REPETITIONS : COMPLEXITY CUES OR ATTENTION TRIGGERS ?

PERCEPTION OF REPETITIONS AND EDITING TERMS FOR NATIVE SPEAKERS OF FRENCH

Iulia Grosman

“There is a lack of consensus in the literature: do disfluencies trigger conceptual priming of complex entity or act simply as attention cues? [15,18,19], Repetitions are the second **most frequent marks of (dis)fluency,** after filled and silent pauses: they represent an average 25% of all disfluency types in various discourse genres [12]. Disfluency have been sometimes depict as a tool to capture attention and/or a cue for conceptual priming of a complex entity [2, 19]. As priming facilitates perceptual processing, some disfluencies would make utterances more fluent. Literature already attests for the structuring function of silent and filled pauses, especially in the hearers’ expectations about the complexity of an upcoming event [7, 19] and its relevance [2]. The field of linguistics tends to assume that all disfluencies types display metalinguistic information [6] but neurological work attested that “**not all disfluencies are equal**”: they do not affect underlying cognitive processes of speech perception identically in terms of ***prediction, attention, comprehension or memorization*** [13].”

Introduction

Background: Evidence show that disfluencies (silent and filled pauses, repetitions, false-starts, repairs, etc.) can display metalinguistic information to listeners. As a result, disfluencies may work as **fluent devices** [15,18,19,17].

Measurement of *utterance fluency* (audio stimuli) + connexion to *cognitive fluency* (Response Time) = understanding *perceived fluency*

Aim: By means of a **decision task latencies**, this study investigates whether lexical repetition co-occurring with an editing term affects the perception of native speakers of French.

Hypothesis:

Complexity	Fluency*Complexity	Disfluencies Co-oc.
Simple vs Compound Easier to process simplest exemplars of a target category [1]	compound+REP < fluent OR simple+REP>simple fluent [19]	REP + Edit OR REP+FP < REP+SP Due to FP relative salience in the speech flow

Methodology

Overview:

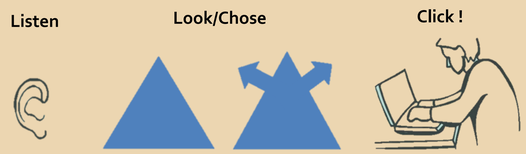
Participants
- 62 native speakers of French

Design
- Within subject Repeated measure design (96 sentences) (Inspired by [19])
- Listen once to sentences describing a simple or a compound shape (*complexity factor*)

Instruction
- Listen once to each sentence and press the left or right key as soon as, from a displayed pair on a computer screen and identifie the shape corresponding to the description

Stimuli composition
- The shapes in the sentences were either preceded by a repetition including (1) a filled pause, (2) a silent pause of same duration, (3) no pause, or (4) no repetition at all (*fluency factor*)

Design:



The paired shapes (Fig.1) were always of the same type and color so that these features would not affect the task. The simple shape was always on the left side and the compound one on the right.

The actual measurement of the exhaustion of the free capacity (log(RT)) is used as a concrete definition of “retrieval disfluency”, the speed with which objects are accessed. They were **automatically extracted** by subtracting the word onset-time (disambiguating syllable) from the RT measured from the start of the sound files.

Stimuli composition:

	(FR)	(EN)
Variables	$1: rouge,bleu, orange $2: circulaire, triangulaire $3: avec les flèches, Ø $4: le bureau, le salon	$1: red, blue,orange $2: circular, triangular $3: with arrows, Ø $4: office, living room
REP + FP *(Original)*	*Apporte-moi le euh le papier orange **[circulaire avec les flèches]** qui est dans le salon*	*Bring me the uhm the orange **[circular paper with arrows]** that is in the living room*
REP + SP	*Apporte-moi le / le papier rouge **[circulaire]** qui est dans le salon*	*Bring me the / the red **[circular]** paper that is in the living room*
REP ***(contiguous)***	*Apporte moi le le papier bleu triangulaire avec les flèches qui est dans le bureau*	*Bring me the the blue triangular paper with the arrows that is in the office*
No REP (« fluent »)	*Apporte moi le papier bleu triangulaire qui est dans le bureau*	*Bring me the blue triangular paper that is in the office*

Stimuli generation:

All sentences were transcribed and phonetically aligned under **Praat** [3] using **EasyAlign** [11]. A thorough prosodic analysis of the 24 original sentences including a filler and a repetition were pronounced twice by a French native speaker, allowing the **selection of stimuli with very little prosodic variation**. The original utterances including a filler repetition were used to generate the 3 other sets of conditions by editing the appropriate audio segment. Using Prosogram v2.9 [14], the 24 stimuli showing the least prosodic variation were selected according to the smallest relative distance from the mean and median of : *the speech rate, the pitch range in semitones, the top and bottom pitch, the pitch mean and median, the mean proportion of glissando, rises and falls of each audio-sample, the relative duration of the filler “euh” and the duration of the schwa in “le”* (the first “le” in “Apporte-moi le euh le papier bleu triangulaire qui est dans le bureau”). T-tests for the two levels of complexity were separately performed for each prosodic feature and **none of them was proven significant** apart from the absolute speech time of the stimuli between the two complexity conditions. On average compound shape stimuli are 600 ms. longer than simple stimuli. Filled pauses in the simple condition were not longer than in the compound shape condition. Schwas before the repetition were uttered with a homogeneous lengthening across conditions *(M = 350 ms., SD = 38 ms.),* in accordance with the tendency observed on the first part of repetitions and segments preceding a FP [18].

Results

Error Rates and Types: Overall, the mean rate of correct responses was 98.147% *(SD=1.73),* results comparable with [19]. Precocious responses (i.e. anticipated responses made before the disambiguating sound) were discarded and treated as errors. Error rates were significantly different in the simple and compound conditions *(t(4,92) = 4.92; p < 0.005),* supporting the fact that the **compound shapes were indeed of higher complexity**.

Main Effect of complexity factor √
- RTs: Complex > simple (*F*(1,61) = 26.76, *p* < 0.001) (> as in [19])
- Error rate: Compound > simple (*t*(4.92)=4.92, p<0.005) (>complexity confirmed)

Main Effect of fluency factory √
- RTs: Fluent > RTs all (simple + compound condition) (disfluencies are attention triggers)
- RTs: REP+ FP & REP < all other (*F*(3,183)=3.87, p=0.0103) (> contrary to [19])

Linear Mixed effect Modelling:

Table 1: Fixed effects Model: lmer(logRT complex + cond + (1—subject)+ (1—item) + (1—nquest) + cogrisk) (57% of variance)

	Estimate (log)	Estimates e(sec)	Df	t value	Sig. *p*
(Intercept)	660.82	1.94	66.13	20.62	<0.001***
Filler rep.- without arrows	-50.25	-1.65	90.52	-10.78	<0.001**
No rep.(fluent)	+13.95	+1.014	90.20	2.12	0.03*
Contiguous rep.	+0.60	+1.000	90.23	0.09	0.93
Silent rep.	+10.79	+1.011	90.80	1.64	0.11
Cogrisk	-1.79	-1.001	60.00	-4.01	<0.001***

REP + FP with arrows

Fluent stimuli = longer to process than disfluent ones *(+1.01 sec. p<0.03)*

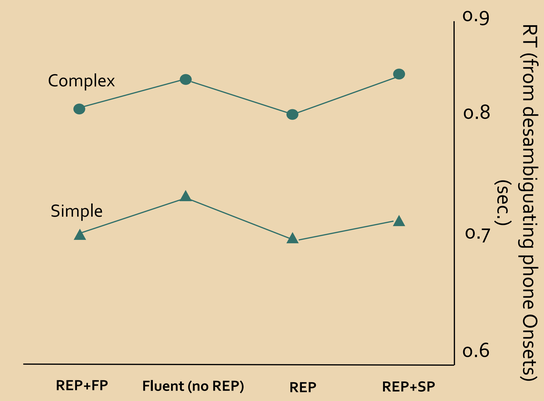
Importance of the individual: Cognitive Reflection Test (simple measure of cognitive ability associated with analytic thinking [10]) highly correlated *(r=0.821)* with the intercept

Negative estimates: “***The lower*** the participants score on the CRT, ***the fastest*** participants react to the stimuli”

Complexity*Fluency ✗
- = No Interaction
- Overall mean scores within fluency conditions were not statistically significant (Post-hoc comparisons using t-test with Bonferroni correction)

Disfluency combinatory ?
- **Additive weight :** RT REP+FP < REP+SP *(t(60) = 4:018; p < 0:001),*
- REP+FP ≠ REP– *n.sig* (+1,011 and +1,00 sec. respectively).
- Latency more due to the presence of REP or TIME than to FP itself ?

Interpretation: Little variance is attested between other fluency levels. Post-hoc tests did show a significant difference among fluency conditions in the simple condition, *(F(3,58) = 2.79, p < 0.05)*, but **no significant difference in the compound shape condition** *(F(3,58) = 1.9, p = 0.131).* These results contrast with [19] who reported and inverted significance. As a result, the second hypothesis according to which RTs to compound shapes would be shorter when there is a repetition than when there is none, and that RTs to simple shapes might be longer with a repetition than without can not be fully supported. In fact, due to the **lack of interaction** between fluency and complexity factors, we can solely conclude that, **no matter the complexity condition, overall sentences with repetitions did induce shorter RTs than fluent ones.**



In decreasing order, fluent sentences, repetitions with silent pauses and contiguous repetitions show longer RTs than repetitions with filler. The findings seem to support that the combination of **repetition with FP does not have an additive effect**. According to the results, repetitions and FPs would cause hearers to react faster; they can thus be interpreted as a cue to catch their attention rather than as a complexity cue.

Conclusions & Discussion

The study tested the hypothesis according to which hearers expect rather long or complex phrases when preceded by a disfluency. Results from ANOVAs and linear mixed-effect modelling show **that the presence of a disfluency triggers a faster response from the participant, however complex the following noun-phrase might be,** supporting the hypothesis that repetition and co-occurring editing terms act as cognitive signposts rather than as cues of complexity of an upcoming event Our results do not entirely converge with previous studies: **no interaction was found between fluency and complexity factors.** Repetition and its editing terms do not seem to facilitate processing or bias hearers’ expectations when complexity rises which does go in line with [13] and [8]. Significant difference in RTs was observed within the fluency condition for simple shapes but not for compound ones. Results show that native speakers of French are quicker to respond to compound and simple shapes **when there is a contiguous repetition or a repetition with a FP**.

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Contact Information

Iulia Grosman iulia.grosman@uclouvain.be VALIBEL Discours & Variation - Université catholique de Louvain (UCL) Louvain-la-Neuve, Belgium