

**A COMPARATIVE STUDY OF THE SOUND PROFILES
OF SITES OF INITIATION IN FRENCH AND
MANDARIN RECYCLING REPAIR***

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ABSTRACT

This study examines the sound profiles of sites of initiation in French and Mandarin recycling repair. Instances of recycling repair were extracted from comparative speech corpora of naturally occurring, face-to-face Mandarin and French interaction. By the interactional prosody approach plus impressionistic judgments, each repair was annotated for its prosodic realization, including relative pitch height, duration, silent pauses and other sound cues for initiating the repair. Through comparing results of acoustic measurements, the discussion focuses on the similarities and differences in the sound realization while initiating and accomplishing recycling repair in both languages. It is suggested that interlocutors of the two languages may orient to rather different methods of initiating the repair in that French speakers tend to incorporate lengthening at the repair initiating sites plus optional filled pauses, while Mandarin speakers employ quick cut-offs for repair initiation, followed by immediate repair.

Key words: Mandarin and French recycling repair; repair initiation; prosody

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1. INTRODUCTION

Repair is a commonly occurring phenomenon in face-to-face interaction. During the process of conversational exchanges, speakers often stop before the end of their turns to make adjustments, in other words, to correct, to elaborate, to qualify what they have said (Jasperson 1998), or even to prepare for what they are going to say. As has been shown in previous studies by Schegloff (1979) and Schegloff et al. (1977) on repair in naturally occurring conversations by the approach of conversation analysis (CA), the type of same-turn, self-initiated repair occurs far more frequently than other-initiated repair. In terms of the sound environment for initiating repair by the CA approach, Schegloff (1979) suggested that the site of initiation in English self-repair may involve a limited number of forms that are sensitive to the most immediate sound environment during production, including cut-offs, silence, or fillers. Schegloff further pointed out that the location of the site of initiation in English repair could be “after the first sound of a word or just before its last” (1979:275). To extend Schegloff’s observation with regard to the site of initiation in self-repair further, Fox and colleagues (2009) reported a cross-linguistic investigation of sites of initiation in same-turn self-repair from seven languages (including Mandarin) with the goal to uncover the universal principles in shaping sites of initiation in recycling and replacement repairs across languages.

The current study attempts to provide detailed acoustic profiles for instances of self-initiated repair that were culled from comparative speech corpora of naturally occurring, face-to-face Mandarin and French interaction. Specifically, this study examines the sound profiles at the sites of initiation of the particular example of *recycling repair* that is defined as “a brief, sometimes a longer repeat or re-saying of part of the utterance occurring in a conversational turn”, following Schegloff (1987:71).¹ Below are two examples of recycling repair in French and Mandarin respectively²:

¹ To follow Schegloff’s definition of recycling repair, here we use the term to refer to instances of repair that involved purely repetitions of the same words or phrases for the action of repairing. Note that it is also possible for speakers to recycle while adding other words, replacing some of the constituents, in order to accomplish the repair. These latter

- (1) **le [R1] le [R2]** terrain commençait à glisser beaucoup (Henry and Pallaud 2003)

the the field begin to slip a lot
'**the the** field began to slip much'

- (2) 他那時候買 - **[R1] 買 [R2]** 這個送 ipod

tā nà shíhou **mǎi mǎi** zhège sòng ipod
she that time **buy buy** this offer ipod
'(At) that time, it was **buying- buying** this one and getting one iPod for free.'

150 instances of recycling repair in Mandarin and French were culled from comparative speech corpora of both languages (cf. Bertrand et al. 2008; Chen et al. 2012). By the interactional prosody approach plus impressionistic judgments (cf. Benkenstein and Simpson 2003; Kelly and Local 1989), each instance of recycling repair was manually annotated in terms of its prosodic realization at and around the site of initiation, including pitch, duration, silence around and in between R1 and R2 while accomplishing the repair, as well as perceivable sound cues including cut-offs and/or sound stretch to initiate the repair. As an application to the previously established comparable corpora of Mandarin and French interactional data, the main goal of the current study is to provide detailed sound profiles for sites of initiation in recycling repair of both languages. Although Fox and colleagues (2009) have provided the cross-linguistic analysis on the sites of initiation in same-turn self-repair, their study wasn't able to cover much analysis

cases, however, are not considered for the purpose of the current study.

² Traditionally in studies of repair or disfluency in spontaneous speech, the segment where the repair is initiated is termed reparandum (cf. Levelt 1983; Shriberg 1994; Tseng 2006), while the segment following the point of repair initiation has been referred to as either reparandum, alternation, or simply repair. To avoid further confusion in terminology and for the sake of consistency, [R1] is used in the current study to refer to the segment where the repair is initiated, and [R2] for the actual repair.

with regard to the sound realizations in repair initiations, due to some constraints on the data collected. As will be shown, through the comparative result of acoustic measurements we identify some shared acoustic features for the initiation and execution of the recycling repair in the two languages. Most of all, the present study suggests that speakers of the two languages seem to favour different methods of initiating recycling repairs in terms of the sound realization: It will be demonstrated that Mandarin speakers tend to initiate the repair by cut-offs at the end of R1, followed immediately by the repair, whereas French speakers incorporate the sound cue of lengthening at the end of R1 with optional filled pauses to initiate the repair. With instances of repair annotated by acoustic features in detail, we attempt to provide some explications for the similarities and differences in the sound realizations while repairing from the viewpoint of speech production as well as further implications from the comparative analyses.

The paper is organized as follows. Section 2 provides a brief review of related research on repair and introduces the approach of interactional prosody. In section 3 a description of the data incorporated in the current study and the methodology adopted for analysing the sound production at and around sites of initiating recycling repair are provided. Section 4 presents results from acoustic measurements and discussions based on these results. Section 5 focuses on general discussions of the implications of the acoustic analyses and further applications based on the current results. Finally, section 6 is the summary and future research.

2. RESEARCH ON REPAIR IN INTERACTION

The following section 2.1 introduces briefly the previous research that focused on repair. Sections 2.2 and 2.3 provide a review of previous studies discussing the phenomenon of repair (and disfluency) in Mandarin interaction and French conversations respectively, whereas section 2.4 presents the interactional prosody approach that is adopted for analysing sound production in the current study.

2.1 Research on Repair/Disfluency

The discussion of same-turn self-repair has been the centre of focus in studies of the relevant fields, including psycholinguistics (e.g. Levelt 1983; Levelt and Cutler 1983), computational linguistics (e.g. on disfluency in speech³: Shriberg 1994, 1995; Tseng 2003), general linguistics (e.g. Chui 1996; Fox et al. 1996; Fox et al. 2009; Tseng 2006; Huang 2013), and also in conversation analysis (e.g. Jasperson 1998; Schegloff 1987; Schegloff et al. 1977). Most of these earlier studies on repair focused on the phenomenon mainly in English. Some previous studies that focused on repair/disfluency in other languages while touching upon the sound realizations include: Benkenstein and Simpson's study on the phonetic correlates of self-repair involving word repetitions in German speech (2003). Bartkova (2005) examined the prosodic features of French disfluencies and Tseng discussed repetitions and repair in spontaneous Mandarin (2003, 2006).

2.2 Repetition Repair in Mandarin Conversation

As stated above, the current study concentrates on the specific instances of recycling repair as one of the methods of repair in conversations. There are several reasons that this particular method of carrying out same-turn self-repair has been chosen as the main focus: first of all, as shown in some previous quantitative studies on Mandarin repair (cf. Chui 1996; Tseng 2003, 2006), the type of repetition repair is the most frequently used method for accomplishing repair in Mandarin conversation. Moreover, Fox and colleagues (2009) also have suggested that Mandarin speakers consistently initiate repair after the word is recognizably completed, in other words, the initiation in or after the last

³ One place to note here is that, while in the literature of computational linguistics disfluency can refer to various types of 'errors' in the speech signals, including silent or filled pauses, repairs, and repetitions, the term repair in interactional linguistics refers to situations when interlocutors retrace part of the speaking turn with or without the intention of making corrections. Thus, for incorporating the term repair, in the current study we refer to the action of repeating part of the turn-so-far for repair, which may or may not be related to error corrections in speech production during interaction. The term 'disfluency' in this paper, therefore, will be used only when referring to the phenomenon in studies from computation linguistics and/or speech processing.

sound of the word in repair while recycling. Most of all, with regard to research methodology, the preference of initiating Mandarin repair after recognizable completions provides another justification for comparing the sound realization of repeated words or phrases while repairing: Since the recycling⁴ would be a complete repetition of the same word or phrase, it actually allows for a straightforward comparison of the prosodic realization between R1 and R2 of the repair.

2.3 Repetition Repair in French Conversation

As for previous studies on repair/disfluency in French, Henry (2002) reported a quantitative study of repetitions based on a corpus of one million-word spontaneous spoken French. Since the purpose of the study was to contribute to the improvement of speech recognition, the article focused mostly on the grammatical categories involved in the French repetitions and the locations of the repetitions within the syntactic constituents (Henry 2002).⁵ Part of the results did suggest that, other than direct repetition (i.e. when R1 is followed directly by R2), the associated repetition is another frequent type of repetition in spoken French. Of the associated repetition, it was found that the repeated combination of [R1+word+R2] occurred more frequently (Henry 2002).

Another study focusing on the prosodic parameters of disfluencies in French conversation was by Bartkova (2005). Based on the method of statistical analysis, Bartkova (2005) examined the prosodic features of French disfluencies derived from speech data consisting of telephone messages. The results from the study suggested that of the prosodic parameters of word repetitions, 65% of the repetitions with filled pauses could have them located between words of repetitions (Bartkova 2005).

⁴ Note in the following text the term 'recycling' will be used interchangeably with 'recycling repair' to refer to the specific type of repair under discussion.

⁵ One additional note is that the results reported in Henry (2002) have shown that some of the commonly used words in repetitions belong to function words in French, including the word class of *determiner* (41.5%), *pronoun* (26%), and *preposition* (13%). Similar results with regard to the grammatical categories of French repetitions have also been reported in Henry and Pallaud (2003), which showed that 91.3% of repeated words in the French data belong to the category of function words.

It was further observed that, when filled pauses were not separated by silent pauses from the words, they tended to follow the final consonants or vowels of the preceding words, forming a very long schwa-like vowel (Bartkova 2005).

2.4 On Interactional Prosody Approach

As mentioned in the introduction, some of the past studies on repair within the field of CA have paid attention to the discussion of the relationship between prosody and interaction in conversation (cf. Schegloff 1979, 1987). It was, however, not until recently that interactional linguists have started paying attention to the systematic organization of phonetic and prosodic details in natural conversations. The interactional prosody approach (cf. Couper-Kuhlen and Selting 1996; also conversational phonology by Kelly and Local 1989) suggested incorporating the following theoretical viewpoints toward the study of the sound system of conversational interaction:

- The material considered derives entirely from naturally occurring face-to-face conversational interaction
- The analysis attempts to prejudge as little as possible the salience of phonetic features
- The analysis seeks explicitly to motivate and warrant the functional categories employed by reference to the observable behaviour of the conversational participants (Kelly and Local 1989: 263)

Moreover, one of the features of the interactional prosody approach is that it advocates an ‘impressionistic’ analysis by closely listening to the production of real speech and notating phonetic details which a trained ear could perceive, including properties such as pitch, loudness, tempo, and others (Kelly and Local 1989).

One previous study focusing on Mandarin recycling repair by the interactional prosody approach toward the analysis of sound patterns of Mandarin recyclings in natural conversation was Chen (2011). The purpose of the study was to examine how the combination of detailed prosodic features (including pitch, silence, duration, and loudness) forms

various sound patterns in reflecting important aspects of talk-in-interaction and the sequential organization of Mandarin conversation through recyclings. The results from the research highlight the interaction-specific, sequence-specific, and function-specific examples of Mandarin recycling repairs in correlation with the use of particular prosodic patterns (Chen 2011). Here in the present study, the analysis of acoustic production at and around the site of initiation of the repair is based mainly on the similar rationale behind the interactional prosody approach, plus the incorporation of impressionistic judgments by the analyst.

3. DATA AND METHODOLOGY

The current section introduces the data and methodology incorporated in the present study. Section 3.1 is devoted to the data and a description of how the recycling repair instances were selected is provided. Section 3.2 explains the annotation procedures for the prosodic profiles of and around the sites of initiation in recycling repair of both languages, as well as the follow-up quantitative tests towards the results of acoustic measurements.

3.1 Data

Examples of French recycling repair were extracted from a Corpus of Interactional Data (CID), which consists of 8 hours of audio-video recorded spontaneous spoken French and contains about 110,000 words (cf. Bertrand et al. 2008; Blache et al. 2009). One of the features of the CID is that the data has been processed automatically and annotated (both automatically and manually) on multimodal levels: not only the corpus metadata, but also the phonetic, prosodic/phonological, morpho-syntactic levels, as well as the level for gestures (Bertrand et al. 2008; Blache et al. 2009). Furthermore, it should be noted that the CID has been pre-processed and annotated with one additional level for cases of French disfluency of different types, including that of recycling repair. For the purpose of the current study, 150 instances of recyclings

produced by two female French speakers were selected out of the annotated instances of repair/disfluency.

On the other side, examples of Mandarin recycling repair were taken from two sources. The first source is a corpus of Mandarin recycling repair described in Chen (2011). The corpus consists of 260 instances of recycling repair culled from about 3.5 hours of video- and audio-taped face-to-face Mandarin interaction.⁶ The second source of the data is an on-going project of constructing a Mandarin corpus of conversational interaction following the French CID (cf. Chen et al. 2012). Together 150 instances of Mandarin recycling repair produced by 4 native Taiwanese Mandarin female speakers were selected for further acoustic analysis of the sound profiles at the sites of initiation in repair.

As for the selection of instances of recycling repair, though simple repetitions were not difficult to detect from the data, this did not mean, however, that all examples of repetitions were considered examples of repair. At least repetitions for the purpose of emphasizing were excluded. One such example is the repetition of the Mandarin adverb *zhende* 'really' and *hen* 'very' later on in the same turn of the following:

- (3) 因為我覺得 J 就很- 我是真的真的對他是覺得很很傷心
yīngwèi wǒ juéde J jiùshì wǒ shì zhēnde zhēnde duì tā shì juéde hěn
hěn shāngxīn
because I feel J just very I be really really to him be feel very very
sad 'because I felt J was very- I was really really feeling very very
hurt by her.'

An additional note to address is that, of the 150 Mandarin recycling instances, 81.3% of the instances (122/150) are single-word lexical items, whereas the rest, 18.7% (28/150), involve recyclings of multi-word constituents or phrases.⁷ Further counting showed that of the 122 single-

⁶ The 3.5-hour conversational data includes 7 segments of two or multi-party Mandarin interaction of 10 female Mandarin speakers. For the ethnographic information of the interlocutors and background information about the data, please refer to Chen (2011).

⁷ Another examination of the 150 instances of recyclings shows that some of the higher frequency (over 5 occurrences within the total 150 instances) single words involved in recyclings include: 就是 *jiùshì* 'just that' (22/150), 我 *wǒ* '1st person singular pronoun'

word recycling repair, 63.9% of the instances were repairing of function words, whereas 36.1% of the recyclings were carried out on content words.

In total, 300 instances of recycling repair were selected from the Mandarin and French corpora for the annotations of the acoustic features at and around the site of initiation while repairing.

3.2 Annotations for Sound Profiles

To analyse the sound production around and at the site of initiation in recycling repair, the current study adopts the aforementioned methodology that combines both acoustic measurements and the impressionistic analysis. Actually, such a combinational approach has also been used in a previous study on word repetitions in German speech by Benkenstein and Simpson (2003). In the present study, the acoustic measurements were carried out by using the computer software Praat (Boersma and Weenink 2007). Additional judgments would be made based on the analyst's impressionistic interpretation of most of the auditory cues, following the impressionistic approach from interactional prosody. The category of annotations noted for each instance of Mandarin and French recycling repair includes the following:

Pitch. The pitch height of R1 and R2 of each recycling was first measured then double-checked against the analyst's impressionistic judgments. Here the pitch height refers to fundamental frequency (F0). Furthermore, it should be mentioned that sometimes when the F0 difference between R1 and R2 was too small to be considered as reflecting hearable differences, the measurement of *semitone* would be incorporated to help determine if R1 and R2 might be perceived as realized at the same pitch height.

Duration. Duration refers to the length of R1/R2 of the repair, reported in milliseconds. The measurement of duration was taken starting from the onset to the ending of the syllable of the word or phrase in R1 and R2.

(18/150), 那個 *nàge* 'determiner-classifier' (7/150), and 就 *jiù* 'just'.

Silence. The profile of silence recorded, in seconds, any audible pause located: a) before R1; b) in between R1 and R2; and c) after R2 of the repair. In the current research a cut-off point at 0.2-second has been applied, following Jasperson's study on focused English repair (1998). Any silent pause under 0.2 seconds was considered as part of the articulatory process (cf. Jasperson 1998) and thus treated as having no significant impact on the production or processing of the repair. Silent pauses longer than 0.2 seconds, on the other hand, would be taken as serving possible function and were otherwise noted. One place to point out is that, as the past discussion on French word repetitions also paid attention to filled pauses, and since the French data was further annotated for instances of pause fillers, here instances of recyclings with filled pauses located in between R1 and R2 were annotated as well.

Other prosodic cues- sound stretch and cut-off. The prosodic cue of sound stretch (or lengthening) records any perceptible prolongation on any syllable of R1 and R2 of the repair. To determine if there were perceivable sound stretches, the impressionistic judgments were made and the result was marked on the transcription of the interaction. When any lengthening was observed, it would be marked, using the convention of the colon symbol ":".⁸

The sound cue of cut-off is defined as an articulatory closure that interrupts the air stream, and it typically involves glottal or other stop closures (cf. Jasperson 2002). To decide if there was a cut-off, the analyzer followed the impressionistic description of ways in which the cut-off is articulated, as proposed by Jasperson (1998, 2002). At least two types of cut-offs were distinguished: "glottalized" cut-offs, which have salient interruption glottalization, and "soft" cut-offs that have either unnoticeable or no interrupted glottalization (cf. Jasperson 1998, 2002).⁹ The glottalized cut-offs were indicated by a percent sign "%" whereas the soft ones were indicated by a dash "-".

⁸ For a detailed list of transcription conventions, please refer to Appendix A at the end of the paper.

⁹ When discussing cut-offs in the environment of English vowels, Jasperson explicated that acoustically, the interruption glottalization consists in an irregularity of frequency and rapid decrease in amplitude (2002:262). According to Jasperson, for cut-offs there would be a rapid decrease in amplitude that would be clearly visible from the change in

One note to add is that, while recording the results of F0 and duration, only the relative pitch height between R1/R2 (such as if R1 or R2 is perceived as in a higher pitch height) and relative duration (i.e. if R1 or R2 is perceived as the longer segment of the repair) would be reported.¹⁰ In addition, as the current study concerns the sites of initiation in recyclings, in the following results reported with regard to the sound cues of cut-off and lengthening we will focus on recyclings in which their R1 is followed immediately by cut-off and/or lengthening. Finally, when presenting the results in numbers, we follow up each result reported with a further test based on the quantitative method. The purpose of incorporating quantification is simply to serve as a tool for verifying the distribution of relative results instead of providing absolute rules or acoustic patterns for executing recycling repair from the data of both languages.

4. RESULTS OF ACOUSTIC MEASUREMENTS

The current section describes the comparative results of acoustic measurements made on the R1/R2 of the recycling in both languages. The results will be reported according to the annotation categories of sound profiles introduced in Section 3.2.

4.1 Pitch

width of the waveform (2002). A change in F0 structure is less visible as the change actually begins before the amplitude decrease (Jaspersen 2002:262). Since we incorporate an impressionistic method towards the sound realizations while repairing, the two types of cut-offs were mainly distinguished auditorily instead of relying on visual judgements.

¹⁰ The reason not to report the exact measurements for F0 (in hertz or in semitone) and duration (in millisecond) is to avoid the discrepancy between the reported differences in numbers and the actual perceived differences in these measurements. As the main purpose of the study here is to focus on the perceptual differences of the acoustic measurements, a relative viewpoint has been adopted towards the acoustic measurements instead.

As mentioned, the measurement of pitch height is reported as the relative F0 realization perceived between R1/R2 of the recycling. Thus the result of relative F0 could be noted as realized in one of the four possible situations:

- R1 is the higher segment of the repair (Higher R1)
- R2 is the higher segment of the repair (Higher R2)
- R1 and R2 are perceived as realized in about the same pitch height (Same)
- Instances that cannot be categorized as one of the above possible situations (Others)

The results of relative F0 between R1 and R2 are presented in the following Table 1 and Figure 1:

Table 1. The results of relative F0 perceived between R1/R2.

| | Higher R1 | Higher R2 | Same | Others | Total |
|---------------------|-----------|-----------|----------|----------|-------|
| French Recyclings | 33 (22%) | 64 (43%) | 18 (12%) | 35 (23%) | 150 |
| Mandarin Recyclings | 30 (20%) | 77 (52%) | 14 (9%) | 29 (19%) | 150 |

Chi-square= 2.404, d.f.=3, P= 0.4929

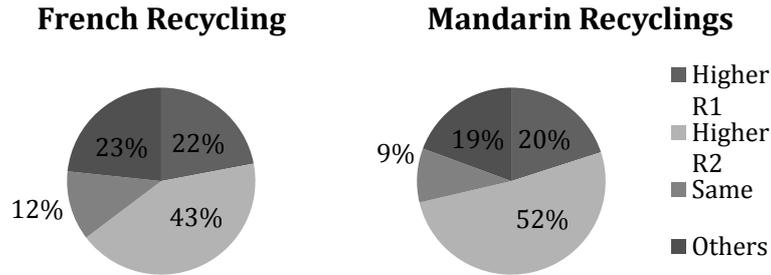


Figure 1. Distribution of relative F0 between R1/R2 in percentage.

Table 1 and Figure 1 demonstrate that for the recycling instances in both languages, it is commonly the cases when R2 is perceived as relatively higher: over 50% of Mandarin recycling instances and over 40% of French recyclings are realized with a higher R2. On the other hand, the situations in which R1 and R2 are realized in about the same pitch height occurs the least (9% for Mandarin recyclings and 12% for French recyclings). There are still around 20% of the overall recyclings in both languages realized with a higher R1, whereas the rest, 20% of the instances, are realized in other situations when neither R1 nor R2 is relatively higher. A further test shows there is no significant difference between the two languages with respect to the relative F0 realization between R1 and R2 (chi-square= 2.404, d.f.=3, P= .4929).

4.2 Duration

The result of the relative duration perceived between R1/R2 of the recycling repair is presented in Table 2.

Table 2. Comparative result of relative duration between R1/R2.

| | Longer R1 | Longer R2 | Total |
|------------|-----------|-----------|--------|
| French | 125 | 25 | 150 |
| Recyclings | (83.3%) | (16.7%) | (100%) |
| Mandarin | 120 | 30 | 150 |
| Recyclings | (80%) | (20%) | (100%) |

Chi-square= 0.5566, d.f.=1, P= 0.4554

From Table 2 it is demonstrated that for both languages, over 80% of the recycling instances are realized with a relatively longer R1. The result thus suggests a strong preference for a longer R1 while executing the repair in both languages. The follow-up test otherwise indicates that there is no significant difference between the two languages with regard to the relative duration between R1 and R2.

4.3 Interim Summary: On F0 and Duration

Based on the results from Sections 4.1 and 4.2, there seems to be a tendency observed with respect to the relative F0 and duration between R1 and R2 in that R2 is in higher F0 and R1 longer duration. In other words, once initiated, the speaker tends to execute the actual repairing segment (R2) in a higher pitch. In addition, after the repair is initiated it doesn't require much more time for the speaker to repeat the same word or phrase in order to accomplish the whole recycling process. Thus preliminarily a shared sound pattern of a longer R1 until the initiation of the repair, followed by the corresponding R2 in a relatively higher F0 has been derived for recyclings from the speech data of both languages.

4.4 Silence

As explained in Section 3.2, for the measurement of silence we noted three relevant locations for interlocutors to pause for accomplishing the recycling, namely right before R1, in between R1 and R2, and right after R2. The following Table 3-a and Table 3-b summarize the number and

distribution of instances with pauses occurring immediately prior to R1 and right after R2, respectively.

Table 3-a. Number of instances with pause immediately preceding R1.

| | With Pause | Without Pause | Total |
|------------|------------|---------------|--------|
| French | 8 | 142 | 150 |
| Recyclings | (5.3%) | (94.7%) | (100%) |
| Mandarin | 41 | 109 | 150 |
| Recyclings | (27.3%) | (72.7%) | (100%) |

Chi-square=26.563, d.f.=1, P=2.6e-7

Table 3-b. Number of instances with pause immediately following R2.

| | With Pause | Without Pause | Total |
|------------|------------|---------------|--------|
| French | 9 | 141 | 150 |
| Recyclings | (6.0%) | (94.0%) | (100%) |
| Mandarin | 10 | 140 | 150 |
| Recyclings | (6.7%) | (93.3%) | (100%) |

Chi-square=0.056, d.f.=1, P=0.8126

From Table 3-a, the French repairs seem to differ from the Mandarin instances in terms of the silent pause occurring immediately prior to R1: French recyclings are less likely to be preceded by pauses longer than 0.2 seconds (8/150, 5.3%), whereas for Mandarin recyclings there are about a quarter of the examples with their R1 preceded by perceivable pauses. The difference between the two languages is actually significant according to the further statistical test (chi-square=26.563, d.f.=1, P=2.6e-7). When turning to the pause immediately following R2, as shown in Table 3-b, we find that overwhelmingly for the majority of recycling instances in both languages there wouldn't be any perceivable silence located right after R2. Further chi-square test results are not significant and thus no difference with respect to the pattern of incorporating silent pauses after recyclings between the two languages could be derived.

Table 4. Number of instances with or without pauses (P) and with filled pauses (FP) occurring in between R1/R2.

| | P<0.2s | P>0.2s | With FP | Total |
|---------------------|-------------|-------------|-------------|-------|
| French Recyclings | 73 (49%) | 27 (18%) | 50 (33%) | 150 |
| Mandarin Recyclings | 81 (54%) | 51 (34%) | 18 (12%) | 150 |

Chi-square= 22.859, d.f.=2, P= 1.1E-05

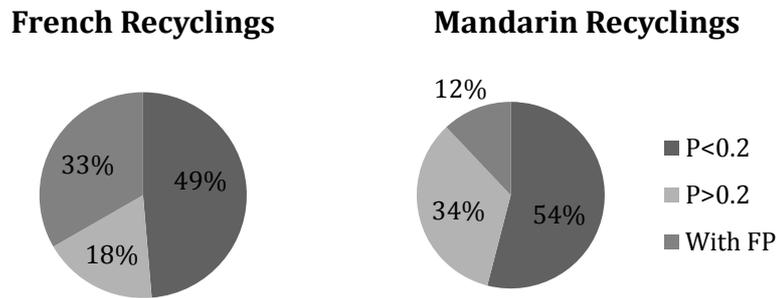


Figure 2. Distribution of instances with or without pauses (P) and with filled pauses (FP) occurring in between R1/R2.

Table 4 summarizes instances of recyclings with or without pauses, and also with filled pauses in between R1 and R2. Figure 2 on the other hand presents the distribution in a percentage. Based on the results, it is shown that around 50% of instances in both languages are realized with in-between pauses under 0.2 seconds. The distribution of in-between pauses over 0.2 seconds and filled pauses, however, differs between the two languages. There are more cases of in-between filled pauses in the French examples, whereas for Mandarin it is the other way around as over one-third of the recyclings have longer pauses in between R1/R2. A further test yields a significant difference among the categorizations,

which suggests that the incorporations of micro pauses, long pauses and filled pauses within the repair are distinct between the overall recyclings from the two languages.

4.5 Other Sound Cues: Sound Stretch and Cut-off

The annotations for the sound cues of sound stretch and cut-off at the end of R1 provide further information with respect to the method of initiating recyclings in both languages. Thus we count instances of French and Mandarin recyclings initiated by either lengthening or cut-off, and the result is presented in Table 5:

Table 5. Summary of tokens of recyclings initiated by either lengthening or cut-off at the end of R1.

| | Recycling initiated by lengthening | Recycling initiated by cut-off | Total |
|------------|------------------------------------|--------------------------------|-------|
| French | 59 | 18 | 77 |
| Recyclings | (77%) | (23%) | |
| Mandarin | 35 | 68 | 103 |
| Recyclings | (34%) | (66%) | |

Chi-square= 32.112, d.f.=1, P= 1e-8

As shown in Table 5, speakers of the two languages seem to orient to different methods of initiation: French speakers tend to initiate the recycling by the means of prolongation at the end of R1 (77%), whereas they incorporate less frequently cut-offs at the point of repair initiation. On the other hand, Mandarin speakers rely more on the cut-off at the end of R1 of the repair (66%), whereas lengthening at the point of repair initiation is less frequently used. We carried out the chi-square test with the distribution, and a significant result is derived (chi-square= 32.112, d.f.=1, P= 1e-8).

4.6 Interim Summary and Discussion: On Methods of Initiating Recycling Repair

In summary, based on the results from Sections 4.4 and 4.5, we find there are some differences in the acoustic realizations between French and Mandarin recyclings. These may include: For one, French speakers incorporate more frequently filled pauses, whereas Mandarin interlocutors rarely do so at the point of repair initiation (cf. Table 4 and Figure 2). Moreover, French speakers show a higher tendency of lengthening at the place of repair initiations, as shown in Table 5. Mandarin interlocutors, on the other hand, demonstrate preferences over cut-offs at the point of initiation. In the following subsections we will elaborate in detail exactly how speakers of the two languages incorporate different methods for initiating recycling repair while taking into consideration at the same time results of in-between silence (including filled pauses) and repair initiators.

4.6.1 Initiating recycling repair in French interaction

According to Table 5, French interlocutors demonstrated a preference of sound stretch or elongation at the end of R1, as 77% of the recycling instances were initiated by a sound stretch at that location. One of the examples taken from the French CID is presented in (4):

- (4) S: mais où est– ce que tu as **des::[R1] des [R2]** feux d’artifice
but where is what you get **some some** firework
‘but where did you get **some:: some** fireworks’

As can be seen, here the speaker makes use of the lengthening at the end of R1 in order to initiate the repair. After the initiation, the speaker follows up by directly repeating the same word *des* “some” to accomplish the repair. When examining further other instances of French recyclings initiated by lengthening, we actually find cases in which the recyclings were initiated by a lengthened R1, followed by a filled pause that is often realized with a sound stretch as well:

- (5) S: j’ai mis mes ski sur le dos puis j’ai commencé à descendre
à pied [R1] euh:::↓ ↓ à pied [R2] toute la station
I put my ski on the back then I have start to descend

by foot FP by foot all the resort
'I put my ski on the back then I started descending **by foot**
guh:~~~~: by foot throughout the resort.'

- (6) S: **et:[R1]=< guh: (.) et [R2]** en même temps euh ils se
sont excusés
and FP and at same time euh they apologize
'**and: =< guh: (.) and** at the same time euh they apologized...'

From the above examples (5) and (6), one place to point out is that not only do French speakers favor initiating the recyclings by lengthening at the end of R1 followed by a lengthened filled pause (such as the lengthened *guh* following R1 in (5)), also they tend to attach the filled pause immediately after the lengthened R1 (as shown in (6) by the transcription notation '=<' in between *et* and *guh*).¹¹ Actually, as stated in Section 2.3, Bartkova (2005) suggested that filled pauses in French speech tend to follow the final consonants or vowels of the preceding words, forming a long schwa-like vowel. As a result, while French interlocutors recycle the turn for repair, they may take advantage of prolongations at the site of initiation, plus a lengthened filled pause, to further withhold the turn in order to gain time to accomplish the repair.¹²

4.6.2 Initiating recycling repair in Mandarin interaction

Turning to the recyclings in Mandarin interaction, based on the result from Table 5, speakers tend to incorporate a cut-off at the end of R1 to initiate the repair. Taking into consideration the results summarized in Figure 2 regarding the distribution of types of in-between silent pauses, Mandarin interlocutors seem to orient to a method of initiating and

¹¹ This transcription notation '=<' indicates that the immediately following talk is 'jump-started' from the syllable prior to the symbol. For a detailed list of transcription conventions, please refer to Appendix A at the end of the paper.

¹² One place to note is that, whereas the filled pause in between R1 and R2 of the French recyclings can be optional, it is also possible for the speakers to insert more than one filled pause or a filled pause plus a discourse marker to further hold the turn when repairing.

accomplishing recycling repair via a quick initiation by cut-off at the end of R1, followed immediately by the direct repetition of R2 without much delay. One of such Mandarin recycling instances derived from the Mandarin CID is shown in the following (7)¹³:

- (7) S: 喔:那- 可是那個- [R1] 那個[R2]Y是% (.)是韓國人
o: nà- kěshi nàge- nàge Y shì% (.) shì hánguó rén
Ex that but **that that** Y be be Korean
'Oh that- but **that- that** Y is% (.) is Korean.'

When the speaker recycles the determiner *nage* "that" there is a cut-off at the end of R1, which otherwise facilitates a quick start at the site of initiation in repairing. To accomplish the repair process, the interlocutor immediately follows up with a direct repetition of the same lexical item but without an additional pause or filled pause. This method of initiating the repair, as has been shown, is rather different from the method of French repair in which interlocutors recycle by the lengthening at the end of R1 then followed optionally by a filled pause.

5. GENERAL DISCUSSIONS

The discussion section will be divided into three parts. First of all, we address further the shared sound features identified in recyclings of the two languages based on the summary from Section 4.3. The second part of the discussion will elaborate further on the different methods of initiating recycling repair in the two languages. Finally, Section 5.3 will be devoted to additional observations from the results of acoustic measurements regarding silence and also includes some further implications from the current results.

5.1 Shared acoustic features while repairing

¹³ Another example of repair when it is initiated by a cut-off at the end of R1 followed by R2 without delay has been presented in (2).

Based on the summary from Section 4.3, there were shared acoustic features identified while speakers of both languages carried out recycling repair: the relatively higher F0 in R2; the relatively shorter segment in R2; and the lack of additional pauses after accomplishing the repair process. In the following we will discuss further how these findings are consistent or inconsistent with results of the acoustic realization in the repair and/or disfluency phenomenon from previous studies.

First of all, with respect to the relative pitch realization, although we have identified that for recycling instances in both languages there is a general tendency to realize R2 in higher F0, previous findings were inconclusive toward the F0 realization between R1/R2. For French disfluency instances, although Bartkova (2005) did mention that F0 movement was slightly smaller on the first occurrence (i.e. R1) than the second occurrence (i.e. R2) in cases of low-low and high-high movements between repetitions, these two categories of pitch movement in repetitions covered only a small portion of the overall disfluency case.¹⁴ Actually, for the majority of disfluency instances the pitch movement was realized rather in a flat pattern (Bartkova 2005). As for Mandarin repair, Tseng (2006) examined the F0 differences of initial positions of *reparandum* (R1) and *alternation* (R2) in repeated and corrected repairs and the relative F0 result was not significant. It has been suggested, however, that a pitch reset was observed in restarting Mandarin repairs (Tseng 2006). Thus there has yet to be a consistent account toward the relative F0 realization between R1/R2 of the repair.

Secondly, with regard to the duration differences, the current result is in general consistent with findings from previous studies on the relatively longer duration of the *reparandum* (R1) in repair/disfluency of various languages (cf. Bartkova 2005; Shriberg 1995; Tseng 2006). A possible explanation has been proposed in Tseng (2006) that this tendency may be due to the fact that the time required for processing the *alternation* (R2) has already been included in the *reparandum* (R1). It has been further suggested that the tendency of a shorter R2 would be more obvious in the case of repetitions, as repetitions themselves involve no new information (Tseng 2006:105). When the speakers have reached

¹⁴ Note that when discussing the F0 pattern and movement, Bartkova (2005) takes measurements on the F0 slopes of only the last vowels of R1/R2.

the point of initiation while repairing, therefore, in most of the cases they wouldn't need to spend much more time in repeating the same word or phrase again.

When turning to the location of silence, especially the result of pauses immediately following R2, one prevalent finding from Table 3-b is that there were rarely cases in which speakers of both languages would attach additional pauses after accomplishing the whole repair process. Such a result strongly suggests that interlocutors simply carry on with the turn-so-far after recycling and without further delay. A similar observation has been found in Clark and Wasow's study of repeating words in spontaneous English speech, as it is suggested that speakers are more likely to add a pause or filler just before the restart of the constituent than after (1998:236). It was explicated that this may be due to the reason that speakers are trying to restore the *continuity* of the speech (Clark & Wasow 1998). In other words, when speakers have passed the point of initiation during repairing, and they repeat the same word or phrase again in a shorter time frame, the whole production process would simply be continued and smoothly resumed.

5.2 Further on methods of Initiating Recycling Repair

Based on the discussion presented in Section 4.6, it has been suggested that different methods for initiating recycling repair by speakers in the interaction of the two languages have been observed: For Mandarin speakers, a quick initiation by cut-off at the end of R1 is incorporated and followed by a repetition of the same word or phrase without much delay, whereas for French speakers the strategy for repair is more likely to initiate at the end of R1 by a sound stretch, followed optionally by a filled pause which may be further lengthened. One interesting question with respect to the current observation is how these different methods of initiating repair might be correlated with the turn-taking practice of the interaction, i.e. if the relatively longer initiation process in French recyclings may be used by the speaker to further withhold the turn and thus prevent listeners from intervening in the continuation of the turn-so-far by the current speaker?

Due to some limitations from the current data, we have not yet been able to provide any concrete account for how different methods of initiating recycling repair would be reflected in the turn-taking between interlocutors in the interaction.¹⁵ It is worth mentioning, nevertheless, that there has been previous study suggesting techniques such as incorporating fillers and elongated syllables may help restore continuity of the speech flow (Clark and Wasow 1998). And the same study further claimed that the inclusion of fillers such as *uh* or *um* may create the illusion of greater continuity in English speech data (Clark and Wasow 1998:237). We hope the current result could be further implemented for future cross-linguistic analyses regarding if different methods in initiating repair acoustically may be reflected in and correlated with similar or different turn-taking techniques between interlocutors in the interaction.

One more note concerning different methods of initiating recyclings is that Figure 4 shows that Mandarin speakers rarely incorporate filled pauses in between R1 and R2. The following (8) and (9) present two of the 18 Mandarin recycling instances that were executed with filled pauses (FP) after the site of initiation, namely at the end of R1:

- (8) A: 然後**就是**::: [R1] 嗯:: (.8) **就是**[R2] 要讓他們覺得有來::
(.7) 付費有收到: 實惠的那種感覺
ránhou **jùshi en jùshi** yào ràng tāmen juéde yǒu lái fùfèi
yǒu shōudào shíhuì de nàzhǒng gǎnjué
Then **just FP just** need let them feel have come pay
have received treat DE that kind feeling
'Then (it's) **just::: en::: (.8) just** to let them feel that (.7)
(since) they've paid, they should get something equal in return.'
- (9) X: 然後所以那個老闆-[R1](.)**就是**(.4) 那個老闆[R2]跟:(.) J 說
ránhou suóyǐ **nàgè lǎobǎn jùshi nàgè lǎobǎn** gēn J shuō
Then so **that boss FP that boss** with J say
'And then, so, **the professor (.) just (.4) the professor** told J...'

¹⁵ This is due to that for part of the data incorporated in the current study, the author was given only the speech data of a single speaker in the whole interaction.

In (8), the recycling is initiated by a lengthening, followed by the filled pause *en*, also realized with a prolongation. Here when the speaker recycles the multi-function word *jùshi*, she has incorporated a method of initiation similar to the French recycling instance presented in (4). Whereas in (9), on the other hand, the recycling of the NP *nàge lǎobǎn* “the boss (lit.)/the professor” is initiated by a cut-off, followed by a brief pause then the filled pause *jùshi*. Given that only limited numbers of Mandarin repair instances were identified to co-occur with filled pauses in between R1/R2, there hasn’t been any consistent pattern yet derived as to whether Mandarin speakers demonstrate any preference for attaching a lengthened filled pause to the end of R1 as a type of the repair initiator. More data will be required to examine further how speakers in Mandarin interaction may employ filled pauses in the process of repairing and of the role of filled pauses in initiating the repair.

5.3 More on the Sound Cues of Silence and Further Applications of Current Results

So far we have discussed some shared acoustic realizations while accomplishing the recycling repair in both languages, and suggested how speakers of the two languages may deploy different methods for initiating the specific type of repair based on results of acoustic measurements. There is, nevertheless, one place in the measurement results with regard to the silence that should be addressed as well. When revisiting the occurrences of pauses located prior to R1 (cf. Table 3-a), we find that Mandarin interlocutors display a higher tendency to initiate recyclings after perceivable pauses, whereas French speakers rarely do so. As the follow-up quantitative test does show a significant difference in the distribution presented, the result deserves some explication. A plausible explanation could be that the discrepancy in the distribution of silent pauses may reflect the differences in locating repairs within a prosodic/intonation unit or syntactic unit: i.e. Mandarin speakers may prefer initiating repair toward the beginning of a prosodic/syntactic boundary, whereas French interlocutors may otherwise initiate the repair toward the middle or even later on within the unit. Though further research would be required to explore if the different practices in terms

of locating pauses while repairing would form certain associations with regard to the location of the repair, there actually has been indirect evidence from some previous and recent studies that may help with further clarifications. For Mandarin repair, it has been reported recently in Huang (2013) that repairing sites tend to take place pre-verbally within intonation units. As for French, Bartkova (2005) otherwise suggested that as the F0 movement patterns of French disfluency are rather flat, and from the prosodic realization it actually hinted an unfinished speech sequence instead of the final position. Thus further comparative research will help to clarify if there would be any difference regarding the locations of repair within comparable intonation or syntactic units between the two languages.

Finally, but not the least, through the current study we have attempted to provide detailed analyses of sound realizations in and around the site of initiation in recycling repair of two different languages. Based on the analyses of similarities and differences in the acoustic practices while initiating and executing the recycling repair, it is crucial to be aware that repair is not simply a phenomenon of correcting self-produced errors in speech signals, but it is a constant action that involves not only the sound aspect of the speech production, but also the syntactic, meaning, as well as the interactional aspect of how speakers interact. To provide a full picture of how self-repair works and functions in interaction, we will have to take into consideration simultaneously all these aspects that may contribute to a well-rounded account.

6. SUMMARY AND FUTURE RESEARCH

This paper presents the study that incorporates the data derived from comparative corpora of interaction in French and Mandarin for the analysis of sound profiles at and around the site of initiation in recycling repair. 150 examples of French and Mandarin recyclings were culled from comparative corpora of conversational interaction in both languages. By the interactional prosody approach plus impressionistic judgments, the relative acoustic measurements at and around R1/R2 of the recycling repair were carried out for the comparative analyses. The

goal of the study is to identify the shared sound features adopted at the sites of initiation in accomplishing the specific type of repair in both languages. In addition to the shared acoustic features in terms of relative pitch height, duration in between R1/R2 and the pause located after the repair, the findings also suggest that Mandarin and French speakers may resort to different methods for initiating the repair: Whereas French interlocutors may employ sound stretch at the end of R1 plus lengthened filled pause(s) at the site of initiation while repairing, Mandarin speakers incorporate more frequently cut-offs at the end of R1, followed immediately by R2 for accomplishing the repair process.

For future research, one of the directions that emerged from the discussion in Section 5.3 is to further explore the location of the repair within an intonational/prosodic or syntactic unit for future comparative analyses. As suggested, the position of the repair could be related to the pause located prior to the repair. Most of all, with the finding from the current study, it may contribute to future advancements in exploring the action of repair in conversation from an integrated standpoint that cover all the relevant aspects in speech production, as well as in interaction.

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APPENDIX: NOTATION CONVENTIONS IN THE TRANSCRIPTION

- = Indicates the following utterance ‘latches’ on to the prior utterance without discernible silence between the two utterances
- (.) A dot in parentheses indicates a hearable ‘micro pause’. A cut-off point of 0.2-second applies. Any silence under 2/10 of a second is reported by using this notation.
- < The “less than” symbol by itself indicates that the immediately following talk is “jump-started” from the syllable prior to the symbol. It sounds like starting with a rush. The symbol can be used in combination with the equation symbol '='.
- ° The degree sign indicates that the talk following it was relatively quiet or soft.
- : Indicates lengthened syllables. Multiple colons indicate longer lengthening in the syllables
- ↓ The up and down arrows mark discernible rises or falls in pitch change.
- The dash indicates a “soft” cut-off that has either unnoticeable glottalization or a glottalization without interruption.
- % The percent sign marks “glottalized” cut-offs that have salient interruption glottalization.

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現代漢語與現代法語回溯修復起始點之音韻特徵比較研究

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本研究比較分析現代漢語與現代法語自發性互動口語語料中回溯修復(recycling repair)起始點之音韻特徵。以互動音韻學的研究方法與直觀分析角度出發，標註取自漢語與法語互動口語語料中各 150 個回溯修復在起始點前的回溯部分，以及起始點後以重複方式產生的修復部分的相對音韻呈現；包括相對基頻音高、音長、停頓現象、及音節延長和(喉音化)語流阻斷(cut-off)等與修復起始方式相關的音韻特徵。經由比較各音韻特徵測量相對結果，分析兩種口語語料中回溯修復起始方式在音韻呈現上的異同處。研究結果顯示除了相對音高和音長等相似處，這兩種語料中回溯修復起始處音韻特徵上的差異主要在於：法語語者常在修復起始處以延長音節加上選擇性的填充停頓(filled pause)起始修復過程；相對於漢語語者則常用短促的語流阻斷起始修復，並迅速地重複回溯部分以完成修復過程。

關鍵字：漢語與法語口語互動、回溯修復、修復起始點、音韻特徵