Detecting Contiguity-Prominence[*]

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Richards (2010, 2016) proposes an account of why languages can differ in the types of overt movement they exhibit:

(1) a. **Who** did Minswu see? [*English*]

b. Minswu-nun **nwukwu**-lul po-ass-ni? [*Korean*]
Minswu-TOP who-ACC see-PAST-Q

c. Jean **voit** souvent Marie. [*French*]
John sees often Mary

d. John often **sees** Mary. [*English*]

Languages may vary, for example, in whether they have overt wh-movement, as in (1a-b), and in whether they have overt movement of the verb to some higher functional head, as in (1c-d). Minimalist approaches to syntax have mechanisms to enforce overt or covert movement (strong and weak features, and their theoretical descendants), and we have discovered a great deal over the years about the nature of these kinds of movement. But the differences in (1) are generally described as parameters; a language must be specified for which kinds of overt movements it has, and these specifications are not typically taken to interact with any other properties of the languages. We know, in other words, that wh-movement (for example) may be overt or covert in a given language, but we do not know why.

It could be, of course, that 'why' is the wrong question. This is the bet that standard Minimalist approaches are making; the fact that English has a strong wh-feature on C is a fact

[*] Acknowledgements to be added.

that the learner must learn, not connected to any other facts about English. Here I will explore the consequences of a different bet.

In Contiguity Theory, overt movement is driven by principles governing the relation between syntax and phonology. There are, for example, universal conditions on the prosody of wh-questions, and these conditions are met in different ways in different languages because of phonological differences between the languages in question (for instance, differences in how prosody is organized). On this account, there may be no purely syntactic parameters, or at least no parameters governing the distribution of overt and covert movement.

In Richards (2016) I posited a binary parameter distinguishing languages by what I called the position of *prosodic activity*. The idea was that languages would realize important prosodic phenomena (boundary tones, lengthening, and so forth) at one or the other edge of phonological phrases. Material which is on the prosodically active side of a phonological phrase was said to be *Contiguity-prominent*, and overt movement operations were driven by a need to achieve Contiguity-prominence. I tried to show in Richards (2016) that the distribution of overt movement could be linked to claims in the existing literature about the prosodic systems of various languages, understood as reflecting the setting of the prosodic activity parameter.

The discussion of prosodic activity in Richards (2016) had several drawbacks, however. One involved Richards' discussion of Irish, which crucially relied on Irish realizing prosodic prominence on the Left edge of prosodic phrases. But Irish is one of a number of languages that have been argued to in fact have prosodic phenomena associated with both edges of phonological phrases (see also de Lacy (2003) on Maori, Selkirk (2011) on Xitsonga, Yasin (2012) on Jordanian Arabic, and Elfner (2012) on Connemara Irish). The status of such languages in Contiguity Theory was left unclear in Richards (2016).

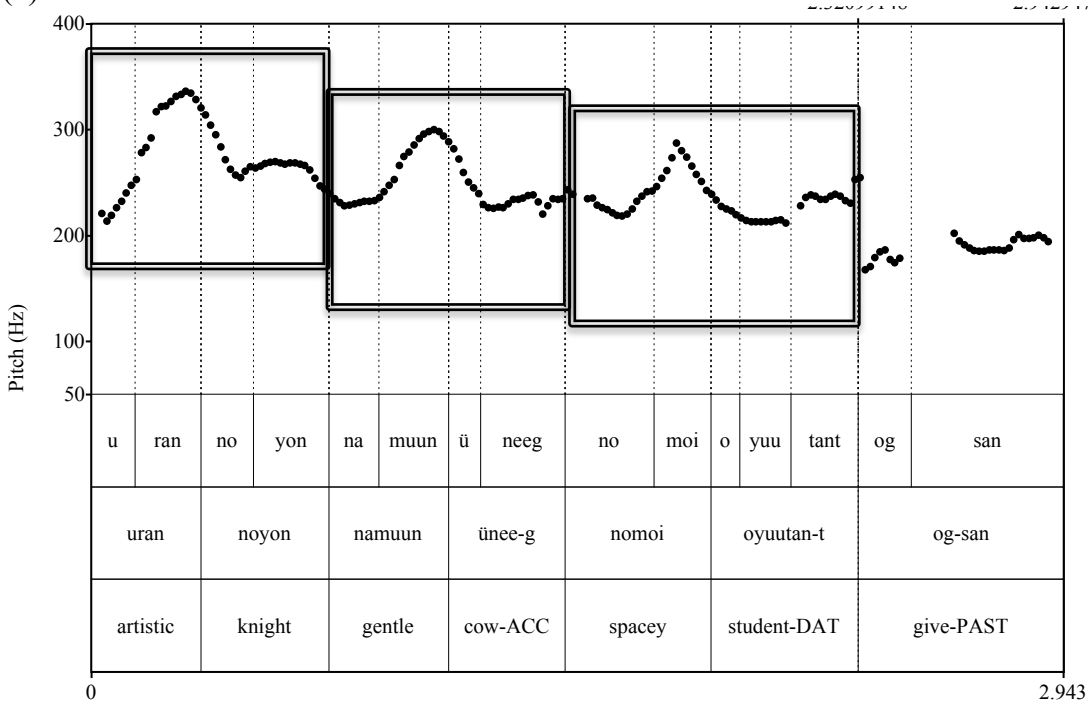
Another problem was that the tests for prosodic activity differed from language to language; one language might realize prosodic activity via a boundary tone, for example, while another might realize it via lengthening. Of course, this could simply be accurate; it could be that there is no single marker of prosodic activity.

In this paper I will try to show that there are in fact two tests for prosodic activity that can be reliably applied in different languages. Having done this, I will show how the results of the tests interact with the basic conditions of Contiguity Theory to yield desirable results.

1. One test for prosodic activity: the Pitch experiment

The first test for the position of prosodic activity has to do with downstep. In order to discuss this test, it will be useful to start by considering a distinction that is typically made in the literature on downstep. Consider the Mongolian pitch track in (2): (Urandari Byambadalai, p.c.):

(2)



'The artistic knight gave a gentle cow to the spacey student'

This sentence contains three DPs, the pitch tracks for which are in boxes. The first thing to note about the pitch track is that every word (with the possible exception of the verb) features a low-high sequence on its last two syllables; in other words, each word has its own pitch peak. There are two kinds of relations between these pitch peaks that are worth considering.

The first has to do with the relation between the pitch peaks in the boxed DPs. If we consider, for example, the highest pitch peak in each box, we can see that they are decreasing in height as the sentence goes along. This is the phenomenon sometimes called *declination* (Poser 1984 and much subsequent work); there is a general tendency for pitch to decline in the course of the sentence, and this tendency may well be universal.

Next, we can pay attention to the two pitch peaks in each box. Here we can see that the first pitch peak (the peak on the adjective) is much higher than the second pitch peak (on the following noun). This is the relation I will refer to as *downstep*. We can see that downstep leads to a more dramatic decline in pitch than declination; although declination guarantees that an adjective will have a lower pitch peak than the adjective in a preceding DP, the noun between those two adjectives is lower than either. As we will see, although declination is a candidate for a universal property of human speech, downstep is not.

For this test, we will be considering the relationship of relative pitch between an adjective and a noun within an NP. The experiment involves asking speakers to utter 10 sentences like the following, with branching, indefinite subjects and objects:

(3) In this novel, a **foolish student** awakens an **evil demon** while camping in the woods.

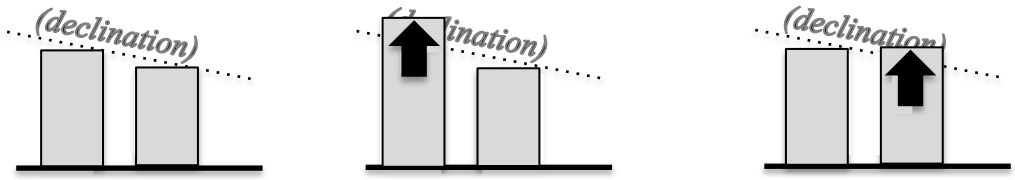
The sentences were all like (3) in being constructed so that the NPs of interest would be neither initial nor final in the clause, to avoid possible prosodic effects of being at the clause edge. Speakers were allowed to familiarize themselves with the sentences before reading them, and

were encouraged to read them in an ordinary conversational style, imagining a context in which a fellow native speaker of their language had just begun a conversation with them. They were also told to feel free to repeat sentences if they felt they had not read them naturally, or if they made speech errors. They were recorded in a quiet room, using a Blue Yeti USB microphone.

In this test, we are attempting to discover the placement of prosodic prominence within the phonological phrase corresponding to the NP. The idea is that Richards' (2016) 'prosodic activity' corresponds to the relevant notion of prosodic prominence. Furthermore, I will follow Richards (2016) in hoping that a given language reliably realizes prosodic prominence on the same side of every phonological phrase; that is, the hope is that once the setting of the prosodic activity parameter has been determined for the phonological phrase corresponding to NP, this will be the setting for phonological phrases in the language more generally. Future research could teach us that this hope is misguided, of course, but it seems like a good simplifying assumption to make, unless we are forced to give it up.

What we will discover is that every language exhibits a boost of relative pitch, either for the word on the left or for the word on the right side of the NP. *Prosodic activity* will be the name for the location of this pitch boost. In interpreting the data, it will be useful to bear in mind the distinction introduced at the beginning of this section between declination and downstep. Because of declination, we expect the first pitch peak in an NP to be higher than the second. Languages with a pitch boost on the left will then exaggerate this general tendency; the first pitch peak will be *much* higher than the second. Languages with a pitch boost on the right will tend to eliminate or even somewhat reverse the general trend induced by declination; the two pitch peaks will be more or less equal in height.

(4) a. (expected) b. (Left-active) c. (Right-active)



In other words, languages may have prosodic activity on the left or on the right, but because of declination, the phonetic consequences of this parameter will look less symmetrical than that description might lead us to expect.

Speakers of eleven languages participated in the experiment:

(5)

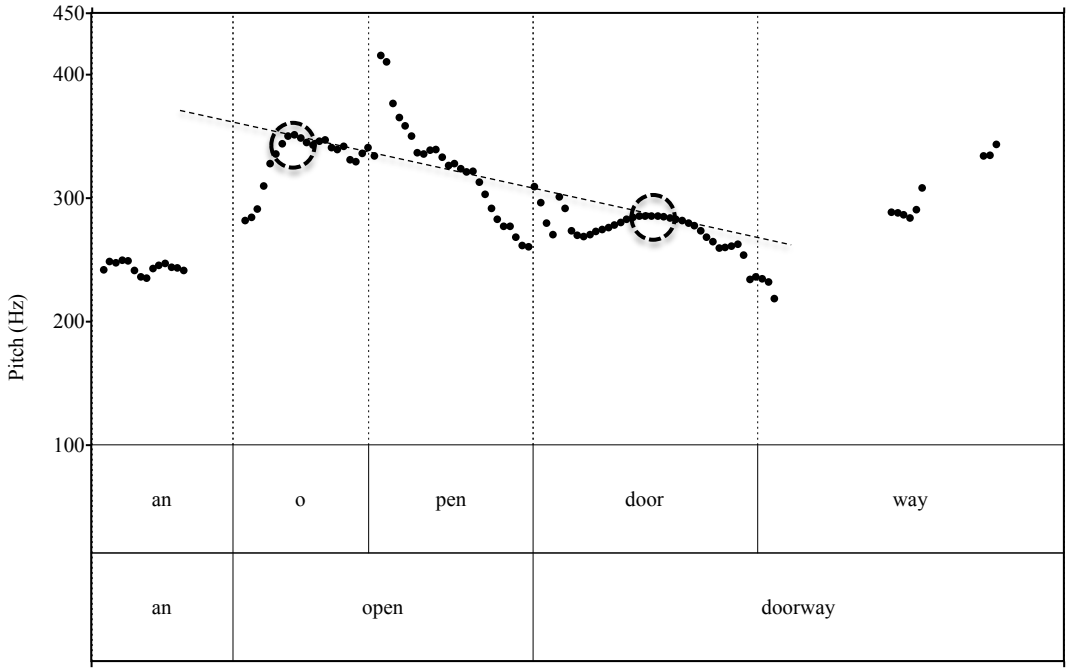
Basque	4 speakers (1 female, 3 male)
Brazilian Portuguese	6 speakers (3 female, 3 male)
Bulgarian	7 speakers (6 female, 1 male)
English	5 speakers (3 female, 2 male)
French	8 speakers (5 female, 3 male)
Icelandic	3 speakers (1 female, 2 male)
Italian	3 speakers (all male)
Korean	2 speakers (both female)
Norwegian	3 speakers (1 female, 2 male)
Russian	3 speakers (1 female, 2 male)
Zulu	2 speakers (both male)

These languages turn out to fall into two major groups.

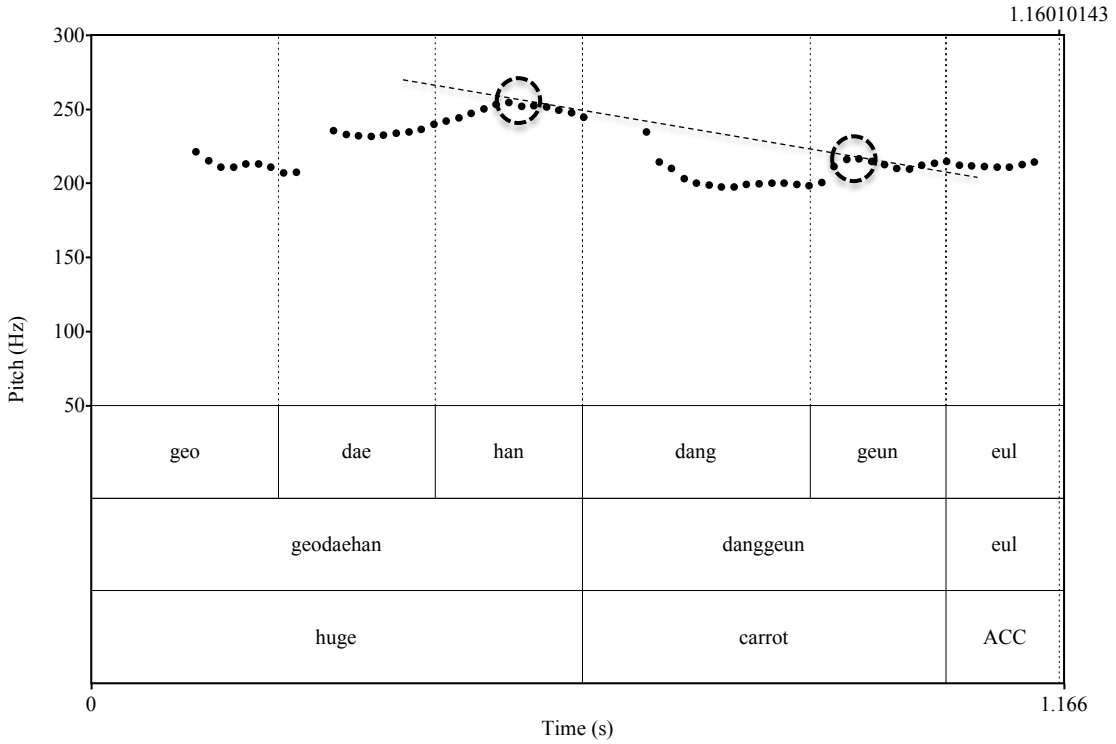
1.1 Left-active languages: English, Norwegian, Korean

In English, Norwegian, and Korean, the highest pitch in the first word in the branching noun phrase (the adjective, in these languages) is substantially higher than the highest pitch in the second word:

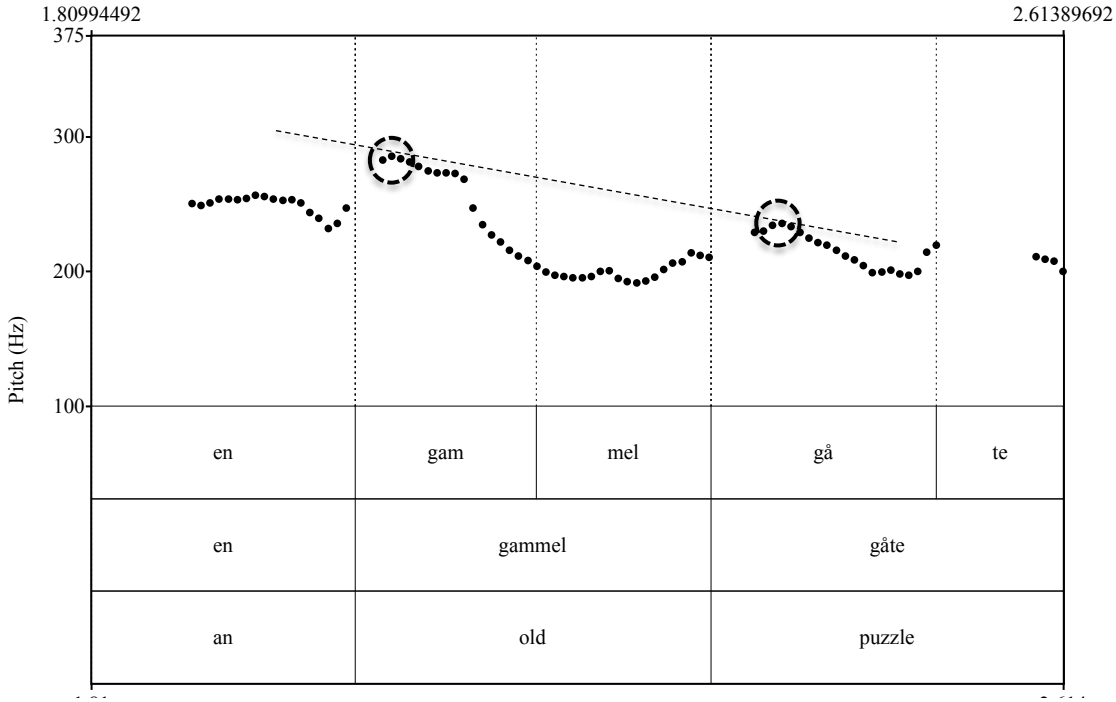
(6) (*English*)



(7) (*Korean*)

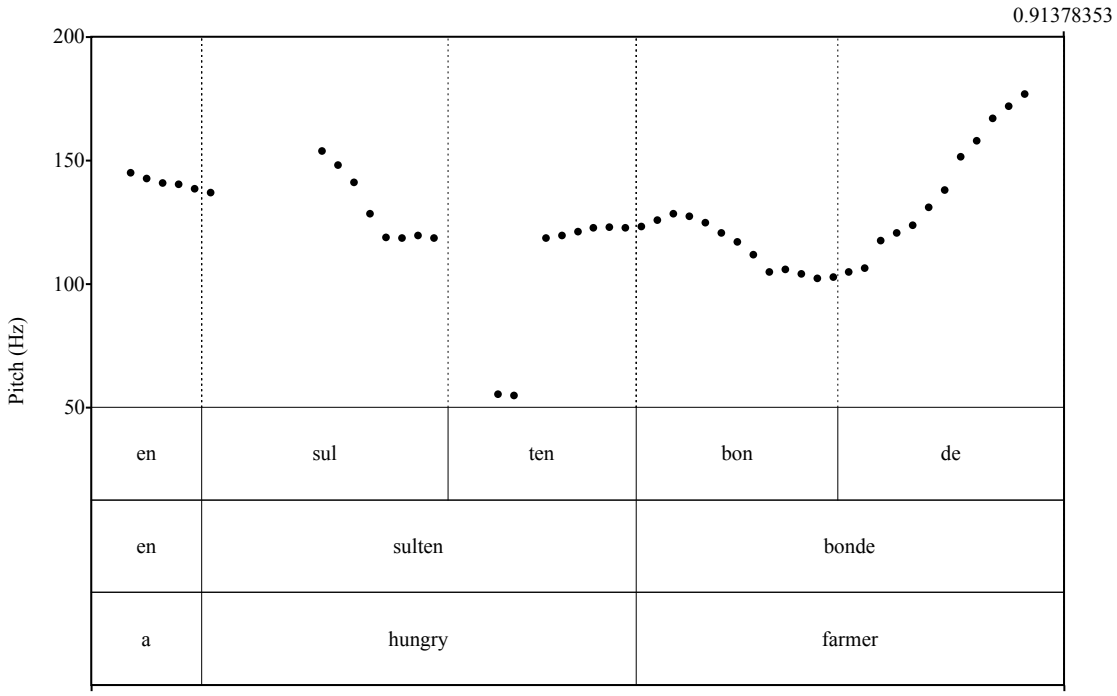


(8) (*Norwegian*)



The Norwegian results offer a complication not found in the other two languages. Slightly more than half of the Norwegian noun phrases in the sample (34/60) show pitch tracks like the one in (8), with pitch peaks on the (stressed) first syllables of the two words of the noun phrase. But a substantial minority (26/60) show a different pattern, adding a high pitch rise at the end of the noun phrase:

(9) (*Norwegian*)



Pitch tracks like (9) were not evenly distributed; one speaker (a man from Bogen) used them for 13 of the 20 noun phrases he recorded, while another (a man from Tromsø) used them for 8 of the 20 noun phrases, and the third (a woman from the Oslo area) used them for only 5 of the 20 noun phrases. For purposes of this study, I discarded data with the form in (9); we will only be studying pitch excursions having to do with stress, ignoring boundary tones as much as possible.

If we now find the ratio between the pitch peak (measured in Hertz) of the first word of the noun phrase and the pitch peak of the second, we get the average ratios in (10) for these three languages:

(10)

Korean	1.24
English	1.19
Norwegian	1.19

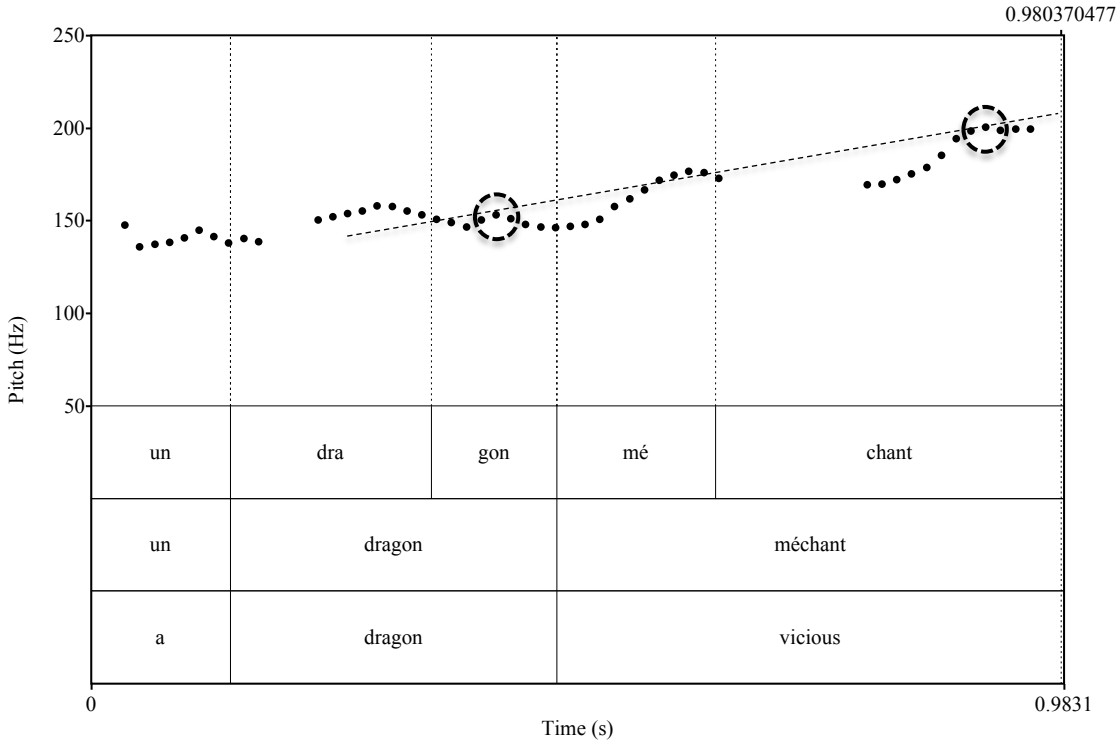
In these three languages, in other words, the first pitch peak of these noun phrases is substantially higher than the second.

1.2 Right-active languages:

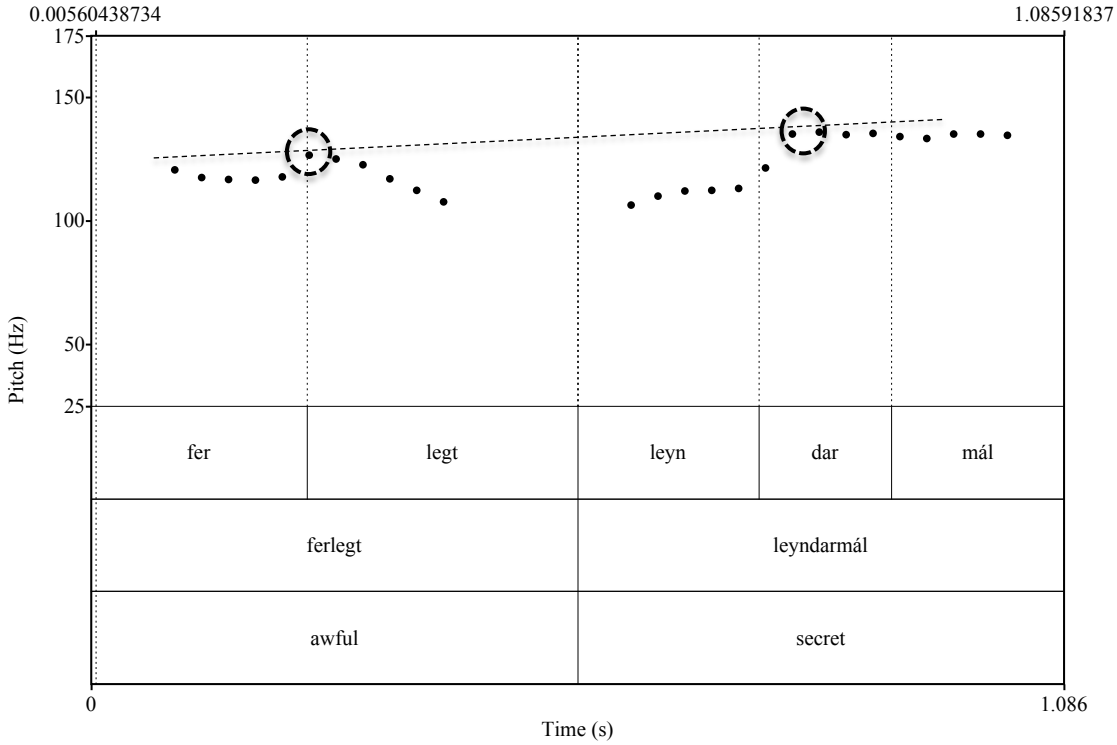
French, Portuguese, Italian, Icelandic, Bulgarian, Russian, Basque, Zulu

In the remaining eight languages, we see a different pattern. Here the second peak is typically as high as the first, or even higher:

(11) (*French*)



(12) (*Icelandic*)



Considering, again, the ratio between the height of the first word and the height of the second, we arrive at these average ratios:

(13)

Zulu	1.07
Basque	1.06
Italian	1.06
Bulgarian	1.04
Icelandic	1.03
Portuguese	1
French	0.95
Russian	0.87

1.3 Comparing Left-active and Right-active languages

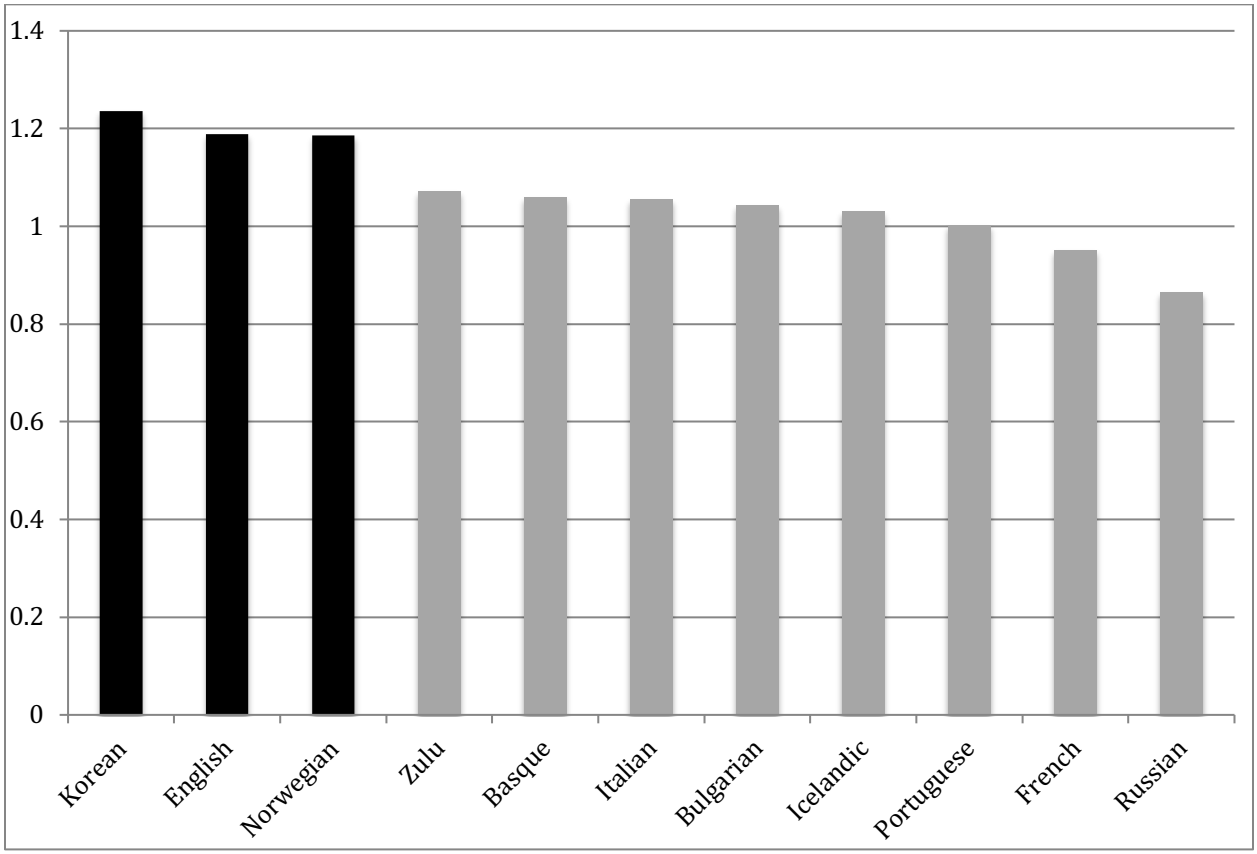
The pitch ratios for the Left-active and Right-active languages are shown together in (14):

(14)

Korean	1.24
English	1.19
Norwegian	1.19
Zulu	1.07
Basque	1.06
Italian	1.06
Bulgarian	1.04
Icelandic	1.03
Portuguese	1
French	0.95
Russian	0.87

In (15), we see the same data as a bar graph:

(15)



The graphs in (14-15) are meant to convince us that the languages under discussion can be profitably split into two groups; there are the three languages on the left-hand side of (15), with pitch ratios around 1.2, and then there are all the other languages, with pitch ratios around 1 or below.

I used a mixed-effects model (R Core Team 2017)[1] to confirm that the difference between Left-active languages and Right-active languages is statistically significant, using the model in (16):

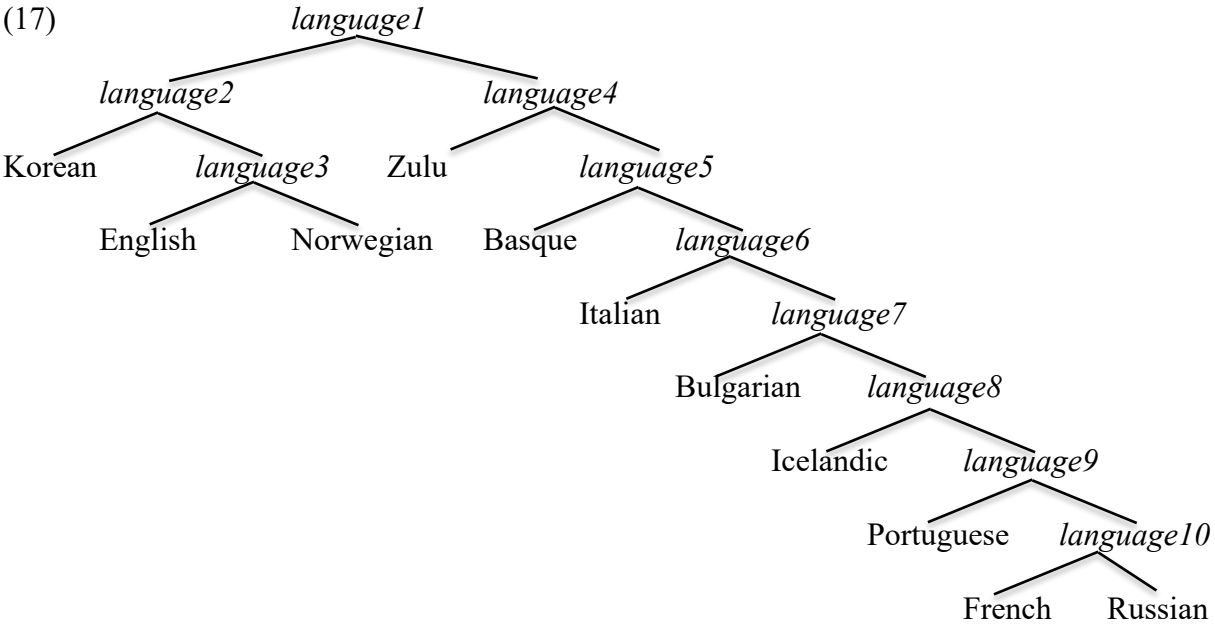
(16) ratio ~ position * language + (1 + position | speaker)

Here the fixed effects are *position*, which checks for differences between subjects and objects, and *language*, which I will discuss further shortly. I also used random slopes for position and speaker.

I used a user-defined coding for *language*, to effectively tell R that the languages are in two groups, and to ask both whether the difference between the groups was statistically significant, and whether there were statistically significant differences among the members of the two groups. In effect, I was asking R to check for statistically significant differences between pairs of sisters in the tree in (17):

[1] Many thanks to Adam Albright for all his patient help with R.

(17)



The node in (17) which is of special interest is *language1*; this is the node dividing the languages into Left-active and Right-active groups. Having checked that division for statistical significance, we are also asking, for example, via *language4*, whether Zulu is significantly different from the other Right-active languages. The languages are ordered by their average pitch ratios; Zulu is where it is in the tree, for example, because it is the Right-active language with the largest pitch ratio, and is therefore the best candidate for a language which does not truly belong together with the other Right-active languages.

R makes the following report for the fixed effects:

(18)	Estimate	Std. Error	df	t value	*p*	
(Intercept)	1.0599861	0.0109604	37.1229945	96.711	< 2e-16	***
position1	-0.0063943	0.0069876	45.2351299	-0.915	0.364995	
language1	0.0172660	0.0023952	39.1287005	7.209	1.09e-08	***
language2	-0.0252635	0.0285266	36.2291357	-0.886	0.381668	
language3	-0.0146487	0.0342160	46.9604905	-0.428	0.670518	
language4	0.0517297	0.0308038	33.6973839	1.679	0.102339	
language5	0.0429059	0.0381662	48.1410491	1.124	0.266508	
language6	0.0361725	0.0248818	35.2803583	1.454	0.154848	
language7	0.0220746	0.0349750	34.0806338	0.631	0.532151	
language8	-0.0112817	0.0265045	34.4755344	-0.426	0.673008	
language9	-0.0590696	0.0241271	38.0519535	-2.448	0.019076	*
language10	-0.1428290	0.0348291	33.5183333	-4.101	0.000247	***
position1:language1	0.0032592	0.0015570	50.2196517	2.093	0.041391	*
position1:language2	-0.0627888	0.0179829	40.3340903	-3.492	0.001178	**
position1:language3	0.0201239	0.0235950	71.0316193	0.853	0.396589	
position1:language4	0.0174690	0.0189316	36.9528297	0.923	0.362126	
position1:language5	-0.0009868	0.0264406	83.1798680	-0.037	0.970317	
position1:language6	-0.0085038	0.0155739	41.4280154	-0.546	0.587973	
position1:language7	-0.0002712	0.0216491	38.4635891	-0.013	0.990070	
position1:language8	-0.0091808	0.0160882	28.4347954	-0.571	0.572716	
position1:language9	-0.0068459	0.0155298	49.8082300	-0.441	0.661249	
position1:language10	0.0806852	0.0213533	36.4651202	3.779	0.000565	***

In (18), *position1* is the effect of position (subjects vs. objects), abstracting away from particular languages. This effect is not statistically significant, though we can see in the lower half of (18) that there are statistically significant effects of *position* in particular languages.

Turning to *language1*, we see that the difference between Left-active and Right-active languages is very significant (p<.0000001). Moreover, we can see that no languages have been misclassified; *language4* is not significant, for example, showing that Zulu truly belongs with the Right-active languages, and Korean, Norwegian, and English are not significantly different from each other, as we can see in *language2* and *language3*.

On the other end of the scale, we can see something that is also visible in the tables in (14-15): French, and especially Russian[2], are *particularly* Right-active, with unusually low pitch ratios. In the particular case of Russian, we may be able to link this fact to the fact represented

[2] Kapitonov (2017) also draws the conclusion that Russian is Right-active, on similar grounds.

by the last line of (18), showing a significant interaction between *position* and *language10*. Russian is unique in the data set in having a very large difference in the behavior of subjects and objects: Russian objects have a pitch ratio of 0.93 (comparable to the overall French ratio of 0.95), but Russian subjects often have a large pitch peak on the noun, giving them an average ratio of 0.8. I suspect that Russian subjects, at least in the context of the experiment, are being granted a special information-structural status that affects their prosody; serious investigation of this possibility will have to wait for careful investigation of the effects of information structure on the ratios discussed here.

1.4 Beyond the experiment

The experiment described in the preceding sections divides languages into two groups; the Left-active languages, with substantial downstep between the first word of the branching NP and the second, and the Right-active languages, which lack this downstep.

With this division in mind, we can consider pitch tracks in other languages, which will allow us to provisionally classify the languages as Left-active or Right-active. There is a substantial literature, for example, on downstep between adjectives and nouns in Japanese (Poser 1984, Pierrehumbert and Beckman 1988, Kubozono 1989, Selkirk and Tateishi 1991):

(19)

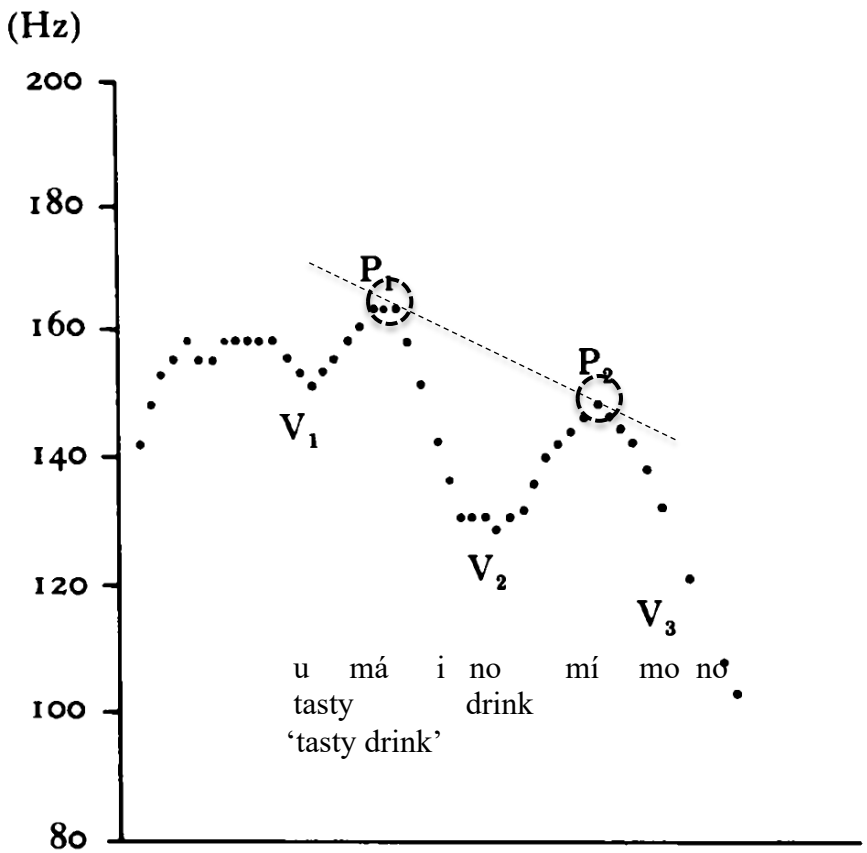


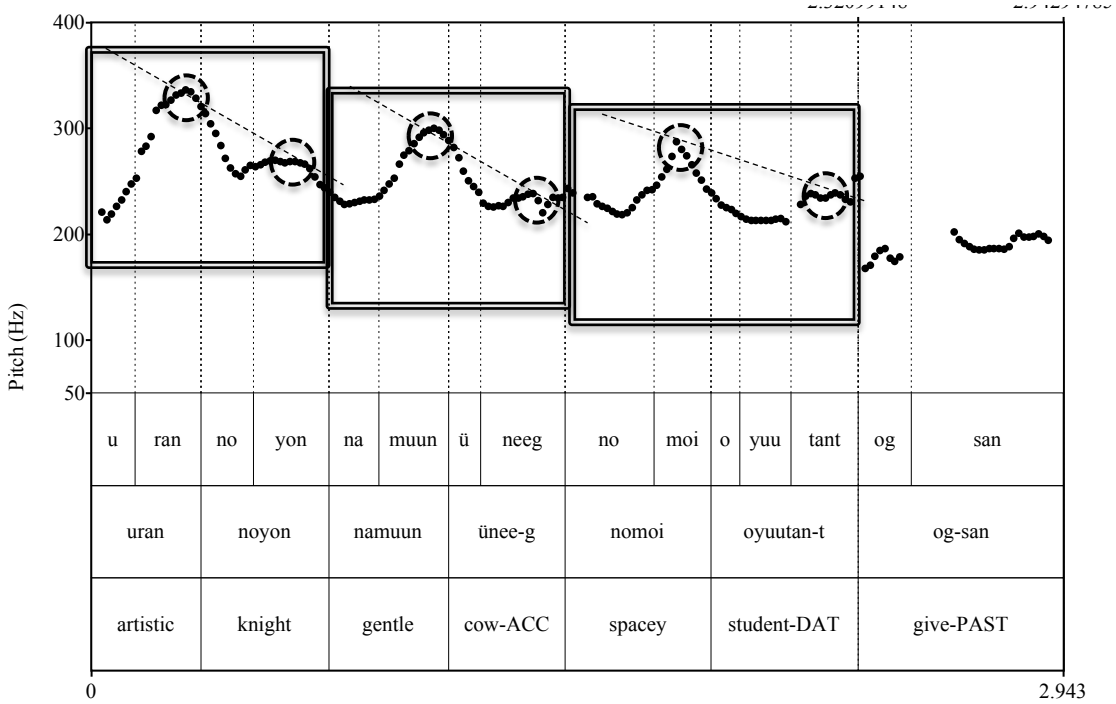
Figure 1

We will have to run the experiment for Japanese to be certain, but pitch tracks like the one in (19) allow us to hope that Japanese will prove to be a Left-active language, since it has downstep between adjectives and nouns[3].

Similarly, the Mongolian pitch track given above in (2) looks like the pitch track of a Left-active language:

(20)

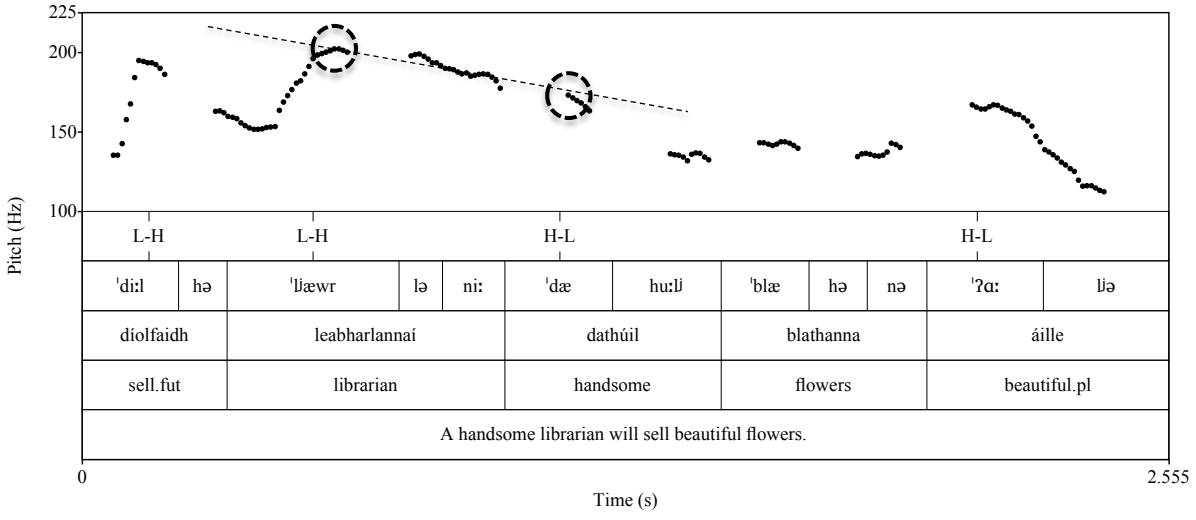
[3] The literature on Japanese downstep discusses interesting interactions between downstep and lexical accent, so lexical accent will have to be taken into account when constructing the Japanese version of this experiment.



'The artistic knight gave a gentle cow to the spacey student'

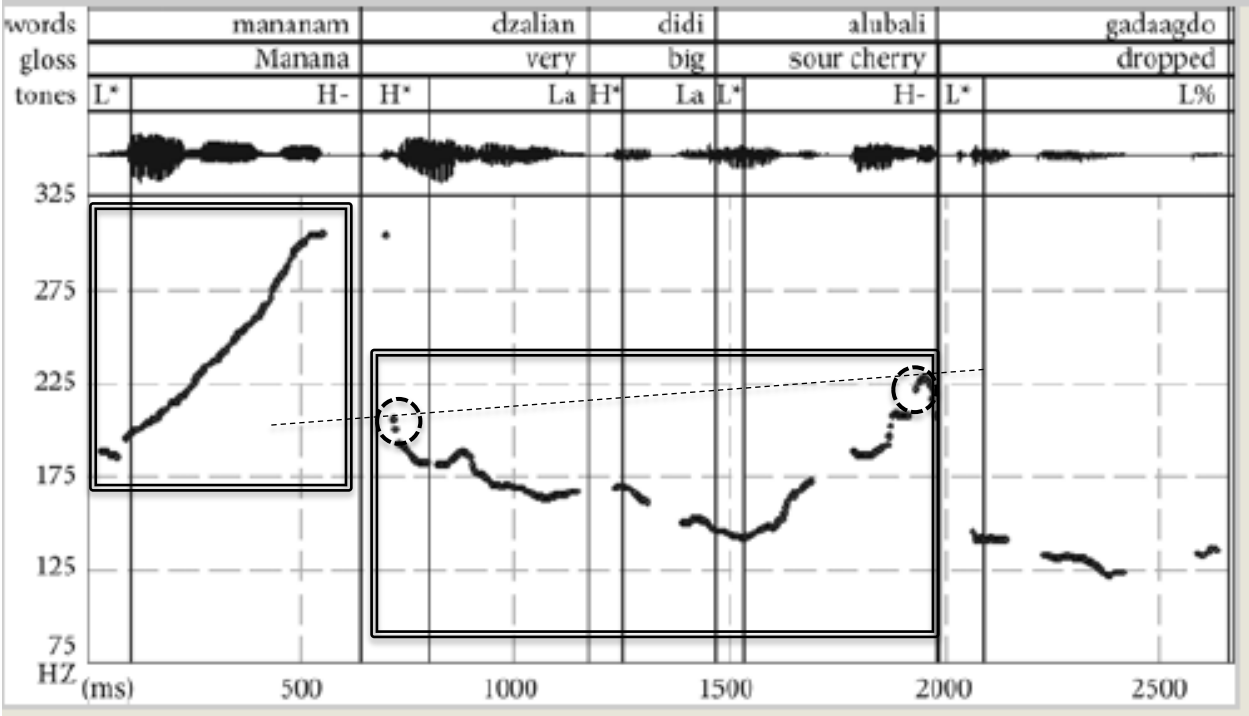
The pitch tracks given by Elfner (2012, 56) for Connemara Irish also look like Left-active pitch tracks:

(21)



Conversely, Georgian appears to be a Right-active language, with a higher pitch at the end of the noun phrase than at the beginning:

(22) (Vicenik and Jun 2014, 163)



Again, we would have to run experiments on these languages to be certain, but these pitch tracks allow us to make a guess about what the results of the experiment would be. In some cases, the results are clearly welcome ones. As mentioned before, Irish is a language that was difficult to classify by just looking at which side of a phonological phrase seemed to be associated with prosodic phenomena, as Richards (2016) had recommended, because Elfner (2012) argues that both edges of the Irish phonological phrase can have tonal melodies associated with them. The method developed here for detecting prosodic activity allows us to say that Irish is Left-active, which is the desired result (see discussion in Richards 2016).

2. A second test: the Length experiment

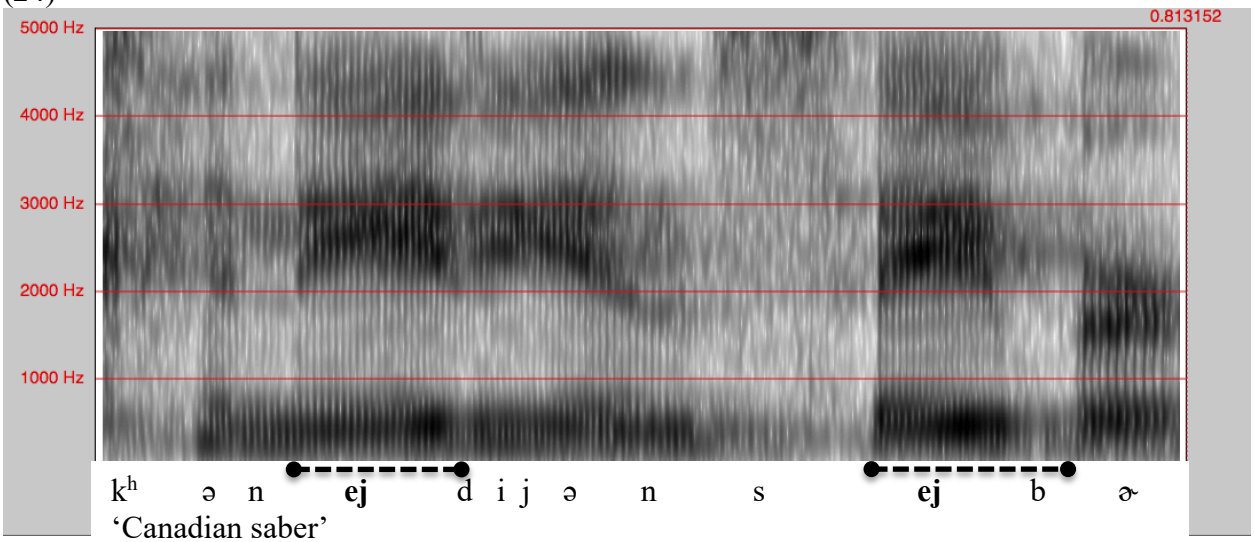
A second test for the location of prosodic activity involves measuring the length of stressed vowels[4] in sentences like:

[4] Many thanks to Edward Flemming for helpful discussion of how to run this test.

(23) At the big fencing tournament in Ottawa, she used a **Canadian saber** for the first time.

The goal, again, is to try to discover the position of prosodic activity within a noun phrase consisting of an adjective and a noun. Examples were constructed so that the stressed vowels of the two words were the same height (most often they were the same vowel, as in (16)), and were both in open syllables, followed by the same kind of consonant (generally both stops, either both voiced or both unvoiced). I was not as careful with the consonants preceding the vowels to be measured, which meant that I had to discard some English data in which a vowel was preceded by an aspirated stop, since the vowels following such stops were markedly shorter than vowels in other contexts. Vowels were measured from the onset of voicing until the release burst of the following stop:

(24)



'Canadian saber'

The experimental setup was much like that of the first experiment; speakers were given twenty sentences to pronounce, asked to pronounce them as conversationally as possible, and recorded in a quiet room using a Blue Yeti USB microphone. After measuring the stressed vowels, I found the ratio of the length of the first vowel to that of the second. I ran this test on the following languages:

(25) Brazilian Portuguese 2 speakers (1 female, 1 male)

English 2 speakers (both female)

German 3 speakers (all female)

Italian 1 speaker (male)

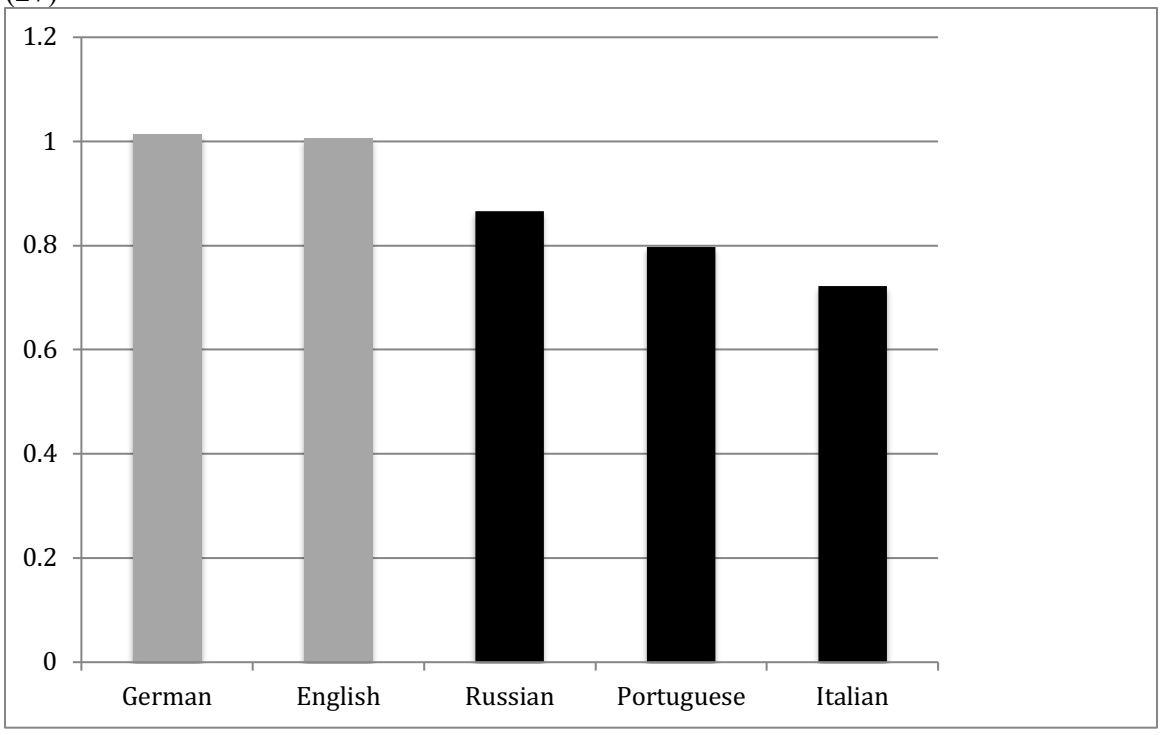
Russian 3 speakers (1 female, 2 male)

The average length ratios for these languages were as follows:

(26)

German	1.02
English	1.01
Russian	0.87
Portuguese	0.80
Italian	0.72

(27)



As with the pitch experiment, we see a division between two kinds of languages: German and English have a comparatively large ratio (around 1, meaning that the vowels of the adjective and

the noun are of roughly equal length), while Russian, Portuguese, and Italian have considerably smaller ratios (so in these languages, the stressed vowel of the second word is considerably longer than the stressed vowel of the first word).

Running the same type of statistical analysis as the one for pitch demonstrates again that the division of the languages into two groups is warranted. Just as in the pitch experiment, the model was the one in (28):

(28) ratio ~ position * language + (1 + position | speaker)

Again, *language* refers to a user-defined coding that groups languages into the two groups of interest and asks whether the groups are statistically significantly different from each other, and whether there are significant differences between the languages within the groups. And, as before, *position* refers to differences between subjects and objects. The results are given in (29):

(29)	Estimate	Std. Error	df	t value	*p*
(Intercept)	0.882538	0.024487	5.750000	36.041	5.42e-08 ***
position1	0.007696	0.015726	60.850000	0.489	0.62635
language1	0.042810	0.009714	5.960000	4.407	0.00461 **
language2	-0.001674	0.035326	6.520000	-0.047	0.96362
language3	-0.002427	0.044784	5.330000	-0.054	0.95875
language4	-0.075651	0.053854	5.300000	-1.405	0.21587
language1:position1	0.005770	0.006319	64.330000	0.913	0.36460
language2:position1	0.014254	0.023674	72.880000	0.602	0.54898
language3:position1	0.044883	0.027960	53.710000	1.605	0.11431
language4:position1	-0.003668	0.033551	53.200000	-0.109	0.91334

This analysis is not based on as much data as the preceding analysis of pitch differences, but it has a similar result; there is a statistically significant difference between Left-active and Right-active languages (represented again as *language1*; $p<.01$), and none of the other effects are significant.

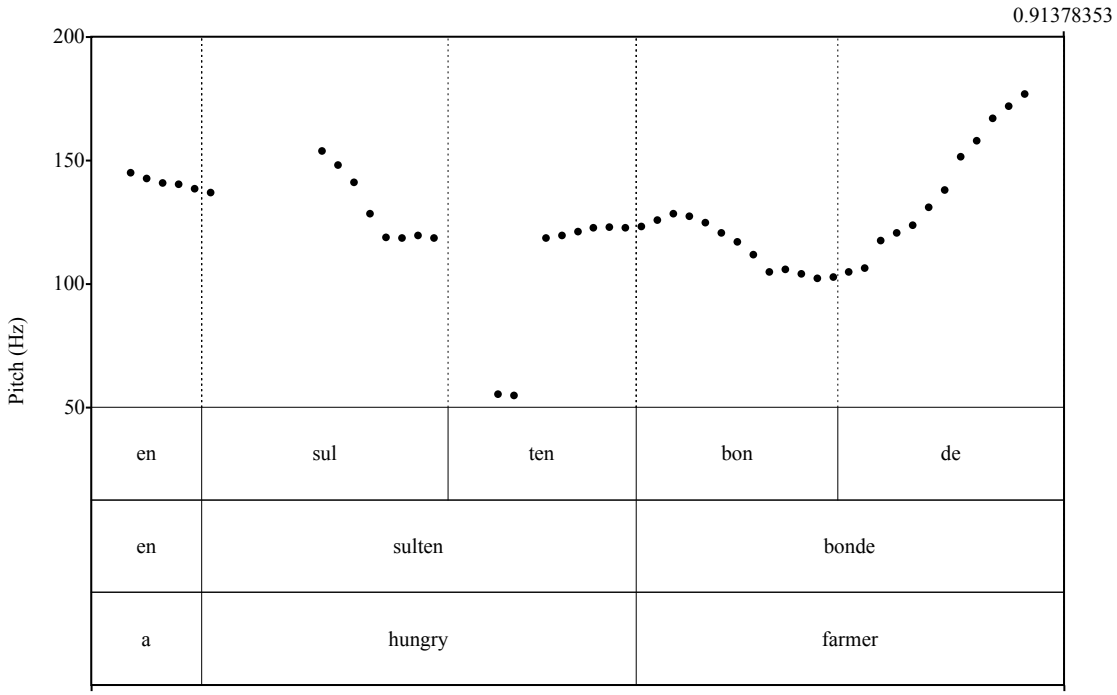
For the languages that have undergone both the pitch test and the length test, the tests agree: English is Left-active, and Russian, Italian, and Portuguese are Right-active. Prosodic activity is apparently associated, not only with a boost in pitch, but also with lengthening.

Several languages have undergone the Pitch test but not the Length test. Only one, namely German, has undergone only the Length test. In the next section I will briefly discuss German pitch.

3. Aside: German pitch

Recall that it was important, in the discussion of Norwegian, to exclude certain examples from the analysis. The (slim) majority of the Norwegian examples had pitch peaks reliably on stressed syllables, but there were also Norwegian examples that added a final rise:

(30) (*Norwegian*)

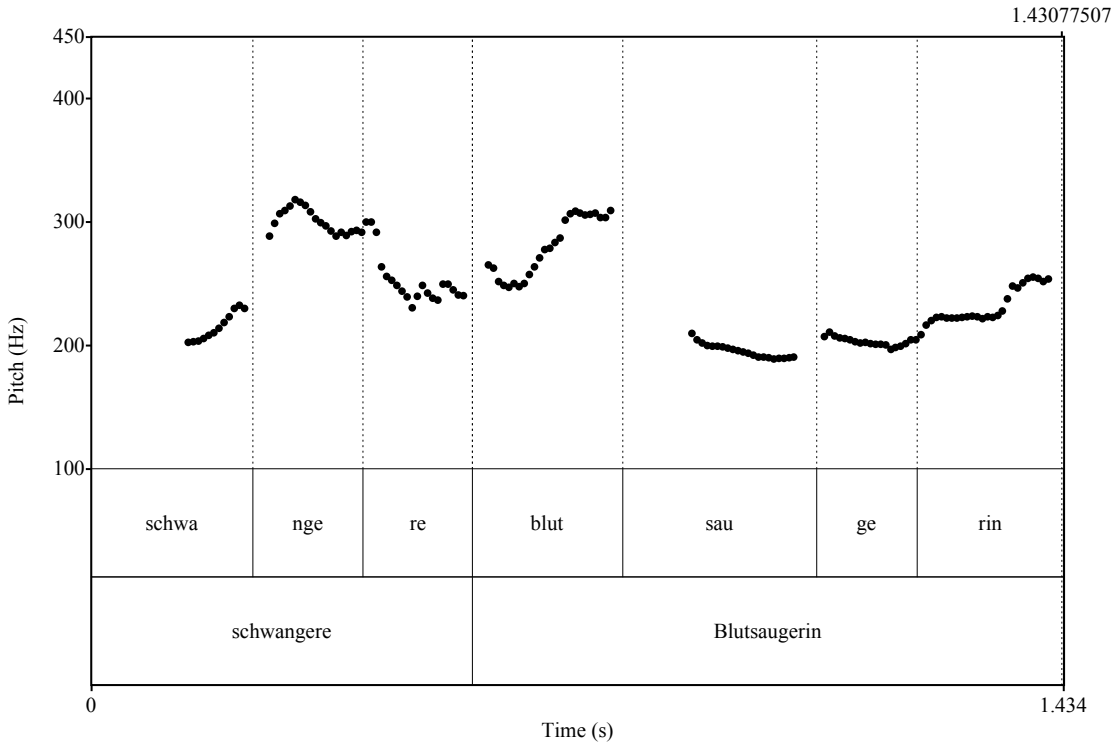


I excluded these data for purposes of the pitch analysis. An alternative, which I explored, would have been to include these examples but to measure only the pitch peak on the stressed syllable,

but it turned out that even these earlier pitch peaks were substantially higher in the presence of a final rise.

In attempts to run the pitch experiment on German, final rises of the type found in Norwegian were extremely common. In German nouns in which stress was distant enough from the end of the word for a final rise to be perceptible, final rises appeared in 5/6 of the examples:

(31) (*German*)



'pregnant vampire'

Here *Blutsaugerin* 'vampire (fem.)' has two pitch peaks, one on the initial stressed syllable, and the other at the end of the word. Excluding these data in German, as I did in Norwegian, would mean excluding too much of the data for statistical analysis to be meaningful. The literature on German prosody (e.g., Féry 1993) makes it look as though German pitch is very sensitive to information structure, and it is possible that a more careful version of this experiment that

controls information-structural factors more precisely would be able to run a version of the pitch test on German. For now, I will rely on the length test to classify German as Left-active.

It may be worth emphasizing the nature of the claim about German here. In principle, both the pitch and the length tests ought to be informative for German, but an identifiable additional factor (in this case, the recurring presence of a final rise) obscures the effects of the pitch test. The goal in future work should be to find some way to prevent final rises from occurring, or to determine a way of compensating for their effect. The picture in Richards (2016), by contrast, was one in which the tests that classify languages as Left-active or Right-active can simply differ from language to language. Richards (2016) referred, for example, to the fact that Japanese exhibits Initial Lowering (Selkirk and Tateishi 1991), a Low tone at the left edge of maximal projections, as evidence that Japanese is Left-active. The claim was not that every language has Initial Lowering in some form; rather, we were to take this particular, Japanese-specific phenomenon as a piece of evidence for the position of activity in Japanese. The goal of this paper is to find cross-linguistically applicable tests for activity; what the German case shows is that the effects of these tests can sometimes be obscured by other factors, which will necessitate study in their own right.

4. Contiguity Theory

The preceding sections have discussed two tests that can be used to classify a language as Left-active or Right-active; languages either associate the left or the right edge of a phonological phrase (at least, the phonological phrases corresponding to NP) with a boost in pitch and in length. As we will see, this prosodic parameter has a number of syntactic consequences.

One of the core claims of Richards (2016) can be summarized as follows[5]:

[5] I am very grateful to Kenyon Branan for helpful discussion of what follows.

(32) Given a Probe and a Goal, there must be a string containing the Probe and the Goal within which the Goal is "Contiguity-prominent".

The hope was that *Contiguity-prominence* would correspond with some more general notion of prosodic prominence; within some string containing the Probe and the Goal, the Goal must be the most prosodically prominent thing (more precisely, there must be nothing else in that string which is more prosodically prominent than the Goal).

We can define *Contiguity-prominence* as follows:

(33) a. Relative relations of prominence are calculated for heads and XPs in a c-command relation.

b. An XP is always more prominent than a head.

c. a parameter: given multiple XPs in a string[6],
a language realizes Contiguity-prominence on the {Leftmost, Rightmost}.

(33b) is a familiar fact about heads and phrases[7]; if a string contains both a head and a phrase, the phrase is more prosodically prominent than the head. In (33c), we see the effects of a binary parameter; when a string contains multiple XPs, some languages assign Contiguity-prominence on the Leftmost element, while others assign it to the Rightmost. These are the Left-active and Right-active languages.

Consider first cases in which a Probe and a Goal are adjacent (and I will assume, throughout, that Goals are invariably phrases, and that Probes are not). Such cases will always satisfy the requirement in (32), because of (33b); if a Probe and a Goal are adjacent, then there is a string containing both in which the Goal is in a c-command relation only with the Probe, and since the Goal is a maximal projection and the Probe is not, (33b) guarantees that the Goal will

[6] I will take an XP to be 'in a string' if all of the terminals dominated by the XP are members of the string.
[7] See, for example, Truckenbrodt's (1995) STRESS-XP.

be the Contiguity-prominent element in that string. The position of prosodic activity will never matter in such a case.

The same would be true in a case in which the Probe and the Goal are not adjacent, but in which the material linearly separating them is not a maximal projection; since there is a string containing the Probe and the Goal in which the Goal is the only maximal projection, the Goal would achieve Contiguity-prominence in the string. The relation between the English verb and the object, for example, shows an adjacency requirement of the kind that this theory is well-suited to handle; verbs and objects can be separated by particles, but not by full phrases (such as adverbs, including adverbs that modify particles):

(34) a. She looked the reference *up*.

b. She looked *up* the reference.

c. She looked the reference *right up*.

d. * She looked *right up* the reference.

e. *She looked *quickly* the reference up.

Finally, consider cases in which some maximal projection intervenes between the Probe and the Goal:

(35) a. PROBE XP GOALP

b. GOALP XP PROBE

In the cases in (35), there is no string containing the Probe and the Goal which does not also contain the intervening XP. In order to know whether the Goal is Contiguity-prominent, then, we must learn how the language in question decides where to assign prominence when a string contains multiple maximal projections; that is, we must know the value of the parameter in (33c). In a Right-active language, the string in (35a) will be acceptable, because the Goal is the

rightmost XP in the string. Similarly, in a Left-active language, the string in (35b) will be acceptable.

On the other hand, in a Left-active language, (35a) will be impossible; in such a language, the Contiguity-prominent element in that string will be XP, the leftmost maximal projection, rather than the Goal. A Left-active language is therefore predicted to be unable to leave a Goal in situ if it is preceded by its Probe and there are maximal projections linearly intervening between them; some operation (such as leftward movement of the Goal) will have to take place to make the Probe and the Goal adjacent.

Similarly, a Right-active language should be unable to tolerate the string in (35b), since, again, it will be the intervening XP, rather than the Goal, that becomes Contiguity-prominent in such a language. In a Right-active language, then, if the Probe follows the Goal, the Probe and the Goal must be adjacent (more precisely, they cannot be linearly separated by maximal projections).

The above discussion can be summarized as in (36):

(36) a. PROBE XP GOALP [*Left-active, √Right-active]

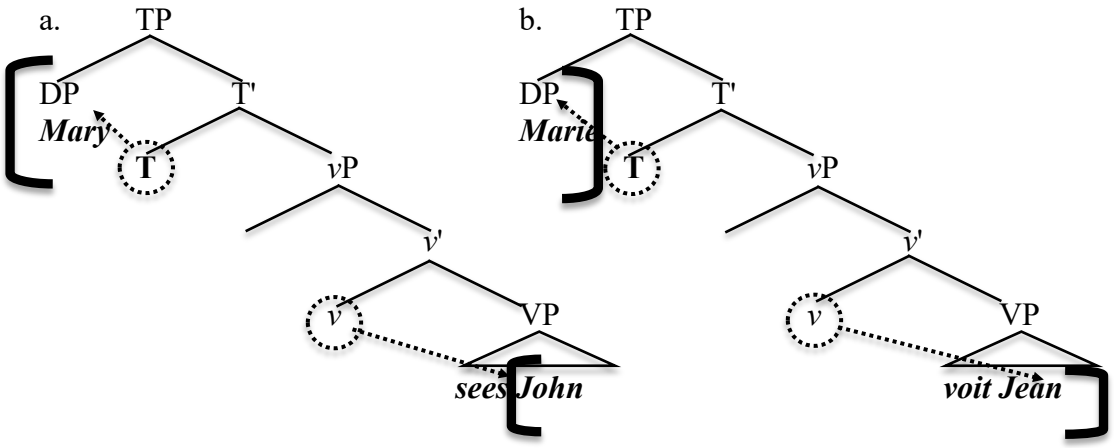
b. GOALP XP PROBE [√Left-active, *Right-active]

If the minimal string containing the Probe and the Goal also contains a linearly intervening XP, the string will be acceptable just if the language realizes prosodic activity on the Goal and not on the intervening XP. Thus, the string in (36a) is acceptable in Right-active languages, since the Goal is to the right of the intervener, and the string in (36b) is acceptable in Left-active languages, since the Goal is the left of the intervener. In the following sections I will review several cases of this principle in action; we will see that the experiments from sections 1-2 sort languages correctly.

4.1 "Verb movement to T"

We have now seen evidence (from the pitch and length experiments) that English is Left-active, and (from the pitch experiment) that French is Right-active. Consider the Contiguity relations that must hold in an SVO sentence in these languages (in the trees below, I have marked the direction of activity with parentheses):

(37) a. b.



In English, for example, there must be a string containing *v* and the object in which the object is the leftmost XP; this is the only way the object can be Contiguity-prominent in the string, since English is Left-active. In other words, there must be a string containing *v* and the object in which no XP precedes the object. To put it yet another way, no XP can intervene between *v* and the object; if there is such an intervener, then any string that contains *v* and the object will also contain the intervening XP, and the object will fail to be Contiguity-prominent. As mentioned before, this is famously true; no adverb can intervene between the verb and the object in English:

(38) Mary sees (***often**) John.

By the same reasoning, we expect that in French, T and the subject should be required to be adjacent. Since French is Right-active, the French subject must be the rightmost XP in a string

containing the subject and T, and this is only possible if no XP intervenes between the subject and T. Again, this is true:

(39) Marie (***souvent**) voit Jean.

We do not expect to see adjacency requirements on the relation between *v* and the object in French, or between T and the subject in English. In the latter case, for example, since English is Left-active, Contiguity requires only that there be a string containing T and the subject in which the subject is the leftmost XP. As long as the subject precedes T, then, the requirement will be satisfied, no matter how many XPs intervene between the subject and T. The same reasoning applies to *v* and the object in French; since French is Right-active, any string in which the object follows *v* will be acceptable, even if the two are not adjacent. Again, the predictions are true:

(40) Mary (**often**) sees John.

(41) Marie voit (**souvent**) Jean.

The adjacency requirement between the verb and the object in English has classically been attributed to a special condition on the assignment of Case in English--in particular, on the assignment of <u>accusative</u> Case, since no such adjacency requirement holds between the subject and T, as we have just seen. In the account given above, the crucial difference between T and *v* is that T typically follows the subject in English, while *v* precedes the object. If we arrange for T to precede the subject in English, an adjacency requirement appears, as we expect:

(42) a. Probably Mary is happy.

b. Is (***probably**) Mary happy?

Once T precedes the subject, as in (42b), English, being Left-active, requires the subject to be the leftmost XP in the smallest string containing T and the subject; as a consequence, no adverb may intervene between them, just in this configuration.

The contrasts between English and French described above have classically (Pollock 1989 and much subsequent work) been described as reflecting a difference in the movement of heads in the two languages; French verbs move to some higher functional head, perhaps T, while English verbs do not. The same literature standardly stipulates that French verbs fail to raise to T in infinitives, in order to account for facts like those in (43):

(43) a. Jean parle **pas** l'italien
Jean speaks not Italian
'Jean doesn't speak Italian'

b. * Jean **pas** parle l'italien
Jean not speaks Italian

c. **Pas** parler l'italien…
not to.speak Italian
'To not speak Italian…'

The data in (43a-b) are familiar, as long as we regard *pas* as a specifier or an adjunct, rather than a head in the clausal spine; like any other XP, *pas* may not appear between the subject and T in French, but may appear between *v* and the object, for reasons that we now understand. When the subject is not pronounced, as in (43c), then the condition requiring T to be adjacent to the subject no longer applies; there is no pronounced subject for T to be adjacent to. There is therefore nothing wrong with *pas* preceding the verb in such clauses, as (43c) shows. For further discussion of the details of the French and English facts, see Richards (2016)[8].

[8] In particular: some condition must guarantee that not only can *pas* precede the verb in (43c), but it must do so, and no such condition follows from the account given here; if the ordering facts are to be accounted for with head movement, we must apparently conclude that head movement is a last resort. The behavior of auxiliaries is also known to be different from that of main verbs; in the account of Richards (2016), this difference falls out of the conditions on Affix Support (the requirement which is crucial to the Contiguity-theoretic account of the EPP).

In the Pitch experiment, discussed in section 1 above, we learned that Norwegian is like English in being Left-active, and Icelandic is like French in being Right-active. And as long as we confine ourselves to non-V2 clauses, the rules for the positioning of adverbs in Norwegian are like those in English, and the rules for Icelandic are like those for French (Wiklund et al 2007):

(44) Jeg vet [hvorfor Hedda (**ofte**) kjøper (* **ofte**) sko] [*Norwegian*]
I know why Hedda often buys often shoes

(45) Ég veit [af hverju Hedda (* **oft**) kaupir (**oft**) skó] [*Icelandic*]
I know why Hedda often buys often shoes
'I know why Hedda often buys shoes'

In order to discover that Norwegian is like English and Icelandic is like French, we must consider non-V2 clauses. In V2 clauses, the two languages share the familiar V2 profile. We must apparently think of the conditions on word order that we are discussing as being subject to disruption by various grammatical forces; the requirement that the verb be adjacent to the object in Norwegian, for example, holds in (44), but would not hold in a V2 clause, because the V2 requirement would override the condition of Contiguity between *v* and the object. In Richards (2016), I proposed that the relation between different grammatical forces should be regulated by cyclicity, and by phase spellout; Contiguity relations must be created in the phase in which Agree takes place, and are enforced until that phase is spelled out, but can then be disrupted by later operations (see also Branan 2018 for much further discussion). Surface order (as usual in syntax, I think) is taken to be the product of multiple simple forces, interacting to create apparent complexity. The claim is that Contiguity for T and *v* are among the forces constraining the

behavior of subjects and objects, and when we find behavior that Contiguity alone does not explain, we should try to find the additional operations responsible.

Several of the remaining languages under discussion exhibit additional operations that obscure the effects of Contiguity. Italian and Portuguese, for example, do both allow adverbs between the verb and the object, as we expect Right-active languages to do, but they also allow adverbs between the subject and T:

(46) a. Giovanni **spesso** parla italiano [*Italian*]
Giovanni often speaks Italian

b. Giovanni parla **spesso** italiano
Giovanni speaks often Italian

(47) a. O Pedro **provavelmente** sabe esta receita [*Portuguese*]
the Pedro probably knows this recipe

b. O João termina **completamente** suas tarefas
the João finishes complete his tasks
antes de começar novas
before of begin.INF new.ones (Schifano 2018, 73)
'João completely finishes his tasks before beginning new ones'

In Richards (2016) I address the unexpected behavior of subjects in these languages, suggesting that we can follow a long literature on the behavior of preverbal subjects in Romance languages that do not exhibit EPP effects, which argues that these preverbal subjects are not in ordinary subject positions, but are (at least optionally) dislocated to high positions in the clause (see Contreras 1991, Barbosa 1995, Goodall 1999, and much other work). On this view, an example

like (46a) might have a structure like that in (48), with a phase boundary between the preverbal subject and T:

(48) [$_{XP}$ Gianni [$_{TP}$ spessa T parla ~~*Gianni*~~ italiano]
often speaks Italian

As long as *Gianni* is in a different spellout domain from the TP, then the spellout domain containing T contains only the lowest copy of the chain headed by *Gianni*, and this copy is in the correct Contiguity relation with T. Since Contiguity requirements are only enforced within a phase, this structure is an acceptable one (and it is available for Italian, though not for French, because French, unlike Italian, exhibits EPP effects; see Richards 2016 for further discussion).

Halpert (2012) argues that Zulu subjects may be left-extraposed; just as in Italian and Portuguese, the interaction of Zulu subjects with adverbs could be affected by this extraposition. Similarly, Bulgarian and Russian have scrambling operations that make word order in these languages too free for the predictions of Contiguity Theory to be straightforwardly tested in this domain.

For several languages, then, the predictions of Contiguity Theory cannot be easily perceived, because of a variety of intervening factors (V2, subject dislocation, scrambling). To the extent that these factors can be avoided, the predictions appear to be on the right track.

4.2 Intervention by experiencers

Branan (2018) points out that the approach of the previous section makes accurate predictions about the cross-linguistic conditions on raising across experiencers:

(49) a. John seems (**to Mary**) __ to be talented. [*English*]

b. Sofie ferekom (**ham**) __ at være helt enig. [*Norwegian*]
Sofie appears him to be.INF completely agreed
'Sofie appears (to him) to completely agree'

c. Jean semble (* **á Marie**) __ avoir du talent. [*French*]
Jean seems to Marie to.have of.the talent
'Jean seems (to Marie) to have talent'

d. Ólafur hefur virst (***mér**) __ vera gáfaður. [*Icelandic*]
Olaf.NOM has seemed me.DAT be.INF smart
'Olaf seemed (to me) to be smart'

e. Gianni sembra (* **a Maria**) __ essere stanco. [*Italian*]
Gianni seems to Maria to.be tired
'Gianni seems (to Maria) to be tired' (Rizzi 1986)

f. O alunos parecem (***ao professor**) __ estar exaustos. [*Portuguese*]
the students seem to.the professor to.be exhausted
'The students seem to the teacher to be exhausted' (Petersen 2016, 5)

As Branan points out, if it is the case that Contiguity relations must be maintained during the phase in which they were created, and if we follow Chomsky (2000) in claiming that the unaccusative *v* head associated with *seem* is not a phase head, then the raised subjects in (49) must be Contiguous, not only with the T of the matrix clause, but also with the T of the embedded clause out of which they raised.

This approach derives the facts in (49). French, Icelandic, Italian, and Portuguese, as the test in section 1 demonstrated, are Right-active languages, in which Probes cannot be separated

from Goals that precede them by any full XP. This was why adverbs cannot intervene between the subject and T in French or (in non-V2 clauses) in Icelandic. If this requirement of near-adjacency holds, not only for the subject and matrix T, but for the subject and embedded T, then we expect that the experiencer, being a maximal projection, will be banned from intervening between the subject and embedded T. This is what we see in (48c-f)[9]. Crucially, the requirement is not one of strict linear adjacency; even without the intervening experiencer, the raised subject is separated from embedded T by at least the matrix verb. But the matrix verb is a head, not an XP, and therefore does not intervene in the relevant sense; it will never be more prosodically prominent than the raised subject itself.

Meanwhile, English and Norwegian are Left-active languages, as we have already seen. Just as adverbs may intervene between the subject and T in these languages, for reasons we now understand, experiencers may also intervene between raised subjects and the embedded T.

Not only does Branan's approach successfully predict which languages will ban raising across experiencers and which will not, but his proposal also captures properties of the ban which have always been difficult to account for. Raising across experiencers becomes possible in these languages if the experiencer is a clitic (depriving it of its full prosodic status), or if the experiencer undergoes extraction itself:

(50) Jean **lui** semble __ avoir du talent. [*French*]
Jean to.him seems to.have of.the talent
'Jean seems to him to have talent'

[9] In the previous section I invoked a type of movement in languages like Italian and Portuguese that moves the subject out of the phase containing T, making it possible for adverbs to intervene between the subject and T in these languages. To capture the results of this section, we will have to understand this movement as being fairly local; it cannot take place from the embedded subject position into the dislocated position in the matrix clause, but must be fed by ordinary raising from the embedded clause to the matrix clause. Raising across an experiencer will then break the Contiguity relation between the subject and the embedded T, as desired; even if the subject then dislocates string-vacuously in the matrix clause, it is still true that a Contiguity relation was broken and never repaired.

(51) a. **Á Marie**, Jean semble __ avoir du talent. [*French*]

to Marie Jean seems to.have of.the talent

'To Marie, Jean seems to have talent'

b. **Hvem** hestarnir virðast __ vera seinir? [*Icelandic*]

who.DAT the.horses seem to.be slow

'To whom did the horses seem to be slow?'

The well-formedness of (51), in particular, raises problems for cyclicity on conventional approaches to syntactic intervention, since we would expect raising to precede A-bar extraction in the derivation. On Branan's approach, the facts are expected. If raising precedes A-bar extraction of the intervener, then the Contiguity relation between the raised subject and embedded T will indeed be temporarily broken, but that relation can be repaired once the intervener has been extracted, and Contiguity between the raised subject and both instances of T will therefore be satisfied in the representation sent to PF.

For some of the languages under discussion here, Branan's test cannot be run, for independent reasons. Bulgarian lacks infinitives entirely, including raising infinitives. Zulu does not allow raising out of infinitives (Halpert 2019, 124):

(52) *uZinhle u-bonakala __ uku-(zo-)xova ujeqe

AUG.1Zinhle 1S-seem INF-(FUT-)make AUG.1steamed.bread

'It seems that Zinhle will make steamed bread'

Neither does Russian (Stepanov 2007, 84):

(53) *Ivan sčitaetsja __ byt' bol'nym

Ivan is.considered to.be sick.INSTR

'Ivan is considered to be sick'

German does not allow experiencers to intervene between raising verbs and their complement clauses, regardless of whether raising takes place (Verena Hehl, p.c.):

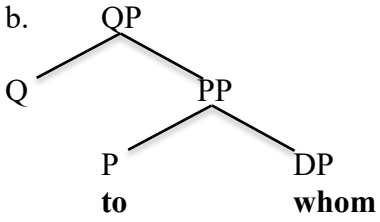
(54) Es scheint (* **mir**), daß er müde ist
it seems me.DAT that he tired is
'It seems to me that he is tired'

For the languages for which Branan's test can be run, however, raising across experiencers is banned in just the cases where he predicts that it should be.

4.3 Pied-piping

Richards (to appear) discusses cross-linguistic differences in pied-piping as another case to be covered by conditions on Contiguity. I adopt Cable's (2007, 2010a, 2010b) approach to pied-piping, positing a functional projection QP which dominates wh-phrases:

(55) a. [To **whom**] are you speaking?

b.


So-called "wh-movement", on this account, is actually movement of QP, and while QP must dominate wh-phrases, it need not immediately dominate them. On this approach, the question of how much material may be pied-piped reduces to a question about the possible structural relations between QP and the wh-phrase.

Still following Cable, I posit an Agree relation between Q and the wh-phrase, and claim that the contrasts in (56-64) then follow from the same considerations that derive the contrasts in the previous two sections:

(56) *[**Q** Paintings of **what**] did you see at the museum? [*English*]

(57) *[**Q** Fotografier av **hvem**] kjøpte hun? [*Norwegian*]

photographs of **who** bought she

'**Who** did she buy photographs of?' (Øystein Vangsnes, p.c.)

(58)*[**Q** Bilder von **was**] hast du gesehen? [*German*]

pictures of what have you seen

'[Pictures of **what**] did you see?' (Verena Hehl, p.c.)

(59) [**Q** Málverk eftir **hvern**] sást þú? [*Icelandic*]

painting by **who** saw you

'[A painting by **who**] did you see?' (Hrafnhildur Bragadóttir, Stefan Olafsson, Helgi Gunnarsson, p.c.)

(60) ?[**Q** Des peintures de **quoi** de Monet] as-tu vu au musée? [*French*]

of.the paintings of **what** by Monet have-you seen at.the museum

'[Paintings of **what** by Monet] did you see at the museum?' (Sophie Moracchini, Paul Marty, p.c.)

(61) [**Q** Isibonelo **sika-bani**] oku-melwe si-si-landel-e? [*Zulu*]

AUG.7.example **7.ASSOC.1-1.who** 17.REL-ought 1PL.S-7.O-follow-SUBJ

'[The example of **who**] ought we to follow?' (Claire Halpert, p.c.)

(62) [**Q** As fotos de **quem**] você comprou? [*Portuguese*]

the photos of **who** you bought (Suzana Fong, p.c.)

'[Photos of **who**] did you buy?'

(63) [**Q** Snimki na **kakvo**] vidja v muzeja? [*Bulgarian*]

pictures of **what** you.saw at museum.the

'[Pictures of **what**] did you see at the museum?' (Nadia Dimitrova, p.c.)

(64) [**Q** Fotografii **čego**] ty videl v muzee? [*Russian*]

photographs **what.GEN.SG** you saw in museum

'[Photographs of **what**] did you see at the museum?' (Mitya Privoznov, Anton Kukhto, p.c.)

Assuming that QP is head-initial in these languages, the ill-formedness of (56-58) is by now a familiar effect; these are Left-active languages, in which Probes must be nearly adjacent to Goals which follow them, and in (56-58), the wh-phrase is too distant from the Q at the beginning of the wh-phrase. In (59-64), on the other hand, we are considering Right-active languages, in which Q should be able to be separated from the following wh-phrase, and we can see that this is indeed the case.

The one outlier in our sample is Italian. Italian, like the languages in (59-64), is a Right-active language, but unlike the other Right-active languages, it does not allow pied-piping by deeply embedded material:

(65) *[**Q** Foto di **cosa**] hai visto nel museo? [*Italian*]

photos of what have.2SG seen at.the museum

'[Photos of **what**] did you see at the museum?' (Enrico Flor, Stanislao Zompì, p.c.)

We will see shortly that Italian wh-questions are unusual in another way. I will revisit the issue of the ill-formedness of (65) then, though I will be unable to explain it.

4.4 Wh-movement

Richards (2010) originally began developing Contiguity Theory as a way of dealing with the behavior of wh-phrases. Let us consider the predictions.

First, in head-final languages, we expect to find two kinds of wh-questions. In Left-active languages like Japanese and Korean, wh-in-situ should be possible:

(66) a. **Dare**-ga pan-o katta (**C**)? [*Japanese*]
who-NOM bread-ACC bought
'Who bought bread?'

b. Pan-o **dare**-ga katta (**C**)?
bread-ACC who-NOM bought

(67) a. **nwukwu**-ka ppang-ul sa-ess **-ni**? [*Korean*]
who-NOM bread-ACC buy-PAST-Q
'Who bought bread?'

b. ppang-ul **nwukwu**-ka sa-ess **-ni**?
bread-ACC who-NOM buy-PAST-Q

On the other hand, in Right-active head-final languages, it should be impossible for full XPs to intervene between the wh-phrase and the Probe at the end of the clause:

(68) a. * **vin** p'ur-i iq'ida (**C**)? [*Georgian*: Erschler 2015]
who.ERG bread-NOM bought
'Who bought bread?'

b. p'ur-i **vin** iq'ida (**C**)?
bread-NOM who.ERG bought

(69) a.* **señek** Jon ikusi rau (**C**)? [*Ondarroa Basque*:
who.ERG Jon see.PRF AUX Arregi 2002, 165]
'Who saw Jon?'

b. Jon **señek** ikusi rau (**C**)?
Jon who.ERG see.PRF AUX

In (68a) and (69a), Contiguity between final C[10] and the wh-phrase is not respected; since Georgian and Basque are Right-active, in a string containing an XP intervening between the wh-phrase and C, the most prosodically prominent element would be the intervening XP, and not the wh-phrase. Georgian and Basque both independently have scrambling as an option (for reasons I will not try to derive here), and perhaps it is scrambling that makes the word orders in (68b) and (69b) possible, satisfying the Contiguity condition.

Turning to left-headed languages, we again expect to see two kinds of behavior. In Left-active languages, it should be impossible for the wh-phrase to be separated from the initial C by any XP:

(70) a. **Who** (**C**)-did you see? [*English*]

b. * (**C**) you saw **who**?

In Right-active languages, on the other hand, we expect no such requirement of adjacency; wh-phrases should be able to remain in situ. For several of the languages we have identified above as Right-active, this is true:

[10] I will continue to call this head C, but it is worth noting that Erschler (2015) argues that Georgian interrogative C is in fact head-initial. Since Georgian is generally head-final, I may have to assume that the relevant Probe-Goal relation involves some other head. Thanks to Tanya Bondarenko, both for pointing out the problem and for the suggested solution.

(71) (**C**) Tu as vu **qui**? [*French*]

you have seen who

'Who did you see?'

(72) (**C**) O Bill comprou **o que**? [*Portuguese*]

Bill bought what

'What did Bill buy?'

(73) (**C**) U-bona-**ni**? [*Zulu*]

2SG-see-what

'What do you see?'

However, there are also several Right-active languages in which wh-in-situ is banned:

(74) *(**C**) Pétur hefur talað við **hvern**? [*Icelandic*]

Peter has spoken with who.ACC

'Who has Peter spoken with?'

(75) *(**C**) Hai visto **chi**? [*Italian*]

have.2SG seen who

'Who did you see?'

(76) *(**C**) Ty videl **kogo**? [*Russian*]

you saw who.ACC

'Who did you see?'

(77) *(**C**) Ivan e kupil **kakvo**? [*Bulgarian*]

Ivan AUX bought what

'What did Ivan buy?'

Richards (2016) made a proposal about why wh-in-situ is unexpectedly banned in Icelandic; Icelandic is V2, and V2 languages typically ban wh-in-situ. See Richards (2016) for further discussion of this ban.

The following section will turn to the surprising ill-formedness of wh-in-situ in (75-77). Italian, Russian, and Bulgarian are not V2 languages, and they are Right-active. Why can they not leave wh-phrases in situ?

5. Prominence in ι

Italian, Russian, and Bulgarian have another property that distinguishes them from the other languages above; they have a general ban on wh-in-situ, even in multiple-wh questions:

(78) a. ***Chi** ha comprato **che cosa**?
who has bought what [*Italian*]

b. **Kto** **čto** kupil?
who what bought [*Russian*]

c. **Koj** **kakvo** e kupil?
who what AUX bought [*Bulgarian*]

Italian does not allow multiple-wh questions at all (Rizzi 1982)[11], and Russian and Bulgarian move all wh-phrases. In this regard these languages are different, for example, from Icelandic, which has multiple wh-questions of the kind familiar from English:

(79) **Hver** bauð **hverjum** í veisluna [*Icelandic*]
who invited whom in the.dinner
'Who invited who to the dinner?'

[11] Here there is apparently a generational split, about which I will have nothing to say; younger Italians do in fact allow multiple-wh questions like the one in (78a) (Stanislau Zompi, p.c.).

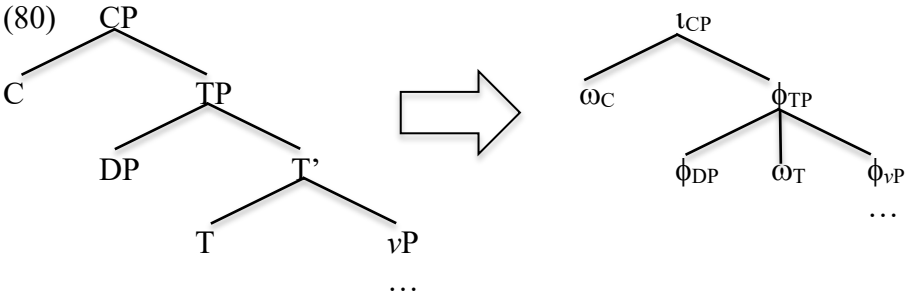
Italian is unique in our sample in banning multiple wh-questions entirely (though it is certainly not unique in the literature; see, for example, Fortin 2009 on Indonesian and McCloskey 1979 on Irish). I will have nothing to say here about why this is, or about whether this property of Italian can be linked to its surprisingly strict limitations on pied-piping, discussed in section 4.3 above[12].

The fact that the conditions described in section 4 cannot drive wh-movement in Italian, Bulgarian, and Russian, then, is arguably not completely undesirable; wh-movement in these languages has characteristics which distinguish them from the other languages under study. The question is then how to guarantee that these languages not only have overt wh-movement, but cannot leave wh-phrases in situ at all.

Here I will adopt a suggestion by Francis (2015). She builds on a generally accepted distinction made in work on prosodic phonology, which typically recognizes a number of prosodic objects of different sizes. One of these (sometimes called the Intonational Phrase) more or less corresponds to the clause, while another (the Phonological Phrase) is smaller. In Match Theory (Selkirk 2009, 2011, Elfner 2012, 2015, Clemens 2014, Bennett, Elfner, and McCloskey 2016), for example, CP maps onto an Intonational Phrase (ι), while maximal projections generally map onto Phonological Phrase (ϕ), and heads map onto Phonological Words (ω):

[12] Fox and Nissenbaum (2018) present an analysis of pied-piping which would at least allow us to reduce these two special properties of Italian to a single one. In their analysis, wh-movement of a phrase like *whose book* actually involves two movement operations, one moving the entire phrase *whose book* and a second movement subextracting the word *whose*. On such an approach to pied-piping, we could regard Italian as a language which does not allow CP to host multiple movement operations (or perhaps does not allow C to participate in multiple probing operations); multiple operations, on this view, are involved both in multiple wh-questions and in pied-piping of DP, both of which appear to be banned in Italian (though Italian does allow pied-piping of PP, which would therefore require a different analysis). Why Italian disallows multiple movement to CP would still be mysterious.

(80)



The distinction between Intonational Phrase and Phonological Phrase is based on a wealth of cross-linguistic observation; languages very frequently have special prosodic phenomena which mark the edges of clauses, and a distinct set of phenomena that are associated with the edges of other maximal projections.

Francis' proposal takes advantage of this typology of prosodic objects. She points out that all of the discussion of Contiguity so far has been exclusively concerned with prominence in the Phonological Phrase (ϕ), and she suggests that there could also be conditions that make reference to prominence in the Intonational Phrase (ι). Moreover, she points out, a language could conceivably have different conditions on prominence in ϕ and in ι; a language could, for example, be Right-active in ϕ but Left-active in ι. We will see that she is quite right.

5.1 Testing for ι-level prominence

Following Francis' idea, let us explore the possibility that while Italian, Russian, and Bulgarian are Right-active in ϕ (as the Length and Pitch tests demonstrate), they are Left-active in ι. Since wh-movement is associated with CP, the position of prosodic activity in ι, the prosodic correlate of CP, might be especially important for wh-questions.

In the domain of ϕ, one of the tests for position of activity was the Pitch test; languages were shown to boost the pitch either of the Left side or of the Right side of the ϕ corresponding

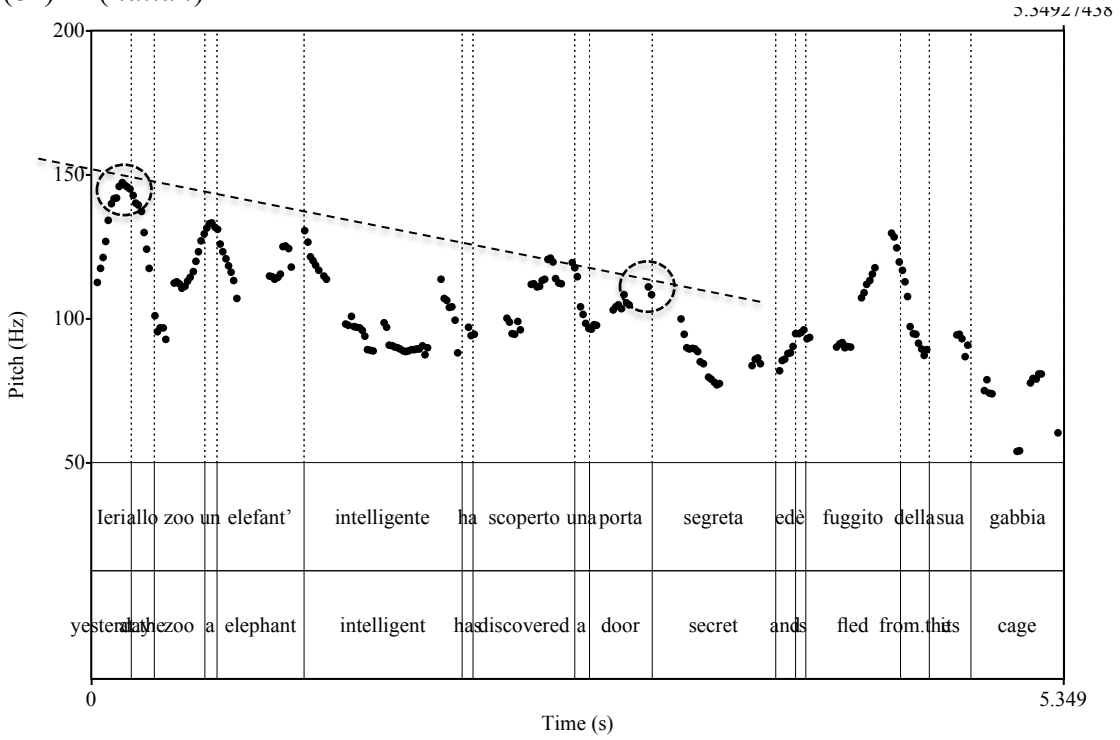
to a noun phrase containing an adjective and a noun. Can we find any evidence for a similar distribution of pitch boosts in ι?

Consider the examples that were used in the Pitch experiment:

(81) **Yesterday at the zoo**, an intelligent elephant discovered a secret door
and escaped from its cage.

The examples all involved branching subjects and objects, and also all began with fronted adverbial material, boldfaced in (81), the purpose of which was to avoid any prosodic effects of having the subject initial in the utterance. Since we are looking for evidence that some languages, but not others, might have a pitch boost at the Left edge of the intonational phrase, this fronted phrase seems like a good place to look. In particular, we will consider the ratio between the highest pitch in this fronted phrase, on the one hand, and the highest pitch in the direct object:

(82) (*Italian*)



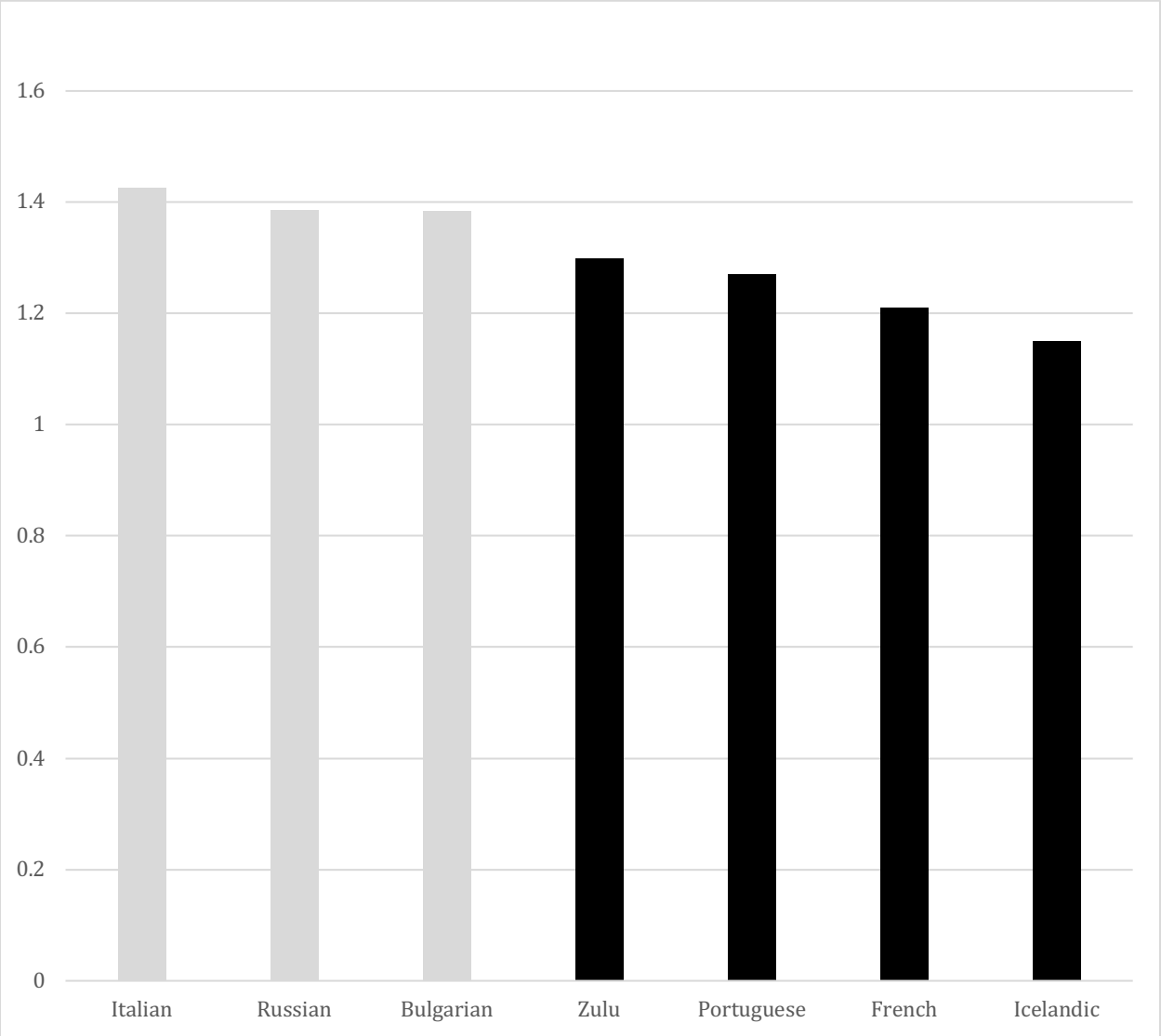
'Yesterday at the zoo, an intelligent elephant discovered a secret door and escaped from its cage'

By measuring this ratio, we hope to find out whether the fronted adverbial material is subject to a special pitch boost (using the direct object as a baseline). In the left-headed languages that the Pitch experiment identified as Right-active in ϕ, the averages for the ratio depicted in (82) are given below in a table in (83), and as a bar graph in (84):

(83)

Italian	1.43
Russian	1.39
Bulgarian	1.38
Zulu	1.3
Portuguese	1.27
French	1.21
Icelandic	1.15

(84)



As (83-84) demonstrate, there are two kinds of languages that are Right-active in ϕ. In one type of language, represented here by Italian, Russian, and Bulgarian, the fronted adverbial material is comparatively high, around 1.4 times as high as the direct object. In the second type, exemplified by Portuguese, French, Zulu, and Icelandic, the fronted adverbial material is only around 1.2-1.3 times as high as the direct object. The contrast between the two groups of languages is statistically significant. I will discuss the statistics in detail shortly, but let me first just point out that this division is the one we had hoped for; Italian, Russian, and Bulgarian

appear to have a special pitch boost at the left edge of the clause, despite being Right-active languages in ϕ, and Portuguese, French, Zulu, and Icelandic lack such a pitch boost.

The statistical analysis of the data involves the model in (85):

(85) ratio ~ language + (1 | speaker)

Here we are simply asking whether the ratio of the highest point in the fronted material to that in the direct object varies significantly with the language, with random slopes for individual speakers. As before, *language* is user-coded to test the hypothesis under consideration, with *language1* dividing Italian, Russian, and Bulgarian, on the one hand, from Portuguese, French, Zulu, and Icelandic, on the other. R reports the following results:

(86)	Estimate	Std. Error	df	t value	*p*
(Intercept)	1.30097	0.02983	22.87538	43.615	< 2e-16 ***
language1	0.02441	0.00861	23.15875	2.836	0.00933 **
language2	-0.01303	0.06638	21.71722	-0.196	0.84620
language3	-0.01621	0.05574	23.06368	-0.291	0.77377
language4	0.02940	0.06061	25.21984	0.485	0.63182
language5	-0.01507	0.05495	23.28865	-0.274	0.78626
language6	-0.08026	0.07194	21.47395	-1.116	0.27690

We can see in (86) that *language1* is statistically significant ($p < .01$): Italian, Russian, and Bulgarian genuinely have a significantly higher ratio than Zulu, Portuguese, French, and Icelandic. None of the other *language* divisions are statistically significant.

It looks as though Francis (2015) was right. Italian, Russian, and Bulgarian, although they are Right-active as far as ϕ is concerned, are Left-active in ι; they have a special pitch boost at the left edge of ι. Zulu, Portuguese, French, and Icelandic, by contrast, lack the clause-initial pitch boost; they are Right-active both in ϕ and in ι. To fully discuss the status of Italian, Russian, and Bulgarian would involve developing a Contiguity-theoretic approach to multiple-wh questions, which is a complicated enough topic that I will reserve it for another paper (Richards in progress). For current purposes, let us simply say that while Italian, Russian, and

Bulgarian are generally Right-active, they are Left-active specifically for the prosodic correlate of CP, the projection which hosts wh-movement. We can say that this is why, despite their generally Right-active status, they behave as Left-active for purposes of wh-movement.

6. Conclusions

I have argued in this paper that it is a mistake to grant ourselves the power to independently specify, for a given type of movement, whether it is overt or covert in a given language. At least for this type of phenomenon, it is possible that there are no strictly syntactic parameters at all; what there are, rather, are universal conditions on the prosodic consequences of Probe-Goal relations, interacting with a cross-linguistically invariant syntax, and cross-linguistic variation which is confined to facts about phonology. For this paper, those facts involved the position of prosodic prominence in the Phonological Phrase (ϕ) and in the Intonational Phrase (ι). We have seen that, as usual, the comparatively simple requirements imposed by this theory interact with other requirements (hopefully also simple in their own right) to yield apparent complexity. Icelandic, for example, should have wh-in-situ as an option, given its distribution of prosodic prominence, but it does not, because of independent properties of V2 languages. The project suggested by this work is a familiar one: we should continue to apply the general approach to more languages[13] and more kinds of movement, to develop an inventory of the kinds of forces that drive the patterns that we find.

[13] See, for example, Tan (2017) on Singapore English (Singlish) and Moran (2017) on Modern Standard Arabic.

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