting it in the IP, are hierarchical in the French intonational structure, making the French ip different from the English ip. According to Yuh & Lee(2003 : 8-15), the plateau, the acoustic property of rhythm in the ip, occurs when the focus is realized as a pitch accent.<sup>1)</sup>

According to B. J. Wenk(1983), the size of the deaccented syllabic group makes the distance like the duration time of the plateau, because the deaccented syllables do not come together at the maximal point of the muscular tension. This phenomenon means that the deaccented syllables have a stable syllabic duration time. For this reason, the French language is called 'trailed-timed(codachrones)', since the deaccented syllables are left at the beginning of the muscular tension. Meanwhile, the English language is called 'leader-timed(capochrone)', as the deaccented syllables are left at the beginning of the muscular relaxation. As such, this phenomenon means that the accented syllables ensure their own syllable duration time, while the deaccented syllables do not.

The deaccented syllables make a plateau due to a lower pitch range, since the

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1) they stated that the Fo should be considered as one of the important acoustical factors in the French accent with the duration.

deaccented syllables between the pitch accented syllables are deprived of the pitch accent. This phenomenon then explains why the French intonational rhythm has a repeated duration time. The pitch accent can be on the final syllable or on any syllable following the speaker's intention. Since the speaker's intention is represented by the pitch accent, a plateau is realized more repeatedly in an emphatic phrase than in a neutral phrase. Even though a plateau is not realized regularly, the speaker's intention can still be read based on the rhythm of the ip. Accordingly, the ip is a place where various types of rhythm can be realized.

YUH & LEE(2004) defined three types of rhythmic plateau: open plateau(henceforward OP), closed plateau(henceforward CP), and parenthesis plateau(henceforward PP). These plateaus are made by four different pitch accents(Hi\*/ H\*, h\*/ hi). The most remarkable aspect of intonational rhythm is pragmatic use, as it can clarify the speaker's message. Therefore, the current study analyzed the acoustic properties of plateaus based on data from six speakers (three males and three females).

## 2. Methods

The data (from 3 French males and 3 French females) was analyzed using a PC quirer. Each waveform was captured using a CSL model 4300B, and the duration and pitch were measured from the spectrograms. The present study attempted to measure three different points for three kinds of analysis. The first analysis measured the duration time between the two prominent pitch accents that occurred over two APs. The second analysis measured the mean value of the pitch of the deaccented syllables(plateau) between the two prominent pitch accents. The third analysis measured the deviation value between the value of each prominent pitch accent and the mean value of the pitch for the plateau just before and after the two prominent pitch accents.

## 3. Results and Discussion

The different plateau patterns (OP ; CP ; PP) were analyzed based on the data from the six speakers. According to the data, when one IP continued into the next IP with almost no pause, an OP with one pitch accent was realized that sometimes included the complete shape of the rhythm in the next IP. In addition, the PP did not have any pitch accent.

However, since the pitch accent is only a reference to read the speaker's intention, the OP and PP were not considered as the complete shape of the rhythm. Meanwhile, the speaker's intention was easier to read in the CP than in the other two plateaus. As the CP had more than two pitch accents, it was possible to read where the speaker's message was expressed narrowly or broadly in intonation contour. For example, in the OP, it was simple to read a speaker's message that was expressed on the left side for an emphatic phrase (highlighting a part of the phrase or contrastive meaning) and on the right side for a neutral phrase (highlighting the whole phrase). Meanwhile, in the CP, besides these simple expressions, the expression was also read statistically through the correlation between the duration time and the pitch range. Yet, in the case of the OP and PP, the expression could not be read statistically, as the OP did not exhibit any correlation, while in the case of the PP, a 'flat plateau' could be identified without any pitch accent realized near to the base line. According to M. Rossi (1978b: 9-18, 1978c: 384-396, 1979a: 51-72, 1979b: 1117-1130), he defined this type of plateau as a 'PAR' (parenthèse intonative; intonational parenthesis).<sup>2</sup> Therefore, it was impossible to read the speaker's message, as there was no pitch accent in the PP. Nonetheless, despite the absence of a pitch accent, the PP is still a way of reading the speaker's message, as the PP can be used to highlight, usually the next IP. The realization of a PP means that the repetitive pattern is broken and delays the OP or CP. Thus, in the current study, it was considered that the sudden occurrence of a PP had a pragmatic meaning. However, the most important thing is to find out which concrete shape is used to realize the extended pragmatical meaning of the AP in the rhythm of the ip. Therefore, the three analyses in the current study examined how the two acoustic factors of the CP and different combinations of the four prominent pitch accents created a pragmatic meaning.

There were three reasons for conducting the present analyses. First, an attempt was made to define the correlation between the duration time and the pitch range of a plateau, as it was observed that the duration time was related to the pitch range of a plateau. Therefore, the analysis focused on how the pitch range of a plateau linked to the duration time. Initially, an inversely or directly proportional relationship was anticipated between the duration time and the pitch range. For example, when the duration time decreased, the pitch range increased, or vice versa. As such, the duration time and mean value of the

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2) M. Rossi (1978b: 9-18, 1978c: 384-396, 1979a: 51-72, 1979b: 1117-1130) defined PAR as an unchangeable L tone spreading to several syllables. However, in the present study, 'PAR' is called a 'parenthesis plateau' to unify the plateau designation.

pitch were measured to define the acoustic property of the CP.

The figures below show the results from the data of 6 speakers (3 males and 3 females).

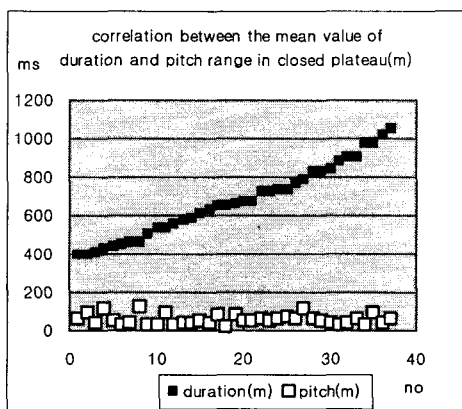


Figure 1.

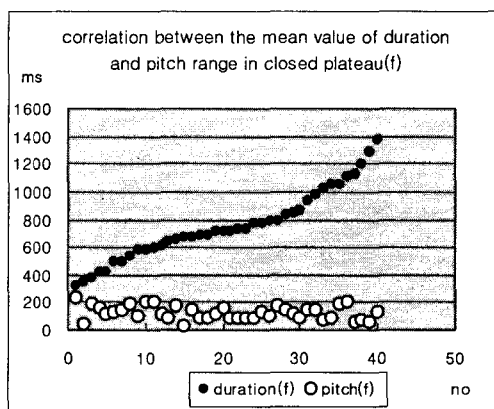


Figure 2.

To summarize the above results, the correlation of the distribution between the duration time and the pitch range was not inversely or directly proportional but rather complementary. In other words, when the duration time increased, the mean value of the pitch also decreased relatively. Conversely, when the duration time decreased, the mean value of the pitch also increased relatively. But the value of deviation relative is not significant. Therefore, the meaning of this function was to stabilize the mean values of two acoustic factors and thereby stabilize the rhythm. The duration time was limited to a maximum for each intonational level. Plus, the limit of the pitch range was also controlled to prevent an excessive decrease or increase to enable every pitch range to be realized within the limits of the mean value. Therefore, the size of the rhythm was maintained based on the correlation that controlled the mean value of the two acoustic factors. Tables 1 and 2 below show the results for the speakers according to gender.

Table 1. Durational deviation realized in emphatic and neutral phrase(m/f)

no.	Emphatic ph.		Neutral ph.	
	minus	plus	minus	plus
Duration(m)	11	7	10	9
Duration(f)	17	7	6	10

Table 2. Deviation of pitch range realized in emphatic and neutral phrase(m/f)

no.	Emphatic phrase		Neutral phrase	
	minus	plus	minus	plus
Pitch range(m)	11	7	12	7
Pitch range(f)	12	12	9	7

The ratio of the duration in an emphatic phrase contrasted well with that in a neutral phrase for the female speakers. Meanwhile, the ratio of short durations was higher than the ratio of long durations for the male speakers in every phrasal pattern. The lower pitch range was more than the higher pitch range in the emphatic and neutral phrases for the male speakers, while the ratio between the lower and higher pitch range was almost same in the two different phrasal types for the female speakers.

The figures below show these results.

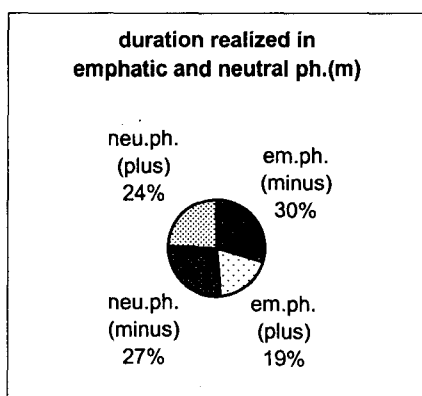


Figure 3.

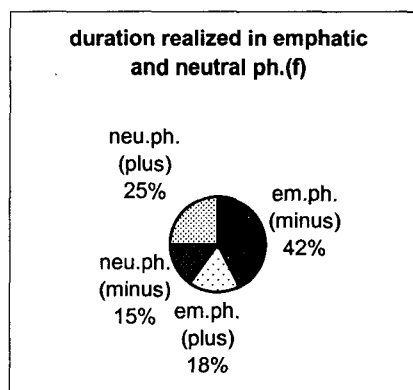


Figure 4.

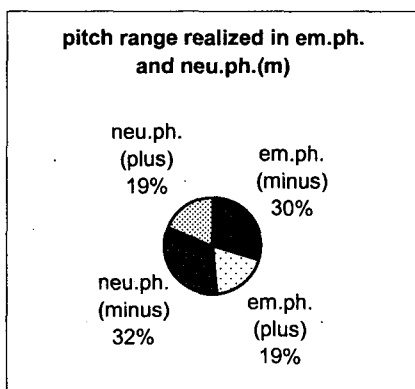


Figure 5.

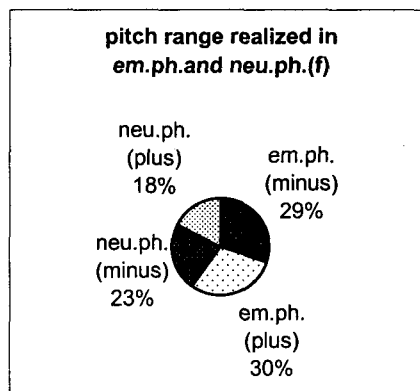


Figure 6.

The results below show the distribution of the maximal and minimal values for the two acoustic factors in the neutral and emphatic phrases, indicating how the distribution limits for the two acoustic factors were realized by the male and female speakers to emphasize the meaning.

Table 3. Max. &amp; min. results for two factors in different phrasal types

ms	Emphatic ph..		Neutral ph.	
	minimum	maximum	minimum	maximum
duration(m)	400	1057.3	431	1019
duration(f)	323.8	1115.4	377.8	1387

Table 4. Max. &amp; min. results for two factors in different phrasal types

Hz	Emphatic ph..		Neutral ph.	
	minimum	maximum	minimum	maximum
Pitch range(m)	27.19	125.45	21.8	114.8
Pitch range(f)	31.02	235.6	56.75	196.6

From the results for the duration time and pitch range, the results for the female speakers were more varied and widely spread than the results for the male speakers. In particular, the results for the female speakers exhibited a large deviation between the maximal and minimal pitch range in an emphatic phrase. Furthermore, in a neutral phrase, there was also a large deviation between the maximal and minimal duration time. These results are shown below.

Table 5. Results of different combinations of two acoustic factors in CP

	Emphatic ph.		Neutral ph.	
	duration	pitch	duration	pitch
Male	-	-	=(+/-)	-
Female	-	=(+/-)	+	-

To summarize, the female speakers exhibited a different way of using the two acoustic factors in emphatic and neutral phrases to realize the meaning of focus. In other words, there was a contrast in the duration time between emphatic and neutral phrases. Meanwhile the tendency of the pitch range to be low or high was almost the same in an emphatic phrase, yet tended to be low in a neutral phrase. As regards the male speakers, the pitch

range tended to be low in both emphatic and neutral phrases, although the duration time tended to be short in an emphatic phrase. However, the tendency of the duration time to be short or long was almost the same in a neutral phrase. Consequently, the female speakers contrasted the duration time to realize the meaning of focus. Plus, the realization of the pitch range was spread equally around the mean value in an emphatic phrase. Meanwhile, the male speakers used a short duration time and low pitch range. Thus, the female speakers changed the duration time according to the different phrasal patterns, whereas the male speakers did not.

The second focus of the analyses was to examine how the four prominent pitch accents organize a specific type of rhythm in emphatic and neutral phrases, so as to identify the particular emphasis of an individual speaker. This is another important reason why rhythm should not be overlooked. Therefore, different combinations of the four pitch accents were analyzed as a specific method of analyzing the pragmatic meaning. Consequently, it is suggested that the results can be used as basic data to define the pragmatic meaning of rhythm. The current study considered various combinations of the four different prominent pitch accents that organize the CP: /Hi\* \_ H\*/ or /Hi\* \_ h\*\_f/ for an emphatic phrase and /hi \_ H\*/ for a neutral phrase. /Hi\*/ always joins with /H\*/ in emphatic phrase. Sometimes /Hi\*/ joins with /h\*\_f/, since the place of /Hi\*/ is not decided. In other words, the changeability of /Hi\*/ belongs to the focus. If the second prominent pitch accent /H\*/ is not realized in the final syllable, /Hi\*/ joins with /h\*\_f/ to control the duration time of the rhythm. Therefore, the relation between /H\*/ and /h\*\_f/ is complementary. The second prominent pitch accent /hi/ controls the duration time of the plateau with the first prominent pitch accent /H\*/ in a neutral phrase, like /h\*\_f/ in an emphatic phrase. From the results for the 6 speakers, three CP patterns were analyzed. The table 5 shows the different rhythm patterns according to the 4 prominent pitch accents.

Table 6. Different combinations of four prominent pitch accents in CP(f/m)

	Hi*/ H*		Hi*/h*_f		hi/ H*	
	no	%	no	%	no	%
Female	22	55	16	40	2	5
Male	18	48.64	-	-	19	51.3

The figure below shows these results.



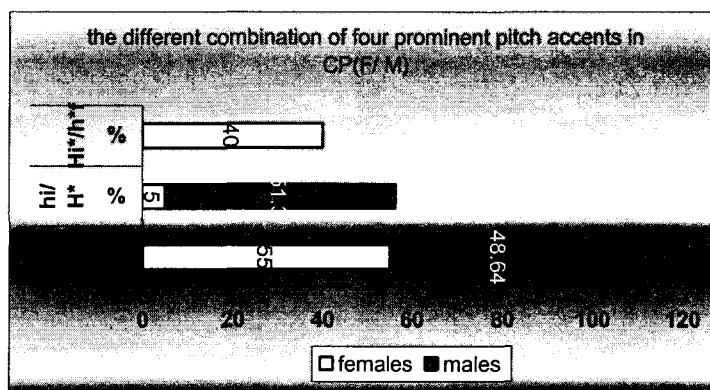


Figure 7.

The last focus was to examine the deviation of the pitch range between the two prominent pitch accents and the plateau in the CP of emphatic and neutral phrases. The reason for this was to verify why the auditor always understands the final syllable to be more prominent than the syllable in focus. Therefore, this analysis was an advance preparation in view of the perception of the rhythm.

Table 7. Deviation value of pitch range between pitch accent and plateau in CP

Hz	Hi*/ H*		hi/ H*		Hi*/ h* <sub>f</sub>	
	Hi*	H*	hi	H*	Hi*	h* <sub>f</sub>
Female	52.09	38	36.31	64.5	42.5	83.5
Male	44.28	34.39	36.8	61.53		

From table 7, the different pitch range between /Hi\*/ and /H\*/ in emphatic phrases was not significant for the different speakers. However, the deviation of the pitch range for /H\*/ and /hi/ in neutral phrases was considerable. The pitch range of /H\*/ was higher than that of /hi/ for all the speakers. The pitch range of /h\*<sub>f</sub>/ in any syllable instead of the final syllable was considerably higher than the case of /Hi\*/ and /H\*/ in an emphatic phrase. Therefore, these results may explain why a listener will perceive /H\*/ in the final syllable to be more prominent in an emphatic and neutral phrase, even though the acoustic results are different. Accordingly, this issue will be further verified with more data in a future study.

#### 4. Conclusion

Studying the role of the AP and IP is important to define how the rhythm is organized and produced in the French intonational structure, since the most part of French prosodic study is attributed to rhythm. In other words, studying the AP clarifies where the rhythm appears, while studying the IP helps define how the intonational rhythm can be transcribed and how the meaning of the rhythm can be interpreted. In addition, the current study also observed the role of the ip in relation to the AP and IP in order to clarify how the role of the ip differs from that of the AP and IP.

First, as regards the role and property of the ip, the current study identified a hierarchical rhythm production process in relation to the AP and IP. Therefore, the correlation between the two acoustic factors and different rhythm combinations were examined. Finally, the statistical results revealed a partial understanding of the pragmatic meaning of the intonational rhythm.

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## Appendix

Three types of plateaus in French intonation analyzed using PCQuirer.

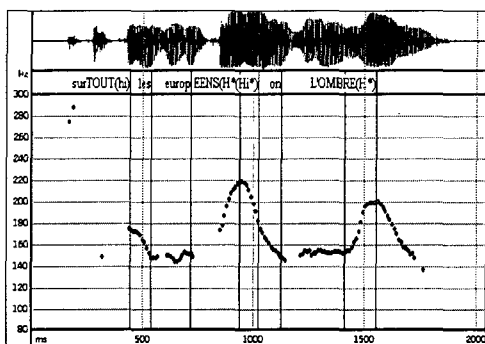


Figure 1.

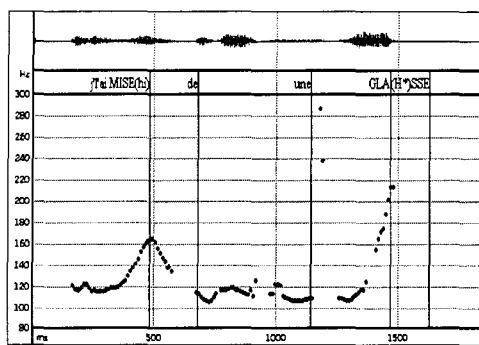


Figure 2.

3APs two closed plateaus consecutive(female)

Figure 1. surTOUT(hi)/ les'euroPEENS(H\*)(Hi\*)/ on vit a L'OMBRE (H\*)(LL%)..

2APs two closed plateaus consecutive(male)

Figure 2. j'l'MISE(hi)/ devant une GLASSE(H\*)(HH%)..

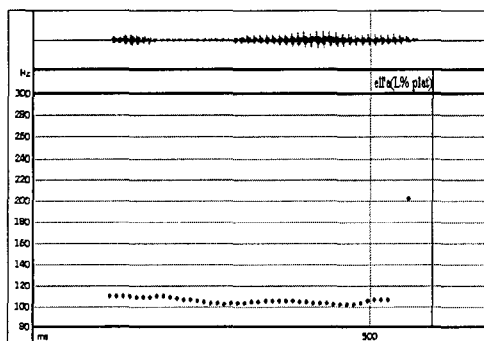


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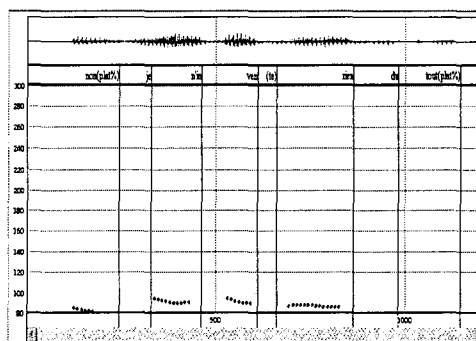


Figure 4.

1AP parenthetical plateau(male)

Figure 3. ell'a(pp%)..

1AP parenthetical plateau(male)

Figure 4. non(pp%).. j'n'invente rien(pp)/ du tout(pp%)..

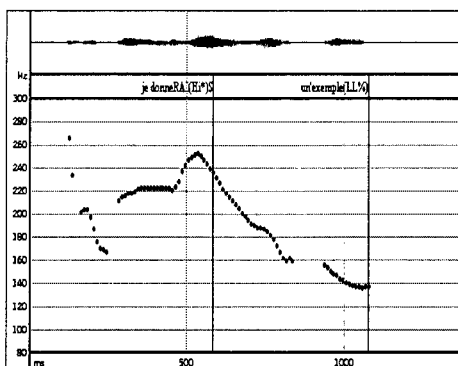


Figure 5.

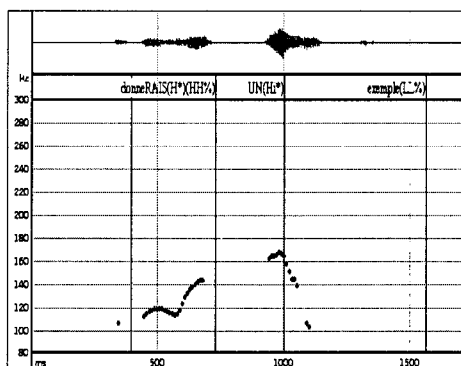


Figure 6.

2APs opened plateau

Figure 5. je donneRAI(Hi\*)S/ un'exemple(LL%)

1APs opened plateau

Figure 6. je donneRAI(H\*)(HH%).. UN(Hi\*) exemple(LL%)