The Roles of Context and Prosody in Disambiguating Utterances with Two Negative Expressions in French[1][2]

Undergraduate Honors Thesis under the direction of Professors Viviane Deprez (Advisor), Francois Cornilliat, Paul de Lacy, and Ana Pairet

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Abstract

This paper experimentally investigates the roles of context and prosody in French in disambiguating simple transitive sentences with multiple negative expressions. Our results indicate that while Negative Concord (NC) is sometimes preferred in French, that this is not always the case, and that some speakers actually prefer Double Negative (DN) interpretations. Our results also show that context plays a significant role in disambiguating these sentences for most but not all speakers, as some speakers consistently choose the same interpretation regardless of context. An acoustic analysis of recordings produced by our participants also shows the use of prosody in the disambiguation of these sentences in the use of a higher pitch accent in the DN interpretation. The location of the pitch accent tended to fall on one (or both) of the negative items in the sentence, but was not uniform across all subjects.

[1] Made possible through generous funding from the Aresty Undergraduate Research Center, the Rutgers University School of Arts and Sciences Honors Program, and the French Embassy in the US

[2] Thanks to the Rutgers University Linguistics and French Departments, the members of the Rutgers CELL Lab as well as the L2C2 Lab in Bron, France for their support throughout this process

Acknowledgements

This project would not have been even a little bit possible without the constant support and guidance of my advisor, Dr. Viviane Deprez. Her help in every phase of this process has been invaluable. She has been more patient with me than I think I would be able to be were I in her shoes. She believed that I could produce something real and encouraged me to do so, even though it meant dragging me kicking and screaming through the theoretical background of this paper. I'd like to thank her for continuing to encourage my academic and professional growth at Rutgers and beyond.

I'd also like to thank the other members of my committee, Professor Paul de Lacy in the Linguistics Department and Professors Francois Cornilliat and Ana Pairet in the French Department for their help and encouragement. The guidance and support I received from both the Linguistics and French departments throughout this project have been wonderful.

The funding for this project, without which none of this would be possible, was provided by the Rutgers University School of Arts and Sciences Honors Program via a grant from the Aresty Research Center for Undergraduates, as well as a Benjamin Franklin Travel Grant provided by the French Embassy in the US.

My parents, Dr. Kathy and Howard Yeaton, also provided a significant amount of funding for this project and I am eternally grateful for their patience and support which allowed me to eat food and not be homeless while I was gathering my data in France. They've also been very supportive of me, both financially and emotionally throughout my years of college (even when I told them I was declaring a French major) and I owe my academic success in large part to both to them and to my siblings, Matt and Jen, for constantly challenging me and encouraging my intellectual growth. There's also no way I could possibly have completed this undertaking without the emotional support of my mother who always urged me onward, looking toward the light at the end of the tunnel.

This project would also not have been possible without the support of the Laboratoire sur le Langage, le Cerveau, et la Cognition (L2C2) in Bron, France, particularly Anne Cheylus, Fanny Meunier, and Ludivine Dupuy. From providing me a place to gather data, to volunteering as subjects, to helping me work out the kinks in the experiment, to just eating lunch with me, I owe you all a great deal. The other members of the Comparative and Experimental Linguistics Laboratory at Rutgers have also been very helpful, with special thanks to Luca Iacoponi who helped me through a number of the more technical bits of my experiment and analysis as well as guided me through some of the other twists and turns of the process. I'd also like to thank (soon to be Dr.) Matt Yeaton and Dr. Suzanne Freynik for keeping me from freaking out about the math and quantitative analysis involved in this paper. I'd also like to thank Ben Kloda, my supervisor at the State Department who encouraged and allowed me to improve my Excel skills that were essential to this project. I'd also like to thank Professor Jenny Yang for her guidance and support throughout my college career.

I'd like to thank my friends and classmates who kept me more or less sane throughout this process, especially Renee Rosiecki, Tashir Hampton, Kristen Fahy, Adrianna Rodriguez,

Marisa Gallicchio, Mason McKenzie, Kristal Mohammed, Alexandra Tweedley, Melissa Gronske, Steven Astafiev, as well as the rest of my roommates at both Hamilton and Hartwell streets. They all manage to keep me in the space of grounded insanity necessary for an undertaking such as this.

Contents

I. Introduction

Negative concord (NC), a construction where multiple iterations of negative terms are interpreted as a single logical negation, is a phenomenon that occurs in many languages including African American Vernacular English (Blanchette, 2013), West Flemish and Romance languages like Spanish, Italian, Catalan and French (De Swart and Sag, 2002) as well as most Creole languages. Examples from French provided in (1) are characterized by so called Negative Spread which features sequences of parallel Negative Concord Items (NCIs), (Watanabe, 2004) but no doubling sentential negation. (1) has two NCIs and can be interpreted as double negation as in (1a) or as single negation as in (1b). The double negative interpretation in (1b), where the two NCIs cancel each other out to result in a positive interpretation, would be the expected interpretation if linguistic interpretation followed mathematical logic and strict compositionality. However it is most commonly assumed to be conceptually complex in Horn (1984: 296–308) and, consequently, to result in a marked reading in most Negative Concord languages as well as in French. The single negation reading in (1b) by contrast, which represents the negative concord interpretation where the two negative items "merge" into one single negative interpretation is said to be the default reading of these constructions, although in effect, it violates the strict logical composition that is standardly assumed to prevail in language semantics.

1. Personne (n')a rien fait.

   No one NE-has nothing done

   a. No one has done nothing (i.e., everyone did something). [DN]

      ¬∃x¬∃y Do(x, y)

   b. No one has done anything. [NC]

      ¬∃x∃y Do(x, y)

The emergence of a negative concord reading in French and other such languages contrasts with languages such as standard English, Dutch and German, where the double negative reading has been claimed to predominate. This has been argued to result from a parametric divide between Negative Concord (NC) and Double Negation (DN) languages (Zeijlstra, 2004).

Understanding how two negations can be interpreted as one has been a subject of significant debate in the linguistics literature, much of which has concentrated on arguing about the exact nature of the NCI expressions that participate in the construction. Some researchers (Deprez, 2000, de Swart, 2010, de Swart & Sag, 2002) posit that NCIs are negative quantifiers, carrying both negation and quantificational force. For Zeijlstra (2004), among others, these expressions are intrinsically non-negative and the negation comes from elsewhere. If it were the case that NCIs are semantically negative, languages should always allow DN readings under the compositional interpretation of the two semantic negations. On this view, the single semantic negation presents a problem for a compositional theory, and requires a special explanation. One semantic solution originally proposed by May (1989) posits that quantifiers that are similar in nature can semantically fuse to form a polyadic quantification, where one quantifier binds more than one variable at a time. Although this explains how a single negative reading can arise from a complex fused negative quantifier, this does not explain how this ambiguity is resolved by the speaker in language use. In languages such as French where both interpretations have been argued to be possible, what are the syntactic, contextual or prosodic conditions that can give rise to one interpretation or the other? Instead of a parametric divide between languages, others (May 1989, Deprez 1997, 2000, de Swart and Sag, 2002) propose that DN and NC readings are the two manifestations of the same ambiguous negative sentences and are therefore possible in any language.

Because of its tolerance for both NC and DN interpretations, French is often considered to be an exception among NC languages, but recent studies (Deprez et als, 2014) have shown that NC is not always the preference of French speakers. Prosody has been posited to be a factor influencing DN interpretations in French (Corblin, 1996, Tovena & Corblin, 2008) but has not been included in previous experiments in French which focused on written presentation.

Our study sought to better understand the nature of NC by experimentally investigating the roles of context and prosody in disambiguating simple transitive sentences in French containing a sequence of two NCIs. We start with an overview of the literature and discussion of the theoretical models that have been put forth to explain the phenomenon of Negative Concord across languages, followed by an overview of previous studies that have investigated the role of prosody in DN and NC. This review of the literature will also demonstrate the gaps in current findings and the necessity of our study. We then introduce our experiment, covering the design of the stimuli and how we controlled both for meaning and prosodic factors, and provide a description of the analysis that was performed on the twofold data that was collected (behavioral and acoustic). Finally, we present our results, followed by a discussion of what the results mean, both with regard to our research questions as well as their theoretical implications.

II. Literature review

Theoretical Models

The three dominant theories on NC are presented below. The macro-parametric approach of Zeijlstra, which posits that NC and DN languages differ inherently based on the semantically negative nature of both their NCIs and negative markers. The polyadic quantification approach of de Swart & Sag proposes that NC interpretations are obtained through differing constraints across languages under Optimality Theory (OT). The micro-parametric approach of Deprez

posits that these forms can arise in different situations within the same language depending on the internal syntactic nature of the NCIs used in the utterance.

Macro-parametric

The macro-parametric account of Zeijlstra (2004) proposes that NC languages differ from DN languages in the nature of the NCIs and the sentential negative operators and the ways in which these two units combine. There are two categories of negative markers- semantically negative (interpretable negation) or semantically non-negative (uninterpretable negation) - where the second is essentially parallel to the so called expletive marker 'ne' in French and two categories of NCIs- semantically negative(i-Neg) or semantically non-negative (u-Neg). This functionally divides languages into four categories:

Table 1.1: Biberauer and Zeijlstra's (2012) typology of NC and DN languages

	NCI semantically negative	NCI semantically non-negative
Negative markers semantically negative	DN languages: *Dutch, German, Swedish*	Non-strict NC languages: *Spanish, Italian, Portuguese*
Negative markers semantically non-negative	*Afrikaans A*	Strict NC languages: *Czech, Serbo-Croatian, Greek, Afrikaans B*

The combination of both semantically negative NCIs and semantically negative sentential negation markers results in a double negative interpretation in languages like Dutch and German. By contrast, if at least one of (or both) the NCI or the sentential negation marker in the language is semantically non-negative, it is possible to achieve a NC interpretation in that language. Spanish, Portuguese and Italian have semantically non-negative NCIs under this approach, but semantically negative sentential negation markers, making them non-strict NC languages. Languages like Czech and Greek have both semantically non-negative NCIs and semantically non-negative sentential negation markers, making them strict NC languages and not allowing a

DN interpretation at all. Giannikidou (1998) breaks down these categories further by introducing the concept of strict and non-strict NC languages. French presents a problem within this system because it is a non-strict NC language, but also a non-strict DN language. It does not fit neatly into one of the four categories because of the similar rates with which French speakers can access DN and NC interpretations in utterances with multiple NCIs. French does not allow for a NC reading when sentential negation is used, though. Haitian Creole, a language with French roots, however, is a strict NC language, and allows concord both in situations with multiple NCIs as well as NCIs in combination with sentential negation (Deprez, 2000). Although rather successful in accounting for cross-linguistic diversity, the macro-parametric approach is not capable of accounting for language-internal variation as is observable in French with its variability of situations where concord is allowed.

Polyadic Quantification approach

By contrast to Zeijlstra, de Swart (2010) posits that NCIs are always negative quantifiers. Under this approach, NC is just one possible interpretation of the interaction of a sequence of multiple NCIs. In this way, there is no parametric distinction between NC and DN languages, given that every sentence with multiple instances of these items can be interpreted under either a compositional iterative operation which results in a DN reading, or under a polyadic resumptive interpretation (NC). In an iterative interpretation, both NCIs maintain their negative semantic power and behave like monadic quantifiers ($\neg\exists x\neg\exists y$ for the relation R(x,y)), so there exists no x and no y such that x does y. In a resumptive interpretation of polyadic quantification, the negation takes scope over both (or more) quantifiers, which act as a single unit ($\neg\exists x\exists y$ for the relation R(x,y)), so there is no x and y such that x does y.

Table 1.2: Compositional iterative vs. polyadic resumptive interpretations of the English sentence "Nobody does nothing"

Interpretation	Semantic representation	Explanation
Compositional iterative (DN)	¬∃x¬∃y, do(x,y)	There is no person x *and* no activity y such that x does y
Polyadic quantification (NC)	NO< x, y>, do(x,y)	There are no pairs <x,y> x, a person, y, a thing such that x does y

This explanation by itself does not account for the cross-linguistic variation between languages having a stronger preference for NC or DN, but it does allow language-internal variation between the two interpretations. To account for cross-linguistic variation De Swart (2010) proposes an Optimality theory approach. Through the ranking of the constraints FNeg (faithfulness to negation), MaxNeg (mark indefinites under the scope of a negation as formally negative), and *Neg (avoid negation in the output). In all languages the FNeg constraint is highest ranked, but NC and DN preferring languages differ in their rankings of the MaxNeg and *Neg constraints: DN languages more strongly disprefer negation in the output, therefore *Neg is ranked higher, whereas NC languages prefer marking indefinites under the scope of a negative, over their dispreference of negation in the output. These preferences are illustrated in table 1.3:

Table 1.3: OT constraints for DN and NC preferring languages

DN-preferring languages	NC-preferring languages
FNeg *Neg MaxNeg	FNeg MaxNeg *Neg

It is important to note that both of these categories of languages allow both interpretations, but prefer one or the other due to the organization of their constraints. Because DN-preferring languages have a higher ranking of the *Neg constraint, they more strongly avoid negation in the output, so if a compositional iterative approach is available which would result in an ultimately

positive interpretation, speakers will tend toward that interpretation. The reverse is true for NC-preferring languages- because the MaxNeg constraint is ranked above its aversion for negatives in the output (*Neg), it is more important in these languages that the scope of a negation be projected as far as possible over not having negation. In these languages, therefore, if a polyadic quantification interpretation is available, speakers will select it at the level of production. This OT approach does not explain the variations in the syntax.

Micro-parametric approach

In contrast to Zeijlstra, or De Swart, Deprez (1997, 2000) and Deprez and Martineau (2004) argue that neither a non-negative approach to NCI or a resumptive analysis presented in May (1990) for English can uniformly applied across all NC constructions or languages. Deprez (1997) proposes that there are two basic semantic types of NC relations. The first is a Negative Polarity Item (NPI) licensing type, where NCI are non-negative expressions and negation comes from the co-presence of the sentential negative marker. The second is a pure resumptive type, where NCIs are negative quantifiers that allow a polyadic interpretation. These two types represent the two extremes on the spectrum of possibilities. She posits that NCIs in French are inherently negative or, more exactly, numeral quantifiers of value zero. Because negating a French NCI is equivalent to negating a numeral zero, it produces the canceling effect of a DN interpretation, shown in (1) below:

1) Je n'ai pas vu personne = Je n'ai pas vu zéro personne

   I did not see zero person = I saw at least 1 person

In a situation that involved negative numeral indefinites as in (2) below, a concord reading is not only possible, but favored.

2) Zéro personnes ont mangé zéro gâteaux.

   Zero people ate zero cakes = no one ate any cakes

Because there were zero (person, cake) pairs in an eating relation, no cake was eaten by anyone. This aligns with May (1989) conception of resumptive quantification where two or more items share an absolute scope, as well as semantic and syntactic parallelisms between the quantifiers involved. French negative concord is therefore only predicted to be sensitive to the NCIs' relative scope and to the parallelism conditions between the NCIs. The contrast in interpretation between (2) and (3) demonstrates that the two expressions (*pas une personne* and *rien*) are neither syntactically nor semantically parallel.

3) Pas une personne n'a rien mangé.

   Not a person ate zero thing = every person ate at least one thing

Because the negative expression *pas une personne* does not share the same syntactic and semantic properties as the NCI *rien = (zero thing)*, a concord reading is not possible, since they cannot be grouped into a pair quantifier for a resumptive interpretation. In situations where two NCIs appear in a given sentence like (4), both NC and DN interpretations are available:

4) Personne ne dit rien pendant les réunions.
   Nobody says nothing/ anything during the meetings

   a. NC: Nobody says anything during the meetings

   b. DN : Nobody says nothing during the meetings = everyone says something

In (4a), the internal syntactic and semantic properties of *rien* and *personne* must be parallel and fall under the same scope so that they may be grouped into a resumptive quantification interpretation: there is no (person, thing) pair in a saying relationship. By contrast, the items in

(4b) are probably not parallel in structure or are not under the same scope, thereby resulting in a DN interpretation: there is no person and no thing in a saying relationship, where the scope of the negation is over each item individually instead of as a pair. While parallelism and common scope are factors favoring an NC reading, they are not absolute conditions to be met in all situations allowing NC.

The two different interpretations are possible depending on the quantificational force interpreted with the NCIs. If the NCIs are interpreted with strong quantificational force, they undergo Quantifier Raising (QR) and are moved higher in the phrase structure in SpecDP, thereby allowing an NC interpretation. Under their weak reading, they are interpreted as cardinality predicates and remain in their lower position in the phrase as a D head, facilitating a DN reading. This micro-parameter would then account for the increased level of ambiguity in French, given that while the surface form can be the same, the internal structure and nature of the NCIs will determine the meaning of the utterance.

Previous Studies in DN and NC

Ambiguity in DN and NC in French

French's acceptability of both DN and NC interpretations is somewhat anomalous in the landscape of NC languages. Experiments conducted by Deprez et al (2014, to appear) sought to determine, through manipulation of the structure of the sentences, to what degree NC is preferred in French and in what syntactic conditions. These experiments used a picture choice task, where a sentence containing two NCIs was presented on a computer screen along with two pictures: one corresponding to a NC interpretation of the sentence and the other corresponding to a DN interpretation. The results of this study show that NC is not always the preferred reading in French and that DN readings occur much more frequently than previously thought. The results

overall indicate a slight preference toward NC interpretations in situations with no context. The question remained, however, as to whether or not both the NC and DN interpretations would still be available to speakers if a context was provided.

Previous studies on prosody in DN and NC

Prosody has been posited to be a disambiguating factor between DN and NC interpretations in French (Corblin, 1996; Corblin & Tovena, 2003), but there has not been any experimental evidence presented to support this claim. Previous work in DN in NC languages (Horn 1984: 296–308) had also proposed that the context that would facilitate a DN interpretation to arise in an NC language would be detailed and only occurs in specific situations, more specifically in a contradiction to a negative statement. Prosody and the role of context have, however, been under investigation in recent years as to their disambiguating power in Afrikaans (Huddlestone, 2010), Dutch, using the model of the Afrikaans study (Fonville, 2013), Catalan and Spanish (Prieto et al., 2013) and Catalan (Tubau et al., 2015). While prosody was not clearly shown to play a distinctive role in the contrasting interpretations of DN and NC in Dutch, it was shown to have an effect in Afrikaans, Catalan and Spanish. The studies conducted in both Catalan and Catalan and Spanish were both primarily perception experiments pertaining to yes/no questions in these languages where the critical disambiguating segment fell on a second speaker's response. Huddlestone and Fonville's experiments in Afrikaans and Dutch used declarative statements in context in a production experiment to allow naïve speakers to disambiguate prosodically. In these experiments, the subjects were presented a few sentences of context and an ambiguous experimental sentence portion on a computer screen and told to read them to themselves, then aloud for a recording. These experiments failed to control for meaning, however, in their production experiments. A lot of variation was observed, particularly in DN contexts, but

without confirmation that the subjects had interpreted the sentence according to the context, it is unclear whether the subjects had a hard time producing the anticipated prosodic behaviors or if they were not appropriately interpreting the contexts. It is possible that participants were simply doing a reading of the other interpretation (i.e.: an NC interpretation in a context designed to elicit a DN or vice versa), but in the absence of confirmation from the participants it is not possible to know for sure. In a study on the prosodic disambiguation of scopally ambiguous quantification, Syrett et al. (2014) used a comprehension question between the context and the production to ensure that the subjects had accessed the anticipated interpretation, and excluded those items where participants did not comprehend the context.

The remaining unanswered questions which we sought to examine in the present study are:

1.) Would a provided context allow a speaker of French to access an interpretation of an ambiguous sentence with multiple NCIs, even if that interpretation were not usually their preference?
2.) If French speakers can access both interpretations, what, if any, prosodic cues exist to distinguish between the two possible interpretations (DN or NC) to an interlocutor?

III. Experimental method

This section will outline the overall design of the experiment. First we will provide a brief description of the participants who took part in the experiment. We will then discuss the stimulus design, describing the conditions we were testing for as well as the controls implemented both for meaning and for prosody. Third will come a description of the procedure for the administration of the experiment. This section will close by describing the two analyses that were performed on the data collected: a behavioral analysis, and a prosodic analysis.

Participants

This section will provide information about the participants in the experiment. This will illustrate that the subjects were sufficiently homogenous and qualified to provide accurate and reliable data for this project.

The participants for the experiment were 28 native speakers of French (18 female) aged 18 to 45. All of the subjects had education at least through the university level. Because of the manner in which age data was gathered, i.e.: subjects selected their age in ranges, a mean age cannot be calculated. 15 of the 28 subjects fell in the 18-24 age range. The largest geographic group (n=12) were from the Rhone-Alpes region, but subjects were from all over France. No patterns were noticed with regard to differences in interpretation by region, which therefore gave no reason to believe region played a role in interpretation. All subjects had been residing in the city where the data was collected for no less than six months. Demographic information was collected in a questionnaire (appendix 1) and asked the subjects' age in 5 year ranges; the sex with which they identified; whether or not they were a native speaker of French, and from what region of France their French was; the length of time they had been a resident of the city in which we collected the

data (Lyon); what, if any, other languages they spoke and at what level; and their level of education (primary, secondary, or superior). All data was collected at the Institute for Cognitive Sciences in Bron, France. Subjects were remunerated 10 Euro, and signed a consent form in their native language.

Stimulus design

The experiment had two main goals: the first was to see if the presence of a guiding context would influence the interpretation that speakers give when presented with ambiguous sentences containing two NCIs; and the second was to see if the two interpretations are differentiated by prosody. In order to reach this dual goal, two sets of controls were used: controls for the interpretation and controls for prosodic factors.

A total of 40 experimental items were developed for this experiment. The items were broken down into 5 categories with 8 token items each: 1) Critical Double Negation, 2) Critical Negative Concord, 3) Control Negative Subject, 4) Control Negative Object, and 5) fillers. Each experimental item was comprised of three parts: a context, a target sentence, and a follow-up sentence used to determine the participants' interpretations. The subjects' responses to these statements were the primary control for meaning, and allowed confirmation of subject comprehension or interpretation, instead of simply assuming all subjects would interpret the items in the same manner according to context.

The two critical and two control conditions all used the same set of eight common used monosyllabic French verbs.

Critical conditions (DN and NC)

The two critical conditions each feature parallel NCIs in each experimental sentence (*personne-rien*). The critical portions of the experimental items all followed the form *personne ne* [verb]

rien [PP]. All test sentences were preceded by one short context sentence prior the critical portion whose goal was to facilitate a particular interpretation of the test items. In the critical DN condition, the contexts were used to facilitate a double negative interpretation of the test items, which themselves remained ambiguous:

a.) CONTEXT : Chez les jeunes, la consommation d'alcool est effrayante :

TEST ITEM : personne ne boit rien dans les soirées.

The amount of underage drinking that occurs is shocking:

nobody drinks nothing at parties.

The context in (a) is designed to elicit a DN interpretation: because the amount of underage drinking that occurs is so shocking, speakers were hoped to interpret the test item with a double negative interpretation. A lot of underage drinking takes place, so nobody drinks nothing at parties, or everyone drinks something at parties since the two negatives are led to cancel one another out. The interpretation that nobody drinks anything at parties would not be congruent with the context. Similarly the contexts for the critical NC condition were used to facilitate an NC interpretation of our ambiguous stimuli:

b.) CONTEXT: Dans notre famille on est tous allergique à l'alcool :

TEST ITEM : personne ne boit rien dans les soirées.

In our family, everyone is allergic to alcohol:

Nobody drinks anything at parties.

In (b), an NC interpretation is expected. Since everyone in the family is allergic to alcohol, it would make sense that nobody drank anything at parties. Interpreting the test item as "everyone

drinks something at parties"—the DN interpretation—would not make sense according to the context and would result in a lot of allergic reactions. For both (a) and (b), the follow up statement was:

c.) FOLLOW-UP : Ils ne boivent pas d'alcool.

They don't drink alcohol.

Participants would respond to this statement, stating whether it were true or false in the context of the target sentence that it followed. A response of false for (a) and true for (b) would be considered contextually appropriate. Due to the ambiguous nature of these sentences, a response of true for (a) or false for (b) could not be considered wrong, but is simply an interpretation that is not expected in the context.

Controls and filler sentences

The controls consisted of unambiguous sentences in context which had only one negative item in the critical portion. This allowed confirmation that subjects were able to appropriately apply negation in unambiguous contexts. The negative subject control used only the term *personne* in the pre-verbal position (subject) whereas the negative object control used only the term *rien* in the post-verbal position (direct object). The controls followed the form *personne ne* [verb] [object] [PP] or [subject] *ne* [verb] *rien* [PP].

In the case of the control conditions, the contexts were designed to more easily facilitate the unambiguous meaning of the sentence:

d.) Quand on sort, il faut un chauffeur sobre :

Raoul ne boit rien aujourd'hui.

When you go out, you need a designated driver:

Raoul isn't drinking anything tonight.

e.) Dans ce bar, il y a de l'ambiance et on consomme beaucoup d'alcool :

personne ne boit d'eau ici.

This bar has ambiance and people consume a lot of alcohol:

Nobody drinks water here.

In (d), the only possible interpretation is that Raoul isn't drinking anything tonight. The context provided—that a designated driver is needed—is not designed to clarify an ambiguity, but simply to more easily facilitate the single negation and to make the items look similar across conditions. The same is true for (e). There is only one possible interpretation for the sentence, that nobody is drinking water here. Both (d) and (e) were also followed by clarification sentences similar to (c). Participants' true or false responses allowed for confirmation that 1) participants were not selecting true or false at random, and 2) participants could understand the meaning of both of the NCIs (*personne* and *rien*) when used by themselves. They thus provided adequate controls to verify that the task was understood and the participants attentive.

The responses to the follow-up statements were evenly split between true and false within each of the experimental conditions (4 true and 4 false responses within each condition) in order to avoid having the sentence bias the subjects' interpretation or response.

The contexts, sentences and clarification statements were piloted in a pencil and paper format with 10 native speakers of French. 8 unambiguous affirmative sentences were used as fillers. Filler sentences are used as distractors mixed in among critical items and controls. They also serve to spread out the critical items so they do not appear one after the other.

Prosodic controls

In order to control for prosodic factors, the stimuli were designed to maximize comparability across experimental items. All of the verbs were monosyllabic and the same eight (like, drink, do, say, put, eat, read, see) were used across both experimental and both control conditions. For the controls, noun phrases with two syllables (mostly proper nouns) were used in the subject position to align with the two syllables of *personne*. Objects with one syllable were used to align with *rien* so that the critical portions would have the same number of syllables:

Table 2.1: Alignment of syllables across conditions

Syllable number:	1	2	3	4	5	6+
Critical	per	sonne	ne	boit	rien	prepositional phrase
Control subject	per	sonne	ne	boit	d'eau	prepositional phrase
Control object	Ra	oul	ne	boit	rien	prepositional phrase

In all items, the critical portion (syllables 1-5 in table 2.1) was followed by an expression of at least two syllables in the form of a prepositional phrase so that sentence-final contour would not fall on the tested items and would leave the pitch of the second NCI or whatever else followed the verb unaffected. Whenever possible, sonorants were maximized in order to obtain a smoother pitch contour for the critical sentences. Sonorants are phonemes marked by continued resonant sound, and allow for a smoother pitch contour. Non-sonorants would result in gaps in the pitch contour of the utterance where no pitch was being produced and could result in less reliable pitch values.

The experiment was administered using a program in Python designed by Luca Iacoponi (2015), a graduate student in the CELL Lab. The items in the experiment were pseudo-randomized in

order to avoid ordering effects. Ordering effects occur when the order of presentation of experimental items influences participants' responses. If the order were left the same across all subjects, it would remain possible that the order had affected the participants' interpretations. If participants always saw the same two items back-to-back, (DN and NC contexts of the same verb, for example), there is a chance that 1) they would get confused by the two different contexts and 2) their interpretation of the first one would impact their interpretation of the second. To avoid this problem the following pseudo randomization was devised:

Fig. 2.1: Illustration of pseudo-randomization scheme

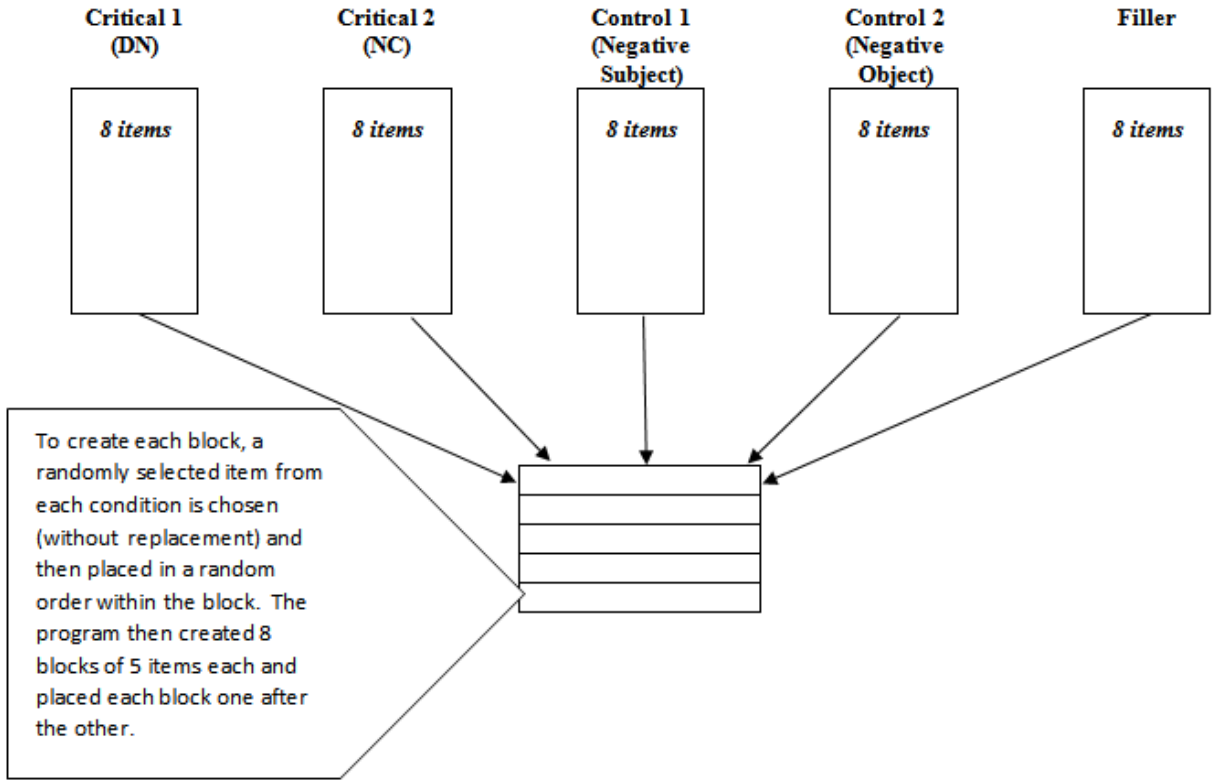


Figure 2.1 illustrates how the pseudo-randomization took place. The 40 total items were divided into eight blocks of five items each. Each block contained one randomly selected item from each of the five conditions: 1) Critical DN, 2) Critical NC, 3) Control Negative Subject, 4) Control Negative Object, and 5) fillers. This would create 8 blocks of 5 items, with the 8 items from a

given condition assigned to 8 separate blocks at random so that they were not always presented in the same order. The items were randomized within each block, so that the conditions were not always in the same order within the block. Once the 8 blocks had been created and randomized, they were presented to the subjects one after the other so that all participants saw all 40 items once each. In a small number of cases, the two contexts for the same target sentence were presented to the participant one after the other. These cases did not present any increase in mismatched responses.

Procedure

The experiment took about 20 minutes from start to finish. Participants were recorded one at a time using an Asus Orion PRO gaming headset with a noise filtering microphone and passive noise-cancelling ear cups in a quiet office in the Laboratory on Language, the Brain and Cognition, a portion of the Institute for Cognitive Sciences located in Bron, France. Stimuli were presented to subjects using PsychoPy on a PC running Windows 7. Each subject was presented with 42 total items (2 practice items to ensure task comprehension, 40 items as part of the experiment). Subjects were then given instructions for the experiment (appendix 2) on paper in French and given the opportunity to ask any questions before they began the experiment. They were alerted to the fact that the goal of the experiment was to record their intonation and were asked to read the sentences as though they were telling a story to a child. They were first instructed to read both contexts and test sentences silently to themselves so that they fully comprehended the entirety of the text on the screen before pressing the spacebar to begin the recording. Subjects were instructed to start over from the beginning of the context and sentence if they made a mistake. Subjects would then press the spacebar again to end the recording and proceed on to the follow-up statement. The context and sentence that the subject had read would

disappear and the follow-up clarification statement would appear on the screen in its place. Subjects would then respond to this statement by pressing either the V or F keys (corresponding to *vrai*- true and *faux*-false in French) indicating whether the verification sentence was true or false with respect to the tested item. Selecting either of these options triggered proceeding onto the next screen to see the following contexts and test sentences.

Analysis

Behavioral analysis

For the behavioral analysis, the true and false responses from the clarification statements task were used to determine what role a provided context could play in disambiguating simple transitive sentences containing the two NCI *personne* and *rien*. From this experiment 1,120 total responses were gathered (subjects= 28, items per subject= 40). Among these, 448 were ambiguous critical items (16 per subject), 448 were control items (16 per subject), and the remaining 224 were fillers (8 per subject). Sentences were assigned a 1 if the true/ false response given by the subject either did not match the context or was incorrect and a 0 if the response was what was expected for the item. Using examples (a) and (b), reproduced below, the expected response would be the one indicating that the subject had interpreted the test item according to the context:

a.) DN CONTEXT : Chez les jeunes, la consommation d'alcool est effrayante :

TEST ITEM : personne ne boit rien dans les soirées.

The amount of underage drinking that occurs is shocking:

nobody drinks nothing at parties.

FOLLOW UP: Ils ne boivent pas alcohol

T response = DN interpretation matching the context

F response = NC interpretation mismatching the context

b.) NC CONTEXT: Dans notre famille on est tous allergique à l'alcool :

TEST ITEM : personne ne boit rien dans les soirées.

In our family, everyone is allergic to alcohol:

Nobody drinks anything at parties.

c.) FOLLOW-UP : Ils ne boivent pas d'alcool.

They don't drink alcohol.

T response = NC interpretation matching the context (coded as 0)

F response = DN interpretation mismatching the context (coded as 1)

A response of false for (a) and true for (b) would be expected because these would indicate that subjects had responded to the follow-up according to the context presented. By responding "false" for (a), the subject would demonstrate that they had accessed the DN interpretation intended in the context: if the statement that "they don't drink alcohol" is false, then it must be the case that people are drinking alcohol. This would be congruent with the interpretation of the test item in (a) that everyone is drinking something (since nobody is drinking nothing), i.e.: a DN interpretation, which was expected based on context. The converse is the case for (b): because everyone in the family is allergic to alcohol, nobody drinks anything at parties. "They don't drink alcohol" would therefore be true according to this context, and a "true" response would demonstrate that the subject had accessed the NC interpretation encouraged by the context. The responses were examined subject by subject to determine if any participants had a significant number of errors in their responses to the control sentences, meaning that they had responded to the follow-up statements without paying close attention to the contexts and test

items. Recall that these control items, like (d) and (e) above, should not have presented any ambiguity and therefore have a clear right and wrong answer. High numbers of incorrect responses to these items would indicate either that the participant was not paying very close attention or that they had trouble applying basic negation rules in French, which would present further problems when trying to interpret multiple NCIs.

Prosodic analysis

The prosodic analysis used the audio recordings produced by the subjects, summarized in table 2.2:

Table 2.2: Breakdown of eliminated items

	Number of recordings
Total critical (DN and NC) recordings	448
Recordings removed because of participant elimination	128
Recordings with context mismatched T/F responses	39
Recordings lost because of technology failure	3
Total recordings used in analysis	278

448 total recordings of ambiguous critical items were collected. Because the goal of the study was to determine if there was a differentiating prosodic cue between the DN and NC interpretations of ambiguous sentences, only the recordings from subjects for whom these sentences were ambiguous were used. Eight participants were eliminated (128 recordings) because they responded with the same interpretation (DN, n=1, or NC, n=7) regardless of context in 75% or more of cases, i.e.: they responded with less than 50% context matches for either the DN or NC condition. These subjects still responded satisfactorily in the controls, with few or no errors. The recordings for items where the participants gave contextually inappropriate responses to the true/ false follow-up statement were eliminated (39 recordings). An additional 3 recordings were lost because of technical issues. All of the remaining recordings were listened to

by two native speakers of French for naturalness and no utterances were marked as unacceptable by both speakers, so no eliminations were made based on this test. This left a total of 278 recordings (138 DN, 140 NC).

The critical portion of the utterance, starting with the onset of the first NCI (*personne*) until the end of the utterance was excised from its context using Audacity audio editing software. This allowed analysis of just the critical portion of the sentence, from the onset of the first NCI (*personne*) until the end of the utterance. The contexts were not analyzed prosodically, so they were not designed to be comparable across items. A Praat (Boersma, 2001) plugin called EasyAlign (Goldman, 2011) was then used to annotate the utterances with their respective texts to the precision of the phoneme level. Text grids were prepared to represent the syllable boundaries within the utterance, as shown below:

Fig. 2.1: Screen grab of an utterance with its text grid in Praat

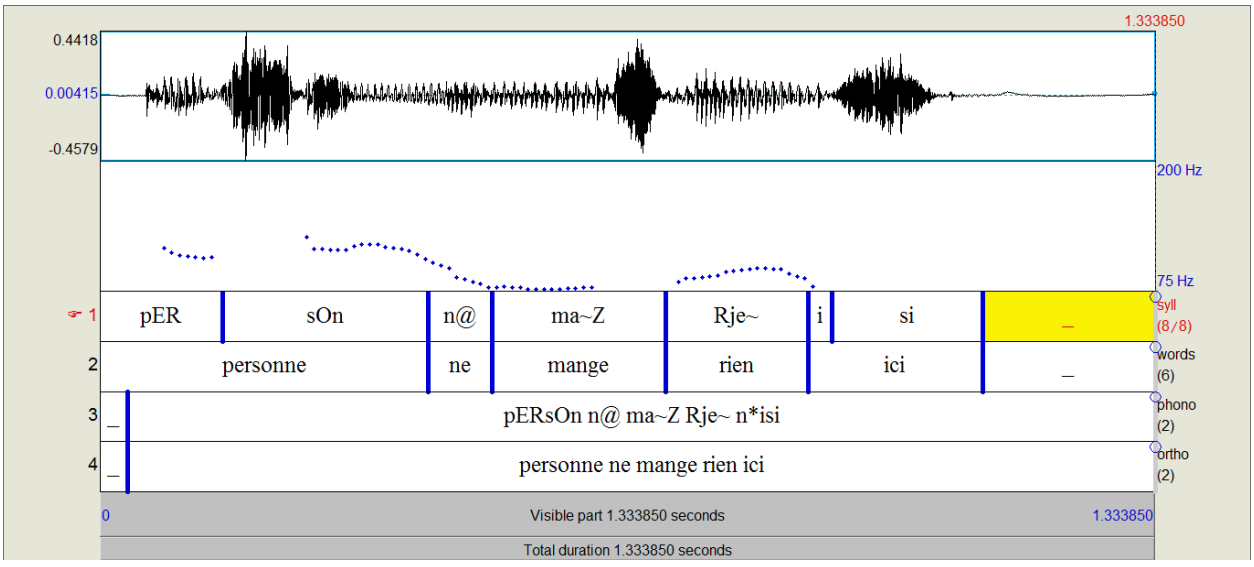


Figure 2.1 is a screen capture of a test item aligned with its text grid in Praat. By dividing the utterance in this way, it is easier to observe where participants' prosodic behaviors are occurring over the course of the utterance. The blue dotted line shows the pitch over the course of the

utterance. The black line in the first tier in the figure is the waveform of the utterance, and is shown as taller when the intensity (in decibels—dB) of the utterance increases.

Another Praat script called ProsodyPro (Xu, 2013) was then used to obtain ten time-normalized fundamental frequency (f0) values over the course of each syllable window. These fundamental frequency values, measured in Hertz (Hz), allow for graphing these values over time. By doing so, we are able to show the pitch behavior of the subject over the course of the sentence. These f0 values were combined into a file for each subject. In order to normalize the pitch for each subject, the mean f0 of all usable utterances was subtracted from the raw f0 value. This allowed inspection of subjects' variations from the mean, as opposed to just examining the contour of the utterance, and enabled the creation of composite f0 contours, both for a given subject, but also for the group as a whole.

Fig. 2.2: Raw f0 contours for the same utterance for a male (109) and female (112) participant

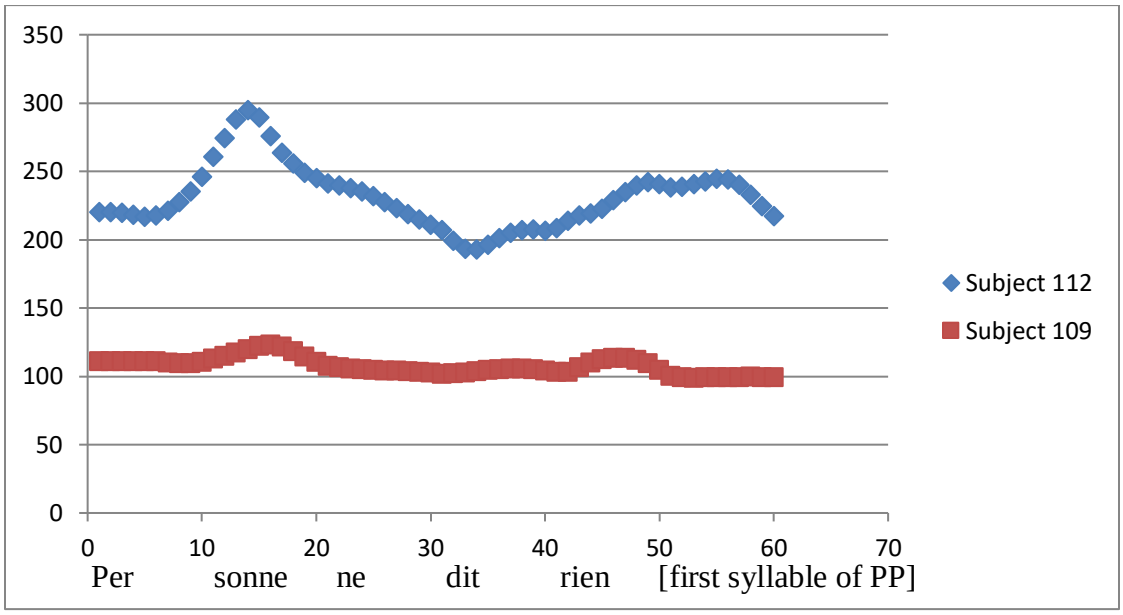


Table 2.3: Delineation of syllable boundaries in figures 2.2 and 2.3

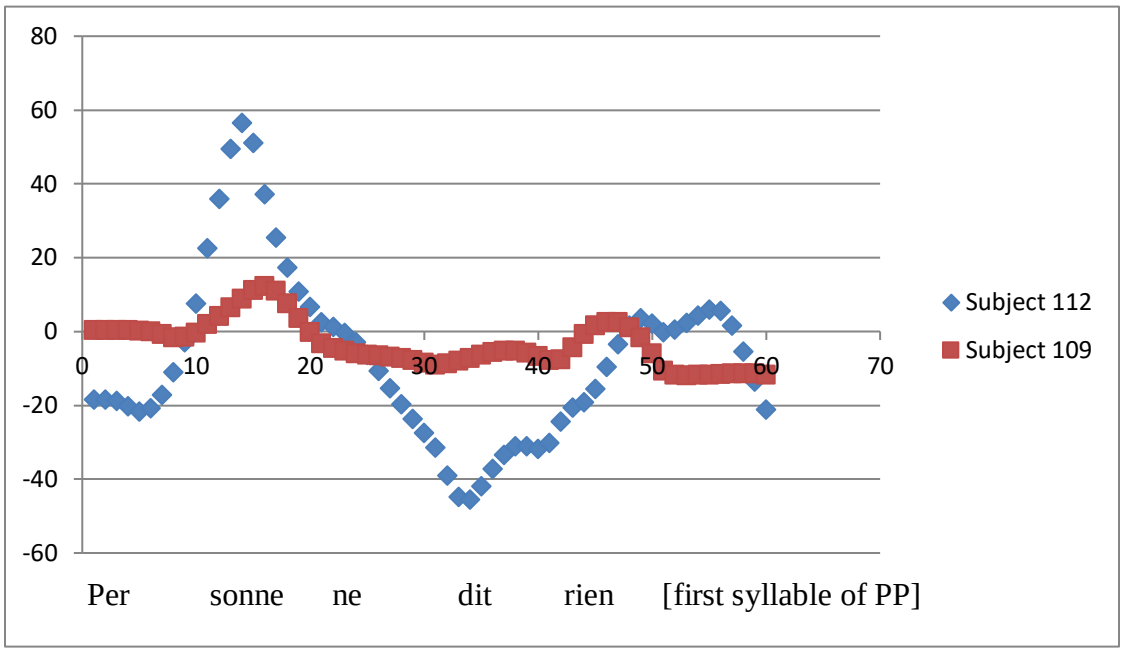
Window	1-10	11-20	21-30	31-40	41-50	51-60
Syllable	per	sonne	ne	[verb]	rien	[first syllable of PP]

In figure 2.2, the x axis represents time, where each syllable is allotted 10 units on the x axis. The y axis is the measurement of the pitch of the participants' voices over the course of the sentence, measured in Hertz (Hz).

Figure 2.2 tracks the raw f0 values for a single test item for two different participants. The utterance depicted in figure 2.2 is an NC test item, and shows the difference in pitch available between two subjects on exactly the same sentence (*personne ne dit rien*- "nobody says anything"). By leaving the values in this form, average values would not be of much use across participants. An average contour could be created for each speaker and compared visually, but would not allow for numerical comparison.

In order to resolve the problem of speaker voice pitch variability, an average f0 value in Hz was obtained across all of each participant's utterances. The average of all of their observed pitch values would therefore be the average pitch of that speaker's voice. All of the utterances produced by that subject would occur either slightly above or below this average pitch. By subtracting this average from each of the raw f0 values, each utterance was then centered on 0 Hz, instead of on the speaker's average. Compare now the raw values in figure 2.2 with the de-meaned values in figure 2.3 *for exactly the same two sentences.*

Fig. 2.3: De-meaned f0 contours for the same item for a male (109) and female (112) participant



Now, instead of each of the utterances being centered about their respective subjects' average f0 values, the contours are centered on 0 Hz. The y-axis of figure 2.3, still measured in Hz, now illustrates speakers' variations from the mean pitch of their voices as opposed to the raw pitch at which they produced the utterance (as was the case in figure 2.2). Negative values are now possible, but just illustrate that that portion of the utterance was produced at a pitch below the speaker's mean.

As a result of this de-meaning process, all f0 values presented in this paper represent variations from the participants' mean f0 values. These values will all be presented in Hz greater or less than the average pitch (now centered on 0 Hz on the y-axis).

An overall prosodic contour was then created for each utterance from the onset of the first NCI to the end of the first syllable of the prepositional phrase following the second NCI (per/sonne/ ne/ [verb]/ rien/ + 1/[PP]). For each of the syllables in the utterance, ProsodyPro produced 10 raw f0 values. The portion to be analyzed therefore consisted of 60 values: 6 windows, with 10

values per window. Once this had been done for each subject, a contour of the subject's average variation from the mean was produced for that subject's DN utterances and a separate one was produced for the NC utterances, as in figure 2.4 below:

Fig. 2.4: Example of a composite contour for a single subject

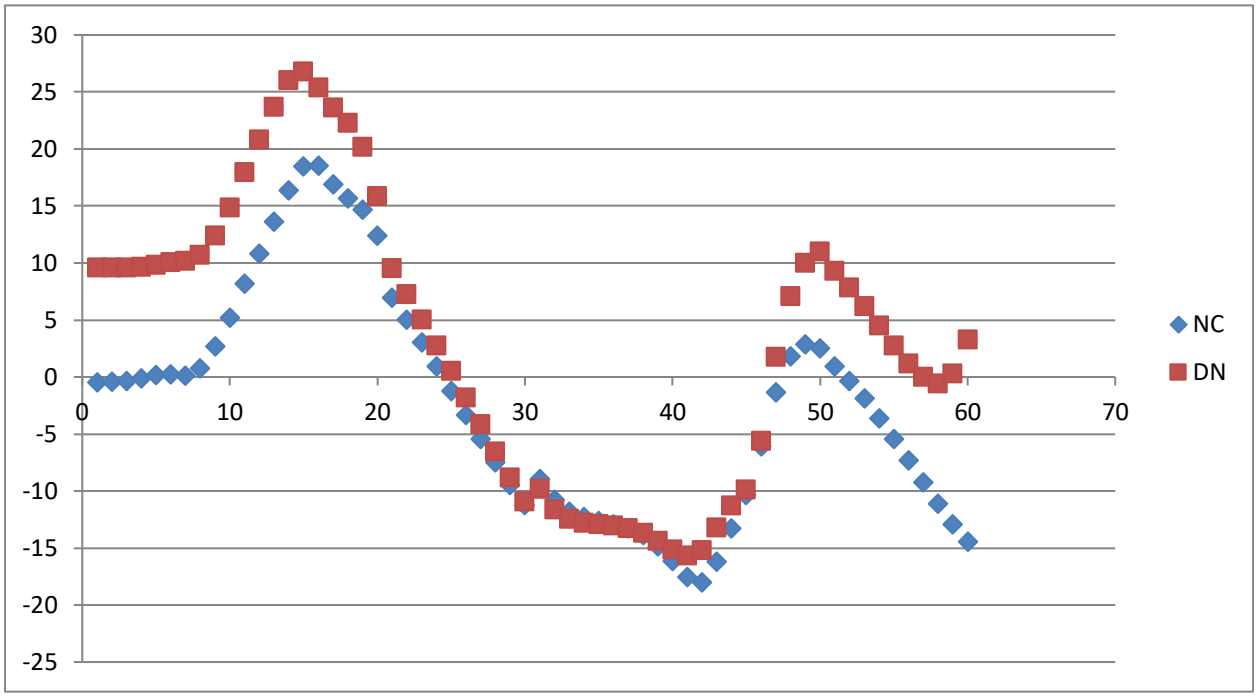


Figure 2.4 illustrates a given participant's average variation from his mean. Each of the points on the curves above is the average of the 8 de-meaned values in that condition at that point. These two curves therefore represent the aggregate of this participant's 8 utterances in that condition. The average values from each subject were combined into a single spreadsheet for all 20 subjects. Two overall contours were then produced for the combined DN and NC averages respectively across all the subjects.[3]

[3] Because not all 8 utterances were able to be used for both conditions for every subject, due to data loss or lack of comprehension, subjects were not weighted equally in the combined curve (it would not make sense for a subject's curve comprised of only 5 utterances to carry the same weight as one comprised of all 8 utterances). Subjects were weighted based on the number of utterances they had contributed to the overall average.

In order to determine significance, statistical tests (t-tests) were run using Excel. These tests compared subject averages from their DN and NC utterances for average syllable pitch.

IV. Results

In this section we will provide the results from the experiment, broken down into the two analyses described above: first behavioral and then prosodic.

4.1 Results from Behavioral Analysis

The behavioral results will be further broken down to explain the results first from the controls and then from the critical items.

Results on Control items

In our control conditions (examples like (d) and (e), reproduced below), responses were correct overall for 96.21% of the items.

a.) Quand on sort, il faut un chauffeur sobre :

Raoul ne boit rien aujourd'hui.

When you go out, you need a designated driver:

Raoul isn't drinking anything tonight.

b.) Dans ce bar, il y a de l'ambiance et on consomme beaucoup d'alcool :

personne ne boit d'eau ici.

This bar has ambiance and people consume a lot of alcohol:

Nobody drinks water here.

This clearly demonstrates the task was well understood by the participants. Participants produced only 17 errors (incorrect responses to the follow-up statements) out of 448 total responses. All control items had high rates of correct responses (between 86% and 100%), showing that responses were far from random. Two control items had more errors than others (four in total) but in general no control items stood out as particularly error driving. When analyzed subject-by-subject, one subject had 5 errors (i.e.: incorrect T/F responses to unambiguous control sentences) out of 16 on the controls and two others had 3, so these subjects were noted in case they exhibited further inaccurate or anomalous behavior.

Results on critical items

Concerning our ambiguous overall for all critical items, responses matched context expectation for 79.91% of the items, significantly above chance at the $p<.001$ level. For contexts with an expected NC interpretation, response to the follow-up statement, i.e.: the expected true/ false response, matched interpretation to the context in 87.05% of items. For contexts encouraging a DN interpretation, responses matched context in 72.77% of items. Note that there were more context mismatches in the critical DN condition:

Table 4.1.1: Percentage of matching and non-matching responses by condition

Category	**% Contextually appropriate response**	**% Context mismatch**
Controls	96.21% (431)	3.79% (17)
All Criticals	79.91% (358)	20.09% (90)
NC Criticals	87.05% (195)	12.95% (29)
DN Criticals	72.77% (163)	27.23% (61)

We can see here that the controls had the highest percentage of correct expected responses (96.21%). This is not surprising as items in these conditions were not ambiguous. Only 3.7% of errors occurred, which again show that overall the task was well understood and not difficult for our participants.

Despite a higher rate of mismatch for our critical items, we can see that context generally highly successful in eliciting the expected interpretation for our subjects. Subjects' responses mismatched the context only 20.09 percent of the time. This means that only 20.09% of our items were interpreted irrelevant of the context.

For all our items, choice of response that corresponds to an NC interpretation occurred in 57.14% of items and choice of response that correspond to a DN interpretation occurred in 42.86% of items. That is, 57.14 % of the time, sentences with *personne ne* verb *rien* were interpreted with a single negation. In contrast, these same sentences were interpreted with a double negation in slightly less often.

Table 4.1.2 and figures 4.1.1 and 4.1.2 more clearly illustrate this difference. Table 4.1.2 divides all subject responses into four categories: 1) NC interpretations in NC contexts, 2) NC interpretations in DN contexts, 3) DN interpretations in NC contexts, and 4) DN interpretations in DN contexts. Categories 1 and 4 would be considered contextually appropriate responses while categories 2 and 3 are considered contextually inappropriate or mismatched responses. Overall, subjects responded with an NC interpretation (both contextually appropriate in the NC context as well as contextually inappropriate in the DN context) in 57.14% of items. Subjects were more likely to access an NC interpretation of the test item in a DN context (13.62% of all critical items) than a DN interpretation in an NC context (6.47% of all critical items). This shows

a slight preference for the NC interpretation, but only significant at the .05 level for a one-tailed test.

Table 4.1.2: Total NC and DN interpretations of critical items

	NC Interpretation	**DN Interpretation**
NC Context	43.53% (195)	6.47% (29)
DN Context	13.62% (61)	36.38% (163)
Total	***57.14% (256)***	***42.86% (192)***

Fig. 4.1.1: Percentage of overall responses by category

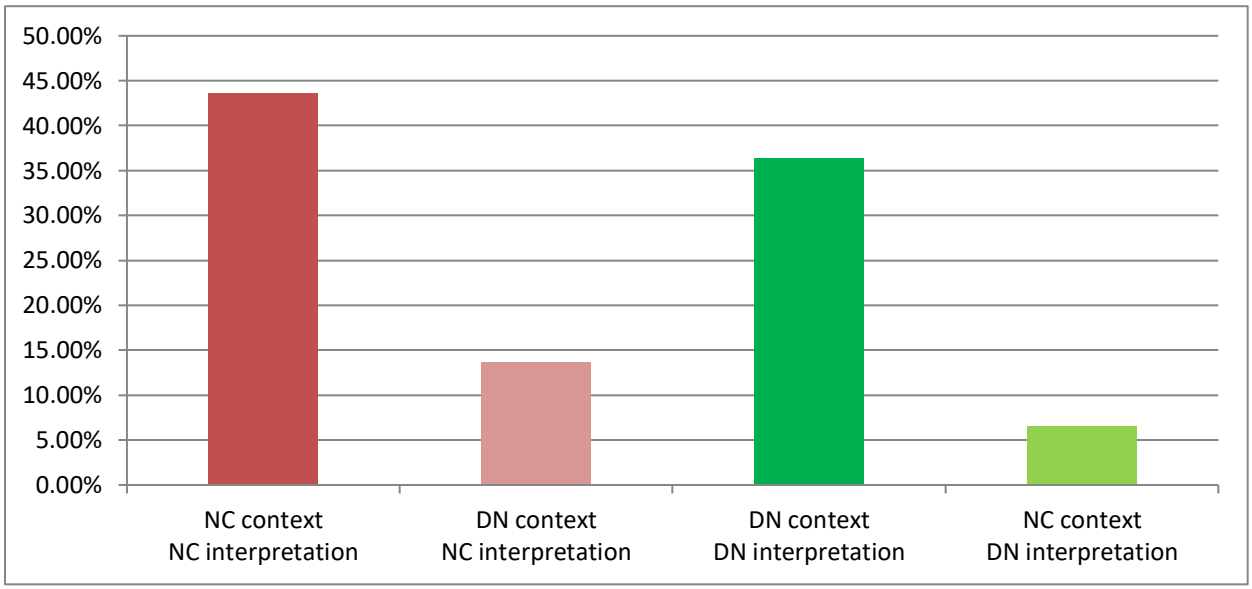
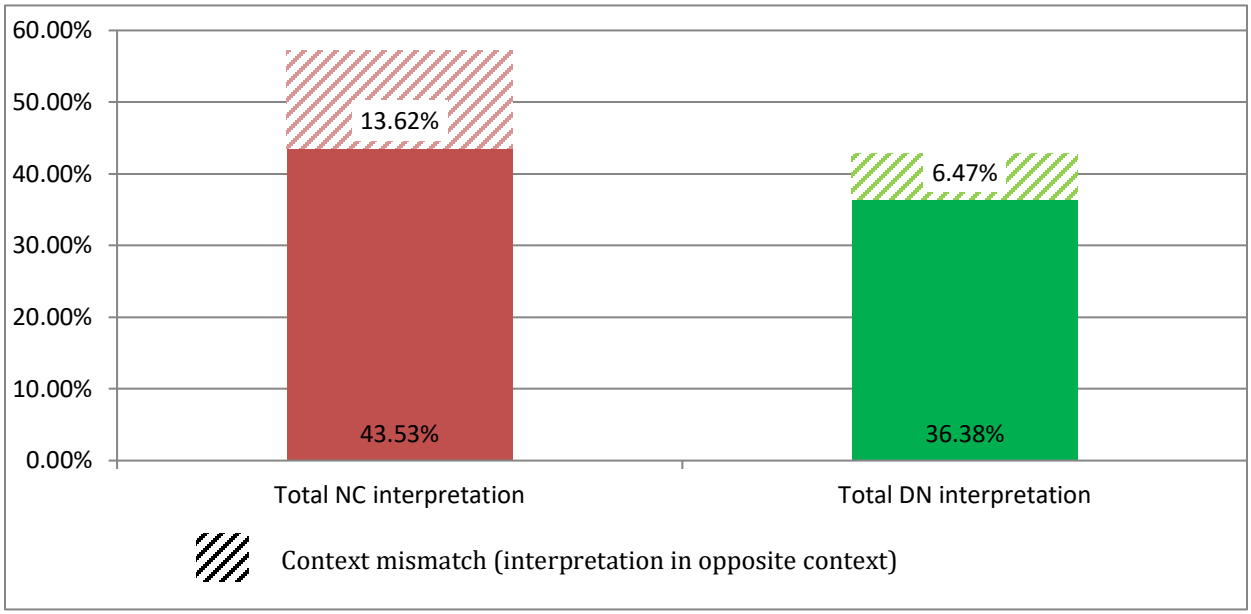


Figure 4.1.1 shows the percentage of overall responses in each category. It is clear that subjects responded appropriately in both the DN and NC conditions the vast majority of the time. Both of the mismatch categories had significantly fewer responses, demonstrating that subjects much

preferred responding according to context. Subjects were more likely, however, to access a NC reading in a DN context than a DN reading in an NC context.

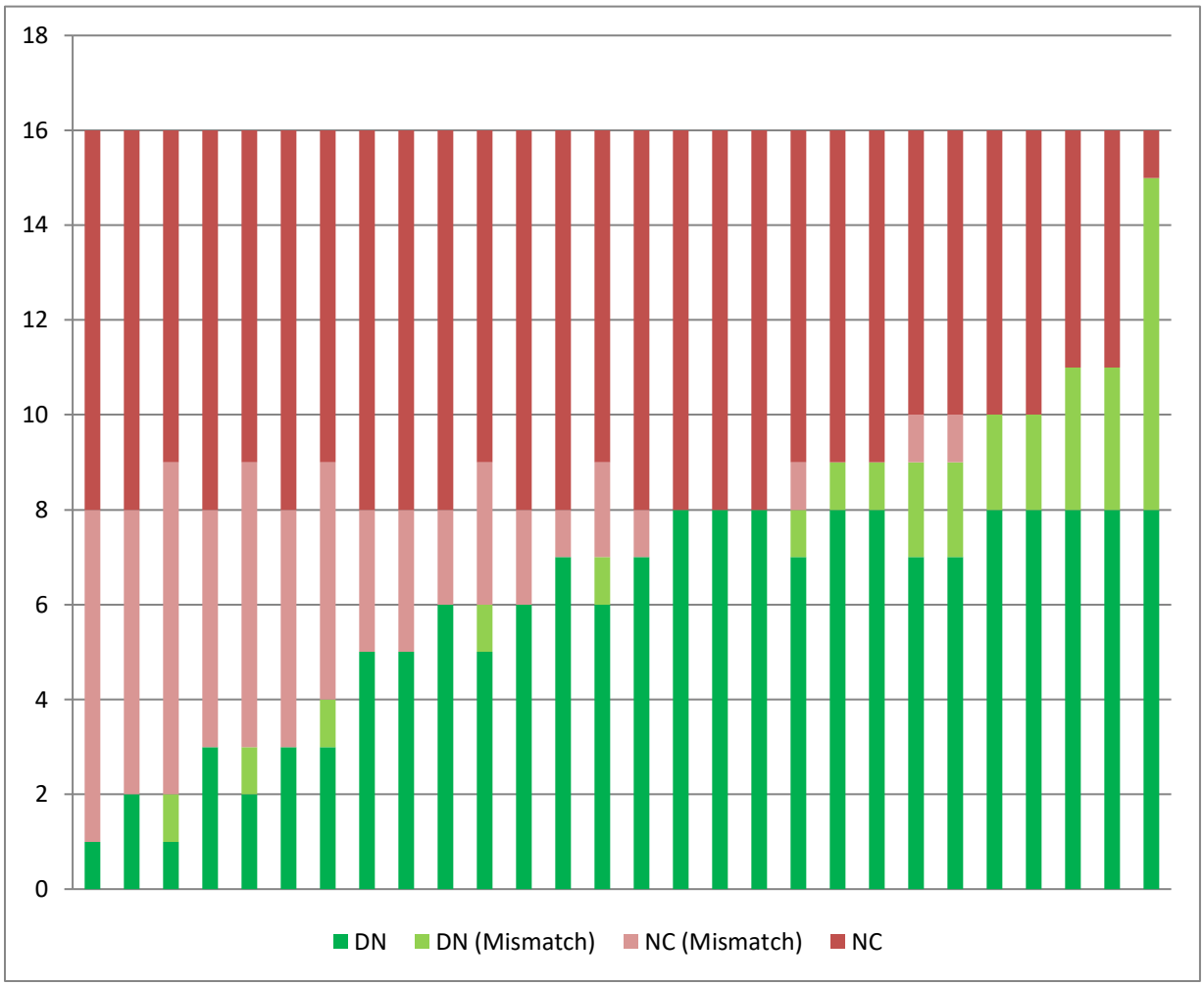
Fig. 4.1.2: Total NC and DN interpretations



Subjects overall had a slight preference for NC interpretations over DN interpretations. Figure 4.1.2 shows this preference by stacking the mismatched responses from the DN and NC conditions on top of the contextually appropriate responses for the opposite condition (mismatches in DN contexts are NC interpretations and vice versa).

Not all subjects had the same preference for NC interpretations, however. Several subjects, in fact, preferred DN interpretations. Only three participants responded according to context in all 16 critical items, and one more had a single mismatch in each condition for an overall count of 8 DN and 8 NC. Others had varying degrees of preference (see figure 4.1.3), either for NC (15 participants) or DN (9 participants). No subject responded to all 16 critical items with either a DN or NC interpretation, i.e.: all subjects had at least one contextually appropriate response in each condition.

Fig. 4.1.3: Responses to critical items by participant



Note that there are more subjects who demonstrated a preference for NC than for DN, but there are still a smaller group of subjects preferring DN interpretations.

8 participants responded[4] with context-mismatched responses in 50% or more of the items for either the DN or NC condition. Seven subjects responded with NC interpretations in 4 or more of the critical items with DN contexts (or at least 12 out of 16 total critical items), and one

[4] These subjects were kept in the behavioral analysis but were excluded from the prosodic analysis. Because sentences with two NCIs are less ambiguous for these 8 subjects, it is likely that they would not demonstrate a prosodic contrast between the two interpretations, since the distinction is not necessary. For this reason, they would not provide much usable data in the prosodic analysis.

subject responded with all but one DN response (15/16 total critical items). This last subject also goes against previous assertions that NC was the preferred interpretation by all speakers of French.

As shown by several of the figures above, participants were more likely to provide a context-mismatched response in a DN context than an NC one, which asserts that speakers are in general more comfortable with NC interpretations. The greater number of mismatches in the DN condition is visible in figure 4.1.4.

Fig. 4.1.4: Responses to critical items by context

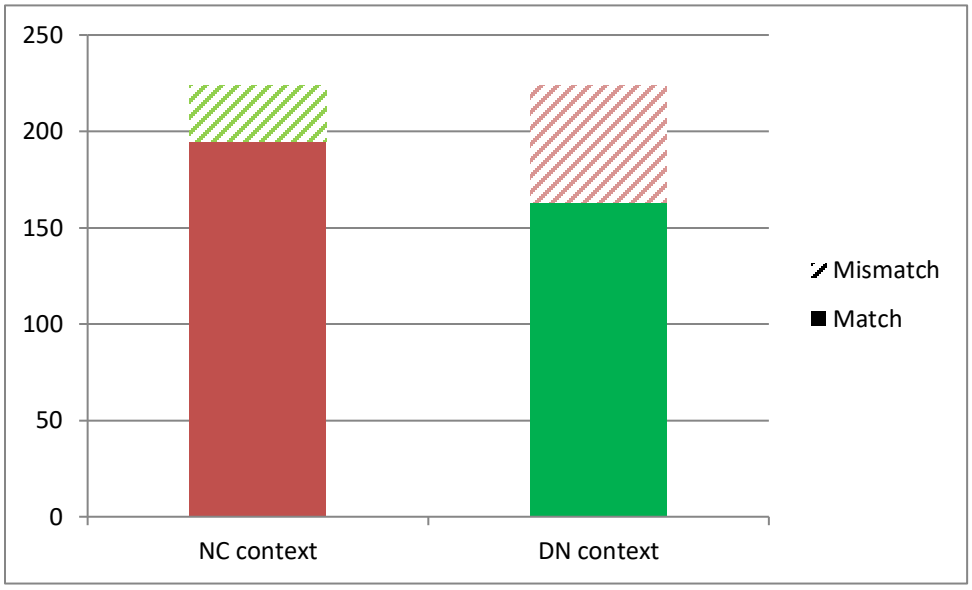


Figure 4.1.4 organizes responses by condition and not by response. Both of the columns account for 50% of all responses, but a much larger portion of the responses in the DN condition are mismatched.

4.2 Results of Prosodic Analysis

This section will cover the results obtained from the analysis of the recordings made during the experiment. We will first cover the initial analysis performed, followed by further analyses once the participants were broken into groups based on their prosodic behaviors.

From the 278 context-matched recordings produced by the subjects, 140 utterances were from the NC condition and 138 were from the DN condition. These utterances were combined into a single average graph of pitch over time with one line for NC and another for DN.

The syllables of the utterance "*personne ne [verb] rien 1/PP*" occur in the ranges in table 4.2.1, which correspond to segments of the x-axis in the composite f0 contours presented in this section. Most of the focus of this section will be on the range 41-50, which corresponds to the object NCI *rien*.

Table 4.2.1: Delineation of syllable boundaries in composite f0 contours

Window	1-10	11-20	21-30	31-40	41-50	51-60
Syllable	per	sonne	ne	[verb]	rien	[first syllable of PP]

Fig. 4.2.1: Composite f0 contour for all 20 participants

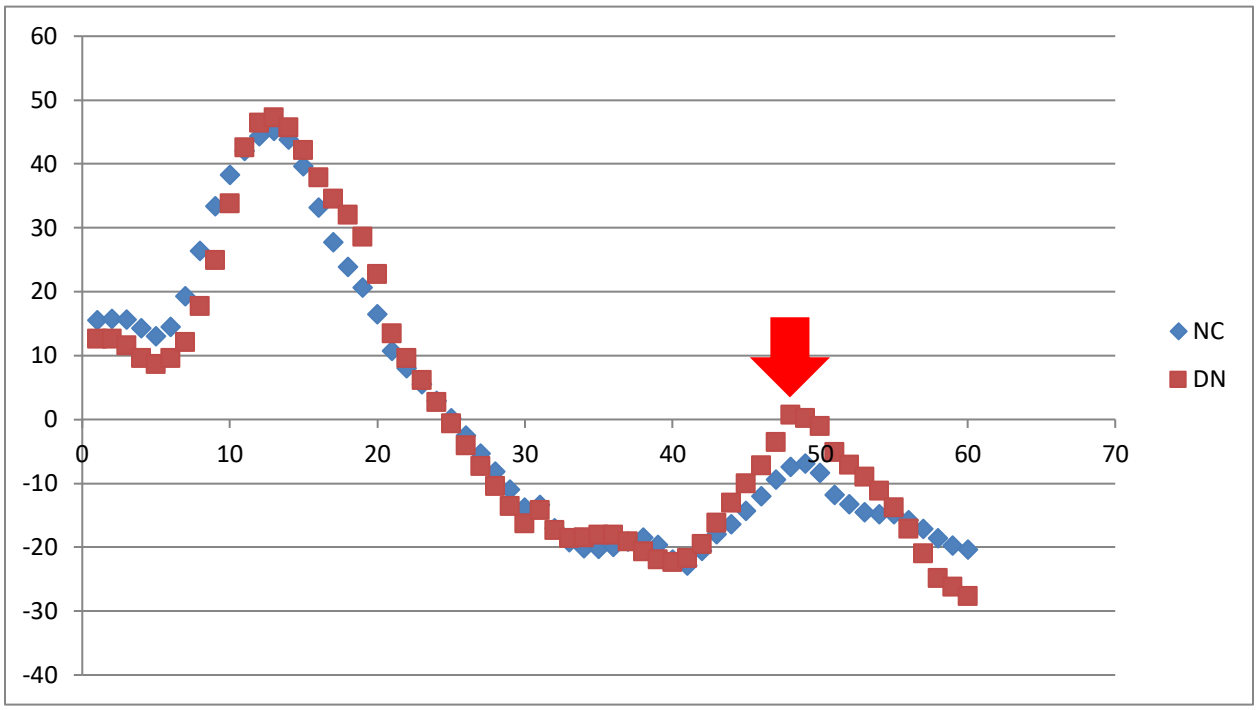


Figure 4.2.1 shows the average of the de-meaned f0 values for all 138 DN and all 140 NC utterances respectively. By averaging all of the de-meaned f0 values together, it is possible to get a general idea of the group's behavior. In figure 4.2.1, it can be noted that pitch is higher on the object NCI in the DN condition. Participants produced the syllable *rien* (nothing/ anything) at an average of 9.11Hz in the DN condition (f) and -13.59 Hz in the NC condition (g).

f.) CONTEXT: A l'approche des dates butoir, tout le monde travaille dur pour finir à temps :

TEST ITEM: personne ne fait rien ces jours-là.

When deadlines are coming up, everyone works hard to finish on time:

Nobody does nothing on these days.

g.) CONTEXT: Il fait vraiment trop chaud aujourd'hui :

TEST ITEM: personne ne fait rien dehors.

It is way too hot today:

Nobody is doing anything outside.

We illustrate this contrast below with two pitch tracks from one of the participants, the first under a DN interpretation, and the second under a NC one

Fig. 4.2.2: Example pitch contour from a DN reading (f)

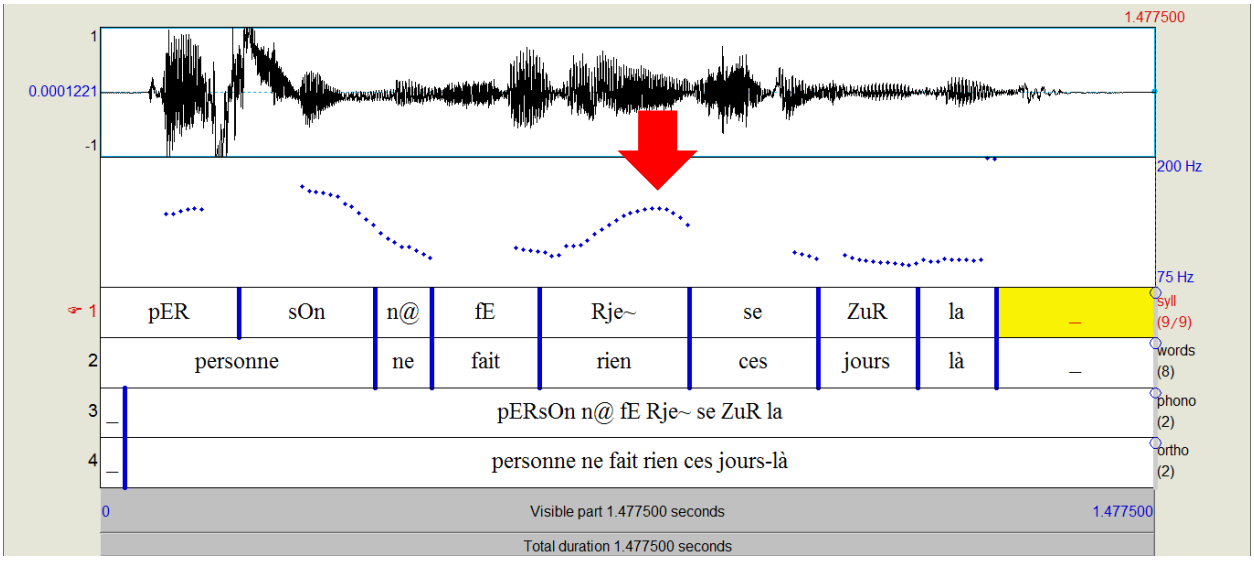


Fig. 4.2.3: Example pitch contour from an NC reading (g)

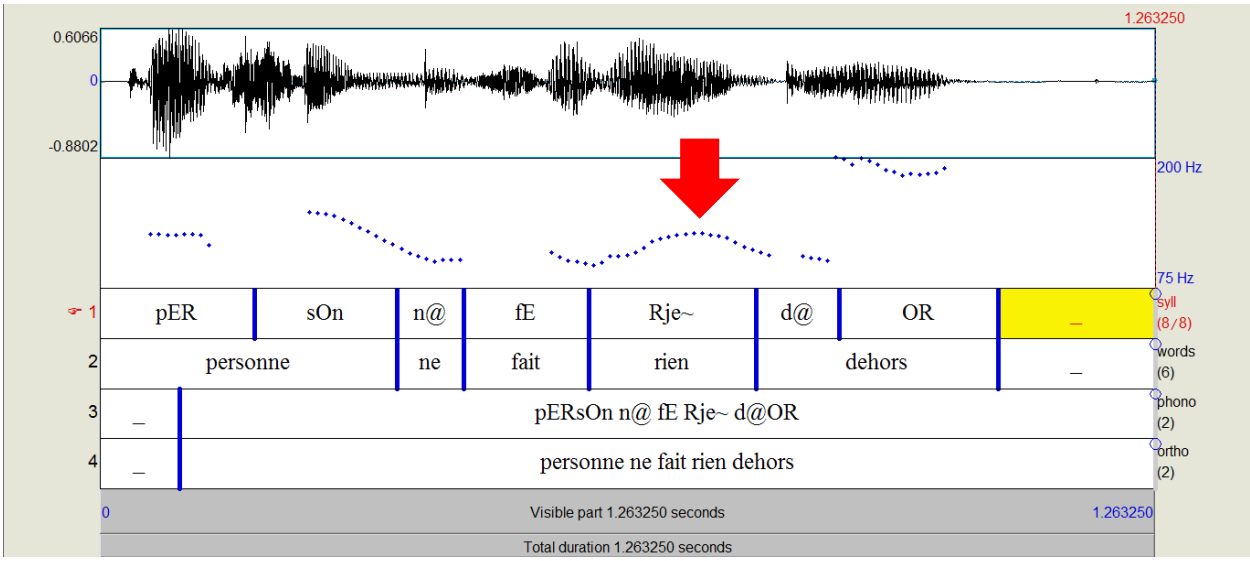


Figure 4.2.2 is the pitch track of the DN interpretation of (f) and figure 4.2.3 the NC interpretation of (g). Note how the pitch (blue dotted line) rises more sharply and higher in figure 4.6 than in 4.7 over the course of the *rien* syllable. The difference in the average pitch of the *rien* syllable in these two exemplars is 28.50Hz (compared to the 22.70 Hz average for the whole group). The difference in the average pitch of *rien* in the DN and NC condition for all subjects combined is significant at the $p<0.05$ level. The peak f0 values for this syllable for all of the subjects (DN=16.90Hz vs NC=6.54Hz) are also significantly different ($p<0.05$).

4.3 Additional analysis: group behavior

After the initial analysis was conducted, we examined the composite f0 contours (figure 4.3.1) for each participant. From this visual inspection, two main patterns of behavior were observed in

the DN condition: 1) high pitch on the object and 2) high pitch on the second syllable of the subject.

Fig. 4.3.1: Exemplars of participants' composite NC and DN contours

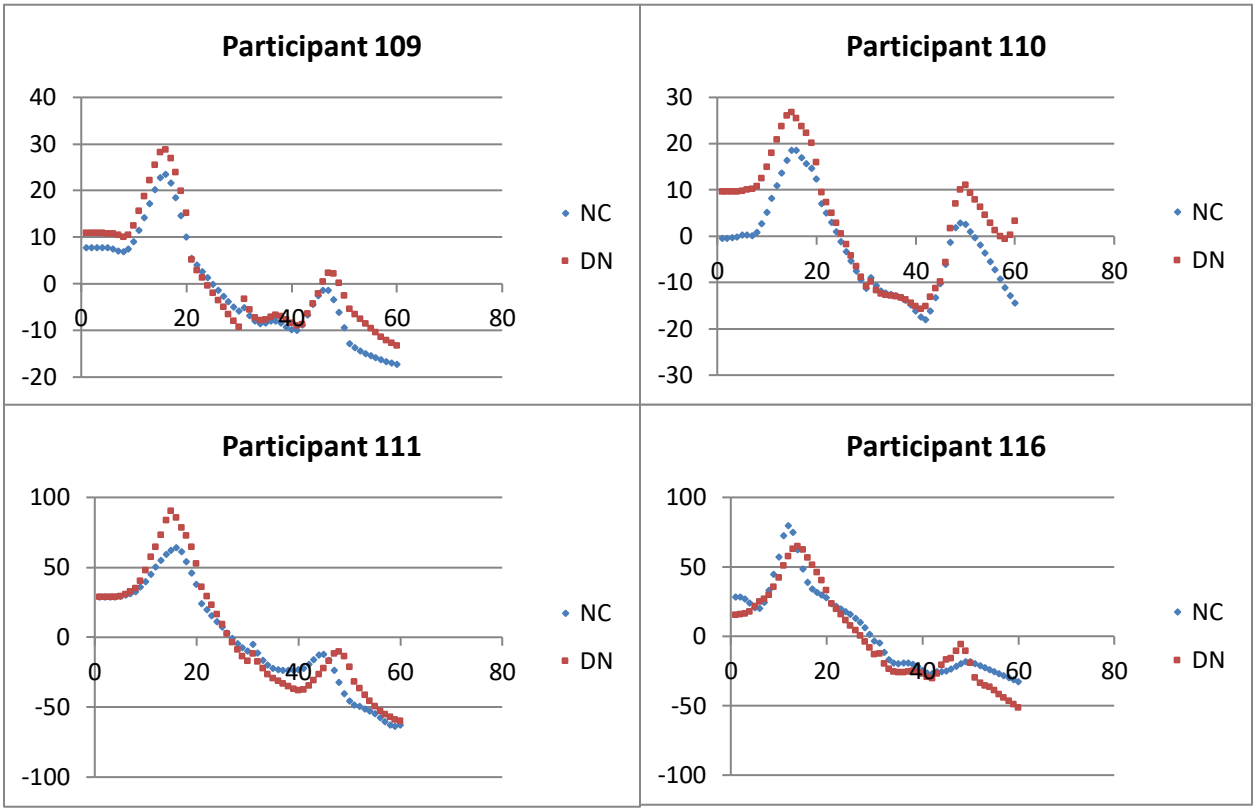
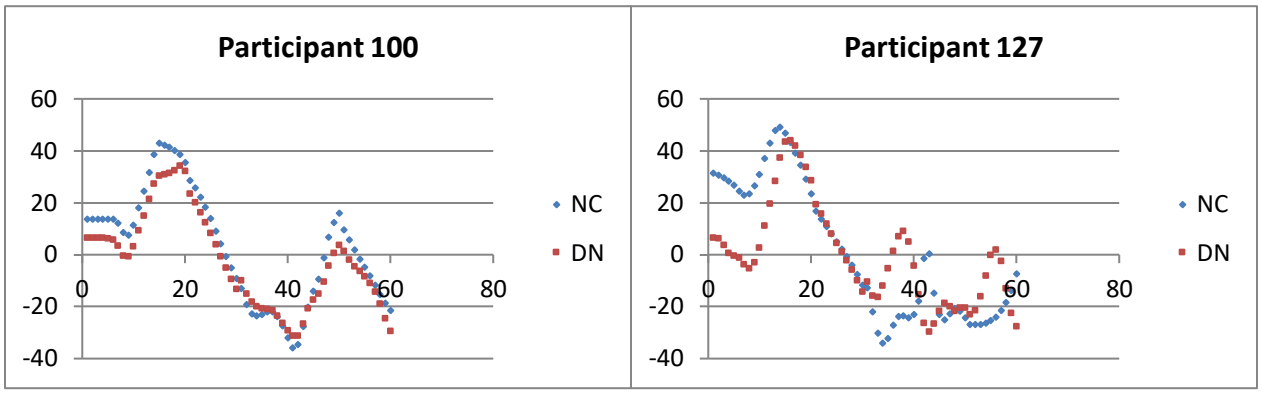


Figure 4.3.1 shows four different participants' average NC and DN contours. Using these contours, subjects were manually coded based on their observed pitch behaviors around the NCIs in the utterances.

The first group (Group 1) was comprised of the 14 participants' whose contours showed a markedly higher pitch on the object NCI in the DN condition. The second group (Group 2) was 4 participants whose contours showed a markedly higher pitch on the second syllable of the subject NCI, but not on the object. A composite contour was prepared for each of these groups. Two of our subjects did not distinctively conform to either of these patterns (figure 4.3.2), showing no significant difference between NC vs. DN readings.

Fig. 4.3.2: Composite contours of non-conforming speakers

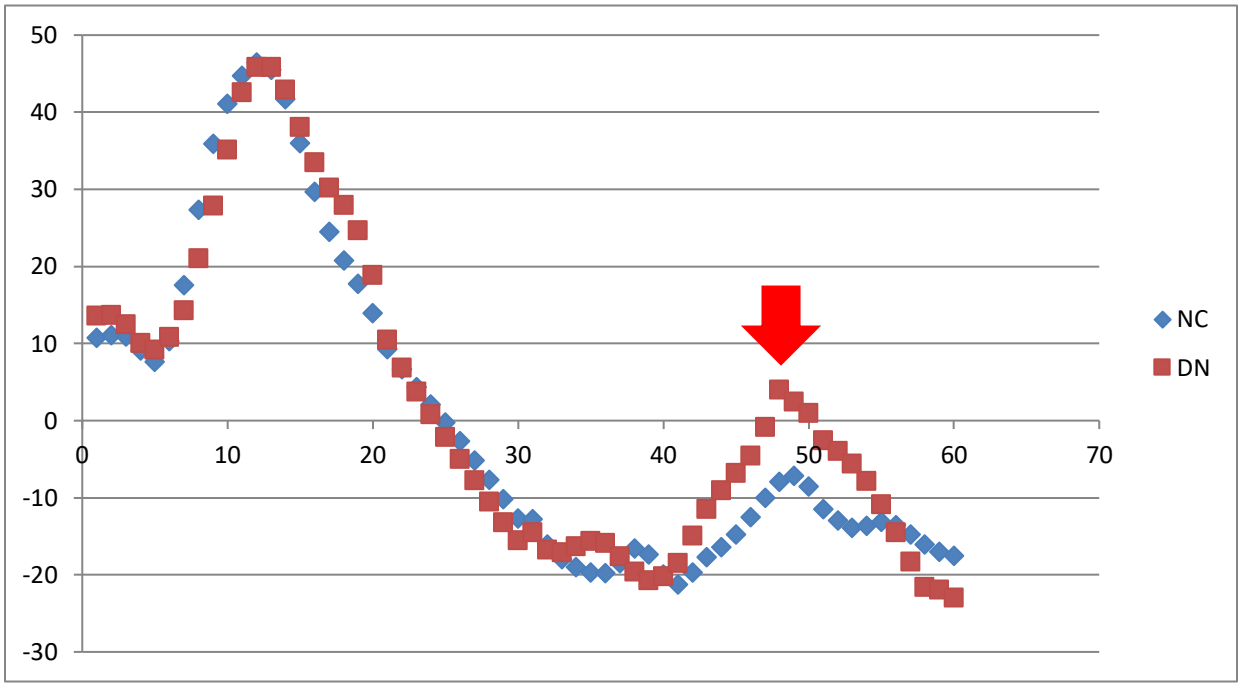


The behavior of the two major groups is further discussed below.

Group 1

In the case of the first group, who demonstrated a higher object NCI in the DN condition, the contrast was more obvious when recombined (figure 4.3.3) compared to the composite for the all 20 speakers together (figure 4.2.1). The average pitch of the second NCI is significantly higher (DN=-5.86Hz vs NC=-13.57Hz), at the p=0.02 level.

Fig. 4.3.3: Composite f0 contour of participants in Group 1



Characteristic examples from a single subject demonstrating a higher pitch on the object NCI in the DN condition are presented in figures 4.3.4 and 4.3.5 below.

Fig. 4.3.4: Characteristic Group 1 NC contour

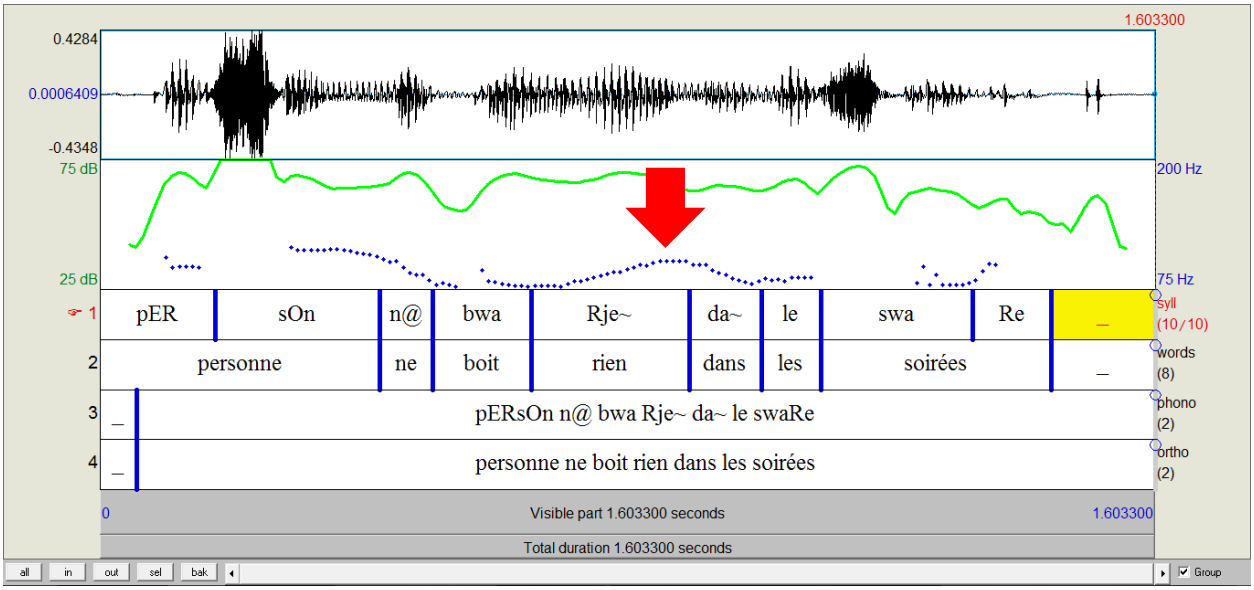
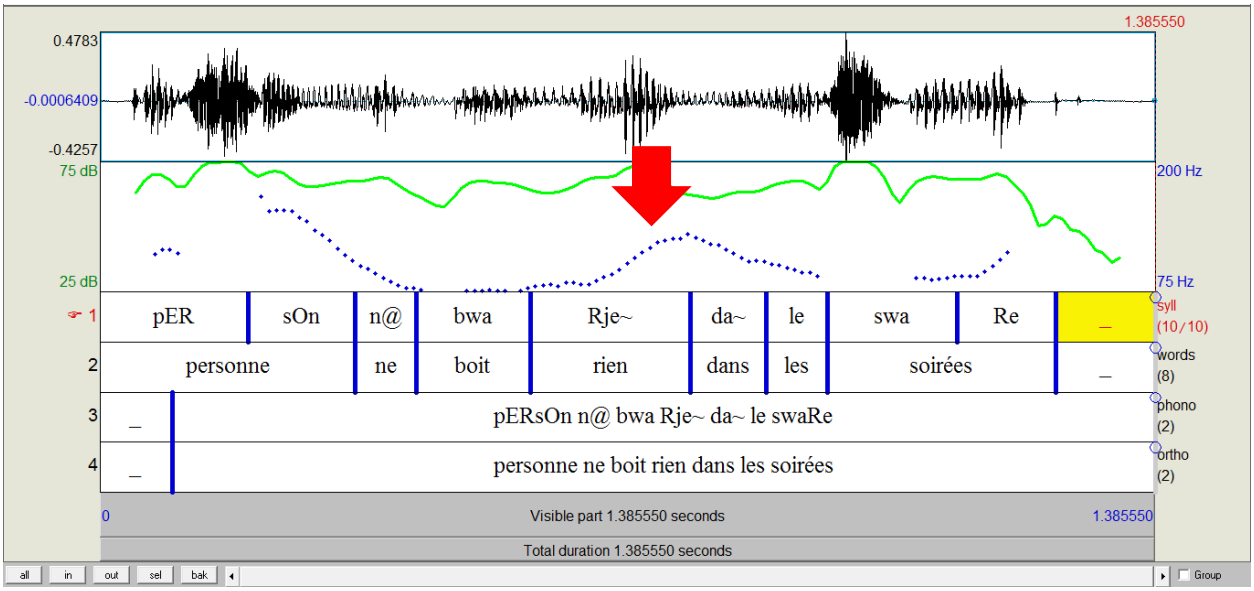


Fig. 4.3.5: Characteristic Group 1 DN contour

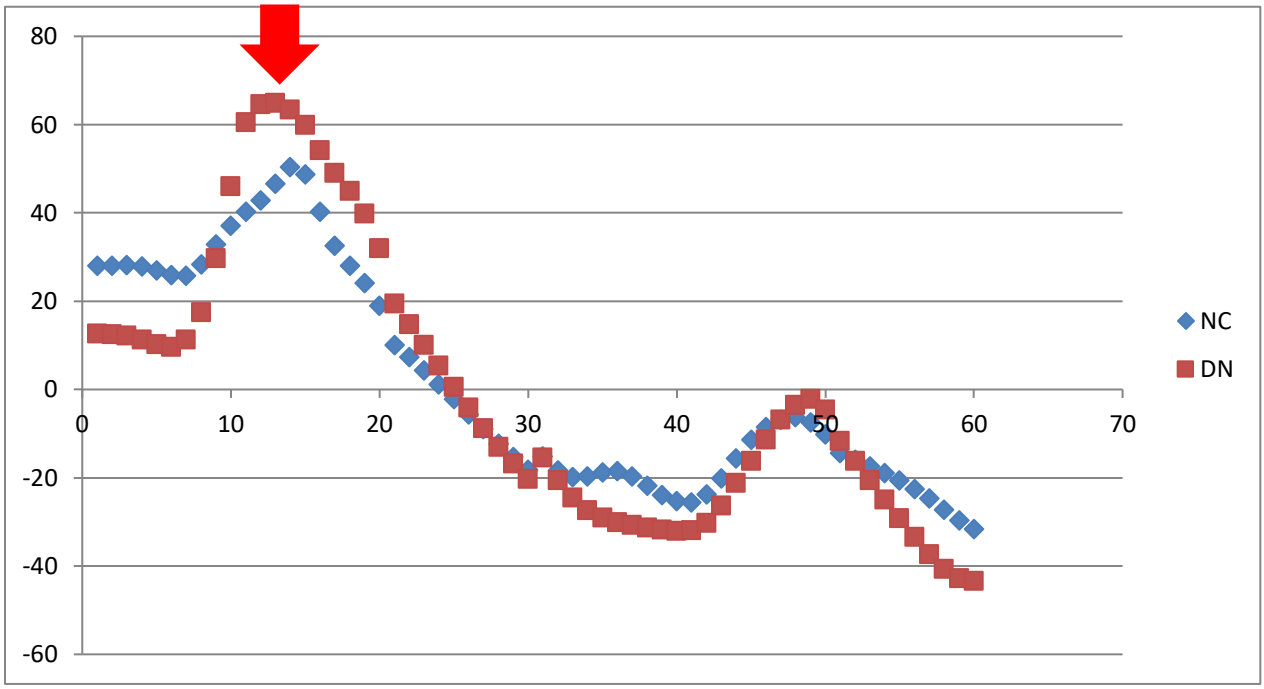


In the subject above, it is of note that a higher pitch accent was demonstrated on both the subject and object NCIs in the DN condition. This was also true of a few other subjects who had pitch accents on both NCIs, but with a more prominent distinction on the object.

Group 2

The lower number of participants in the second group reduced the significance of the results, but the difference between the contours for the two conditions is visible during the second syllable of the subject NCI (window 11-20 on the x-axis):

Fig. 4.3.6: Composite f0 contour of participants in Group 2



The higher pitch on the second syllable of the subject NCI (*perSONNE*) is clearly evident in figure 4.3.6, while the object NCI manifests at the same pitch for both conditions. This contrast is only significant at the p=0.05 level for a one-tailed test, but the DN (53.33Hz) is still significantly higher than the NC (37.28Hz) condition.

Characteristic examples from a single subject demonstrating a higher pitch on the subject NCI in the DN condition are presented below:

Fig. 4.3.7: Characteristic Group 2 NC contour

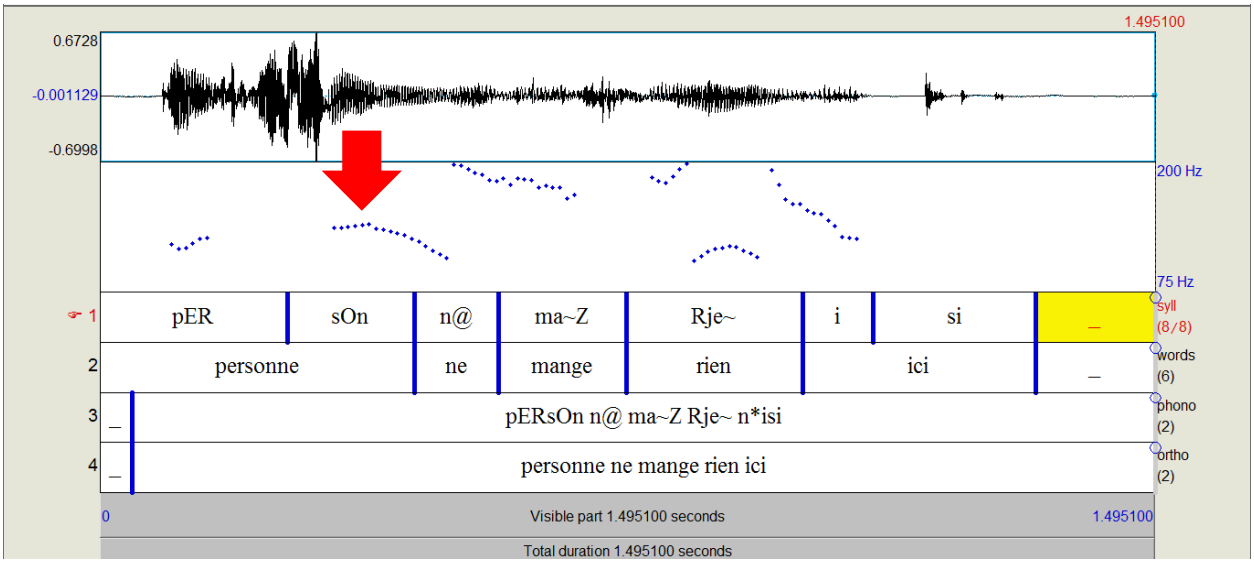
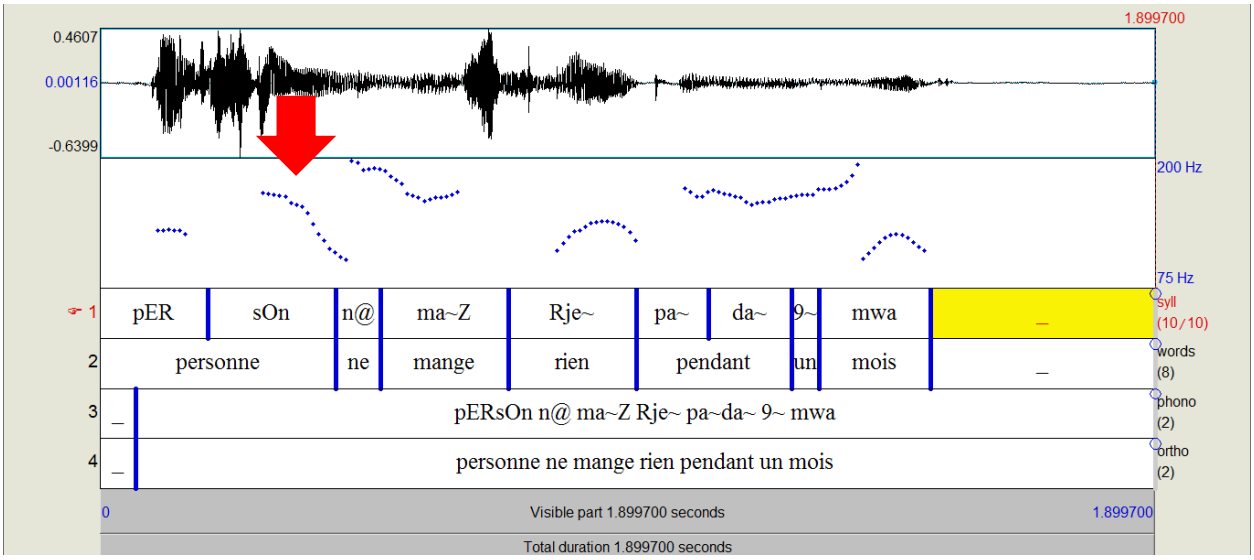


Fig.4.3.8: Characteristic Group 2 DN contour



The difference between the average pitch of the –*sonne* syllable in the DN and NC conditions is 37.88Hz for the utterances in figures 4.3.7 and 4.3.8. The *rien* syllable, however, does not show a significant difference in average pitch.

It is also of note that for both groups, no other syllable showed a statistically significant difference in pitch, except for the NCI syllable in question for that group.

4.4 Additional analysis: maximum and minimum pitch values

Once the participants were coded into groups ProsodyPro was used again to obtain minimum and maximum f0 values for each syllable. This gave us the lowest pitch and highest pitch produced during each syllable. These max and min values underwent the same de-meaning process as was used in the first part of the analysis. These de-meaned max and min values were used to in two different ways. The first was to compare the averages of the highest pitch on the NCIs in the NC condition to the highest pitch on the NCIs in the DN condition. The second was to take the difference between the highest pitch value on a given syllable and compare it to the lowest pitch value on the following syllable, because we had noted that speakers demonstrated a much sharper drop in pitch after an accent syllable.

Fig. 4.4.1: Range between max and min values on *rien* in NC and DN conditions

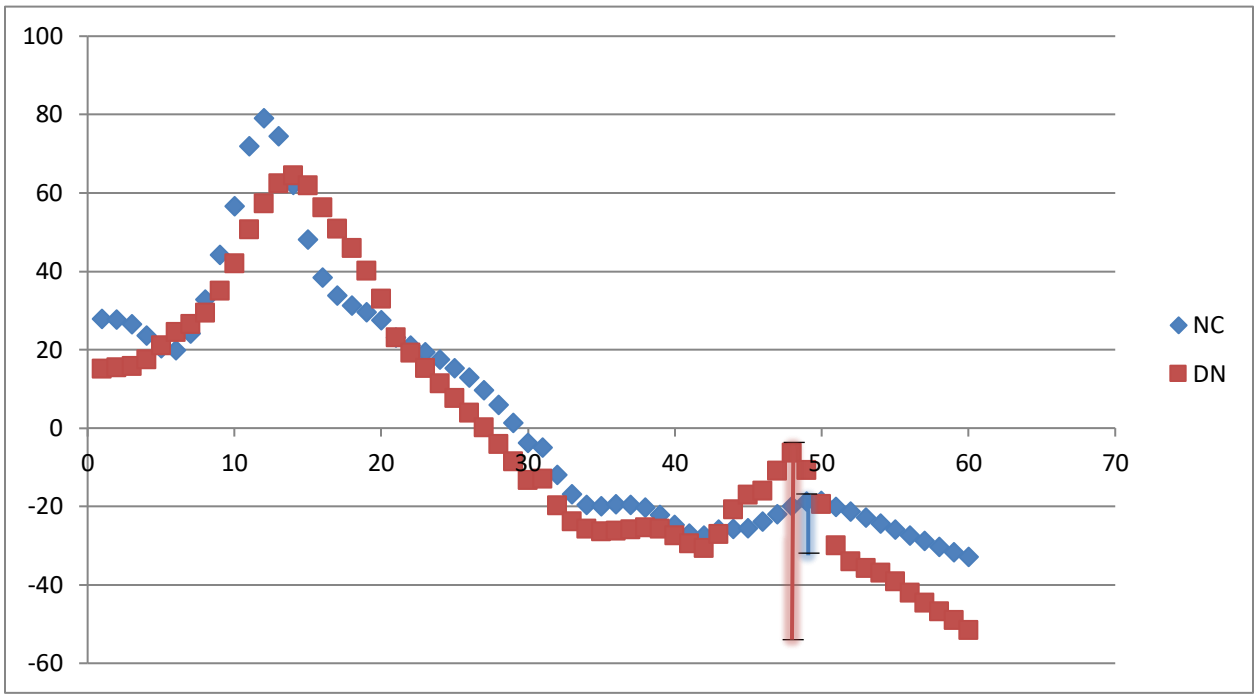


Figure 4.4.1 shows the range between the maximum (or peak) f0 value of the object NCI (in range 40-50) and the minimum f0 value on the following syllable (range 50-60), by condition. By examining the differences between the max and min values over these two syllables, it is possible to observe how much of a contrast exists between the highest pitch of one syllable and the lowest pitch in the next.

These two comparisons were conducted among the two groups set out in section 4.3 above.

Group 1

When examining the peak value of the object NCI (*rien*), the difference becomes even more significant with the peak of the DN syllable at 21.44Hz and the peak of the NC syllable at 3.04Hz. This contrast is significant at the $p<0.01$ level. In this group, the difference between the

peak value on the object NCI and the lowest value on the following syllable (i.e.: the first syllable of the prepositional phrase) were compared between conditions, as it was noted that the DN contour started higher and ended lower than the NC contour. The average difference for the DN contour is 56.61Hz compared to 38.27Hz for the NC contour. The steeper drop in pitch in the DN condition is significant at the p=0.03 level.

Group 2

In examining the peak value of the second syllable of the subject NCI, the peak value was significantly higher in the DN condition. The DN peak manifests at 105.27Hz, much higher than the NC peak (74.95Hz), but only at the p=0.05 level on a one-tailed test. The decreased significance is due to the small sample size of this group.

4.5 Summary of results

Overall, it was noted that speakers had a slight preference for NC interpretations in sentences with two NCIs, but this preference was not universal across all participants, including some who had a marked preference for DN interpretations. On the whole, though, context played a significant role in determining meaning for these sentences, as it predicted the interpretation in roughly 80% of experimental items.

Among those speakers whose dialects allowed both interpretations, a higher pitch accent is used on one of the two NCIs to disambiguate. More participants marked the DN reading with a higher object NCI, but some also produced a higher pitch accent on the subject NCI. These higher pitch accents were also accompanied by a lower pitch on the following syllable, creating a greater pitch contrast between the accent and whatever followed it.

V. Discussion

In this section we will discuss the implications of the results on the various theories of Negative Concord, as well as make suggestions for future research.

Discussion of Behavioral Results

These results demonstrate that context is clearly linked to speaker interpretation in ambiguous double negative sentences in French. The fact that subjects followed the context a majority of the time, despite the sentences themselves being basically identical demonstrates that a large majority of speakers have both interpretations in their grammar. These results directly conflict with Zeijlstra's macro-parametric model. Since these results demonstrate both interpretations in a single speaker, it is very unlikely that the DN vs NC distinction occurs at the language level. The only other explanation for this phenomenon would be that speakers had two grammars and would switch back and forth, but this is improbable. While most speakers have both interpretations in their dialect, it seems that some are less affected by context than others. These subjects may still access both interpretations but demonstrate a preference toward one interpretation or the other. The speakers who demonstrated a preference for a given interpretation still responded appropriately to the controls, indicating that this preference is not a result of error.

Despite most speakers accessing both interpretations, it seems that NC is still slightly more of a preferred interpretation. Overall, subjects had a slight preference toward NC (53%) vs DN (47%). There were also significantly more subjects who had a strong preference for NC than those who had a strong preference for DN.

These data demonstrate, though, that NC and DN interpretations are not the result of a macro-parameter, and that while most subjects can access both interpretations without much trouble,

there may still be a slight preference for NC in ambiguous sentences. These data also disprove previous assertions that DN readings in NC languages were limited to contradictions to negative questions and other similarly complicated contexts. The use of single sentence contexts throughout with high success rates of matching interpretations indicate that the same effect can be achieved in French with a simple, brief context.

Discussion of Prosodic Results

The results indicate that a DN vs NC distinction is made prosodically in French. This distinction is marked by a higher pitch accent on one of the two NCIs, usually the object, but the pitch accent is still realized in some speakers' dialects on the second syllable of the object NCI. Another feature of the contrast is that subjects demonstrate a much steeper drop in pitch after the accent syllable in the DN interpretation. Corblin et al (2004) proposed that a prosodic boundary might serve to disrupt a resumptive quantification of the negative items, therefore increasing the probability of a DN reading. The data support this hypothesis: by demonstrating a higher pitch accent on one of the two NCIs in the DN interpretation, speakers are marking that a resumptive interpretation is dispreferred there in place of an iterative one.

It seems as though the prosodic cues observed in this study serve to mark a contrast between the two NCIs in the DN condition. By emphasizing one or the other (for example *rien*), speakers are indicating that one item does not fall under the same scope as the other (*personne* in this case), and that the items are not parallel in structure. By drawing the distinction between the two, speakers prevent a resumptive quantification interpretation from being possible. Instead of the negation taking scope over the pair of (*personne* and *rien*) in a relation, it takes scope over each item separately in a DN interpretation.

Deprez's (2000) micro-parametric approach is the approach most capable for accounting for all of the data presented. Zeijlstra's macro-parameter does not account for the spectrum of preference for DN or NC that exists between the strict and non-strict NC languages. De Swart's polyadic quantification approach accounts for this language-to-language variation by demonstrating that languages may have different preferences depending on the rankings of the *Neg and MaxNeg constraints under Optimality Theory at the level of production, but not in the syntax. Languages can therefore have varying degrees of dispreference for Negation in the output or preference for projecting negation over other quantifiers. This theory does not explain the distribution of DN and NC interpretations within a language, however. Under this theory, speakers would uniformly prefer either the DN or NC interpretation, and not have some speakers who preferred NC and others who preferred DN, as were observed here in French. The micro-parametric approach accounts for the fact that the NCIs themselves may vary in their syntactic and semantic structure. The concept that NCIs have variable quantificational force provides an impetus for syntactic movement within the DP and would explain how a resumptive interpretation could take place syntactically.

Further study is still needed in the form of a perception study in order to ensure that speakers of French can use these prosodic cues to access the appropriate interpretations in the absence of context. It would also be useful to examine how the contours of sentences with NC interpretations compare to the contours of unambiguous single-negation sentences.

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Appendices

Appendix 1 : Demographic questionnaire

Numéro de sujet : _____ Date : _____

1. Quel est votre âge ? (Cochez la bonne réponse)
   - A. 18-24
   - B. 25-30
   - C. 31-35
   - D. 36-40
   - E. 40-45
   - F. 46-50
   - G. 51-55
   - H. 55-60
   - I. 61-65
   - J. 65+
2. Quel est votre sexe ? (M) (F) (Autre)
3. Etes-vous un locuteur natif du français ? (Oui) (Non)
4. De quelle région est votre français ?_____
5. Depuis combien de temps êtes-vous à Lyon ?_____
6. Parlez-vous une ou plusieurs autre(s) langue(s) ? La/les quelle(s) ? (Non) (Oui) :_____
7. Si oui, quel est votre niveau de compétence ?

   Débutant Intermédiaire Avancé Natif
8. Quel est votre niveau d'éducation ?
   - A. Primaire
   - B. Secondaire
   - C. Supérieur

Appendix 2: Instructions

Bonjour, merci d'avoir accepté de participer à notre expérience. Le but de cette expérience est d'enregistrer l'intonation de vos phrases. Des phrases en contexte vont apparaitre sur votre écran.

Pour bien comprendre ces phrases et leur contexte, lisez le tout une première fois silencieusement.

Puis, quand vous êtes prêt, cliquez sur le bouton gauche de la souris pour démarrer l'enregistrement. (Pour continuer, cliquez le bouton gauche de la souris.)

Le message "Enregistrement en cours" s'affichera. Lisez alors le contexte et les phrases à voix haute, clairement et le plus naturellement possible, comme si vous racontiez une histoire à un enfant. Votre lecture sera enregistrée.

Quand vous avez fini de lire, cliquer le bouton gauche de la souris pour poursuivre l'expérience. (Pour continuer, cliquez le bouton gauche de la souris.) A la fin de l'expérience, un message de remerciement s'affichera.

Pour vous entrainer, vous aurez deux contextes d'essai. L'expérience commencera après.

A la fin de l'expérience, avant de partir, merci de bien vouloir remplir le questionnaire qui vous sera présenté.

Appendix 3: Experimental stimuli

Type	CSS	Crit	Question	Answer
Critical1 NC	Dans cet hôtel, les clients ne sont pas contents du service :	personne n'aime rien ici.	Tout le monde aime quelque chose ici.	F
Critical1 NC	Dans notre famille on est tous allergique à l'alcool :	personne ne boit rien dans les soirées.	Ils ne boivent pas d'alcool.	V
Critical1 NC	Tous les profs s'ennuient en conseil de classe :	personne ne dit rien pendant les réunions.	Ils restent tous silencieux.	V
Critical1 NC	Il fait vraiment trop chaud aujourd'hui :	personne ne fait rien dehors.	Ils ont tous trop chaud pour faire quelque chose.	V
Critical1 NC	Les profs se plaignent tous que les élèves n'étudient pas pendant les vacances :	personne ne lit rien en été.	Les élèves lisent tous quelque chose.	F
Critical1 NC	Depuis toujours, cette cantine est absolument infecte :	personne ne mange rien ici.	Les gens ne mangent pas ici.	V
Critical1 NC	Dans ce pays, la monnaie n'a plus aucune valeur :	personne ne met rien à la banque.	Les gens placent leur argent à la banque.	F
Critical1 NC	On vient de couper l'électricité et il fait tout noir ici :	personne ne voit rien dans la pièce.	Ils voient tous quelque chose.	F
Critical2 DN	Dans ce restaurant on trouve toujours quelque chose de bon :	personne n'aime rien dans les plats proposés.	Ils aiment tous quelque chose.	V
Critical2 DN	Chez les jeunes, la consommation d'alcool est effrayante :	personne ne boit rien dans les soirées.	Ils ne boivent pas d'alcool.	F
Critical2 DN	Chez nous, les profs veulent tous donner leur avis :	personne ne dit rien pendant les réunions.	Ils disent tous quelque chose.	V
Critical2 DN	A l'approche des dates butoir, tout le monde travaille dur pour finir à temps :	personne ne fait rien ces jours-là.	Ils ne font pas de travail.	F
Critical2 DN	Dans cette école exceptionnelle, absolument tous les élèves font leurs devoirs :	personne ne lit rien pour sa classe.	Les élèves lisent tous quelque chose.	V
Critical2 DN	Même quand on fait un régime, il faut se nourrir :	personne ne mange rien pendant un mois.	Ils ne mangent pas pendant un mois.	F
Critical2 DN	La plupart des gens amassent un tas de bricoles inutiles :	personne ne met rien dans son placard.	Les gens laissent les placards vides.	F
Critical2 DN	Les études cognitives nous montrent que même les aveugles ont une vision inconsciente :	personne ne voit rien du tout.	Tout le monde voit quelque chose.	V
Critical3 NegOb	La rupture avec son copain l'a complètement déprimée :	Noëlle n'aime rien en ce moment.	Noelle déteste tout.	V
Critical3 NegOb	Quand on sort, il faut un chauffeur sobre :	Raoul ne boit rien aujourd'hui.	Il ne boit pas d'alcool.	V
Critical3 NegOb	Parce qu'elle est très timide,	Aline ne dit rien pendant les cours.	Elle dit toujours quelque chose.	F
Critical3 NegOb	Comme elle est très religieuse,	Marla ne fait rien le dimanche.	Marla fait toujours quelque chose le dimanche.	F
Critical3 NegOb	Comme elle travaille comme relectrice toute la semaine,	Marie ne lit rien le week-end.	Marie lit quelque chose le week-end.	F
Critical3 NegOb	Pour bien digerer,	les gens ne mangent rien le soir.	Les gens ne mangent pas le soir.	V
Critical3 NegOb	Comme il est très dépensier,	Julien ne met rien de coté pour l'avenir.	Julien n'économise pas son argent.	V
Critical3 NegOb	Elle est très intelligente mais elle a la tête dans les nuages :	Lucie ne voit rien autour d'elle.	Lucie est très observatrice.	F
Critical4 NegSub	Quand on s'amuse, on a pas toujours envie de rester sobre :	personne n'aime l'eau dans les fêtes.	Ils aiment tous l'alcool.	V
Critical4 NegSub	Dans ce bar, il y a de l'ambiance et on consomme beaucoup d'alcool :	personne ne boit d'eau ici.	Ils boivent tous de l'eau.	F
Critical4 NegSub	Tout le monde fait très attention pendant ce cours :	personne ne dit mot pendant une heure.	Les étudiants restent silencieux.	V
Critical4 NegSub	Beaucoup de gens se lèvent très tôt pendant la semaine,	personne ne fait ça le dimanche.	Ces gens font tous la grasse matinée le dimanche.	V
Critical4 NegSub	Tous les meubles d'Ikea viennent avec des notices de montage :	personne ne lit ça en général.	Les gens ne lisent pas les notices.	V
Critical4 NegSub	Les oeufs sont difficiles à digérer. On en mange plutôt le matin ou le midi :	personne ne mange ça le soir.	Tout le monde mange des oeufs le soir.	F
Critical4 NegSub	Les mini-jupes sont super à la mode :	mais personne ne met ça à l'église.	Les femmes mettent toutes des mini jupes à l'eglise.	F
Critical4 NegSub	Dans la brousse, les gens se promènent tout nu :	personne ne voit ça ici.	On voit tous ça ici.	F
Control	Il y a un match de foot cet après-midi :	tout le monde va au stade.	Les gens restent tous à la maison.	F
Control	La leçon d'aujourd'hui n'était pas trop claire :	chaque élève avait des questions de clarification.	Les eleves n'ont pas compris la leçon.	V
Control	Son ordi est cassé :	Alain va en acheter un nouveau.	Alain ne veut plus d'ordinateur.	F
Control	Il fait vraiment très beau aujourd'hui :	tout le monde est dehors.	Les gens restent tous à l'intérieur.	F
Control	Demain, c'est un long week-end :	tout le monde part à la campagne.	Les gens profitent de la nature.	V
Control	Le printemps est arrivé :	tous les arbres sont en fleurs.	Il n'y a que des feuilles sur les arbres.	F
Control	Aujourd'hui les gens ne se parlent plus face à face :	tout le monde utilise son téléphone portable.	Les gens n'ont pas de contact direct.	V
Control	C'est une habitude chez nous après le diner :	tout le monde regarde la télévision.	Les gens regardent la télévision le soir.	V