# Imperative Phonetic Analysis

by

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# Abstract

Null subject imperatives are hypothesized to contain a null pronominal subject with second person $\phi$-features (*pro*) (Potsdam, 1998). The two experiments in this thesis test whether this null element significantly impacts the phonetic stress assigned to the following word, as compared to imperative sentences containing an overt *you* subject instead. The two types of imperative sentences were compared to raising sentences, which have previously been found to show no significant phonetic stress assignment changes regardless of the presence of an expletive *i*t subject (Weir, 2019). It was hypothesized that a significant interaction between imperative and raising sentences would appear as an effect of subject presence. No significant interaction was observed in either experiment and thus, no phonetic impact of *pro* was found. Both experiments, however, showed a significant effect of clause type independent of subject presence, suggesting that participants were employing phonetic means to distinguish imperative and raising sentences when reading them.

**Keywords:** Syntax; Phonetics; Null-pronominals; Imperatives; Phonetic stress

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# Chapter 1

# Introduction

Imperatives are utterances with distinctive imperative morphology on the verb, and they canonically express the illocutionary force associated with commands or requests (Han, 2001). An important point to note from this definition is that the term imperative is in reference to the form of the sentence while terms related to the illocutionary force focus on the function of the sentence (Han, 2001). Imperative sentences in English contain main verbs which are uninflected and their subjects are typically limited to the types shown in (1). *You* in (1a) can be interpreted as either a specific or non-specific second person referent. (1b) has a null subject that is interpreted as a specific or non-specific second person referent. (1c) has an overt third person subject that is only valid so long as the subject is an addressee. (1d) contains a quantified subject which ranges over a whole set of addressees (Potsdam, 2007; Zanuttini, 2008).

(1) a. You sit on the bench and wait!
    b. Keep yourself occupied!
    c. Drivers have their money ready!
    d. Everybody pick up your pencils!

These four cases in (1) are universally accepted by speakers of English without controversy (Zanuttini, 2008). Of particular interest to this thesis are imperatives with an overt second person subject pronouns and null subject pronouns (i.e. (1a) and (1b)).

The reflexive pronoun *yourself* in (1b) provides evidence that there is something underlyingly occupying the subject position of the null subject imperative that is binding the reflexive. Because reflexive pronouns are anaphoric, they need to be bound by an antecedent in their binding domain (Chomsky, 1981). Compare the null subject imperative sentence in (1b) to a declarative sentence like (2), where it is ungrammatical to have a reflexive pronoun that is not bound by some co-indexed antecedent.

(2) * John kept yourself occupied.

Comparing (2) and (1b), we have evidence that not only is there some underlying referent occupying the subject position of (1b), but that it always has to correspond to a second person addressee.

It is not possible to have a null subject imperative in English with a third person addressee as shown in (3)[1].

(3) a. Passengers keep themselves occupied!

b. * Keep themselves occupied!

An early analysis of these null subject imperatives argues that this subject is initially a fully formed second person pronoun (i.e. *you*), which is deleted at some late stage of the derivation (Schmerling, 1975). Contemporary analyses of these null subject imperatives argue that the subject pronoun is a null pronominal at all stages of the derivation, but that this null pronoun has the appropriate features to be interpreted as a second person antecedent (Potsdam, 1998; Zanuttini, 2008). This analysis is elaborated on in Chapter 2 of this thesis.

The goal of this thesis is to compare audio recordings of participants reading both null subject imperatives and overt subject imperatives in an effort to obtain phonetic evidence that signals the presence of the null pronominal subject. The studies described in this thesis had their methodology adapted from a previous study on raising sentences in English (Weir, 2019). This previous study found evidence suggesting that when subject pronouns are deleted in spoken English, they have no significant phonetic impact on the adjacent raising verb (Weir, 2019). If null subject imperatives in English are derived with a null pronoun rather than a deleted subject, it is possible that phonetic effects may be observable on adjacent words in the sentence, which this thesis aims to investigate. The details of this previous work will also be described in Chapter 2.

The results of the experiments in this thesis show that more investigation into the proposed methodology is needed to determine if the underlying structure of the syntax can impact the phonetic output of participants reading sentences in a lab setting. Although no significant evidence was found to support phonetic effects of a null pronominal subject in null subject imperatives, significant differences in the intensity of imperative and raising verbs suggest that the differences in clause types can impact the phonetic output when participants are reading the sentences out loud.

The thesis is structured as follows. Chapter 2 details the minimalist syntactic analysis of imperatives and gives supporting evidence for why the current theories incorporate imperative subjects into the syntax of a sentence. This chapter also discusses the specifics of null subject imperatives in English and introduces the previous study by Weir (2019) that was adapted for this thesis. Chapter 3 details the first experiment conducted as part of this thesis that compared several different imperative verbs to a single raising verb (*seems*) and observed the phonetic output when participants read them aloud. The second experiment in Chapter 4 attempts to resolve some of the potential issues in the first experiment by using the same verb form for both imperative and raising sentences. Chapter 5 summarizes the implications of the results from both experiments and discusses future directions for this research.

[1]First person reflexives are not applicable here because imperatives do not permit first person addressees.

# Chapter 2

# Background

The goal of this chapter is to introduce background material related to imperatives and to motivate the two experiments included in this thesis. The chapter is structured as follows. In the first section, I introduce the theoretical assumptions about imperative syntax necessary for this research. The next section then clarifies the difference between imperative subjects and vocatives by combining arguments from Potsdam (1998) and Zanuttini (2008), which is a crucial distinction needed for the experiments contained in this thesis. This is followed by a discussion on the specifics of null subject imperatives, which also introduces the research question that this thesis aims to answer. The final section of this chapter links the syntactic form of imperative sentences to the phonetic form using the y-model of grammar in the minimalist program. This section also discusses research on stressed pronouns in utterance initial position, including discussion of a previous study conducted on raising sentences in English, the methodology of which has been adapted for the experiments in this thesis (Weir, 2019).

## 2.1 Imperative Syntax Analysis

As previously established in (1) (reiterated as (4) below), there are four types of imperative structures that are universally accepted by all English speakers without controversy. These are referred to as the 'Core Cases' of imperatives by Zanuttini (2008).

(4) a. You sit on the bench and wait!
    b. Keep yourself occupied!
    c. Drivers have their money ready!
    d. Everybody pick up your pencils!

This thesis focuses on the overt second person pronoun subject imperatives in (4a) and the null subject imperatives in (4b). This choice was made because these two imperative forms can be minimally contrasted while maintaining functionally identical interpretations, since they only differ in the presence of an overt subject pronoun. This is shown in (5).

(5) You keep yourself occupied! ≈ Keep yourself occupied!

The interpretations of the imperatives in (5) are approximately equal. This is despite the fact that, according to the theories assumed in this thesis, the underlying representation of the subject in null subject imperative is not a second person pronoun, but a null pronominal with second person $\phi$-features (i.e. *pro*). This assumption, and its relevance to the research question, is revisited in Section 2.3.

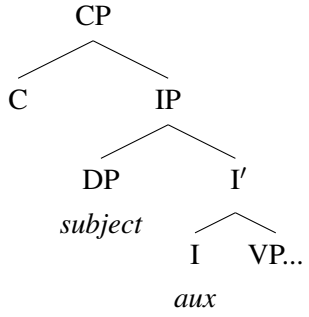
While it is possible for the other 'Core Cases' of imperatives to have subjects that refer to second person reflexives which are direct objects of imperatives (shown in (6)), the meaning of null subject imperatives cannot be interpreted as anything other than a pronominal with second person $\phi$-features which corresponds roughly to a *you* pronoun[1].

(6) a. Drivers keep yourselves occupied! ≠ Keep yourselves occupied!

b. Everybody keep yourself occupied! ≠ Keep yourself occupied!

The phrase structure of imperatives is assumed to be in line with the CP hypothesis put forward by Potsdam (2007), which argues that the Determiner Phrase (DP) subject of an imperative raises to the specifier position of the Inflectional Phrase (IP). This operation results in a structure similar to declaratives and interrogatives. A sample of an imperative clause tree diagram is shown in (7) to illustrate the relative position of the subject within the clause.

(7)




Adopting the CP hypothesis has two consequences for this thesis. First, this hypothesis assumes that the subject of an imperative is incorporated within the syntax and is not a vocative, which is further discussed in the next section of this chapter. Secondly, Potsdams (2007) analysis removes the ambiguity of the subject position in null subject imperatives. This analysis, and the underlying form of the subject in null subject imperatives, is revisited in Section 2.3 of this chapter.

[1]Zanuttini (2008) introduces a Jussive operator to explain the ability for a bare plural and a quantifier to refer to a second person referent within an imperative structure, but this analysis is not pertinent to this thesis.

## 2.2 Imperative Addressees as Subjects

A core assumption built into the CP hypothesis put forward by Potsdam (2007) is that the subject of an imperative is incorporated into the syntax and is not a vocative introduced by the speech act layer. While it is possible for vocatives to precede imperative clauses, a typical imperative structure with an overt subject like that in (1a) consists of a syntactic subject and not a vocative. What follows is a summary of the arguments brought forward in Potsdam (1998) and additional evidence summarized in Zanuttini (2008) that support this assumption. It is important to emphasize the evidence from Potsdam (1998) and Zanuttini (2008) because the phonetic consequences of syntactic subjects as opposed to vocatives introduced by the speech act layer is a crucial assumption for the experiments conducted as part of this thesis.

Potsdam (1998) presents three pieces of evidence that the subject of an imperative differs from a vocative. The first piece of evidence presented is related to the unique intonation of vocatives, which is separate from the rest of the sentence. When written, vocatives will typically be separated from the rest of the sentence by a comma to reflect this, as shown in (8) (Potsdam, 1998).

(8) a. Mary, is there a performance this evening?
    b. The man with the newspaper, what does it say about tomorrow's weather?
    c. Waiter, we need more rolls please.
    d. Everyone, we're leaving in fifteen minutes.

Vocatives are not analysed as being part of the sentence, as they function more like interjections (Potsdam, 1998). Analysing vocatives in this way accounts for the intonation break that follows them (Potsdam, 1998). Vocatives can also precede imperative clauses, but the intonation break persists, denoted by the comma in (9).

(9) Mary, go to the store!

By contrast, a standard imperative like (10) has no intonation break and all words would be integrated into a single intonational phrase.

(10) You go to the store!

So while it is possible for vocatives to precede imperative clauses, the subjects of imperative clauses like (10) are not vocatives, as there would need to be some explanation for the lack of an intonation break. This first piece of evidence is perhaps the most crucial for the purpose of this thesis, as the experiments in this thesis attempt to make claims about the presence or absence of a subject affecting the stress assigned to other parts of the sentence. If the subject of imperative clause was always a vocative, this would mean that the presence or absence of the subject would not affect the imperative clause at all because the subject would be analysed as it's own, independent intonational phrase.

The second piece of evidence that Potsdam (1998) provides is related to the reference problems when vocatives precede an imperative clause. Potsdam (1998) points to the requirement that vocatives must refer directly to the addressee of the main statement. The set of infelicitous vocatives shown in (11) contrast with the sentences in (12), where the same forms are permissible as subjects of imperatives.

(11) a. * Hey, *you and Fred*, did no one say to stay out of the construction zone?
b. * *Nobody*, that man just rode off with my bicycle!

(12) a. *You and Fred* stay out of the construction zone!
b. *Nobody* ride off with my bicycle!

In (11a), the second person pronoun *you* picks out the addressee, meaning that the entire noun phrase *you and Fred* cannot also correspond to the addressee (Potsdam, 1998). Since vocatives must correspond exactly to an addressee, *you and Fred* is not an acceptable vocative. In (12a), we see that the noun phrase *you and Fred* is acceptable as the subject of an imperative clause, because there is no requirement for imperative subjects to refer solely to the addressee. Further evidence in (11b) shows that *nobody* is inappropriate as a vocative because the set of individuals it picks out is empty (Potsdam, 1998). Again with the imperative in (12b), the subject *nobody* is not the addressee, but it is able to evoke a relevant set of addressees that should not be riding off with the speaker's bike giving further evidence of the difference between a vocative and an imperative subject. The evidence in (11) and (12) allow us to develop a diagnostic for determining if a noun phrase is a vocative or a subject of an imperative clause. If the noun phrase in question refers to something other than the addressee of the sentence, it cannot function as a vocative and must be an imperative subject (Potsdam, 1998). In other words, while vocatives are limited to being identical to the addressee of the sentence, imperative subjects are not restricted to the addressee discourse role.

The final evidence that Potsdam (1998) presents relates to the ability for imperative subjects to trigger third person anaphoric agreement, which is not possible for vocatives. This can be seen when looking at vocatives in (13a) and (13b) in contrast to imperatives in (13c) and (13d).

(13) a. Ladies and gentlemen, you may seat yourselves.
b. * Ladies and gentlemen, they may seat themselves.
c. Ladies seat yourselves, gentlemen remain standing!
d. Ladies seat themselves, gentlemen remain standing!

The vocative in (13a) agrees with the second person subject and second person reflexive anaphor without issue. In (13b), the vocative is unable to agree with a third person subject and reflexive anaphor, resulting in an ungrammatical sentence. In contrast to this, the subject *ladies* in examples (13c) and (13d) can agree with either a second person or third person reflexive anaphor, suggesting that imperative subjects are not vocatives. This means that it is not possible to say that the subjects in (13c) and (13d) are vocatives and they must be subjects within the syntax proper.

One could make an argument that imperative subjects which trigger second person agreement are ambiguously vocatives (in absence of all other evidence), and that only imperative subjects that trigger third person agreement are definitively subjects within the syntax. This argument falls short when looking at the examples in (14) where the subject of the imperative is a negative quantifier like *nobody*, which can trigger both second and third person agreement.

(14) a. Nobody forget your lunch tomorrow!

b. Nobody forget his lunch tomorrow!

It has already been established that these negative quantified subjects cannot serve as vocatives in (11b). This removes the possibility of vocative ambiguity in (13c) and (14a) (Potsdam, 1998).

The three pieces of evidence that distinguish imperative subjects from vocatives are summarized in Table 2.1.

| VOCATIVE | SUBJECT |
|---|---|
| separate intonational phrase | intonationally integrated with clause |
| identical to addressee | not restricted in discourse role |
| agreement is 2nd person | agreement is 2nd or 3rd person |

Table 2.1: Vocative versus Syntactic Subject Criteria (c.f. Potsdam (1998))

In addition to the evidence in Table 2.1, Zanuttini (2008) summarizes two additional arguments that further distinguish vocatives and imperative subjects. When a proper name is used as a vocative, it can be followed by a null subject imperative clause (shown in (15)), but when a proper name is used as a subject of an imperative clause, there must be, at minimum, one additional contrasting imperative clause (Zanuttini, 2008). This is shown in (16).

(15) John, close the door!

(16) a. * John close the door!

b. John close the door, Susan shut the blinds!

This same pattern is observed with bare nouns. When a bare noun is used as a vocative, a null subject imperative is free to follow without restriction, but when it is used as a subject of an imperative, additional contrasting clauses are required to produce an acceptable imperative (Zanuttini, 2008). A bare noun vocative is provided in (17) and bare nouns as subjects of imperative clauses are shown in (18) as further evidence to support this argument (Zanuttini, 2008).

(17) Boys, be quiet!

(18) a. * Boys be quiet!

b. Boys be quiet, girls be in charge of the orchestra!

The final piece of evidence from Zanuttini (2008) is similar to the second piece of evidence put forward by Potsdam (1998) and relates to how vocatives refer to addressees. Rather than focusing on their occurrence in isolation, Zanuttini (2008) presents cases where vocatives and subjects co-occur to showcase the difference in how vocatives and subjects pick out addressees. When a vocative with multiple addressees co-occurs with a proper name subject, the previous restriction applies to the imperative clause: that is, an imperative clause with a proper name subject cannot occur in isolation. This is shown by the difference in grammaticality between (19) and (20) (c.f Zanuttini (2008), 34, 35).

(19) a. Kids, Gabriel comb your hair; Dani put on your shoes!

b. Guys, John raise your hand; Mary wiggle your finger!

(20) a. * Kids, Gabriel comb your hair!

b. * Guys, John raise your hand!

From the examples in (19) and (20), a proper name used as a subject of an imperative without any intonation break to separate it from the rest of the clause will pick out a subset of the addressees identified by the vocative and is unable to be used in isolation as a result. Unsurprisingly, this restriction also extends to bare noun subjects, as shown in (21) (Zanuttini, 2008).

(21) a. Kids, boys comb your hair; girls put on your shoes!

b. * Kids, boys comb your hair!

It is crucial to build this argument that the subjects of imperative clauses are within the syntax proper. As argued by Potsdam (1998), vocatives are not part of the sentence and form a separate intonational phrase. This means that if imperative subjects were always vocatives, the remainder of the imperative sentence would form an independent intonation phrase and the presence or absence of the subject could not impact it phonetically. Having shown that imperative subjects exist within the syntax, it can now be assumed that they also exist within the same intonational phrase as the remainder of the sentence and that their presence or absence may have some impact on the intonational phrase as a whole. The details of this assumed phonetic impact is discussed in Section 2.4.

We can now abandon the concept of vocatives and instead focus on the sentences that will be used as stimuli for the experiments in this thesis. The next section of this chapter will focus on how the CP hypothesis accounts for the existence of a null-pronominal subject in null subject imperatives, and discuss the possibility that these null subject imperatives may result in a different phonetic form as compared to overt subject imperatives.

## 2.3 Null Subject Imperatives

Having established the fact that imperative subjects are not vocatives and belong within the CP layer of the syntax, we can now return to the pair put forward in (5) (repeated here as (22)).

(22) You keep yourself occupied! ≈ Keep yourself occupied!

The subject position of the null subject imperative in (5) needs to be occupied by some pronominal subject with second person $\phi$-features in order to bind the reflexive *yourself* (Potsdam, 2007; Zhang, 1990; Zanuttini, 2008). This section walks through the logic of previous research and discuss all of the possible explanations for this null subject in English.

The first possibility to discuss is that these null subject imperatives manifest as a result of a second person pronoun *you* that is simply phonetically deleted. This was the original analysis of null subject imperatives (Schmerling, 1975) prior to the discussion of empty category properties by Chomsky et al. (1981). To begin, we can disprove this phonetic deletion analysis and show that an empty category analysis is the only reasonable explanation.

The sentences in (23) illustrate that there is an acceptability difference between null subject imperatives, and imperatives with an overt *you* subject.

(23) a. Don't you try the cake!
b. Don't try the cake!
c. * Do you try the cake!
d. Do try the cake!

In (23a) and (23b), both null and overt subjects are able to exist in a negative imperative structure, but the ungrammaticality of the overt subject in (23c) suggests that the subject of (23d) is not simply a deleted subject pronoun and must be some other null element. There is no question about the grammaticality of (23d) and we are still able to recover the interpretation that it has a second person addressee. Incorporating a second person reflexive into (23d), as shown in (24), proves that this null element has second person $\phi$-features, despite not being a deleted second person pronoun.

(24) Do try the cake yourself!

The sentences in (23) provide evidence that the subject position of null subject imperatives is occupied by some empty category object with second person $\phi$-features as opposed to a phonetically deleted subject (Potsdam, 1998; Chomsky et al., 1981). Indeed, the consensus in the literature is that the subject position (Spec IP) is occupied by some null element (Beukema and Coopmans, 1989; Potsdam, 1998, 2007; Zanuttini, 2008; Zhang, 1990). So, what are the possible elements that could reasonably occupy this position?

In total, there are four things that could possibly occupy this position in English: a trace of NP-movement, a null topic operator, the proniminal anaphor PRO, or the null pronominal *pro* (Potsdam, 1998). These four possibilities are discussed in turn using arguments from previous research on null subject imperatives.

The NP-movement trace hypothesis implies that the null subject is a trace of an NP that moves to some other position in the syntax. This is quickly ruled out by Beukema and Coopmans (1989) as it would require the null subject trace to be identified by an antecedent in a c-commanding argument

position. This would rule out the possibility of these null subjects appearing in an utterance initial position in English.

Beukema and Coopmans (1989) instead build an argument for the null topic operator theory. They argue that subjectless imperatives are the result of topicalizing an empty topic. If the subject position were to be occupied by this null topic operator, its referent would need to come from the discourse (Beukema and Coopmans, 1989). This is refuted by Henry (1995), who shows that discourse priming in (25) cannot force a third person interpretation of a subjectless imperative.

(25) Everybody take out their books! After that, write down their names!

The first imperative of (25) has a distributed reading where for each individual addressee, they should take out their book. In the following subjectless imperative, the *their* in *their names* cannot refer to the addressees and must be some unidentified third parties. The subject of this imperative must also be interpreted as *you*, which would not be possible if it were a null operator that was topicalized to the subject position which would attempt to get its reference from the previous discourse marker (*everybody* in this case).

In addition to this, Potsdam (1998) points out that topicalizing a null operator would prevent overt topicalization in subjectless imperatives, as this would result in double topicalization. In English, it is not possible to topicalize more than one phrase, as shown in (26).

(26) a. This book, John put on the table.

b. * This book, on the table, John put.

If it is not possible to topicalize multiple phrases, it should not be possible to topicalize a phrase in a subjectless imperative as the null operator was already topicalized according to Beukema and Coopmans (1989). This hypothesis is refuted by Potsdam (1998) in (27).

(27) The tie, give to Bob; the aftershave, give to Don!
(c.f. Potsdam (1998): (82))

The ability to topicalize the direct object phrases of both the imperatives in (27) implies that they are the only phrases that have been topicalized and rules out the possibility that the subject position is occupied by a topicalized null operator.

The pronominal anaphor PRO is an unlikely candidate because of the fact that there is a minimal contrast made between the sentences in (5) with no major syntactic changes anywhere in the clause. For instance, there is no alternation in the presence or absence of an overt complementizer *for*, as in subordinate infinitival clause containing overt subjects versus PRO. An example of this is seen in (28).

(28) a. It is impossible [$_{CP}$ **PRO** to win at roulette.]

b. * It is impossible [$_{CP}$ for **PRO** to win at roulette.]

c. It is impossible [$_{CP}$ for Bill to win at roulette.]

d. * It is impossible [$_{CP}$ Bill to win at roulette.]

(Adapted from (Hornstein, 1999: 92))

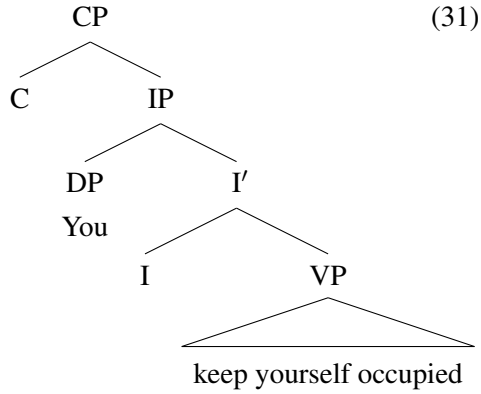
The inability for PRO to exist in a CP clause with an overt complementizer *for* in (28b), combined with the inability for an overt subject like *Bill* to exist without one in (28d) means that it is not possible for PRO to exhibit a minimal alternation like we see in the subject position of imperatives (Potsdam, 1998; Zhang, 1990). This restriction can also be observed in (29), where the embedded PRO clause appears in the subject position of the main clause, giving further evidence against the possibility that PRO is occupying the subject position of a null subject imperative.

(29) a. To lose is always disheartening.
[$_{CP}$ [$_{IP}$ **PRO**$_{arb}$ [$_{I'}$ to lose ] ] ] is always disheartening.
(c.f. (Potsdam, 1998: 123))

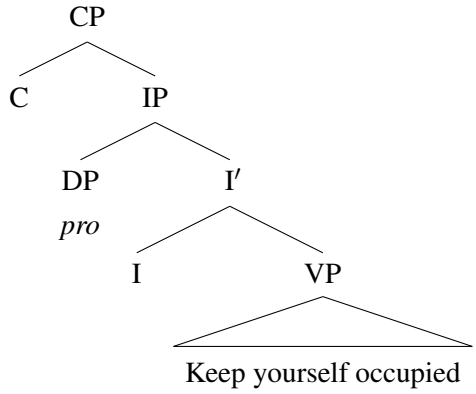
b. For one to lose is always disheartening.
[$_{CP}$ For [$_{IP}$ one [$_{I'}$ to lose ] ] ] is always disheartening.

The only possibility that remains for subjectless imperatives, according to Potsdam (1998), is the null pronominal *pro*. If the subject position of a null subject imperative is occupied by *pro*, we can represent the sentences in (5) with the two tree structures in (30) and (31).

(30)




(31)



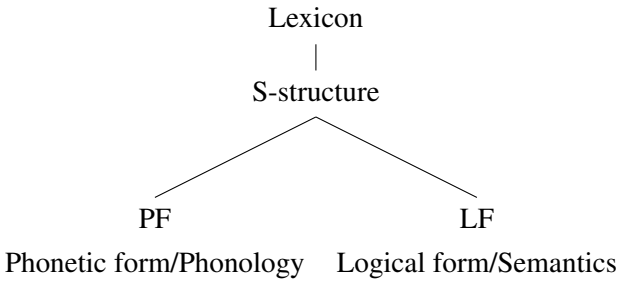

Null subject imperatives are universally accepted in English and are present in multiple languages, regardless of where those languages fall in terms of the traditional divide between null subject and non-null subject languages (Zhang, 1990). This means that despite being a non-pro drop language, English permits a *pro* subject in null subject imperatives, and we have cross linguistic evidence to support this exception. Assuming the imperative structures in (30) and (31) for the sentences in (5), a question arises as to the phonetic output of these two sentences. If we adopt a

y-model of grammar in line with the minimalist program, the syntactic derivation of a clause will send information to both the Phonetic Form (PF) and the Logical Form (LF) interfaces to be interpreted phonologically and semantically at spellout (Chomsky, 2014). Note that the only syntactic difference between the structures in (30) and (31) is the contents of the DP at the Spec IP position. The question becomes, is there reason to expect a significantly different phonetic output from these two constructions based on this difference? In other words, is the presence of a null pronominal *pro* as opposed to an overt subject pronoun *you* distinct enough in English to be noticeable in a spoken imperative sentence when focussing only on the stress of the verb? The next section of this chapter introduces phonetic research for the stress of subject pronouns to motivate the assumption that the use of a null pronominal subject may have implications on the stress of the utterance. The next section also introduces previous research examining expletive pronouns in English raising conditions that provides the methodology that was adapted for the experiments in this thesis.

## 2.4 Phonetic Motivations and Previous Research

The interface between the syntactic module and the phonetic/phonological output is an assumption built into the y-model of grammar contained within the minimalist program (Chomsky, 2014). The assumption within this model is that information from the lexicon undergoes a series of computational processes to create an intermediate phrasal structure (S-structure). This S-structure then interfaces with LF and PF. The LF module handles all meaning and semantic relations of the S-structure and the PF module deals with all phonetic and phonological rule resolutions. An important assumption with this model is that LF and PF are independent and unable to communicate with each other. This means that the logical form should not influence the phonetic form in any way beyond the input that is received at the S-structure/PF interface. A visual summary of this model is provided in (32).

(32)




Returning to the comparison of the two imperatives in (5) (repeated here as (33), it has been established in this chapter that they are nearly structurally identical, with the only difference being the content of the subject DP at Spec IP.

(33) You keep yourself occupied! ≈ Keep yourself occupied!

Assuming that this is true, one can now ask how the PF interface would treat the two sentences based on this difference. The utterance initial position of an imperative, particularity one that contains a subject pronoun *you*, has not been investigated in previous research.

Broadening the scope to look at other pronoun possibilities and other clause types in English does reveal an interesting finding. An investigation by Travis and Cacoullos (2014) found that a trend emerges in English recorded speech where the pronoun *I* is stressed approximately 24% of the time when it is the initial intonational unit (IU) at the beginning of a turn-taking phrase, as compared to the same pronoun in other positions, which were stressed approximately 9% of the time. This trend does suggest that there is something unique about utterance initial subject pronouns in English from a phonetic standpoint. The measures of stress that are considered by Travis and Cacoullos (2014) are primarily vowel quality, vowel length, syllabic status and amplitude. Although spectral analysis involving fundamental frequency was not conducted in this research, they refer to work by Pierrehumbert and Hirschberg (1990) that mentions spectral characteristics such as rising intonation serving as indicators of stress in speech.

This investigation by Travis and Cacoullos (2014) was conducted in response to claims that the stress on subject pronouns at the left edge of an utterance was related to clausal markers, such as *I think that...* or *I know that...*, acting as the source of the stress on these pronouns (Dehé and Wichmann, 2010). The results from Travis and Cacoullos (2014) suggest that this is not the case, and the increased stress is related to other discourse factors. Most importantly for this thesis, the turn taking and utterance initial position are highlighted as a source of increased pronoun stress in an utterance.

The results from Travis and Cacoullos (2014) suggest a special property of sentence initial pronouns making them more likely to be stressed when compared to other pronoun locations in English declaratives. However, there is no reason for this property to be linked specifically to declaratives and it is reasonable to assume that this property extends to other clause types. There is nothing syntactically specific to declaratives that would license this increased stress, and Travis and Cacoullos (2014) find that this increased stress is independent of discourse factors such as focus, so there is no reason to link this property to a specific clause type. This means that, in an overt subject imperative sentence, it is expected that the pronoun will be stressed if it occurs in utterance initial position.

The hypothesis proposed in this thesis is that if there is some special property of utterance initial subject pronouns causing them to be stressed more often, then a stark contrast will emerge between overt and null subject imperatives. In the latter, no stress will be assigned to the phonetically null pronominal in the subject position. If this is true, the lack of utterance initial stress may significantly alter the stress placed on the following word (the imperative verb, in the case of the experiments included in this thesis). Imperative utterances with overt subject pronouns will have comparatively less stress markers on the imperative verb because of the stress placed on the utterance initial pronoun, potentially resulting in lower F0 values, lower intensity, and shorter vowel lengths on the verb (Pierrehumbert and Hirschberg, 1990; Gordon and Roettger, 2017). I hypothesize that imperatives with null pronominal subjects will have no stress assigned to the subject position resulting in significantly different levels of stress being assigned to the rest of the sentence. I predict that this will manifest as increased levels of stress on the main verb of the imperative sentence which, in the case of the experimental stimuli, is adjacent to the subject in all cases.

Rather than just looking at imperatives alone, a replication of previous findings by Weir (2019) is also attempted in the experiments that follow. This also provides a baseline of comparison with a sentence type that has already been studied in this way. The background information of this study and its relation to this thesis is expanded on in the next subsection.

### 2.4.1 Previous Research - (Weir, 2019)

The study conducted by Weir (2019) investigated audio productions of participants reading sentences that contained a raising verb *seems* with an expletive subject pronoun, like the examples shown in (34). The presence of the expletive subject pronoun was manipulated, with half of the sentences presented to participants containing an overt subject pronoun (see (34a)) and half of the sentences having no expletive subject pronoun (see (34b)).

(34) a. It seems he is tired.
b. Seems he is tired.

In addition to the expletive *it* raising sentences in (34), the experiment also included sentences with an expletive *there* pronoun and sentences with a referential *it* pronoun, with all sentences using the raising verb *seems*. The hypothesis of this study was that the deletion of the subject pronoun, whether expletive or referential, would significantly change the stress of the following word because the pronoun would need to be present syntactically and then deleted at the PF interface. This hypothesis was formulated based on the link between deleted expletive subjects and informal speech in English, as well as phonological theories proposed by Weir (2012) arguing that subjectless raising sentences are only permitted in a spoken context (i.e. the phonological domain) and are ungrammatical when written (i.e. the syntactic domain).

Weir (2019) analysed the F0 and vowel length of the raising verb *seems* with all three types of subject pronouns, which had their presence alternated in a 3x2 Latin Square design. The participants were situated in a soundproof booth and were instructed to read blocks of text on a computer screen out loud. Each block of text consisted of three separate sentences on three lines, with the target sentence containing the raising verb always appearing as the second sentence of the block (Weir, 2019). Having three sentences served two functions for this study. First, the two sentences surrounding the target sentence would act as carrier sentences so that the target word would not be the first word that participants spoke in a trial and the sentence containing the target word would not be the only sentence present in the trial. Second, the first sentence provided a context for the trial, which was especially important in trials where a referential *it* subject pronoun was missing from what participants were reading. A referential pronoun trial from Weir (2019) is presented in (35) to demonstrate how participants would see each trial.

(35) The toaster did not pop on schedule.
(It/??∅) seems to be broken.
I guess it's time for a new one.

Without the context of the toaster in the first sentence of (35), the second sentence would be difficult to interpret if the subject *it* pronoun were present because the subject pronoun would have no referent to license its appearance. In trials where the subject pronoun was deleted, the sentence would be completely unacceptable without the context. Even including the context sentence in the trial still makes the sentence only questionably grammatical at best.

Weir (2019) did not find any significant effects of the presence of the subject pronoun on the stress of the raising verb in any of the three conditions. This suggests that the presence or absence of a subject pronoun did not significantly impact the way that participants read the raising verb *seems* in terms of F0 and vowel length. What was found instead was a significant effect of stress markers depending on whether the subject pronoun was expletive or referential (Weir, 2019). In other words, when participants were producing a sentence containing a referential *it* subject pronoun, the F0 of the raising verb was significantly lower and the vowel was significantly shorter across the 24 participants (Weir, 2019). This effect is interesting because it occurred independently of any subject presence effects, meaning that participants also showed this pattern on sentences where the subject pronoun was not present in what they were reading.

The inference taken from these results is that the stress on a raising verb that raised a referential pronoun was significantly lower because the referential *it* pronoun was contributing semantic content to the utterance and was being stressed more than the expletive pronouns. This resulted in less stress on the raising verb in the referential condition compared to expletive conditions. This finding is also supported by the claim in Travis and Cacoullos (2014) that subject pronouns in utterance initial position have a unique property that makes them more likely to be stressed. The results of Weir (2019) expand upon the results of Travis and Cacoullos (2014) by showing this effect for pronouns other than first person *I*. Weir (2019) claims that the referential nature of a subject pronoun is important to stress assignment at the PF interface, which is why we do not see the same reduction in verb stress occurring with the expletive pronouns introduced by the raising verbs.

Weir (2019) theorizes that the reason why reduced verb stress persists for sentences with absent subject pronouns is connected to the fact that the deletion of the subject pronouns in raising conditions occurs at a late stage in the derivation. This stage is thought to be after stress and intonation have been assigned at the PF interface, meaning that the phonetic effects of the pronoun would still be apparent.

The experiments in this thesis adopt the previous methodology of Weir (2019) using a stimuli set that includes imperative sentences, as well as raising sentences which introduce an expletive "it" pronoun.. This results in a 2x2 design comparing SENTENCE TYPE (*imperative* and *raising*) and SUBJECT PRESENCE (*absent* and *present*). The hypothesis discussed in Section 2.4 predicts a significant difference in the *imperative* sentences as a function of SUBJECT PRESENCE where *imperative* sentences with an *absent* subject pronoun will have significantly less stress markers compared to *imperative* sentences with a *present* subject pronoun. In addition, the *raising* results are hypothesized to replicate the findings of Weir (2019), meaning that there will be no significant difference in the *raising* sentences based on SUBJECT PRESENCE. This expected difference in the *imperative*

sentences combined with the expected lack of difference in the *raising* sentences would result in a significant interaction between the two sentence types as a function of SUBJECT PRESENCE.

## 2.5 Chapter Summary

The purpose of this chapter was to introduce background literature related to imperatives that motivates the experiments in this thesis. The background literature here includes a set of theoretical assumptions that are necessary to build up a testable research question. First, the CP hypothesis argued for by Potsdam (1998) assumes that the subject of an imperative is contained within its syntactic structure and is distinctly different from a vocative. With this, we can construct a pair of sentences in English where one sentence will have an overt second person subject *you* and the other will have a null *pro* subject as shown in (36a) and (36b) respectively.

(36) a. You fix the bathroom light!

b. *pro* Fix the bathroom light!

A previous investigation by Travis and Cacoullos (2014) has shown that subject pronoun *I* will often receive stress in the utterance initial position in declarative sentences, a phenomenon that is independent of the surrounding lexical content. Combining this with the results of Weir (2019), This thesis proposes that there is a special property or feature of referential pronouns in English that makes them more likely to be stressed in utterance initial positions, and this can observed based on stress markers like F0, intensity and vowel length.

Based on the information in this chapter, the following line of reasoning has been established:

1. The y-model of grammar dictates that the spellout of a clause occurs when the syntactic derivation of a clause is complete. The syntax sends all relevant information to the phonological module where all phonological rules and things like stress assignment occur.

2. The minimal pair in (36) are structurally near-identical with the only difference being the content of the subject DP at Spec IP position.

3. The null pronominal *pro* at Spec IP of (36b) contrasts with the *you* pronoun in (36a), meaning that the input that PF sees for (36a) and (36b) are different.

4. Based on the investigation by Travis and Cacoullos (2014), subject pronouns at the left edge of an utterance are frequently stressed in declaratives, and it is argued in this chapter that this property is specific to referential pronouns, not to the clause type, meaning that this will also occur in imperatives.

5. If this is true, the overt subject pronoun in (36a) will be stressed, resulting in less stress on the imperative verb.

6. Because the null subject pronominal *pro* is phonetically null, it should not be assigned stress at PF. This lack of stress at the left edge means the stress on the verb will not be affected in (36b), resulting in more stress on the imperative verb compared to (36a).

To test this line of thinking, the methodology of Weir (2019) was used to examine participants' phonetic data when reading imperative sentences both with and without subjects. The previous findings of Weir (2019) showed that, in raising sentences with expletive subjects, manipulating the presence of the expletive subject does not create significant phonetic differences in what participants read. This lack of a difference is thought to be related to a late stage phonological deletion, which is different from the PF input difference argued for imperatives in this thesis. The stress markers that are tested in the experiments that follow are F0, intensity, and vowel length (only tested in Experiment 2) which are all found to be significant markers of stress in previous literature (Gordon and Roettger, 2017; Pierrehumbert and Hirschberg, 1990).

Based on this reasoning, the next chapters report experimental studies that attempt to answer two questions:

1. Does the null pronominal *pro* in null subject imperatives result in stress assignment on the imperative verb that is significantly different from imperative sentences containing an overt second person pronoun *you*?

2. Will a significant interaction emerge when comparing imperative sentences and raising sentences, which have previously been shown not to have a significant difference in stress assignment based on alternating subject presence?

# Chapter 3

# Experiment 1: Comparing Imperatives and 'seems' Raising Sentences

The first experiment investigated the phonetic effects of subject presence on imperative sentences in English. The intent of this experiment was to test whether null subject imperative sentences have significantly different levels of stress assigned to the imperative verb compared to imperative sentences that have an overt *you* subject. In addition to this, raising verb sentences with expletive pronoun subjects were included to provide a baseline of comparison and attempt to replicate the results of Weir (2019).

## 3.1 Method

### 3.1.1 Participants

30 native English speakers were recruited to participate in this experiment. For the purposes of this study, native English speakers are defined as speakers who grew up speaking English as the primary language in their household. Of the 30 participants, 13 were monolingual, 12 spoke two languages, and 5 participants spoke three or more languages. The most common second languages were French (spoken by 7 participants), Mandarin (spoken by 3 participants), and Japanese (spoken by 3 participants). Participants were undergraduate students enrolled in various linguistics courses at Simon Fraser University and received research participation credit as compensation for their participation in the study. There were 23 female participants, 5 male participants, and 2 non-binary participants, with a mean age of 20.6 years.

### 3.1.2 Design

The experiment had a 2x2 design with independent variables SUBJECT PRESENCE and SENTENCE TYPE. SUBJECT PRESENCE consisted of *present* for overt subject sentences and *absent* for null subject sentences. The SENTENCE TYPE factor consisted of *imperative* and *raising* sentences. Each participant would see the same sentence twice, once with the subject pronoun and once without,

for both *imperative* and *raising* sentences, making the variables within-subject. Each item consisted of three sentences presented to participants simultaneously. The target word, the imperative verb or raising verb, was always in the second sentence. The second sentence was always contained within quotation marks to indicate that a person referenced within the previous sentence was speaking. A sample stimuli set for the *imperative* condition is provided in (37) and an example of the *raising* condition is provided in (38).

(37) Benjamin told Mia,
"(You/∅) feed the dogs on time tonight!"
Mia promised that she would remember.

(38) Leo remarked to Nora's son,
"(It/∅) seems she is treating you well."
The child smiled and showed off their ice cream.

In addition to the experimental items, a set of filler items were included to distract participants from the purpose of the study. These filler items consisted of sentences with and without a referential subject. (The items without referential subjects were ungrammatical.) An example of this is shown in (39).

(39) Carter warned Amy about the mouse,
"(The mouse/*∅) is hiding behind the fridge."
They knew it was time to call an exterminator.

### 3.1.3 Materials

Experimental items consisted of 16 sentences with *imperative* verbs and 16 sentences with *raising* verbs. The *imperative* verbs were selected to meet the following criteria:

1. The verb must be monosyllabic
2. The verb must begin with a voiceless fricative
3. The vowel must be a single, high front vowel (no diphthongs)

Because the *raising* verb (*seems*) was consistent in all 16 raising sentences, the criteria above were chosen to make the differences between the conditions as phonetically minimal as possible. Eight *imperative* verbs with the tense [i] vowel were selected along with eight verbs with the lax [ɪ]. A full list of all stimuli sentences is provided in Appendix A. The 16 experimental items and eight filler items were presented twice, once with the subject and once without. The items were pseudo randomized in order to ensure that participants would not see the same type of sentence consecutively. A second list was used which was the reverse order of the first list to control for any inadvertent ordering effects.

### 3.1.4 Procedure

Participants were invited into the lab and were situated in a closed booth. Sentences were presented using Psychopy® version 2021.2.3 (Peirce et al., 2019). Data collection was done in accordance with COVID protocols which allowed participants to remove their masks during the data collection so that the audio would not be distorted in any way. Participants were instructed to read all the sentences aloud as soon as they saw them without reading them in their heads first. Audio was recorded on a headset microphone which allowed for speech intensity to be tracked. In addition to intensity, the fundamental frequency (F0) of the verb vowel was also measured just as it was in Weir (2019).

### 3.1.5 Predictions

Based on the results of Weir (2019) discussed in Chapter 2, there should not be any significant differences between *absent raising* and *present raising* sentences in terms of F0 or intensity. This is predicted due to the fact that the subject in *absent raising* sentences is believed to be deleted after stress has been assigned at the PF interface and the stress is not reassigned or shifted to another word (Weir, 2019). If this holds true for the *raising* sentences, two possible outcomes are predicted for the *imperative* sentences:

1. Participants will not place additional stress on the verb of null subject imperatives, resulting in no significant interaction between SENTENCE TYPE and SUBJECT PRESENCE. This suggests that the subject of the sentence was deleted, or was treated as phonetically null at a later stage in the derivation, after the phonology has already gone through the operation of assigning stress to the utterance.

2. Participants will place additional stress on the verb of null subject imperative sentences since the verb is interpreted at PF as utterance-initial compared to overt subject imperatives where the pronoun will be utterance-initial, resulting in a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE. This suggests that the subject was deleted or phonetically null prior to reaching the PF interface and was not assigned stress at any point.

Stress for the purposes of this study is defined as phonetic prominence that manifests as increased F0 and/or intensity measured as an average value on the vowel of a target word. A previous survey of several studies by Gordon and Roettger (2017) found that a heightened F0 was a marker of stress in 46 of 63 (73%) studies surveyed, and that intensity was found to be a marker of stress in 39 of 52 (75%) of studies surveyed. F0 was evaluated as a measure of stress for this experiment to try and replicate the results of Weir (2019). Because a head mounted microphone was used in this experiment, it was decided to analyse the intensity of the speech as well because the microphone position relative to the mouth would be consistent, allowing for accurate intensity measurements for each participant.

If the results of this study align with the second prediction, it would serve as evidence that there is a difference in the underlying structure of *absent* and *present imperatives*, and that it is causing a difference in how the utterances are realized phonetically. This prediction aligns with the theory that *absent imperatives* in English have a phonetically null *pro* subject and the difference in structure is influencing the phonological output at the PF interface (Potsdam, 2007).

If the results align with the first prediction and we do not observe a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE, it could be interpreted in several ways. The previous research conducted by Weir (2019) had the advantage of being able to use the same raising verb in all conditions, allowing for a more direct comparison. This study, however, is relying on completely different words in the *imperative* condition versus the *raising* condition. Effort was made to ensure that the differences were as minimal as possible, but this may be a confounding factor. Because this study is also reusing the *raising* verb *seems* again, it does allow for a partial replication of the results of Weir (2019). If those results are replicated but the interaction of the SENTENCE TYPE is not significant it might suggest that the methodology still has potential but that there was some underlying factor preventing a difference from being observed.

## 3.2 Results

Audio data was aligned to the phonetic level using the Montreal forced aligner (McAuliffe et al., 2017). Average F0 and intensity values over the duration of the vowel in the target verb were measured using Praat (Boersma, 2001). Each of the 30 participants read a total of 16 *imperative* and 16 *raising* stimuli sets creating a total of 960 tokens. A total of 12 data points were removed from analysis. The reasons for removal ranged from Praat's inability to get an F0 reading due to participants speaking too softly or devoicing the vowel (4 occurrences), producing the wrong verb (7 occurrences), or stopping midway through the verb and restarting (1 occurrence). The final analysis consisted of 948 tokens (472 imperative and 476 raising), which were analysed using mixed-effects modelling with fixed factors of SENTENCE TYPE and SUBJECT PRESENCE. A total of 19 of these tokens needed to be manually aligned to a text grid due to false starts by participants in non-target words, or premature audio cuts that resulted in errors with the aligner. All F0 and intensity values were z-score normalized within participants to mitigate any potential effects of participant variation. For this analysis, SENTENCE TYPE was sum coded, with the *imperative* level coded as 1 and the *raising* level coded as –1. SUBJECT PRESENCE was also sum coded, with the *absent* level coded as 1 and the *present* level coded as –1.

### 3.2.1 F0

Fundamental frequency values were z-score normalized within participant and analysed using a mixed-effects model in R (R Core Team, 2019). The normalization was done because of the large number of female participants in this study, which would skew the mean F0 values higher if raw means were used in the analysis. The lme4 package was used to fit the model (Bates et al., 2015)

| | Estimate | Std. Error | df | t value | Pr(>\|t\|) | |
|---|---|---|---|---|---|---|
| (Intercept) | -1.29e-04 | 7.100e-02 | 7.228e+00 | -0.008 | 0.9986 | |
| SentenceType1 | 1.465e-01 | 6.753e-02 | 9.290e+00 | 2.170 | 0.0572 | + |
| Subject1 | 1.260e-02 | 3.101e-02 | 9.335e+02 | 0.406 | 0.6847 | |
| SentenceType1:Subject1 | 4.981e-02 | 3.100e-02 | 9.329e+02 | 1.606 | 0.1085 | |

Formula in R: lmer(F0.z $\sim$ SentenceType * Subject + (1|Participant) + (1|Item)
Significance levels: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .1$

Table 3.1: F0 stats, Experiment 1

and the lmerTest package was used to obtain *p*-values (Kuznetsova et al., 2017). The data was fit to a maximal random-effects structure with random intercepts. The model is summarized in Table 3.1. There was no interaction between SENTENCE TYPE and SUBJECT PRESENCE, but a marginally significant main effect of SENTENCE TYPE. The SENTENCE TYPE difference here suggests that the *imperative* verbs had a relatively higher F0 on average across this pool of participants.

The lack of interaction between SUBJECT PRESENCE and SENTENCE TYPE, as well as the lack of a significant main effect of SUBJECT PRESENCE, provides no evidence that the underlying structures of these two sentences impacts their phonetic output. The SENTENCE TYPE conditions are plotted separately in Figure 3.1. The values in Figure 3.1 represent the mean of all within participant normalized F0 values. Values above 0 indicate a higher F0 on average while values below 0 indicate a lower F0 on average. Because all variables are normalized using z-scores, this is true of all graphs created in this thesis.

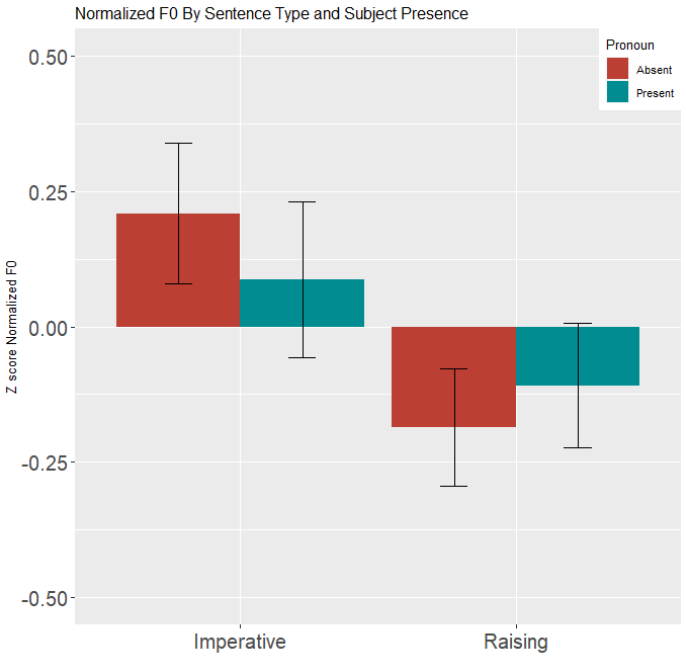



Figure 3.1: Bar graph comparing z-score normalized F0 of Imperative and Raising sentences as a function of Subject Presence in Experiment 1

The normalized F0 pattern in Figure 3.1 shows that the *imperative* sentences and *raising* sentences appear to be conforming to opposite patterns. *Imperative* sentences had an increased F0 in sentences where the subject pronoun was *absent* while *raising* sentences had a decreased F0 in sentences where the subject pronoun was *absent*. Neither of these differences resulted in significant effects due to the high amount of variance indicated by the error bars in Figure 3.1. The increased F0 on average in the *imperative* sentences, which was marginally significant in the model, is also seen in this figure.

The marginally significant main effect of SENTENCE TYPE shows that *imperative* verbs (raw mean = 244 Hz) had a higher F0 overall compared to *raising* verbs (raw mean = 239 Hz). This is similar to the secondary results of Weir (2019) which found that *raising* verbs which raised a referential pronoun to the subject position rather than inserting an expletive pronoun had significantly different F0 values. This difference was found to be independent of the SUBJECT PRESENCE alternation. This result was thought to be related to the semantic content associated with the referential subject being at the left edge. The fact that a similar contrast emerged when comparing *imperative* verbs with referential pronoun subjects and *raising* verbs with expletive pronoun subjects is a promising finding for the methodology.

The lack of a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE is not entirely unexpected. As mentioned in the previous section, there are reasonable explanations for this lack of a difference, which is elaborated on in Section 3.3 of this chapter.

### 3.2.2 Intensity

As with the F0 data, the intensity data was z-score normalized and fit to a mixed effects model with random intercepts for participants and items (R Core Team, 2019; Kuznetsova et al., 2017; Bates et al., 2015). The normalization here was done to mitigate effects of participant intensity variation, just as it did with the F0 values. The model is summarized in Table 3.2. As with the F0 data, there was no interaction between SENTENCE TYPE and SUBJECT PRESENCE, but main effects of both SENTENCE TYPE and SUBJECT PRESENCE appeared independently.

| | Estimate | Std. Error | df | t value | Pr(>\|t\|) | |
|---|---|---|---|---|---|---|
| (Intercept) | 1.612e-04 | 1.244e-01 | 1.315e+00 | 0.001 | 0.9991 | |
| SentenceType1 | 3.841e-01 | 1.015e-01 | 3.135e+00 | 3.786 | 0.0299 | * |
| Subject1 | 1.392e-01 | 2.700e-02 | 9.262e+02 | 5.156 | 3.09e-07 | *** |
| SentenceType1:Subject1 | 3.879e-02 | 2.698e-02 | 9.227e+02 | 1.438 | 0.1509 | |

Formula in R: lmer(Intensity.z $\sim$ SentenceType * Subject + (1|Participant) + (1|Item)

Significance levels: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .1$

Table 3.2: Intensity stats, Experiment 1

The lack of interaction between the two variables provides no evidence to support the hypothesis that *pro* impacts the phonetic form of the sentence, as was predicted in Section 3.1.5. The significant main effects indicate that *imperative* verbs had a higher intensity on average, and sentences with *absent* subjects also had a higher intensity. From this, it could be inferred that *imperative* verbs are more stressed than *raising* verbs, and that both *imperative* and *raising* sentences with absent subjects have higher stress on the verbs. Because the two SENTENCE TYPE measures are trending in the same direction as a function of SUBJECT PRESENCE, no interaction was found. The intensity measures are shown in Figure 3.2.

Figure 3.2 shows that in both *imperative* and *raising* sentences, average intensity was higher in sentences with *absent* subjects compared to sentences with *present* subjects. The significant difference between the SENTENCE TYPE conditions is visually apparent here with *imperative* sentences having positive normalized z-score values and *raising* sentences having negative normalized z-score values on average. This was also true of the F0 data shown in Figure 3.1, but the difference is more pronounced in Figure 3.2 and results in a significant difference as opposed to a marginally significant difference. Here the *imperative* sentences (raw mean = 72.43 dB) have a higher intensity on average compared to *raising* sentences (raw mean = 69.82 dB). This is a promising result for the methodology as a whole as it replicates the secondary finding of Weir (2019). Although the lack of an interaction between SENTENCE TYPE and SUBJECT PRESENCE is disappointing in terms of the alternative hypothesis for this study, the fact that both the F0 means and the intensity means are trending in the same direction with respect to SENTENCE TYPE suggests that there is something inherently different about the two types of sentences.

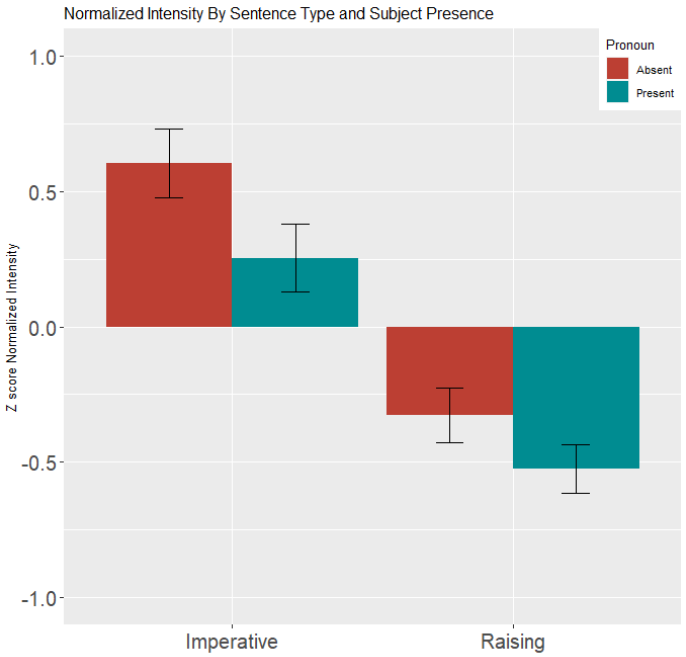
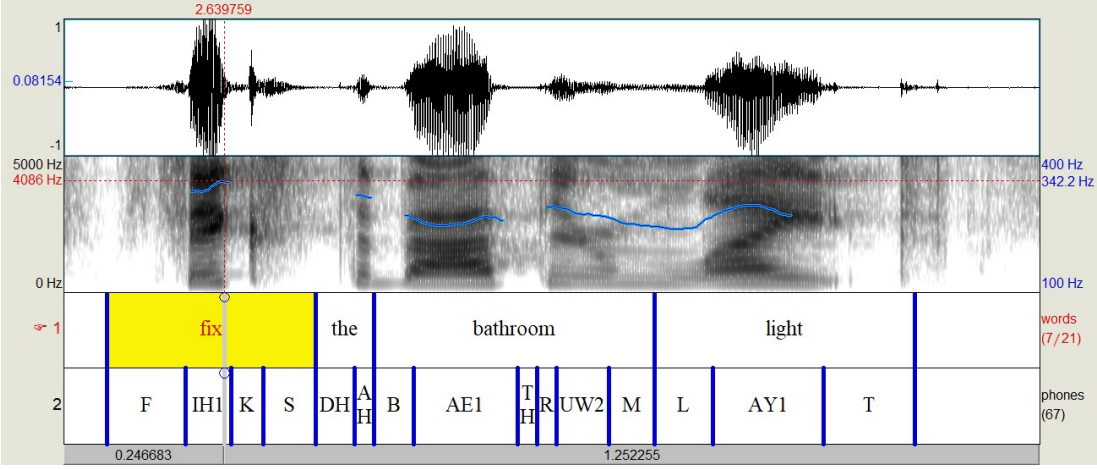



Figure 3.2: Bar graph comparing z-score normalized intensity of Imperative and Raising sentences as a function of Subject Presence in Experiment 1

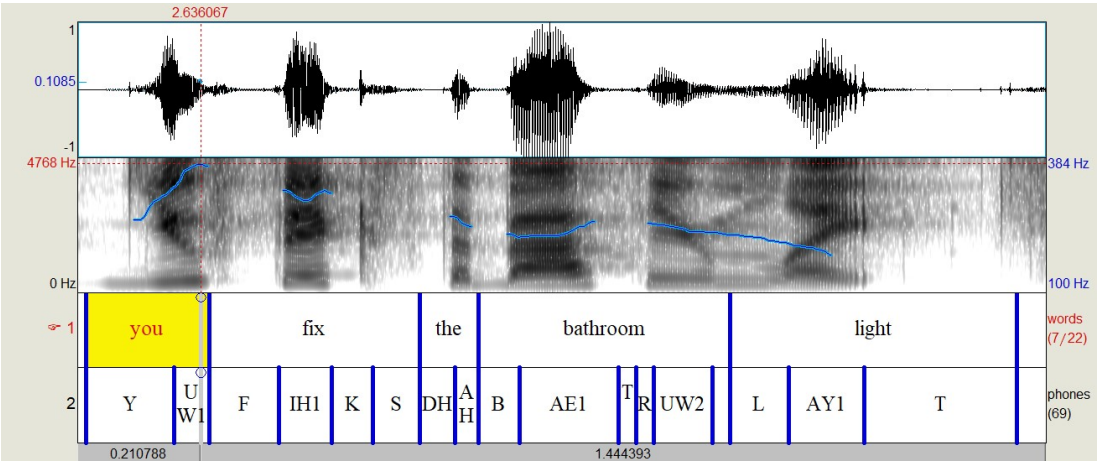
## 3.3 Discussion

The results of this experiment did not show any significant interaction between SENTENCE TYPE and SUBJECT PRESENCE with respect to the F0 measures. The lack of a significant interaction could suggest several things at this stage. The first possibility is that, like it is theorized with *raising* verbs, the subject of the *imperative* verb in the *absent imperative* sentences is deleted at a late stage in the derivation after stress has already been assigned, resulting in near identical F0 means.

The most promising result to come out of this first experiment is that *imperative* verbs are significantly different from *raising* verbs in terms of intensity, with higher intensity being associated with the *imperative* condition compared to the *raising* condition. This finding does suggest that there is some underlying difference between *imperative* verbs and *raising* verbs, with significantly more stress being placed on the *imperative* verbs. This could be due to the fact that *imperative* verbs have greater semantic content and assign a theta role to the subject while *raising* verbs do not contribute the same level of semantic content, as was previously suggested in Weir (2019). The result here is similar to the secondary finding of Weir (2019): *raising* verbs which raised a referential subject as opposed to inserting an expletive pronoun had significantly higher F0 values. These results together suggest that semantic content and the referential versus expletive aspect play some role in stress assignment on the verb.




(a) Subject Absent Imperative - Fix the bathroom light



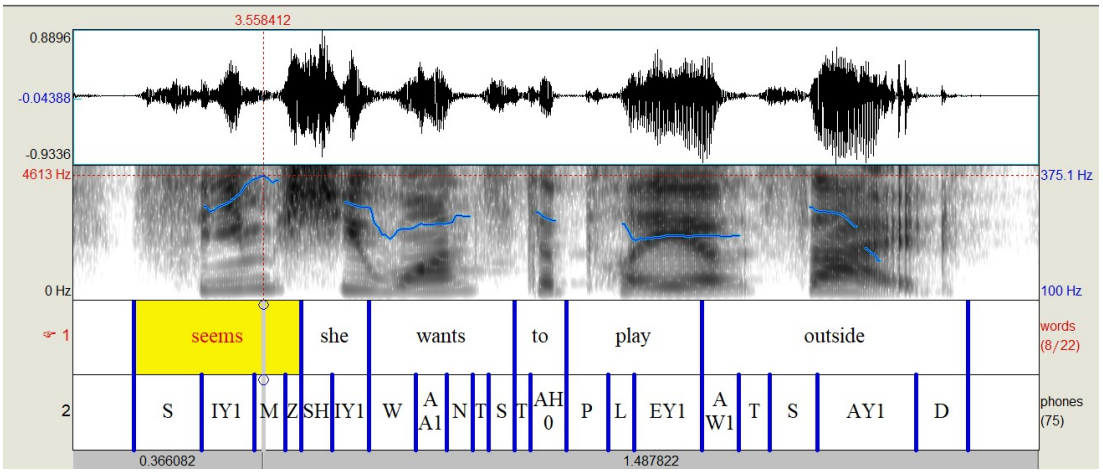

(b) Subject Present Imperative - You fix the bathroom light

Figure 3.3: Imperative sentence intonation contours from a single participant in Experiment 1

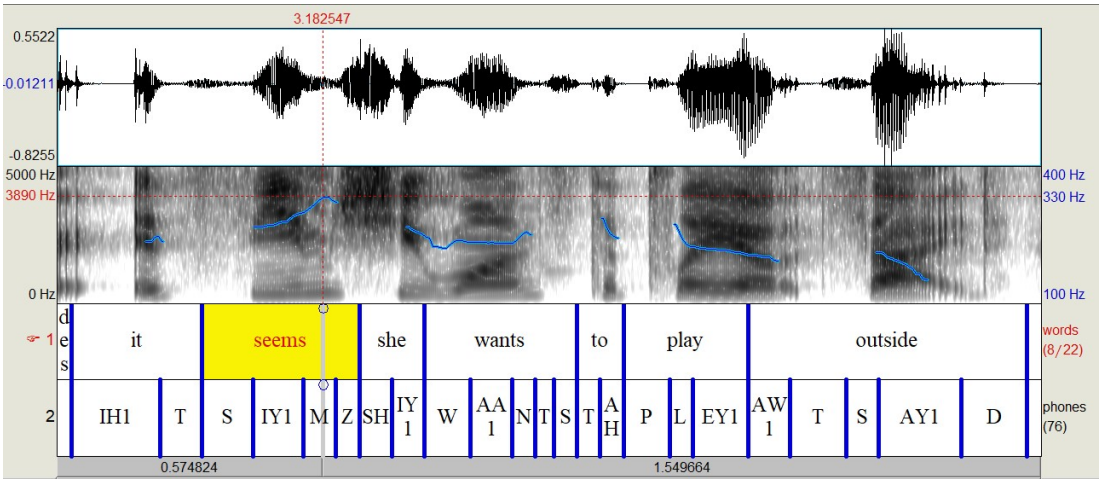
The significant main effect of subject presence when looking at intensity is a good finding for this methodology. However, as mentioned in Section 3.2.2, this did not result in a significant interaction when combined with the SENTENCE TYPE finding because it trended in the same direction for both variables. This is easy to see when looking at Figure 3.2, where both *imperative* and *raising* sentences have higher normalized intensity values when the subject pronoun is *absent*. Combining this with the fact that *imperative* sentences have higher intensity than *raising* sentences on average makes finding an interaction here difficult.

Despite not finding an interaction between SENTENCE TYPE and SUBJECT PRESENCE, looking at the F0 contour of the entire sentence containing the target verb gives some insight into the validity of the methodology. Figure 3.3 contains sample recordings of one participant's production of two *imperative* sentences, one with a *present* subject and one with an *absent* subject.

The intonation contour in Figure 3.3a shows a pitch peak at the vowel of the *imperative* verb, denoting primary stress in the sentence and secondary stress on the word *light*. The primary stress




(a) Subject Absent Raising - Seems she wants to play outside




(b) Subject Present Raising - It seems she wants to play outside

Figure 3.4: Raising sentence intonation contours from a single participant in Experiment 1

occurred on the *imperative* verb in all participants' recordings, but the secondary stress placement varied depending on the participant (if it even occurred at all). Secondary stress was not a factor that was considered in this study and participants were not instructed to emphasize any portions of the sentences. Nevertheless, participants all placed primary stress on the imperative verb without instruction. Looking at the contour in Figure 3.3b, there is a rising intonation on the subject pronoun. This is representative of the majority of participants, although many participants still had the pitch peak on the *imperative* verb despite the rising intonation on the subject. This rising pitch on the subject pronoun seems to suggest that the utterance initial position of pronouns has some unique property that increases the amount of stress assigned to the pronoun (Travis and Cacoullos, 2014). Finding this in imperative clauses suggests that this property is linked to the pronoun and not to a specific property of the clause or some other discourse factor.

Two samples of a *raising* sentence pair from this same participant are shown in Figure 3.4 for comparison. The pitch peak in Figure 3.4b comes near the end of the *raising* verb *seems* and

secondary stress occurs on *outside*. This intonation pattern is present in all participant recordings in Experiment 1. Again here, the primary stress is appearing on the target word completely unprompted. The most interesting observation about these intonation contours comes from comparing Figure 3.3b and Figure 3.4b. As discussed above, the *you* in the *imperative* sentence has a rising pitch, while the *it* in the raising sentence only has a low boundary tone. This gives more credibility to the idea that has been perpetuated throughout this thesis: that the referentiality of utterance-initial pronouns is an important factor for stress assignment with referential pronouns being stressed often in an utterance initial position compared to the expletive pronouns in this experiment.

Overall, the two key observations that can be made about these intonation contours can be summarized as follows:

1. The words at/near the target region are always stressed. This means that the methodology of looking at changes in stress on the imperative/raising verb is correct and it was not the case that these words were unstressed in all cases and small changes in stress markers would not have been noteworthy.

2. The *imperative* subjects' rising intonation is likely related to their referentiality and their location at the left edge of the utterance, directly contrasting with the expletive subjects in the *raising* conditions, which are not referential.

These two observations taken together indicate that, if there were phonetic differences to be observed as a function of the interaction between SENTENCE TYPE and SUBJECT PRESENCE, the assumption was correct to look at the *imperative* verbs and *raising* verbs because these are the stressed portions of their respective sentences.

This experimental design is a novel way of attempting to examine syntactic differences in spoken output and as a result, there are potential issues that should be considered, worked out, and improved upon in future studies. The first possible issue with this study is that we are looking at different phonetic environments between the *imperative* and *raising* verbs, as well as within the imperatives themselves. There were efforts to minimize the differences between the experimental items by ensuring that the *imperative* verbs all began with a voiceless fricative and were monosyllabic with a high front vowel. Nevertheless, these are not identical words and this may be influencing the results in some way, and preventing a difference from being observed. Care was taken to minimize the difference in the phonetic environment before the vowel of the verb, but the environment after may have influenced the F0 and intensity measures as well. In the *raising* condition, the word *seems* consistently had the vowel leading into a bilabial nasal, but the *imperative* condition had coda sounds ranging from voiced alveolar stops to short lateral /l/ sounds.

In order to get a more direct comparison between the *imperative* and *raising* sentences, a second experiment was designed which took advantage of the fact that the word *appear* can serve as both an imperative and a raising verb in English.

# Chapter 4

# Experiment 2: Comparing 'appear' as an Imperative and Raising Verb

As mentioned in Chapter 3, this experiment attempts to correct some potential methodological issues of the first experiment. The results from Experiment 1 suggest that there is an inherent difference between *imperative* and *raising* sentences in terms of F0 and intensity, but at this point, it is unclear if this difference is due to the SENTENCE TYPE or the variety of different verbs used in the *imperative* sentences. For this experiment, the *imperative* verbs were changed to always be *appear* and the *raising* verbs were changed to always be *appears*. This ensured that the phonetic differences between the stimuli were minimized as much as possible and any differences that manifested between their pronunciations would most likely be due to the SENTENCE TYPE being spoken.

## 4.1 Method

### 4.1.1 Participants

16 native English speakers were recruited to participate in this follow-up experiment. None of the participants in this second experiment had participated in Experiment 1. The definition of a native speaker of English from Experiment 1 was used again for this study. Of the 16 participants, 5 were monolingual English speakers, 8 spoke two languages and 3 participants spoke three or more languages. The most common additional language for participants was French (spoken by 5 participants) followed by Punjabi (spoken by 2 participants). No other additional language was shared between multiple speakers. Participants were undergraduate students enrolled in various linguistics courses at Simon Fraser University and received research participation credit as compensation for their participation in the study. There were a total of 11 female participants, 4 male participants, and 1 non-binary participant, with a mean age of 22.4 years.

### 4.1.2 Design

This second experiment, like Experiment 1, had a 2x2 design with the independent variables SENTENCE TYPE and SUBJECT PRESENCE. Rather than separating the *raising* and *imperative* verbs into completely different sentence groups as in Experiment 1, for this experiment, a total of 16 stimuli sets were created with four variants each, as shown in (40). These stimuli were distributed into four separate lists using a Latin Square technique.

(40) a. IMPERATIVE ABSENT
Jackson ordered Sophia,
"Appear to be cleaning the house."
They both knew that she had no interest in actually cleaning.

b. IMPERATIVE PRESENT
Jackson ordered Sophia,
"You appear to be cleaning the house."
They both knew that she had no interest in actually cleaning.

c. RAISING ABSENT
Jackson said to Sophia,
"Appears you are cleaning the house."
Sophia had been working hard all day.

d. RAISING PRESENT
Jackson said to Sophia,
"It appears you are cleaning the house."
Sophia had been working hard all day.

The number of participants in this experiment resulted in each experimental item being recorded four times. All experimental items are presented in Appendix B. The same filler items from Experiment 1 were reused in this experiment as distractor items, as well as eight more items with a similar design to balance the number of experimental and non-experimental items that participants would see.

### 4.1.3 Materials

The materials for this experiment were modified variants of lexicalizations from Experiment 1. The intent behind each *imperative* item is that the first mentioned referent is giving an order to the second referent that they should look like they are doing something. With the *raising* items, the first referent is simply commenting on a situation they are observing. *Imperative* items contained one of the words *commanded, ordered,* or *implored* in the first sentence and the *raising* items used any of *spoke with, said to*, or *remarked to* as a way to signal that the *imperative* items and *raising* items had different intents behind them.

### 4.1.4 Procedure

Participants were invited into the lab and situated in a closed booth. Sentences were presented using Psychopy® version 2021.2.3 (Peirce et al., 2019). Data collection was done in accordance with COVID protocols which allowed participants to remove their masks during the data collection so that the audio would not be distorted in any way.

Because participants would see two meanings of the same word (i.e *appear*), this second study runs into a potential disambiguation problem that was not encountered previously in Experiment 1. In both the first experiment and Weir (2019), participants were asked to read the sentences aloud as they saw them and not to read them in their heads first. This was not a problem in the first experiment since the *imperative* verbs were clearly distinct from the *raising* verbs at first glance and it would not be possible to confuse the two SENTENCE TYPE conditions. By contrast, in Experiment 2, the *imperative* verbs and *raising* verbs were always *appear/appears*, so it could be ambiguous which clause type the verb belongs to until the end of the word (*imperative* verbs are always untensed and *raising* verbs are always present tense by nature). By asking participants to begin reading as soon as the sentences appear, a potential confound would be introduced where participants might produce an *imperative* verb the way that they would produce a *raising* verb or vice-versa. To address this, participants were asked to read the stimuli once in their head first before beginning to speak. The recording equipment used in this experiment was identical to Experiment 1.

### 4.1.5 Predictions

The predictions for this experiment are similar to Experiment 1. Again, *raising* verb sentences are not predicted to have any significant differences between *present* and *absent* subject sentences in terms of stress. The two potential outcomes for the *imperative* sentences are restated here:

1. Participants will not place additional stress on the verb of null subject imperatives resulting in no significant interaction between SENTENCE TYPE and SUBJECT PRESENCE. This suggests that the subject of the sentence was deleted, or was treated as phonetically null at a later stage in the derivation, after the phonology has already gone through the operation of assigning stress to the utterance.

2. Participants will place additional stress on the verb of null subject imperative sentences since the verb is interpreted at PF as utterance-initial compared to overt subject imperatives where the pronoun will be utterance-initial, resulting in a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE. This suggests that the subject was deleted or phonetically null prior to reaching the PF interface and was not assigned stress at any point.

Because the *imperative* and *raising* verbs are nearly identical, there are no potential confounds of surrounding phonetic environment that could impact the results. Although participants are only seeing each lexicalization once, the use of identical verb forms for both *imperative* and *raising*

stimuli ensures that each participant will have multiple productions of the same target word. Because of this, all variables were still considered within participant variables. In this second experiment, any interaction observed between the two SENTENCE TYPE conditions as a function of SUBJECT PRESENCE would most likely be due to the underlying syntactic structure of the sentence.

An added benefit of considering identical word forms across all conditions is that the length of the vowel can be compared between the two SENTENCE TYPE conditions. In the previous experiment, this was not possible because for two reasons. First, half of the *imperative* vowels were high front tense vowels ([i]) which matched the *raising* vowel, but the other half that were high front lax vowels ([ɪ]) would not have the same average lengths to begin with, making this an invalid comparison. Second, while the onset of the syllables was controlled to be as phonetically close as possible between the *imperative* verbs and *raising* verbs, the codas of the words were very different. This was done for practical reasons as it was only realistic to try to control either the onset or the coda of the *imperative* verbs in experiment one; trying to control both would have greatly restricted the number of verbs that could have been tested. However, having several different types of coda consonants would have impacted the duration of the vowel. For example, a vowel that appears before a voiceless coda consonant (e.g. heat - /hit/) will have a shorter duration than a vowel appearing before a voiced coda consonant (e.g. feed - /fid/). This process is known as pre-fortis clipping (Gimson, 1945; Keating, 1984) and is one of several possible factors that could have impacted vowel duration from Experiment 1. As a result of this, analysing the vowel duration in Experiment 1 would not have been informative. With the use of the same word form for both the *imperative* and *raising* conditions in Experiment 2, it is now possible to observe differences in vowel length because we are looking at identical phonetic environments.

In the *raising* condition, there should not be a significant difference in the length of the vowel as a result of the subject being *present* or *absent* in what participants are reading. This is because, like F0 and intensity, vowel length is used as a measure that determines whether a syllable is stressed or not, with longer vowel length being associated with stressed syllables (Gordon and Roettger, 2017). If the expletive subject is deleted at some late stage in the derivation after stress has been assigned at PF in the raising condition, there should be no impact on the stress of the raising verb as a result. In the *imperative* condition, there are again two possible outcomes that could be observed which would align with previous predictions for both F0 and intensity. If participants increase the length of the vowel on the stressed second syllable of the word *appear* in the null subject imperative verbs, this will produce a significant interaction between the two SENTENCE TYPE conditions as a function of SUBJECT PRESENCE.

## 4.2 Results

Audio data was aligned to the phonetic level using the Montreal forced aligner (McAuliffe et al., 2017). Average F0 and intensity values over the duration of the vowel in the target verb were measured using Praat (Boersma, 2001). Vowel length was also extracted from the audio files. The vowel

length is only measured in 10 ms increments as a result of the forced alignment output. Each participant read a total of 8 *imperative* and 8 *raising* stimuli sets, giving a total of 256 recordings. A total of 2 data points were removed from analysis. One data point was discarded because the participant accidentally skipped the item without reading the sentences. The other discarded data point was a result of the participant mispronouncing the target word without correcting themselves. The final analysis consisted of 254 tokens (126 imperative and 128 raising), which were analysed using mixed-effects modelling. A total of 6 tokens needed to be manually aligned to a text grid due to false starts by participants in non target words, or premature audio cuts that resulted in errors with the aligner. All F0, intensity and vowel length values were z-score normalized within participants to mitigate any potential effects of participant variation. For this analysis, SENTENCE TYPE was sum coded, with the *imperative* level coded as 1 and the *raising* level coded as –1. SUBJECT PRESENCE was also sum coded, with the *absent* level coded as 1 and the *present* level coded as –1.

### 4.2.1 F0

Fundamental frequency values were z-score normalized within participant and analysed using a mixed-effects model in R (R Core Team, 2019). The lme4 package was used to fit the model (Bates et al., 2015) and the lmerTest package was used to obtain *p*-values (Kuznetsova et al., 2017). The data was fit to a mixed effects model with random intercepts for participants and items. The model is summarized in Table 4.1. No significant main effects or interactions were found in this data.

| | Estimate | Std. Error | df | t value | Pr(>\|t\|) |
|---|---|---|---|---|---|
| (Intercept) | 4.894e-04 | 6.274e-02 | 1.373e+01 | 0.008 | 0.994 |
| SentenceType1 | 4.369e-02 | 6.072e-02 | 2.334e+02 | 0.719 | 0.473 |
| Subject1 | -9.672e-02 | 6.072e-02 | 2.335e+02 | -1.593 | 0.113 |
| SentenceType1:Subject1 | 1.481e-02 | 6.072e-02 | 2.335e+02 | 0.244 | 0.808 |

Formula in R: lmer(F0.z $\sim$ SentenceType * Subject + (1|Participant) + (1|Item)

Significance levels: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .1$

Table 4.1: F0 stats, Experiment 2

The lack of any significant main effects here suggests that the difference observed in F0 based on sentence type in Experiment 1 may be a result of different phonetic forms of the verb rather than SENTENCE TYPE. These similarities in F0 values are visually apparent in Figure 4.1.

In Figure 4.1, it is obvious that the high variance in the data and the near identical trend in terms of SUBJECT PRESENCE is preventing any significant main effects or interactions from emerging. This lack of interaction between SUBJECT PRESENCE and SENTENCE TYPE provides no evidence to support the idea that a null, underlying pronoun is influencing the phonetic output of participants.

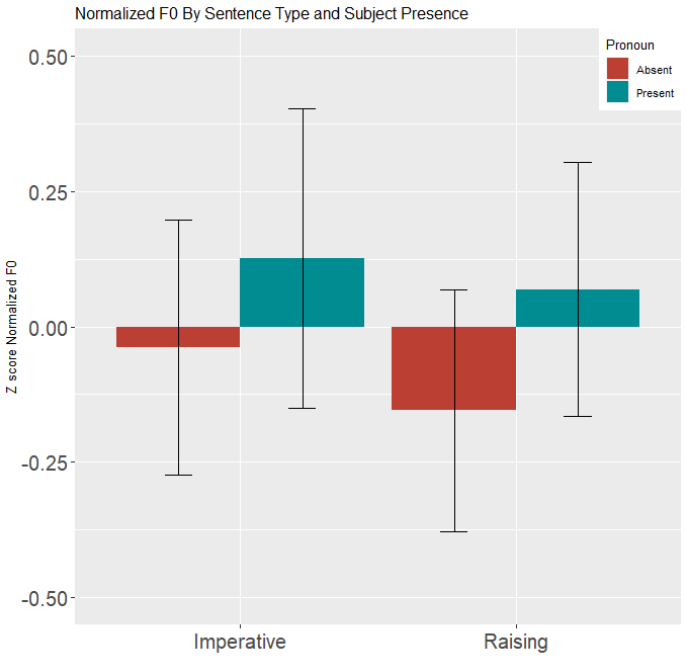



Figure 4.1: Bar graph comparing z-score normalized F0 of Imperative and Raising sentences as a function of Subject Presence in Experiment 2

### 4.2.2 Intensity

As with the F0 data, the intensity data was normalized and fit to a mixed effects model with random intercepts for participants and items (R Core Team, 2019; Kuznetsova et al., 2017; Bates et al., 2015). The model is summarized in Table 4.2. There was a main effect of SENTENCE TYPE as in Experiment 1, but there was still no interaction between SENTENCE TYPE and SUBJECT PRESENCE. The normalized intensity data are plotted in Figure 4.2.

| | Estimate | Std. Error | df | t value | Pr(>\|t\|0) | |
|---|---|---|---|---|---|---|
| (Intercept) | 0.001961 | 0.060955 | 13.271557 | 0.032 | 0.975 | |
| SentenceType1 | 0.240077 | 0.059121 | 232.661738 | 4.061 | 6.69e-05 | *** |
| Subject1 | 0.000239 | 0.059121 | 232.693645 | 0.004 | 0.997 | |
| SentenceType1:Subject1 | -0.047887 | 0.059121 | 232.693645 | -0.810 | 0.419 | |

Formula in R: lmer(Intensity.z ~ SentenceType * Subject + (1|Participant) + (1|Item)

Significance levels: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .1$

Table 4.2: Intensity stats, Experiment 2

Unlike in the data from Experiment 1, there was no main effect of SUBJECT PRESENCE. The replication of the main effect of SENTENCE TYPE found in Experiment 1 suggests that the clause

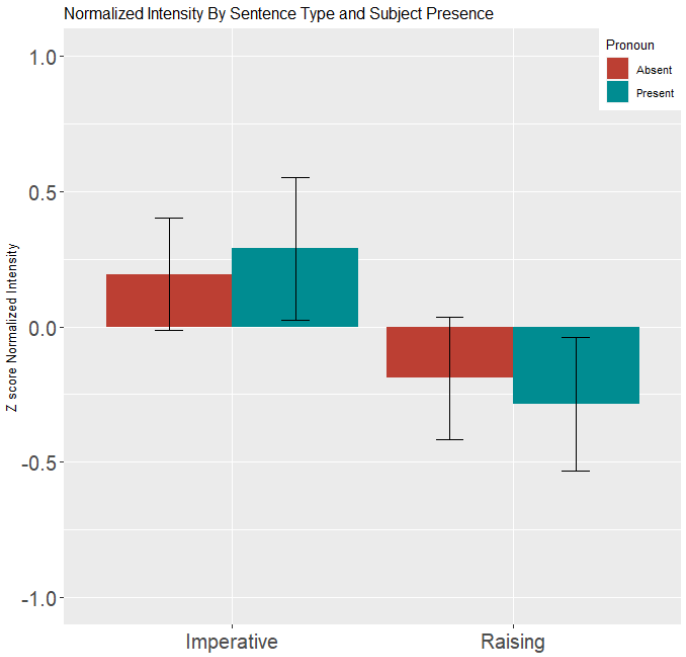



Figure 4.2: Bar graph comparing z-score normalized Intensity of Imperative and Raising sentences as a function of Subject Presence in Experiment 2

type of the sentences is affecting the stress of the utterance, even if it is not manifesting in both intensity and F0 measures. Like Experiment 1, the intensity measured at the vowel of the *imperative* verbs was significantly greater than the intensity of the *raising* verbs, despite the similarity of the words. This may suggest that the semantic content provided by an *imperative* verb is influencing the phonetic output that participants are producing, resulting in additional stress.

### 4.2.3 Vowel Length

Because Experiment 2 dealt with identical word forms and target vowels, it is now possible to look at the length of the vowel as a measure of stress as well. The prediction is that an increase in vowel length correlates to greater stress on that particular syllable. The normalized vowel length data was fitted the same way as the F0 and intensity data, and the model is summarized in Table 4.3. There was a significant effect of SENTENCE TYPE, showing that *imperative* verbs had significantly shorter vowels compared to *raising* verbs. The normalized vowel length data is plotted in Figure 4.3.

The significant effect found in the data here is unexpected as it was predicted in Section 4.1.5 that the imperative verbs would have longer vowel length as a result of increased stress being assigned to the verb. This finding seems to indicate the opposite conclusion where raising verbs have significantly longer vowels on average. However, it is not likely that this finding is an indicator of increased stress on raising verbs because it would be in direct conflict with the significant in-

| | Estimate | Std. Error | df | t value | Pr(>\|t\|) | |
|---|---|---|---|---|---|---|
| (Intercept) | -0.001557 | 0.072956 | 15.345705 | -0.021 | 0.98325 | |
| SentenceType1 | -0.212505 | 0.058691 | 234.711468 | -3.621 | 0.00036 | *** |
| Subject1 | 0.023715 | 0.058692 | 234.732135 | 0.404 | 0.68654 | |
| SentenceType1:Subject1 | 0.036988 | 0.058692 | 234.732135 | 0.630 | 0.52917 | |

Formula in R: lmer(VowelLength.z $\sim$ SentenceType * Subject + (1|Participant) + (1|Item)
Significance levels: *** $p < .001$, ** $p < .01$, * $p < .05$, $^{+}$ $p < .1$

Table 4.3: Vowel length stats, Experiment 2

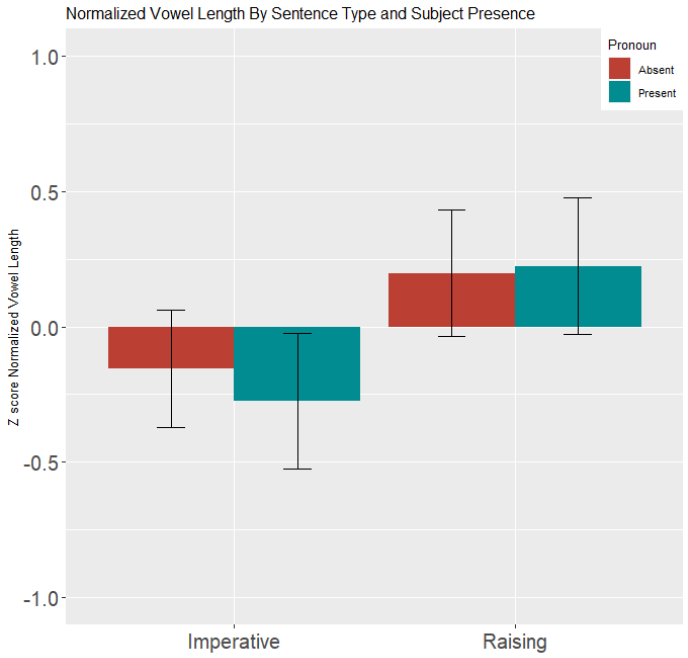



Figure 4.3: Bar graph comparing z-score normalized Vowel Length of Imperative and Raising sentences as a function of Subject Presence in Experiment 2

tensity findings in both Experiment 1 and this experiment. This significant effect warrants further investigation in future work, but like the F0 and intensity data, these results do not support the idea that a null, underlying pronoun is influencing the phonetic output of participants in null subject imperatives compared to sentences with an overt *you* pronoun.

## 4.3 Discussion

The second experiment, like the first, did not find an interaction between SENTENCE TYPE and SUBJECT PRESENCE for any of the measures of stress analysed. Attempting to resolve potential issues from Experiment 1 by using the same verb for both SENTENCE TYPE conditions and having participants completely read the sentences once before reading them aloud did not result in a significant

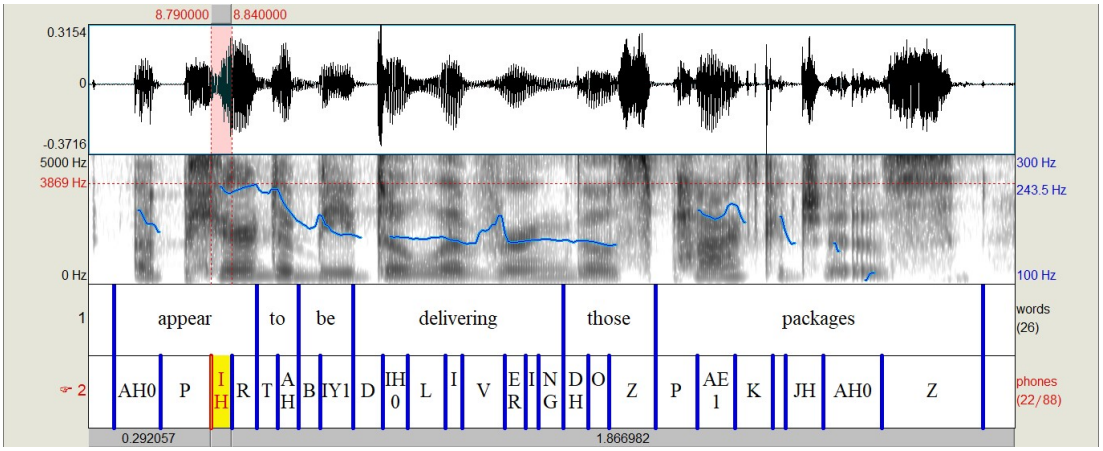
interaction. The encouraging finding from this data is that there was a significant main effect of SENTENCE TYPE in the intensity data, where *imperative* verbs were significantly more intense than *raising* verbs. This is a replicated finding from Experiment 1 and shows that, while the predicted interactions were not found, there is evidence to support some difference being observed using this novel methodology.

*Imperative* verbs appear to have some increased level of stress compared to *raising* verbs which is signalled by the significant main effect of SENTENCE TYPE in this study. This significant effect gives merit to the methodology used in these experiments and in Weir (2019). The lack of F0 and vowel length differences between *imperative* and *raising* sentences is not entirely surprising because the words that participants were reading were phonetically identical at the point being analysed. However, this does further highlight the significance of the intensity changes as a function of SENTENCE TYPE found in both experiments.

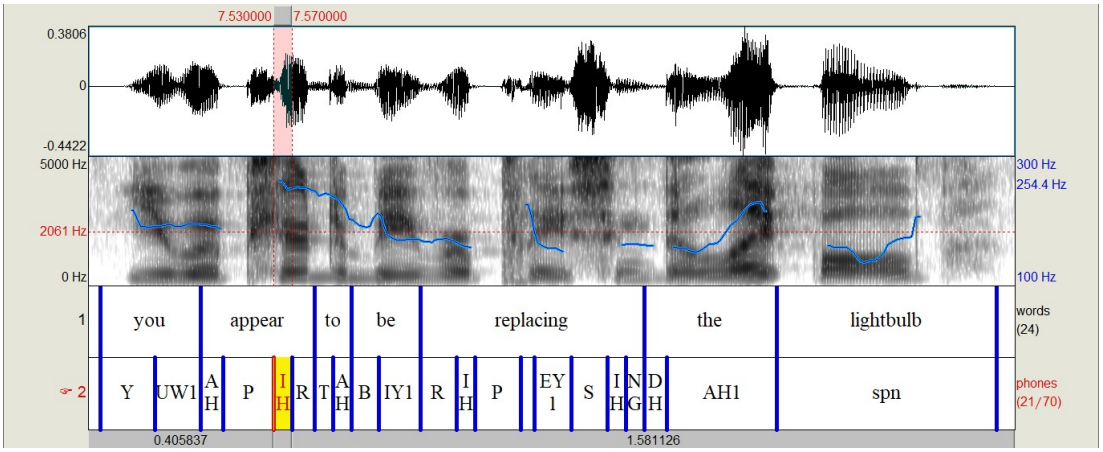
The intensity measurement in this experiment did not replicate the significant main effect of SUBJECT PRESENCE from Experiment 1. Looking at the normalized values in Figure 4.2 it is clear why this was not found in the data. In the *imperative* condition, the average intensity was lower when the subject was *absent* compared to when it was present. The exact opposite trend is observed in the *raising* sentences where the intensity is higher on average when the subject is *absent*. Neither of these individual trends by SENTENCE TYPE are significant due to the high amount of variance in each condition. The same observations can be made when looking at the SUBJECT PRESENCE data for both F0 and vowel length in this experiment. There were no main effects of SUBJECT PRESENCE observed in any of the measures of stress in this experiment. This suggests that even though participants may have had different phonetic outputs as a result of reading *imperative* and *raising* sentences, as signalled by the main effects of SENTENCE TYPE in the intensity and vowel length measures, this same change did not extend to the alternation of SUBJECT PRESENCE. It is possible that the change in PF input from sentences with *present* subject pronouns to those with *absent* subject pronouns is not enough to cause an observable difference in stress assignment when looking at F0, intensity and vowel length measurements. Some suggestions for further research that could look at this SUBJECT PRESENCE alternation in a different way are covered in the next chapter of this thesis.

Figure 4.4 contains sample recordings of one participant's production of two *imperative* sentences, one with a *present* subject and one with an *absent* subject. The findings in these intonation contours are similar to the contours shown in Experiment 1 (Figure 3.3).

Like Experiment 1, participants pronounced the *imperative* verb with primary sentence-level stress and secondary stress occurred on some other word later in the sentence, usually in a way that would signal emphasis or contrast. Unlike Experiment 1, the *present* subject in Figure 4.4b did not have rising intonation and was a uniform low boundary tone. This could be because of the [ə] sound at the beginning of the word *appear* being unstressed. Rather than having a rising intonation on the subject pronoun that falls for the unstressed [ə] before rising to the peak of the sentence, the participants instead produced the subject pronoun with a low boundary tone that matched the onset

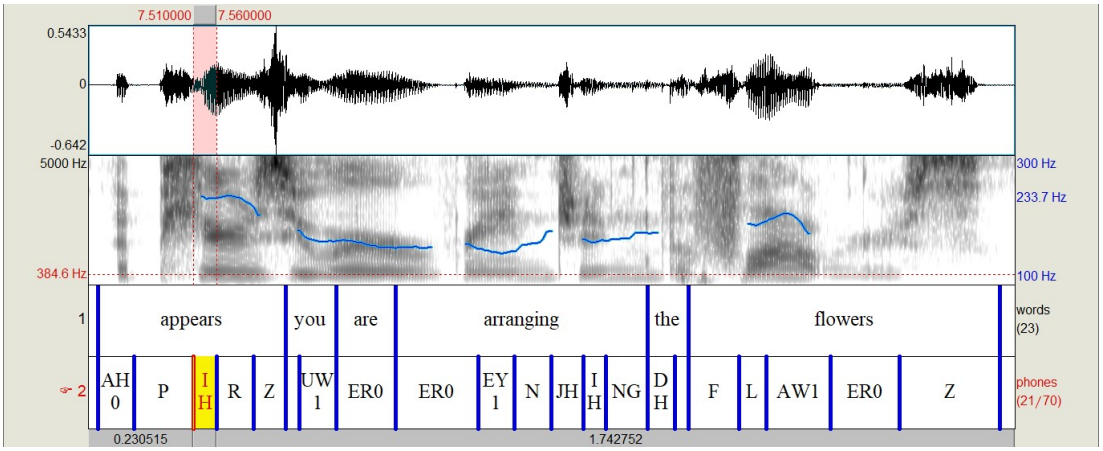



(a) Subject Absent Imperative - Appear to be delivering those packages

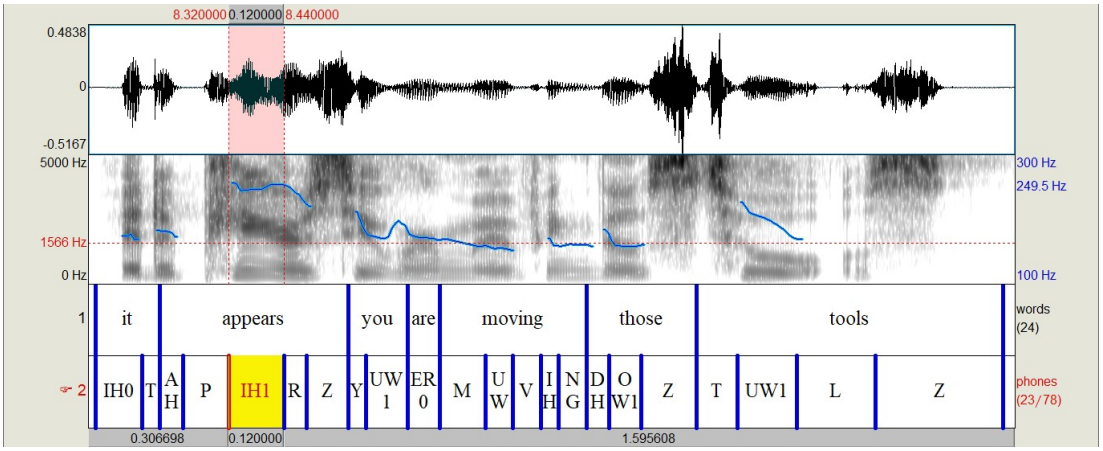



(b) Subject Present Imperative - You appear to be replacing the lightbulb

Figure 4.4: Imperative sentence intonation contours from a single participant in Experiment 2




(a) Subject Absent Raising - Appears you are arranging the flowers




(b) Subject Present Raising - It appears you are moving those tools

Figure 4.5: Raising sentence intonation contours from a single participant in Experiment 2

of the word *appear/appears*. This lack of rising intonation also ensured that the intonation peak always occurred at the stressed syllable of the imperative verb and not at the boundary of the subject and imperative verb as it was in Experiment 1.

The *raising* contour samples in Figure 4.5 show a nearly identical pattern to the contours in Figure 4.4, making it unsurprising that no significant effect would be found when comparing the F0 values based on SENTENCE TYPE.

In the *raising* sentences, participants pronounced primary stress on the *raising* verb of the sentence and secondary stress usually occurred at the direct object of the main verb (*flowers* and *tools* in Figure 4.5a and 4.5b, respectively). As in Experiment 1, the expletive subject pronoun *it* was unstressed and in Figure 4.5b, it is nearly identical in pitch to the unstressed [ə] at the beginning of *appears*.

The lack of a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE does not provide evidence to support the hypothesis that the underlying null pronoun in null subject imperatives is significantly impacting participants' phonetic output. This is not to say that the *absent*

*imperative* sentences are derived by some other method; rather, the current methodology has provided no phonetic evidence of its presence in terms of overall (vowel) F0, intensity and duration. There are a few possible reasons for this lack of interaction. Like with any experimental phonetic study, participants were placed in laboratory conditions and were not necessarily speaking naturally when reading the stimuli. This may have impacted the stress that they placed on particular words within a sentence, making it different from how they would speak these sentences conversationally. There is also the possibility that using the disyllabic words *appear/appears* may have prevented any effect of the subject pronoun "influencing" the stress of the imperative or raising verb because the [ə] may have acted as an unstressed barrier of sorts. This is seen in the lack of rising intonation on the subject pronoun *you* in the *present imperative* productions. If word choice was a factor, it likely only influenced the F0 results, since the intensity results were similar to those in Experiment 1.

The results of the two experiments taken together and future directions for this line of inquiry is discussed in Chapter 5.

# Chapter 5

# Discussion and Future Directions

The goal of this thesis was to investigate the phonetic differences between null-subject imperatives and imperatives with an overt second person subject. Based on the background literature in Chapter 2, the null and overt subject imperative sentences examined in both experiments only differed in the content of the DP at Spec IP. It was therefore hypothesized that the phonetic output may be significantly different as a result of the null and overt subject imperative sentences providing different PF interface input. One of the key assumptions behind this hypothesis is that the imperative sentences used in these experiments did not incorporate vocatives. The use of vocatives would have resulted in intonation breaks in the overt subject imperative sentences, and the fact that vocatives exist outside of the CP layer means that there would have been no syntactic difference between the overt and null subject imperatives. As such, their PF input would be the same and no difference could be reasonably predicted. It was decided to examine the stress on the adjacent word in these imperative clauses which, in the case of the stimuli used, was the imperative verb.

The hypothesized difference in the phonetic output was predicted to manifest as an interaction when comparing the imperative sentences to sentences with a raising verb and an expletive pronoun subject which underwent the same SUBJECT PRESENCE alternation. It was predicted that imperative sentences would show a significant difference in stress on the imperative verb as a result of the subject presence alternation, but no difference was predicted for the raising sentences, which would lead to a significant interaction between SENTENCE TYPE and SUBJECT PRESENCE. The comparison to raising verbs was based on a previous study which found no significant differences between null and overt subject raising sentences (Weir, 2019). The lack of difference in Weir (2019) was theorized to be due to a late PF deletion after stress had been assigned, meaning that the PF input was the same for both the null- and overt-subject raising sentences.

For the purposes of these experiments, stress was signaled by increased F0 and/or intensity on a word in line with previous phonetic research (Gordon and Roettger, 2017; Pierrehumbert and Hirschberg, 1990). In addition, for Experiment 2, vowel length was considered as a stress signal with longer vowels being associated with increased stress. This additional consideration was possible in Experiment 2 because the target imperative verb *appear* and the target raising verb *appears* were phonetically similar. Since the surrounding phonetic environment would not have impacted

the vowel length, meaning that any differences in length here would have likely been a result of changes in word stress.

The results of the two experiments did not show any interaction between the presence of a subject pronoun and clause type in terms of any of the measures of stress examined. The data did show that imperative verbs had a higher intensity on average, which manifested as a significant main effect of clause type in both experiments.

The F0 data in Experiment 1 suggested that there may have been some difference related to the clause type of the sentence, with imperative verbs having an increased F0 on average compared to raising verbs. The F0 data in Experiment 2, where the same word was used for both imperative and raising conditions, failed to replicate this marginally significant effect. This failure to replicate the F0 finding suggests that the difference in Experiment 1 manifested as a result of the various imperative verbs being compared to a single raising verb *seems* rather than being linked to the clause type of the sentence.

The vowel length data in Experiment 2 showed a significant effect where the imperative verbs contained a significantly shorter vowel than the raising verbs. This suggests that the raising verbs were more stressed compared to the imperative verbs, as longer vowel length is correlated with increased stress (Pierrehumbert and Hirschberg, 1990). This is in direct conflict with the intensity data from Experiment 1 and Experiment 2, which suggests that the imperative verbs are comparatively more stressed. This data may have been influenced by the aligner only rounding to 0.01 second intervals. In addition, the analysis by Gordon and Roettger (2017) showed that, while the majority of studies looking at duration as a stress marker focused solely on the vowel, many studies chose to look at the duration of the rhyme (the onset and the coda combined), the entire syllable of interest, or even the entire word. Taking one of these approaches may have revealed something different about the data in Experiment 2, although this would also not have been a reasonable way to analyze the data because of the difference in the stressed syllable coda of *appear* (/piɹ/) versus *appears* (/piɹz/). This difference in vowel length between clause types is certainly noteworthy, but it is not worth abandoning the intensity differences, which was replicated across both experiments.

The lack of interaction observed in any measure of stress in either experiment is not sufficient evidence against the idea that the subject of a null subject imperative is a null pronominal *pro*. It was shown in Chapter 2 that i) the subject position needs to be occupied by something that can bind a reflexive pronoun (as in (41)) and ii) that the null pronominal *pro* is the most likely candidate (see Section 2.3).

(41) Brace yourself for impact!

There are other explanations for the lack of interaction. One possible explanation for the lack of observable difference as a function of SUBJECT PRESENCE in imperatives is that maybe *pro*, while still being phonetically null, does receive stress at spellout in some way and, because it is phonetically null, the stress is disregarded in the output. This becomes difficult to test with other null elements in English such as the pronominal anaphor PRO because there is no possible minimal pair

for these types of subject or object control sentences that works in the same way as the minimally paired imperative sentences in this thesis. This can be shown by trying to create the pairing in (42), which results in one of the sentences being ungrammatical.

(42) a. He$_i$ wanted PRO$_i$ to leave.

b. * He$_i$ wanted him$_i$ to leave.

The sentence in (42b) would be grammatical if the third person pronoun *him* were referring to another referent rather than the subject of the main clause, but this is problematic because then the interpretations of the two sentences are very different. It could be that any differences in the PF output are linked to the differences in interpretation, despite the two sentence being syntactically very similar.

In addition to the examples in (42), returning to examples in (28) and (29) (repeated here as (43) and (44)), it is not possible to minimally pair these PRO examples like we can with null subject imperatives versus overt subject imperatives[1].

(43) a. It is impossible [$_{CP}$ **PRO** to win at roulette.]

b. * It is impossible [$_{CP}$ for **PRO** to win at roulette.]

c. It is impossible [$_{CP}$ for Bill to win at roulette.]

d. * It is impossible [$_{CP}$ Bill to win at roulette.]

(Adapted from (Hornstein 1999: 92)

(44) a. To lose is always disheartening.
[$_{CP}$ [$_{IP}$ **PRO**$_{arb}$ [$_{I'}$ to lose ] ] ] is always disheartening.
(c.f. (Potsdam, 1998: 123)

b. For one to lose is always disheartening.
[$_{CP}$ For [$_{IP}$ one [$_{I'}$ to lose ] ] ] is always disheartening.

It is only possible to alternate these null anaphors by also changing the wording of the sentence and including/excluding the overt complementizer *for*, unlike the imperative sentences studied in this thesis, which only differed in the subject DP content. If the example sentences (43a) and (43c) were studied using the same methodology as Experiments 1 and 2, it would be difficult to determine whether any significant differences that emerged were the result of the null anaphor alternation, or the inclusion/exclusion of the complementizer.

If it is possible for null subjects to interact with PF and receive stress that is ultimately ignored/disregarded, such a phenomenon would be very difficult to prove by focusing on English

[1]It may be possible to pair the sentence in (42a) with the sentence "*He wanted himself to leave.*", but this is not a perfect solution. I personally find the use of a reflexive in this construction to be only marginally grammatical and participants in a study might be tripped up by the awkwardness of the structure, causing them to produce strange phonetic patterns when reading it.

alone. It is widely known that English is not a pro-drop language, and although it is commonly accepted cross-linguistically that non-pro drop languages will accept null-subject imperatives, this is the only instance of *pro* occurring in English (Zanuttini, 2008; Zhang, 1990). Rather than pursuing an uncommon occurrence in English, it might be better to start by investigating a language like Spanish where pronoun dropping is much more common and occurs in other clause types. In Spanish, the rich morphological agreement system permits the dropping of pronoun subjects in declarative clauses, which is not possible in English. This is because the rich agreement present on the verb indicates whether the subject is a first, second, or third person subject. Examples of subject pronoun dropping in Spanish are shown in (45).

(45) a. ∅ Llegué a la casa.
∅ Arrive-1S.PAST to the home
'I arrived home.'

b. ∅ Llegaste a la casa.
∅ Arrive-2S.PAST to the home
'You arrived home'

∅ Llegó a la casa.
∅ Arrive-3S.PAST to the home
'He/She arrived home'

While there is a preference for subject dropping in Spanish, it is still possible to produce an utterance with an overt subject pronoun, but the meaning is slightly different. This difference is highlighted in (46).

(46) a. Juan le pegó a Pedro. (pro) Está enfadado.
'Juan$_i$ hit Pedro$_j$. He$_i$ is angry.'

b. Juan le pegó a Pedro. Él está enfadado.
'Juan$_i$ hit Pedro$_j$. He$_{i/j}$ is angry.'

In Spanish, the use of an overt pronoun is typically a marker of emphasis. An utterance without the third person pronoun (46a) has a preference for Juan as the subject, while using an overt pronoun means that either Juan or Pedro in (46b) is a likely co-referent for the pronoun (Alonso-Ovalle et al., 2002)[2].

Because subject dropping is more widespread in Spanish and occurs in multiple clause types, it may be interesting to look for phonetic evidence of the null pronominal subject in this language. In

[2]I consulted a colleague who is a native speaker of Spanish regarding this data. I was told that the presence of an overt pronoun in (46b) makes it slightly more likely that it is referring to *Pedro* rather than *Juan* because an overt subject pronoun typically signals a topic change, but that both are definitely still possible referents. This lines up with the claims by Alonso-Ovalle et al. (2002). Alonso-Ovalle et al. (2002) also claim that placing emphasis on the subject pronoun in (46b) makes it more likely that the pronoun corresponds to the non-subject referent, but my colleague did not agree with this assessment.

particular, because an overt pronoun can be associated with focus, the effects of an overt pronoun may be more prominent depending on the interpretation of the sentence. This would need to be a variable that is accounted for by asking participants to not simply read the material presented to them, but to aim for a specific interpretation of a context. A preliminary outline of this is presented in (47).

(47) a. Participants are presented with a null subject sentence. This null subject will be biased in interpretation to reference the subject of the previous sentence. Based on the data from this thesis, it is predicted that stress may be assigned and ignored so no phonetic effects on the surrounding words are anticipated.

b. Participants are presented with an overt subject sentence. This will be ambiguous and not biased toward assigning the reference to either the subject or the direct object of the previous sentence (Alonso-Ovalle et al., 2002). It is predicted that there will be variable levels of stress on the pronoun and the surrounding words depending on how the participant is interpreting the sentence. According to the data in Alonso-Ovalle et al. (2002), the subject interpretation would place less stress on the pronoun compared to the direct object interpretation.

Investigating another language would provide evidence of the phonetic properties of *pro* in languages where it is more common and comparison to the English results found in this thesis may provide more insight into null pronominals cross-linguistically.

Before furthering the research on imperatives in English, it may be interesting to look at phonetic effects of other empty categories, such as traces instantiated as a result of subject-auxiliary inversion. Subject auxiliary movement involves the movement of the auxiliary verb to C, crossing over the subject in Spec IP and leaving a trace at the head of IP. The pair of sentences in (48) demonstrates this process.

(48) a. You will think highly of Carmen.

b. Will you *t* think highly of Carmen?

Because this trace of movement in (48b) is classified as an empty category just like *pro*, a similar investigation into the phonetic effects of this movement trace could be conducted. Looking at the stress on the word *think* in both sentences may reveal some phonetic effects of the trace element on the adjacent main verb in (48b). This investigation would have the advantage of all lexical units being the same between the two sentences that are being compared, as opposed to the imperatives investigated in this thesis, which had two sentences with different lexical inputs. Subject auxiliary inversion occurs within the syntactic derivation according to the current minimalist theory, which means that there would again be two different PF interface inputs to examine.

Finding a significant difference in terms of stress on the main verb *think* in (48a) and (48b) using the methodology used in this thesis would go a long way toward not only proving the effectiveness of the methodology, but also showing that the phonological output is sensitive to null elements

like movement traces. The pairing in (48) does run into the issue of dealing with different clause types, which did produce a significant main effect in this thesis when comparing imperative and raising sentences. However, even a stress difference between clause types would be an interesting and useful finding for developing this methodology further. Since this methodology is novel and relatively untested, applying it to obvious sentence alternations like those in (48) and observing a significant effect would indicate that there is some value in pursuing it further. An inability to observe significant differences here may indicate that the methodology needs to be further examined and refined.

In conclusion, the experiments in this thesis did not provide any evidence of the null pronominal subject impacting the phonetic output when participants read English null subject imperative sentences compared to imperative sentences with an overt *you* subject. The significant effect of increased intensity in imperative sentences compared to raising sentences, which was found in both experiments, is promising for this methodology, as it indicates that syntactic differences (e.g. clause type) can be captured by examining phonetic stress markers. Further investigation into other empty categories, such as traces instantiated in subject-auxiliary inversion, should be pursued to refine this methodology further. In addition, investigating other languages with more robust pro-drop in multiple clause types may also show significant results that are not present in English imperatives.

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# Appendix A

# Stimuli - Experiment 1

**Imperative Stimuli**

1. Jackson commanded Sophia,
   "You fill this pitcher up for me!"
   Sophia took the pitcher and filled it with water.

2. Liam directed Olivia,
   "You sit on the bench and wait!"
   Olivia nodded and sat patiently.

3. Chloe called on Oliver,
   "You fix the bathroom light!"
   Oliver grabbed his tools and began to fix it.

4. Abigail warned Jacob,
   "You sip that hot chocolate slowly!"
   Jacob listened so he would not burn his tongue.

5. Emma ordered Noah,
   "You heat up some leftovers!"
   Noah put the leftovers in the microwave.

6. Charlotte instructed Lucas,
   "You sear those steaks on the barbecue!"
   Lucas made sure that the outside was cooked.

7. Benjamin told Mia,
   "You feed the dogs on time tonight!"
   Mia promised that she would remember.

8. Ethan implored Zoe,
   "You seize those criminals!"
   Zoe ran, and tackled the criminals.

**Raising Stimuli**

1. Leo remarked to Nora's son,
   "It seems she is treating you well."
   The child smiled and showed off their ice cream.

2. Hannah commented on Logan's health,
   "It seems he has an awful cold."
   Logan had a stuffy nose and puffy eyes.

3. William discussed Avery's mood,
   "It seems she is happy today."
   Avery was smiling and she had a skip in her step.

4. Emily alluded to Aiden's investments,
   "It seems he is having success."
   Aiden had made some profitable decisions.

5. Thomas disclosed Alice's dilemma,
   "It seems she doesn't like her job."
   Alice had been thinking about a career change.

6. Madison complained about Owen's contribution,
   "It seems he isn't helping much."
   Owen had done very little for his part of the project.

7. Nathan spoke of Lisa's desire,
   "It seems she wants to play outside."
   Lisa wanted to enjoy the beautiful weather.

8. Victoria recounted Levi's decision,
   "It seems he is selling his car."
   Levi preferred to take transit and needed the cash.

# Appendix B

# Stimuli - Experiment 2

1. (a) Jackson ordered Sophia,
"Appear to be cleaning the house."
They both knew that she had no interest in actually cleaning.

   (b) Jackson ordered Sophia,
"You appear to be cleaning the house."
They both knew that she had no interest in actually cleaning.

   (c) Jackson said to Sophia,
"Appears you are cleaning the house."
Sophia had been working hard all day.

   (d) Jackson said to Sophia,
"It appears you are cleaning the house."
Sophia had been working hard all day.

2. (a) Liam directed Olivia,
"Appear to be signing the documents."
It was important to Liam to at least look like they were interested.

   (b) Liam directed Olivia,
"You appear to be signing the documents."
It was important to Liam to at least look like they were interested.

   (c) Liam remarked to Olivia,
"Appears you are signing the documents."
Liam was happy that Olivia agreed to the terms.

   (d) Liam remarked to Olivia,
"It appears you are signing the documents."
Liam was happy that Olivia agreed to the terms.

3. (a) Chloe instructed Oliver,
"Appear to be moving those tools."
Oliver was loafing about with no intention of working.

   (b) Chloe instructed Oliver,
"You appear to be moving those tools."
Oliver was loafing about with no intention of working.

(c) Chloe spoke with Oliver,
"Appears you are moving those tools."
Oliver had finally gotten around to doing his chores.

(d) Chloe spoke with Oliver,
"It appears you are moving those tools."
Oliver had finally gotten around to doing his chores.

4. (a) Abigail implored Jacob,
"Appear to be arranging the flowers."
Abigail knew that Jacob was not good at floral arranging.

(b) Abigail implored Jacob,
"You appear to be arranging the flowers."
Abigail knew that Jacob was not good at floral arranging.

(c) Abigail said to Jacob,
"Appears you are arranging the flowers."
Jacob was pleased with how it looked so far.

(d) Abigail said to Jacob,
"It appears you are arranging the flowers."
Jacob was pleased with how it looked so far.

5. (a) Emma commanded Noah,
"Appear to be replacing the lightbulb."
They both wanted to look like they were working hard.

(b) Emma commanded Noah,
"You appear to be replacing the lightbulb."
They both wanted to look like they were working hard.

(c) Emma remarked to Noah,
"Appears you are replacing the lightbulb."
Noah was tired of working in a dim room.

(d) Emma remarked to Noah,
"It appears you are replacing the lightbulb."
Noah was tired of working in a dim room.

6. (a) Charlotte asked Lucas,
"Appear to be solving the puzzle."
Charlotte wanted Lucas to feel like he was contributing.

(b) Charlotte asked Lucas,
"You appear to be solving the puzzle."
Charlotte wanted Lucas to feel like he was contributing.

(c) Charlotte spoke with Lucas,
"Appears you are solving the puzzle."
Lucas was proud of himself for figuring it out.

(d) Charlotte spoke with Lucas,
"It appears you are solving the puzzle."
Lucas was proud of himself for figuring it out.

7. (a) Benjamin suggested to Mia,
"Appear to be planning the wedding."
Benjamin sensed that Mia had no interest in actually helping.

   (b) Benjamin suggested to Mia,
"You appear to be planning the wedding."
Benjamin sensed that Mia had no interest in actually helping.

   (c) Benjamin said to Mia,
"Appears you are planning the wedding."
Mia was excited to be married this summer.

   (d) Benjamin said to Mia,
"It appears you are planning the wedding."
Mia was excited to be married this summer.

8. (a) Ethan ordered Zoey,
"Appear to be learning the material."
Ethan was having a hard time getting through to her.

   (b) Ethan ordered Zoey,
"You appear to be learning the material."
Ethan was having a hard time getting through to her.

   (c) Ethan remarked to Zoey,
"Appears you are learning the material."
Zoey was finally starting to understand this tricky concept.

   (d) Ethan remarked to Zoey,
"It appears you are learning the material."
Zoey was finally starting to understand this tricky concept.

9. (a) Leo ordered Norah,
"Appear to be building a tower."
Leo only expected a bare minimum of effort.

   (b) Leo ordered Norah,
"You appear to be building a tower."
Leo only expected a bare minimum of effort.

   (c) Leo spoke with Norah,
"Appears you are building a tower."
Norah was stacking the boxes as high as she could.

   (d) Leo spoke with Norah,
"It appears you are building a tower."
Norah was stacking the boxes as high as she could.

10. (a) Hannah directed Logan,
"Appear to be delivering those packages."
Hannah did not want to see Logan get fired for not working.

   (b) Hannah directed Logan,
"You appear to be delivering those packages."
Hannah did not want to see Logan get fired for not working.

(c) Hannah said to Logan,
"Appears you are delivering those packages."
Logan had found spare time to deal with the backlog.

(d) Hannah said to Logan,
"It appears you are delivering those packages."
Logan had found spare time to deal with the backlog.

11. (a) William instructed Avery,
"Appear to be leading the discussion."
William hoped that Avery would figure it out eventually.

(b) William instructed Avery,
"You appear to be leading the discussion."
William hoped that Avery would figure it out eventually.

(c) William remarked to Avery,
"Appears you are leading the discussion."
Avery was confidently teaching the students.

(d) William remarked to Avery,
"It appears you are leading the discussion."
Avery was confidently teaching the students.

12. (a) Emily implored Aiden,
"Appear to be sleeping on the job."
They were excited to pull this prank on their boss.

(b) Emily implored Aiden,
"You appear to be sleeping on the job."
They were excited to pull this prank on their boss."

(c) Emily spoke with Aiden,
"Appears you are sleeping on the job."
Aiden was embarrassed that he was caught.

(d) Emily spoke with Aiden,
"It appears you are sleeping on the job."
Aiden was embarrassed that he was caught.

13. (a) Thomas commanded Alice,
"Appear to be watching the news."
Thomas was worried they would be caught watching cartoons.

(b) Thomas commanded Alice,
"You appear to be watching the news."
Thomas was worried they would be caught watching cartoons.

(c) Thomas said to Alice,
"Appears you are watching the news."
Alice wanted to stay informed about the upcoming election.

(d) Thomas said to Alice,
"It appears you are watching the news."
Alice wanted to stay informed about the upcoming election.

14. (a) Madison asked Owen,
"Appear to be pointing to the answer."
Madison knew the teacher would give him credit for trying.

(b) Madison asked Owen,
"You appear to be pointing to the answer."
Madison knew the teacher would give him credit for trying.

(c) Madison remarked to Owen,
"Appears you are pointing to the answer."
Owen was confident that he was correct.

(d) Madison remarked to Owen,
"It appears you are pointing to the answer."
Owen was confident that he was correct.

15. (a) Nathan suggested to Lisa,
"Appear to be finishing the dishes."
Nathan knew their mom would be mad if she caught them not working.

(b) Nathan suggested to Lisa,
"You appear to be finishing the dishes."
Nathan knew their mom would be mad if she caught them not working.

(c) Nathan spoke with Lisa,
"Appears you are finishing the dishes."
Lisa hoped they could afford a dishwasher soon.

(d) Nathan spoke with Lisa,
"It appears you are finishing the dishes."
Lisa hoped they could afford a dishwasher soon.

16. (a) Lucy commanded Adam,
"Appear to be eating the cake."
Lucy did not want Adam to act rude to the host.

(b) Lucy commanded Adam,
"You appear to be eating the cake."
Lucy did not want Adam to act rude to the host.

(c) Lucy said to Adam,
"Appears you are eating the cake."
Adam explained that today was his cheat day.

(d) Lucy said to Adam,
"It appears you are eating the cake."
Adam explained that today was his cheat day.