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# Segmental Faithfulness to Semantic Heads in Novel Spanish Blends[1]

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## Abstract

In an experiment testing segmental faithfulness using novel blends in Spanish, we find that segments from a blend's semantic head are preserved at the expense of segments from the nonhead. These results replicate and extend previous results from English, confirming that the semantic head can function as a phonologically strong position. More broadly, these findings contribute to evidence that factors beyond phonetic salience are able to motivate phonological privilege.

**Keywords:** blend phonology; emergent effects; positional faithfulness; semantic head; experimental phonology

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**Resum.** En un experiment que comprova la fidelitat segmental per mitjà de nous encreuaments lèxics de l'espanyol, es demostra que els segments del nucli semàntic d'un encreuament lèxic es conserven, en detriment dels segments no nuclears. Aquests resultats reprodueixen i amplien els resultats anteriors sobre l'anglès, i confirmen que el nucli semàntic pot funcionar com una posició fonològica forta. A més, aquesta troballa aporta evidència que factors addicionals a la prominència fonètica poden motivar el privilegi fonològic.

**Paraules clau:** fonologia dels encreuaments lèxics; efectes emergents; fidelitat posicional; nucli semàntic; fonologia experimental

## 1. Introduction

Many languages show *positional neutralization effects* (see, e.g., Trubetzkoy 1969 [1939]: 235-236; Casali 1996; Beckman 1997; Steriade 1999; Zoll 2004). In this pattern, *strong* or *privileged* positions or domains, such as syllable onsets or stressed syllables, allow a phonological contrast to surface, while the complementary *weak* positions or domains, such as syllable codas or unstressed syllables, require the neutralization of that same contrast. Although positional neutralization effects are widely observed, there has been controversy over the best phonological account of such patterns.

Early approaches within constraint-based phonology (e.g., Casali 1996, 1997; Zoll 2004; Beckman 1997, 1999) hold that constraints referring to members of a universal inventory of strong positions are part of a universal constraint set, even if in some languages these positional constraints are ranked too low for their effects to be observed directly. This view predicts that positional privilege effects that are not otherwise active in driving the phonology-internal patterns of the language can *emerge* in other contexts, including interlanguage phonology (Broselow et al. 1998) and language games (Moreton et al. 2008).

An alternative view holds that certain positions in particular languages acquire phonological privilege for diachronic reasons (Kochetov 2002, 2003; Barnes 2006). Specifically, some positions are *phonetically* better able to support contrasts. For example, Barnes (2006) argues that stressed syllables are often longer, which allows vowel contrasts to be produced and perceived more accurately than in unstressed syllables. As a result, such phonetically strong positions are less likely to be affected by misperception and reanalysis than their weak counterparts during diachronic transmission, which leads to a lower likelihood of neutralization in phonetically strong positions over time. On this view, there is no role for a universal component of the phonological grammar—whether innate, or induced by all learners on the basis of universally available phonetic or other factors—in specifying, say, 'stressed syllable' as a position that is privileged compared to 'unstressed syllable'. Speakers simply learn phonological patterns that they are exposed to, which happen to have been shaped by the dynamics of historical change. Consequently, this approach does not predict that effects of positional privilege beyond those supported by the ambient language data should emerge in novel contexts, since speakers would have no innate or crosslinguistic tendency to treat positions as inherently strong in the absence of direct phonological evidence.

While this diachronic explanation for positional privilege in phonetically strong positions is appealing, there are other strong positions whose phonological privilege arises for *non-phonetic* reasons, such as special status in the psycholinguistic or morphological domain (Beckman 1999). Effects of this type are difficult to account for in terms of diachronic phonetic factors alone—especially in the case of emergent effects, which show speaker sensitivity to strong positions in the absence of phonology-internal evidence.

Non-phonological *headedness* is one non-phonetic factor that can give rise to phonological privilege. Morphological head-privilege effects have been found for lexical stress in Greek, Russian, and Salish languages (Revithiadou 1999), and for segment preservation in Hebrew denominal verb formation (Ussishkin 1999). Similarly, a growing body of experimental evidence supports the view that *semantic head-privilege effects* influence speakers' phonological acceptability judgments of novel *lexical blends*, which are the output of a nonconcatenative morphological process that is semantically similar to compounding, but has the status of a playful or expressive process (Pullum & Zwicky 1987; Piñeros 2004), much like a language game. Shaw (2013; Shaw et al. 2014) found evidence of semantic head-privilege effects both for stress and for segmental faithfulness in novel-blend experiments with English speakers, even though there is no clear evidence for a similar effect of privilege for semantic heads in the non-blend phonology of English (in compounds, for example, it is actually the nonhead that bears the compound stress in many cases (Chomsky & Halle 1968), though see also Plag (2006; Plag et al. 2008)). These effects were replicated on a larger scale in an internet-based experiment by Moreton et al. (2017). In addition, Broad

(2015) found that the pitch-accent pattern of the semantic head is one of several factors influencing pitch accent in lexical blends in Japanese.

We present results from an experiment on novel-blend judgments in Spanish. Since Spanish, unlike English, allows blends to be semantically left-headed, this experiment provides a potentially more sensitive method for detecting head-privilege effects than was available in similar experiments with English speakers. The results do indeed show head-privilege effects for segmental faithfulness—contributing to evidence that (a) the semantic head is a strong position, and (b) positional-privilege effects are available to speakers even when there is no direct evidence for such effects in the non-blend phonology.

Background discussion of lexical blends, semantic headedness, and the head-privilege hypothesis is provided in §2. The experiment design and methodology, along with the predictions of the head-privilege hypothesis, are presented in §3, with results and analysis given in §4. Finally, conclusions and implications are discussed in §5.

## 2. Blends, semantic headedness, and the head-privilege hypothesis

The novel-blend experiment asks participants to choose the best way of matching two different blend forms with definitions that correspond to two different headedness structures, as a way to test for semantic head-privilege effects in segmental faithfulness. This section provides background and context for the experiment, giving an overview of lexical blends and associated terminology in §2.1, laying out criteria for determining the semantic head of a blend in §2.2, and presenting the head-privilege hypothesis in §2.3.

### *2.1 Blends*

A *lexical blend* is the outcome of an intentional, nonconcatenative word-formation process in which material from two (or sometimes more) *source words* is combined into a single phonological word that is shorter in length than a concatenation of the source words would be, due to *truncation* of one or both source words and/or to *overlap* of identical or similar material from the source words (see, e.g., Algeo 1977; Kubozono 1990; Bat-El 2006; Renner et al. 2012). Because blending, like language games, is outside the ‘ordinary’ morphological and phonological systems of the language, it has the potential to serve as external evidence for claims about the structure of the grammar (Piñeros 2004; Gries 2012; Moreton et al. 2017).

Blending is relatively productive in some languages, such as English (Algeo 1977). Blends are likewise attested in Spanish (Casado Velarde 1985; Pharies 1987; Rodríguez

González 1989; Piñeros 1998, 2004), although blending seems to be less productive in Spanish than it is in English. Examples of Colombian Spanish blends from Piñeros (2004) are shown in (1), where segments from the first source word (Word1) are indicated with **bold type** and segments from the second source word (Word2) with *italic type*. A segment corresponding to both source words (in the case of overlap) is also underlined. Material from a source word that is truncated from a blend is indicated in <angle brackets>.[2]

(1) Spanish blends (Piñeros 2004: 207)

| | Word1 | | Word2 | | Blend |
|---|---|---|---|---|---|
| (a) | [**pansa**] | + | [<*sant*>*aklos*] | → | [**pans**_**a**_*klos*] |
| | 'belly' | | 'Santa Claus' | | 'potbellied Santa Claus' |
| (b) | [**bɾux**<**a**>] | + | [<*m*>*uxeres*] | → | [**bɾ**_**ux**_*eres*] |
| | 'witch' | | 'women' | | 'mean women' |

Like the naturally occurring blends in (1), each novel blend created for the experiment (see §3.1) begins with material from the left edge of Word1, ends with material from the right edge of Word2, and has overlap between the two source words at the blend's *switchpoint*, the point in the blend where material from Word1 ends and material from Word2 begins. Blends created for the experiment involve truncation of at least one of the source words as well.

### *2.2 Semantic headedness*

If the *semantic head* is a phonologically privileged position, this predicts that, all else being equal, speakers will preserve material from the source word that is the semantic head of a blend at the expense of material from the nonhead source word. To test this hypothesis, we must be able to determine which source word forms the semantic head of a given blend.

Blends are similar to compounds in being composed of two independent words that are morphologically combined. For compounds, the semantic head can be determined on the basis of the semantic relation of *hyponymy*, the IS-A-KIND-OF relation (Allen 1978; Guevarra

2 Piñeros (2004) argues that Spanish blends of the type called *portmanteaus* by Algeo (1977) involve overlap between segments that are featurally similar and stand in equivalent prosodic positions, such as [b]:[m] and [a]:[e] in [_**b**_**ɾ**_**uxe**_*res*] (compare (1b)), or [p]:[s], [a]:[a], [n]:[n], and [s]:[t] in [_**pansa**_*klos*] (compare (1a)). Piñeros's analysis therefore posits less truncation and more overlap in these two blends than is indicated in (1). See §2.3 for discussion.

& Scalise 2009). A compound A+B is *left-headed* if A+B is a kind of A, or *right-headed* if A+B is a kind of B. Some compounds, known as *coordinating* or dvandva compounds, mean something like “a combination of A and B”, and thus have both A and B as heads. (*Exocentric* compounds, in which A+B is neither a kind of A nor a kind of B, are not relevant here.) Given the similarity between compounds and blends, the hyponymy diagnostic can also be used to identify the head of a blend (Piñeros 2004; Bat-El 2006).

Just as compounds in Spanish can be either left-headed or right-headed (Guevara 2012), both semantically left-headed and semantically right-headed blends can be formed in Spanish as well, as illustrated in (2), where semantic heads are indicated with SMALL CAPITALS in the English gloss.

(2) Left-headed and right-headed blends in Spanish

(a) Left-headed (Pharies 1987: 273)

| | | | | |
|---|---|---|---|---|
| [**kɾistaleɾia**] | + | [*espaɲola*] | → | [**kɾist**<u>*a*</u>*ɲola*] |
| ‘GLASSWARE’ | | ‘Spanish’ | | ‘Spanish GLASSWARE’ (a brand name) |

(b) Right-headed (Piñeros 2004: 207)

| | | | | |
|---|---|---|---|---|
| [**bɾuxa**] | + | [*muxeres*] | → | [**bɾ**<u>*ux*</u>*eres*] |
| ‘witch’ | | ‘WOMEN’ | | ‘mean WOMEN’ |

The blend definitions presented in the experiment (see §3.1) were constructed to provide one left-headed and one right-headed blend interpretation for each source-word pair.

As is discussed further in §3.4.2 below, Spanish crucially differs in this respect from English, which does not allow left-headed blends like that in (2a). Previous experiments on semantic head-privilege effects in English (Moreton et al. 2017) could only compare right-headed with coordinating blends.

### *2.3 The semantic-head privilege hypothesis*

Although, to our knowledge, no previous research has uncovered direct evidence showing semantic (or even morphological) head-privilege effects for segments in the non-blend phonology of Spanish, there are reasons to expect Spanish speakers to be sensitive to semantic head privilege for segmental faithfulness in blends. The novel-blend experiment is designed to test this (*semantic) head-privilege hypothesis*, which predicts that speakers will prefer blend forms that are faithful to segmental material from the semantic head source word at the expense of material from the nonhead.

The main factor supporting this prediction is that experiments with English speakers, using a paradigm much like that used here, have found head-privilege effects for both stress and segments in novel-blend formation, despite the fact that no direct evidence of head privilege for either stress or segments is known to be available in the non-blend phonology of English (Shaw 2013; Shaw et al. 2014; Moreton et al. 2017). These results are consistent with the view that semantic head privilege is a crosslinguistic phenomenon, and provide evidence that speakers can be influenced by segmental semantic head-privilege effects in blend formation; therefore, we expect to see a similar result in Spanish. In fact, given that the properties of blend formation in Spanish let us directly compare left-headed and right-headed blends, which is not possible in English, segmental head-privilege effects should be even stronger in Spanish (see §3.4.2 for discussion).

We also note that semantic head privilege for stress (though not for segments) may play a role in one class of attested Spanish lexical blends. Piñeros (2004) follows Algeo (1977) in distinguishing between blends that are *telescopes*, composed of syntagmatically related words (adjacent in an utterance), and blends that are *portmanteaus*, composed of paradigmatically related words (with some kind of semantic association, including near-synonyms and words that are semantically linked in the context). Crucially, Piñeros (2004) argues that the two classes of blends in Spanish are phonologically distinct. Telescopes, such as [**kɾistaleɾia**] 'glassware' + [*espaɲola*] 'Spanish' → [**kɾista**<u>*a*</u>*ɲola*] 'Spanish glassware' (2a), tend to overlap by a few segments at the switchpoint while maintaining Word1 and Word2 material at the left and right edges respectively. In contrast, Piñeros proposes that portmanteaus, such as the examples in (1), tend to preserve the prosodic structure (including syllable count and stress pattern) of whichever source word is the semantic head—which would be evidence for semantic head privilege in the stress domain. This pattern is only indirectly related to the novel-blend experiment discussed here, where the faithfulness effects in question involve segmental preservation rather than stress, and where all blend stimuli have the phonological structure of telescopes (with a small amount of medial overlap) rather than portmanteaus (which have near-complete superposition of one source word onto another). Nevertheless, if Piñeros (2004) is correct that semantic head-privilege effects for stress are at work in Spanish portmanteau blends, the potential for semantic head-privilege effects for segments in telescope blends may be relatively accessible to Spanish speakers.[3]

Semantic headedness is conceptually distinct from morphological headedness, and there is preliminary evidence that the two types of headedness are indeed distinct in Spanish blends. The results of a pilot experiment (Pertsova et al. 2016) show that grammatical gender in Spanish blends is significantly better predicted by the right-hand element than by the semantic head; this suggests that the *morphological* head is typically the blend's second source word, no matter which source word serves as the *semantic* head. Nevertheless, semantic headedness and morphological headedness are both types of non-phonetic privilege that involve standing in a structurally privileged relation to associated material. Given this general similarity, it is worth noting that there is evidence for morphological head-privilege effects in non-blend phonology. Revithiadou (1999) proposes, on the basis of stress patterns in Greek, Russian, and several Salish languages, that faithfulness to lexically marked stress on morphological heads takes precedence over faithfulness to lexically marked stress on nonheads. She accounts for this pattern by proposing a set of *morphological head-faithfulness* constraints on stress, that is, positional faithfulness constraints (Beckman 1997, 1999; Casali 1996, 1997) that assign violations for deletion or insertion of stress specifically within a morphological head. Ussishkin (1999) extends Revithiadou's proposal beyond stress, demonstrating that in a particular denominal verb construction in Modern Hebrew, segments from the verb-creating affix, which is the morphological head, are preserved at the expense of segments from the noun base.

There may in fact be evidence for morphological head-privilege effects for stress in the non-blend phonology of Spanish. The analysis of Spanish word stress has a long and

3 This tentative prediction is further complicated by the fact that Piñeros (2004) proposes head faithfulness for prosody, but *nonhead* faithfulness for segmental material, in portmanteau blends. This aspect of his proposal would seem to predict that experiment participants would show nonhead privilege, rather than head privilege, for segmental faithfulness. However, the segmental aspect of Piñeros's analysis may bear reconsideration. Fundamentally, his proposal is that the head establishes the prosodic structure of a portmanteau, and nonhead segmental material is superimposed over head material, leading to greater segmental (featural) faithfulness to the nonhead. But this need not be caused by faithfulness to the nonhead specifically; Piñeros's blend-specific constraint RECOVERABILITY, which requires that the source words be identifiable to the listener when a blend is uttered, might be the driving force behind the overwriting of head segments by nonhead segments.

controversial history, but the account developed by Piñeros (2016) allows for individual morphemes to distort a phonologically regular stress-placement pattern by being either "stress repellers" or "stress attractors." Crucially, Piñeros (2016) argues that such a morpheme can realize its status as a stress repeller or attractor only when it is the morphological head (the root or the outermost derivational affix) of a word, a proposal that is consistent with morphological head-specific faithfulness to lexical stress representations.

In summary, if phonological constraints enforcing semantic head privilege are universal—either innate, or induced by learners on the basis of universally available factors—then semantic head privilege should have an effect on Spanish speakers' judgments about segmental faithfulness in novel blends, similar to what has been found for English. This prediction may be strengthened by the fact that semantic head-privilege effects for *stress* are evident in Spanish portmanteaus, a different subtype of blend formation, and perhaps even by the fact that *morphological* head-privilege effects for stress are seen in the Spanish non-blend phonology. Crucially, however, head faithfulness for *segments*—whether semantic or morphological—does not seem to play a role in either the blend or non-blend phonology of Spanish, and so finding evidence for the emergence of segmental head privilege in blend formation would have implications for the crosslinguistic availability of phonological privilege effects for positions that are defined by non-phonetic salience.

## 3. Research questions, experiment design, and predictions

The Spanish novel-blend experiment addresses the following research questions:

(3) Research questions

- (a) Can the segmental semantic head-privilege effect previously found for English novel blends be replicated for Spanish?
- (b) Is evidence for semantic head-privilege effects stronger when comparing left-headed vs. right-headed blends (Spanish) than when comparing coordinating vs. right-headed blends (English)?

The (semantic) head-privilege hypothesis, under the assumption that head-specific faithfulness constraints are universally available, predicts that the answer to both questions is *yes*, as discussed below in §3.4. First, however, this section presents the details of the experiment: stimuli in §3.1, task in §3.2, and participants in §3.3.

*3.1 Stimuli*

The participants' task in the novel-blend experiment, described more fully below, was to decide how two different blend forms made from the same pair of source words should be matched to two possible definitions. Thus, each stimulus item in the experiment consisted of a pair of source words, two blend forms created from the source words, and two definitions.

Each pair of source words was *ambiblendable*, following the methodology developed by Shaw (2013; Shaw et al. 2014). That is, the source words could be acceptably blended at two different switchpoints, such that the earlier switchpoint preserved less of Word1 and more of Word2, while the later switchpoint preserved more of Word1 and less of Word2. This configuration forced participants to make a choice: for a given blend definition, which source word should the blend form preserve more fully?

The source-word pairs and corresponding blend pairs for this study were created according to the following criteria.

(4) Criteria for stimuli in blend headedness experiment

- (a) All source words were nouns
- (b) The two source words in each pair had the same gender (feminine or masculine)
- (c) The two source words in each pair included a string $C_1VC_2$, where $C_1$ and $C_2$ were found in each source word, but V differed between the source words (example: **ra**{**tón**} 'mouse' + {*tún*}*el* 'tunnel', which share [t]_[n] but differ in [o]/[u])
- (d) All blends had plausible left-headed and right-headed definitions
- (e) Blends that could be given a phrasal (noun+adjective) interpretation were avoided, in order to ensure that all source words were interpreted as nouns

The Spanish lexical frequency database LEXESP (Sebastián Gallés et. al. 2000) was searched exhaustively for source-word pairs meeting the morphological and phonological criteria (4a–c). The results of this search were then inspected manually to identify a set of eleven source-word pairs that met the semantic criteria (4d–e) and had phonologically plausible blend candidates. (A complete list of source-word pairs, blend forms, and definitions is included in the Appendix.)

The two blend options for each source-word pair were created by blending the source words in two ways, using either the first matching consonant ($C_1$) or the second matching consonant ($C_2$) as the switchpoint. For example, the source-word pair **ratón** 'mouse' + *túnel* ‘tunnel’ would have the blend forms **ra*t***_únel_, with switchpoint [t], and **rató*n***_el_, with switchpoint [n]. These blend forms do not necessarily represent the only way to blend their two source forms in Spanish, but they are plausible. Even if an alternative blend form is preferable, participants’ judgments about how to assign the two blend forms they are given to the definitions in the experiment provide crucial information about the role of head faithfulness in blend formation. As demonstrated by the tableaus in section 3.4.1 below, the response options were explicitly selected in order to control for all factors other than whether head or nonhead material is preferentially preserved.

Finally, each pair of blends was given two definitions, one making the blend left-headed and the other making the blend right-headed, as in (5).

(5) Left- and right-headed definitions for **ratón** ‘mouse’ + *túnel* ‘tunnel’

(a) Left-headed definition

*Un* ________ *es algo que vive en un túnel y es una especie de ratón*

‘A ________ is something that lives in a tunnel and is a kind of mouse’

(b) Right-headed definition

*Un* ________ *es una especie de túnel en que viven los ratones*

‘A ________ is a type of tunnel that mice live in’

The order of the source words was held constant across the definitions, with Word2 appearing first and Word1 appearing afterward. This strategy, which made the definitions sound less similar to the blends themselves, was intended to encourage participants to pay attention to the meanings of the definitions rather than scanning them superficially. This did, however, mean that one of the definitions in each pair sometimes had slightly less natural syntax than the other.

The definitions, as well as the experiment instructions, were reviewed by a native speaker before the experiment was run.

*3.2 Task*

As outlined above, we predict that, if participants prefer to preserve material from the semantic head in creating a blend, they will prefer to match a left-headed definition with the blend option that preserves more of Word1, and a right-headed definition with the blend option that preserves more of Word2. Therefore, on each trial in the experiment, participants were presented with a source-word pair, the two corresponding blend options, and the two different definitions, and their task was to match each blend option to one of the definitions.

This task was performed by means of a drag-and-drop interface: participants were asked to click on and drag a blend form from the top of the display and drop it into a box contained in one of the two definitions. The other blend form would then automatically appear in the other definition. Participants were able to change their answer by moving either blend form into the other box as many times as they needed before submitting their response. An example stimulus screen from the experiment is shown in Figure 1, for the blend pair **ratón** 'mouse' + *túnel* 'tunnel' whose definitions were given in (5) above.

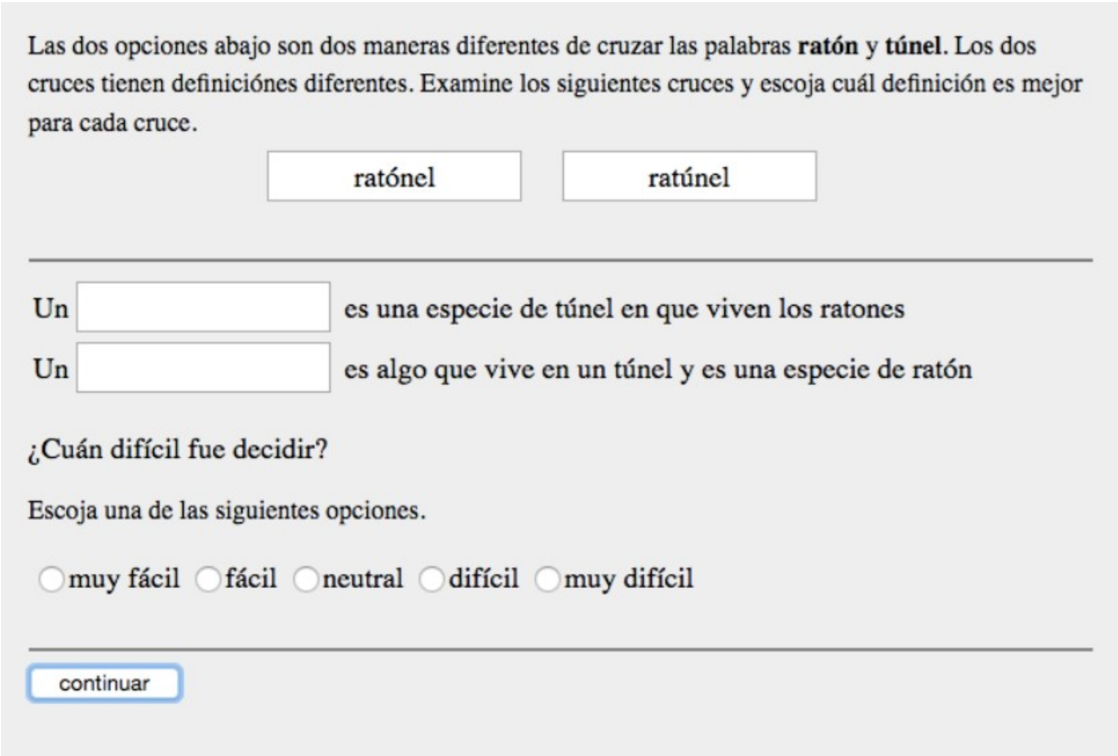


*Figure 1. An example stimulus screen from the experiment, for blends created from* ***ratón*** *'mouse'* + túnel *'tunnel'.*

The experiment was presented to participants using Experigen (Becker & Levine 2013), an online experiment platform developed for linguistics experiments. Participants were first given a short introduction to the concept of lexical blending. Then they completed a warm-up exercise designed to familiarize them with the drag-and-drop interface. After that came the main experiment, in which 11 blend stimuli were presented, one at a time (in one of four versions, each with different randomized orders of the blend stimulus screens, and each with a different but balanced distribution of orders of the blend form options and definitions). Each stimulus screen included a short version of the drag-and-drop task instructions, reminding participants that they were being asked to choose which definition is best for each blend. Each stimulus screen also included a difficulty rating scale: participants were asked to rate the difficulty of their decision for the current blend pair from 1 (very easy) to 5 (very difficult). At the bottom of the screen was a button that participants could click in order to progress to the next item. Both the blend response and the difficulty rating had to be completed before the experiment would progress, ensuring that participants were not able to skip any questions.

At the end of the experiment, participants were asked to fill out a demographic survey, which collected information about native language, any additional languages spoken, gender, place of birth, current location, and age. Responses were not required for all questions, but any participants that listed only a language other than Spanish as a native language were excluded from analysis (see below).

*3.3 Participants*

Participants for the novel-blends experiment were recruited in March 2016 on Amazon Mechanical Turk (AMT), an online labor exchange that has been used to collect speaker judgments in linguistics experiments (Sprouse 2011). Pavlick et al. (2014: 87), in a study of speaker demographics and translation reliability on AMT, included Spanish in a list of 13 languages that they determined to be "good candidates for research now," i.e., at approximately the time when the Spanish blend judgments were collected.

A total of 80 participants completed the experiment. Of these, eight participants were excluded from data analysis: five who listed only a native language other than Spanish in the demographic survey that followed the main experiment, one whose answers to the demographic survey were incoherent, indicating a lack of understanding; one whose responses were not recorded correctly due to a technical malfunction; and one who matched the first versus second blend form to the first versus second listed definition in the same way for all stimulus screens, suggesting a lack of attention to the task. As a result, data from 72 participants was included in the statistical analysis.

Participants were paid USD $2.00 each for their participation. The experiment and demographic questionnaire took an average of 12.5 minutes for participants to complete; 85% of the participants finished within 20 minutes, and 93% finished within 30 minutes.

All participants recruited for this study had previously completed at least 100 tasks on AMT with an approval rating of at least 95%. This criterion was established both to increase the likelihood that participants would contribute valid responses, and also to replicate the criteria for the participants in the English novel-blend headedness experiments reported in Moreton et al. (2017).

### *3.4 Predictions of the head-privilege hypothesis*

The research questions addressed by this experiment, stated above in (3), are repeated here in (6). The predictions made by the semantic head-privilege hypothesis for each question are discussed in the remainder of this section.

(6) Research questions

- (a) Can the segmental semantic head-privilege effect previously found for English novel blends be replicated for Spanish?
- (b) Is evidence for semantic head-privilege effects stronger when comparing left-headed vs. right-headed blends (Spanish) than when comparing coordinating vs. right-headed blends (English)?

*3.4.1 Prediction: Segmental head-faithfulness effects in Spanish.* Following Revithiadou (1999) and Ussishkin (1999) in their work on morphological heads, we model semantic head-privilege effects by means of *positional faithfulness* constraints (Beckman 1997, 1999; Casali 1996, 1997)—faithfulness constraints that are indexed to particular strong positions and assign violations only within the relevant domain.[4] Deletion of segments violates the faithfulness constraint MAX (McCarthy & Prince 1995), so preservation of segments from the semantic head of a blend (at the expense of the nonhead) is driven by the positional version MAX-HEAD, formally defined in (7).

(7) MAX-HEAD Assign one violation for every input segment in the semantic head that has no output correspondent.

4 See Moreton et al. (2017) for a comparison of the positional-faithfulness approach with one assuming positional markedness, in which phonological requirements are enforced only within weak positions (e.g., Zoll 2004).

A phonological grammar that includes MAX-HEAD predicts segmental head-privilege effects in blends, regardless of the relative ranking (in Optimality Theory; Prince & Smolensky 2004) or weighting (in Harmonic Grammar; Legendre, Miyata, & Smolensky 1990) of this head-specific faithfulness constraint. The result of including MAX-HEAD in the grammar is illustrated in (8) and (9) for representative blend stimuli from the experiment. Each candidate in these tableaus represents one of the two ways of matching the Word1-maximizing and Word2-maximizing blend forms with the left-headed and right-headed definitions—that is, *each* candidate includes *both* blend forms and *both* definitions, and the two candidates in a tableau differ only in how blend forms are *matched* to definitions (indicating which source word is the head for each blend form). Crucially, it is the two different ways of matching the blend forms with the definitions (indicating headedness) that causes the candidates to violate MAX-HEAD to different degrees. Moreover, since the experiment only involves deciding which blend form to pair with which definition, the blend options and headedness options are the same in both candidate responses; as a consequence, the two candidates in each tableau incur *exactly the same* constraint violations for all constraints other than head-faithfulness constraints.

In (8), candidate (8a) represents the response that pairs **rató**_**n**_*el*, the blend option that preserves all of Word1, with the left-headed definition, and **ra**_**t**_*únel*, which preserves all of Word2, with the right-headed definition. As a result, candidate (8a) has no violations of MAX-HEAD. The alternative response, candidate (8b), assigns blend options to definitions the opposite way: the left-headed definition is paired with the blend form that has lost [**on**] from Word1, and the right-headed definition with the blend form that has lost [*tu*] from Word2, incurring a total of four violations of MAX-HEAD for the four deleted segments. (MAX and MAX-HEAD violations are represented with the segments whose deletion results in those violations. **Bold** and *italic* typefaces indicate correspondence between the source words and the blend forms; _**overlapping**_ segments correspond to both source words.)

(8) Predicted head-privilege effects: **ratón** ‘mouse’ + *túnel* ‘tunnel’

| | | Source words & headedness | Candidate | MAX-HEAD | MAX |
|---|---|---|---|---|---|
| → (a) | i. | **ratón** (hd) + *túnel* | **ratón*n****el* | | *t u* |
| | ii. | **ratón** + *túnel* (hd) | **ra*t****únel* | | **o n** |
| (b) | i. | **ratón** + *túnel* (hd) | **ratón*n****el* | *t u* | *t u* |
| | ii. | **ratón** (hd) + *túnel* | **ra*t****únel* | **o n** | **o n** |

As explained above, since both candidates contain the same two blend forms, they have *identical violations* of all other constraints, including general MAX as well as any relevant markedness constraints such as NOCODA. For this reason, MAX-HEAD predicts head-privilege effects even if it is not particularly highly ranked (in OT) or heavily weighted (in HG); it could be ranked anywhere in the constraint hierarchy, or contribute any non-zero amount of weight, and would still cause the grammar to prefer candidate (8a) over (8b).

Tableau (9) confirms that head-privilege effects are predicted even for a blend-form pair where neither candidate satisfies MAX-HEAD perfectly. Candidate (9a), which pairs the Word1-maximizing blend option with the left-headed definition and the Word2-maximizing blend option with the right-headed definition, still violates MAX-HEAD to a lesser degree than candidate (9b), which has the opposite assignment of blend forms to definitions.

(9) Predicted head-privilege effects: **vitamina** ‘vitamin’ + *manzana* ‘apple’

| | | Source words & headedness | Candidate | MAX-HEAD | MAX |
|---|---|---|---|---|---|
| → (a) | i. | **vitamina** (hd) + *manzana* | **vitami*n****zana* | **a** | **a** , *m a* |
| | ii. | **vitamina** + *manzana* (hd) | **vita*m****anzana* | | **i n a** |
| (b) | i. | **vitamina** + *manzana* (hd) | **vitami*n****zana* | *m a* | **a** , *m a* |
| | ii. | **vitamina** (hd) + *manzana* | **vita*m****anzana* | **i n a** | **i n a** |

As shown in (8) and (9), we treat segments in blend forms as overlapping (corresponding to both source words) if they are *featurally identical* in both source words, form a *contiguous string*, and are *adjacent to source-word material*, specifically, to Word1 material on the left and to Word2 material on the right. By contrast, Piñeros (2004) proposes that Spanish blends of the portmanteau type have overlap between segments that are featurally similar and stand in equivalent prosodic positions, even when this means that an overlapping segment is not identical to one of its source-word correspondents.[5] If Piñeros's analysis were extended to the telescope-type blends in the experiment, we would treat the blend forms as preserving all or nearly all segments from both blends: **rató_n_**_el_ from (8) would be represented as **ra_tón_**_el_, as in (10)—with additional correspondence between the blend [t] and the [t] in Word2 *túnel*, and between the blend [o] and the [u] in *túnel*, although this blend form would be unfaithful to the [+high] feature specification of the Word2 [u].

(10) Predicted head-privilege effects, extended overlap: **ratón** 'mouse' + *túnel* 'tunnel'

| | | Source words & headedness | Candidate | IDENT[±high]-HEAD | MAX-HEAD | MAX |
|---|---|---|---|---|---|---|
| → (a) | i. | **ratón** (hd) + *túnel* | **ra_tón_**_el_ | | | |
| | ii. | **ratón** + *túnel* (hd) | **ra_tún_**_el_ | | | |
| (b) | i. | **ratón** + *túnel* (hd) | **ra_tón_**_el_ | *u* | | |
| | ii. | **ratón** (hd) + *túnel* | **ra_tún_**_el_ | **o** | | |

As (10) indicates, under Piñeros's assumptions about overlap, MAX-HEAD no longer distinguishes between the two candidates; all segments from both source words have correspondents in each blend form, so neither pairing of blends with definitions violates MAX-HEAD at all. However, head-specific versions of *featural faithfulness* constraints (McCarthy & Prince (1995), such as IDENT[±high]-HEAD, now differentiate the candidates instead. The blend form **ra_t[o]n_**_el_ violates IDENT[±high]-HEAD when the head is Word2 *t*[*u*]*nel*, as in (10b), but not when the head is Word1 **rat[o]n**, as in (10a), and vice versa for the blend form **ra_t[u]n_**_el_. Comparing (8) with (10) demonstrates that, no matter which approach to defining overlap is taken, some type of head-faithfulness constraint predicts head-privilege effects. Thus, the overall predictions for the blend experiment do not depend on how source-word

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5 Piñeros (2004) also allows for overlap involving segments that are not contiguous with material from the same source word; see his analysis of **_b_r_uj_**_eres_ in footnote 2, where **_b...u_** corresponds to the *mu* of Word2 *mujeres* despite the intervening **r** that corresponds only to the **r** of Word1 **bruja**.

overlap in blend forms is defined: if there are segmental head-faithfulness constraints in the grammar, this predicts head-privilege effects in the experiment.

*3.4.2 Prediction: Stronger head-privilege effects in Spanish.* Shaw (2013; Shaw et al. 2014) and Moreton et al. (2017), using a similar blend-to-definition matching task, found evidence for segmental head-privilege effects in English. Because left-headed blends are not generally acceptable in English, the two definitions used in the English experiments contrasted *right-headed* blends, where Word2 is the head, and *coordinating*, or double-headed, blends, where both Word1 and Word2 are heads. The difference between these two headedness structures likewise predicts head-privilege effects in a blend-to-definition matching task, as shown in (11). Specifically, violations of MAX-HEAD are minimized when the the right-headed definition is matched with the Word2-maximizing blend option (here, **pi***rhino*), as in candidate (11a), rather than with the Word1-maximizing option (**pira*****n****ho*), as in candidate (11b).

(11) Prediction of head faithfulness, English: **piranha** + *rhino* (Moreton et al. 2017: 359)

| | | Source words & headedness | Candidate | MAX-HEAD | MAX |
|---|---|---|---|---|---|
| → (a) | i. | **p ɪ ɹ ɑ n ə** (hd) + *ɹ aɪ n oʊ* (hd) | **p ɪ ɹ ɑ *n*** *oʊ* | **ə**, *ɹ aɪ* | **ə**, *ɹ aɪ* |
| | ii. | **p ɪ ɹ ɑ n ə** + *ɹ aɪ n oʊ* (hd) | **p ɪ** *ɹ aɪ n oʊ* | | **a n ə** |
| (b) | i. | **p ɪ ɹ ɑ n ə** + *ɹ aɪ n oʊ* (hd) | **p ɪ ɹ ɑ *n*** *oʊ* | *ɹ aɪ* | **ə**, *ɹ aɪ* |
| | ii. | **p ɪ ɹ ɑ n ə** (hd) + *ɹ aɪ n oʊ* (hd) | **p ɪ** *ɹ aɪ n oʊ* | **a n ə** | **a n ə** |

For both the English and Spanish blend experiments, then, the response option that minimizes constraint violations is the one that matches the *right*-headed definition with the *Word2*-maximizing blend. But for Spanish, the other definition, which must be matched to the Word1-maximizing blend, is *left*-headed, meaning that this half of the response option choice also serves to minimize MAX-HEAD violations. For English, left-headed blends are not an option, so the Word1-maximizing blend has to be matched to a *coordinating* blend. As a result, this half of the response option incurs multiple violations of MAX-HEAD for all of the Word2 segments that are missing from the blend (even though there is a high degree of faithfulness to Word1). This difference can be seen in comparing the winning candidate's violations in (11), for English, with those in (8) and (9) above, for Spanish.

In summary, the difference between the two candidates for each experiment item, in terms of their degree of constraint violation, is larger in Spanish than it is in English. This difference predicts a greater head-privilege effect in Spanish—a stronger preference for responses confirming to the semantic head-privilege hypothesis in the Spanish experiment than has been found for English.

## 4. Results and analysis

The experiment design included 11 source-word pairs, but after participant responses had been collected, we discovered that one of the blend response options for the stimulus **hospital** 'hospital' + *telegrama* 'telegram' had been misspelled ('hospitel**i**grama' instead of the intended 'hospitel**e**grama' for the blend option preserving more of Word2). All responses for this item were excluded from the statistical analysis, leaving 10 source-word pairs and a total of 720 responses.

Following Shaw (2013; Shaw et al. 2014) and Moreton et al. (2017), the results were analyzed both by participant and by response (with responses pooled across all participants). Each response was coded as *conforming* if it was consistent with the head-privilege hypothesis, mapping the blend that preserved more of Word1 to the left-headed definition and the blend that preserved more of Word2 to the right-headed definition, and *nonconforming* otherwise. Participants were coded as *conforming* if they gave a majority of conforming responses (6 or more out of 10), as *nonconforming* if they gave a minority of conforming responses (4 or fewer out of 10), and as *tied* if they gave exactly 5 out of 10 conforming responses. Both the by-participant analysis (§4.1) and the by-response analysis (§4.2) support the head-privilege hypothesis.

### *4.1 Results by participant*

As shown in (12), 75% of all participants had a majority of conforming responses, while only 12.5% had a majority of nonconforming responses, and another 12.5% had equal numbers[6] of conforming and nonconforming responses. The number of participants with each possible number of conforming responses (0 through 10 conforming responses) is plotted in Figure 2.

6 The 9 participants in the "tied" category were approximately evenly divided on the excluded item **hospital** 'hospital' + *telegrama* 'telegram', with 4 participants giving conforming responses for this item, and 5 giving nonconforming responses.

Dark bars represent conforming participants, white bars represent nonconforming participants, and the gray bar represents the 9 tied participants.

(12) Categories of participants in the blend headedness experiment

| Conforming | Tied | Nonconforming | *Total* |
|---|---|---|---|
| 54 (75%) | 9 (12.5%) | 9 (12.5%) | *72* |

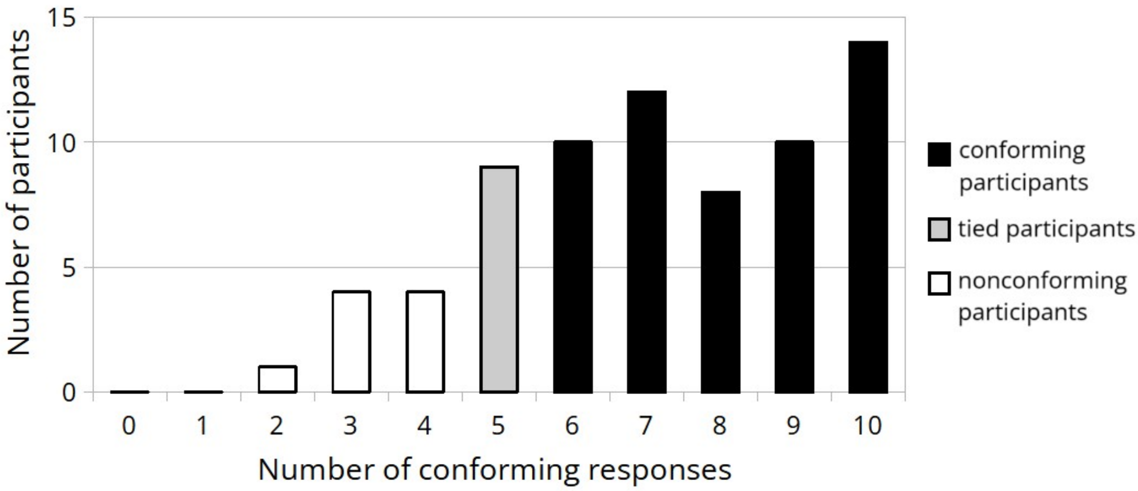


*Figure 2. Conforming, tied, and nonconforming participants in the blend headedness experiment.*

The proportion of conforming participants out of all conforming or nonconforming participants (that is, excluding tied participants), 0.86, was compared to the chance level of 0.5 with a two-sided exact binomial test (*binom.test()*) using the *stats* package of the statistical software R (R Core Team 2023). The results were highly significant, as reported in (13).

(13) Exact binomial test of non-tied participants in headedness experiment

| Conforming responses | | 95% confidence interval | | | |
|---|---|---|---|---|---|
| 6 or more | 4 or fewer | Min. | Est. | Max. | *p* |
| 54 | 9 | 0.75 | 0.86 | 0.93 | <0.001 |

The observed proportion of conforming participants, at 0.86 (with the model's estimated 95% confidence interval between 0.75 and 0.93), is significantly greater than chance. Thus, the results of the by-participants analysis support the claim that Spanish speakers show a preference for matching blend-form pairs to definitions in the way that maximizes segmental faithfulness to the semantic head.

*4.2 Results by response*

When the results from all 72 participants on the 10 analyzed items are pooled, there is an overall majority of conforming responses, as shown in (14). The number of conforming responses (out of a possible 72) is plotted for each source-word pair in Figure 3; these range from a high of 58 conforming responses for **sepultura** 'tomb' + *tortuga* 'turtle' to a low[7] of 43 conforming responses for **chimpancé** 'chimpanzee' + *pingüíno* 'penguin', but every source-word pair shows more than 36 (50%) conforming responses.

(14) Conforming vs. nonconforming responses in the blend headedness experiment

| Conforming responses | Nonconforming responses | Total responses |
|---|---|---|
| 513 (71%) | 207 (29%) | 720 |

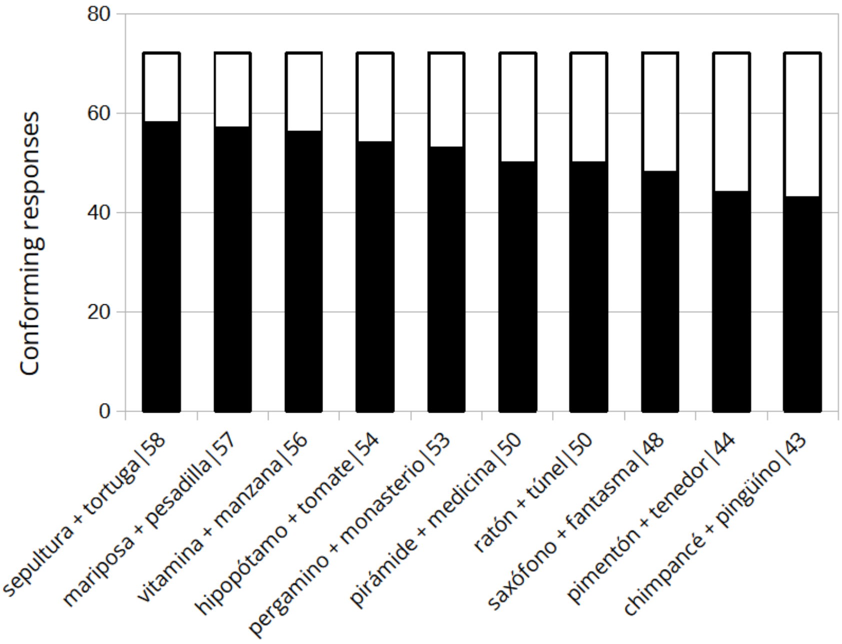


*Figure 3. Conforming responses for each source-word pair in the blend headedness experiment.*

7 The excluded item **hospital** 'hospital' + *telegrama* 'telegram' had an even lower rate of conforming responses, 39/72. It is unclear whether this result is related to the spelling error, or whether this item would have had a similarly low rate without the error. In any case, even for this item, the number of corresponding responses is greater than 36 (50%).

The by-response data was analyzed with a mixed logistic regression with random effects for subjects and items, fit with the GLIMMIX procedure in SAS. Here again, the results were highly significant, as reported in (15).

(15) Logistic regression analysis of pooled responses in blend headedness experiment

| Mean estimate | Confidence limits | | Standard error | *p* |
|---|---|---|---|---|
| 0.73 | 0.65 | 0.80 | 0.17 | <0.001 |

The model's estimate of the proportion of conforming responses, at 0.73 (with the 95% confidence interval between 0.65 and 0.80), is significantly greater than chance. Thus, the results of the by-response analysis show that, across all participants, responses to the blend-to-definition matching task tend to conform to the head-privilege hypothesis.

**5. Conclusions and implications**

The results of the Spanish novel-blend experiment, analyzed both by participant and by response, support the head-privilege hypothesis: blends that preserve more segments from the semantic head source word are preferred. These effects are *emergent*, in that there does not appear to be evidence for segmental head faithfulness (of either semantic or even morphological heads) in the non-blend phonology of Spanish.

The effects of segmental head privilege are even stronger in this study than those found for English (Shaw 2013; Shaw et al. 2014; Moreton et al. 2017). This is consistent with our prediction, based on the fact that Spanish, which has both left-headed and right-headed blends, allows for a larger difference between the response options presented in the experiment than was possible for English. That said, additional factors may contribute to the stronger effect in the Spanish experiment by helping to make semantic head privilege generally more salient to Spanish speakers. In particular, semantic head faithfulness to stress may be involved in portmanteau blend formation, and morphological head faithfulness to lexical stress specifications may be at work even in the non-blend phonology (see §2.3).

The results of the experiment add to the cross-linguistic evidence for the semantic head as a strong position on the basis of data from lexical blending, an expressive or playful morphological process beyond concatenative derivation. It remains an open question to what extent semantic head faithfulness plays a role in non-blend phonological grammars, especially given that semantic and morphological heads are likely to coincide in many word-formation processes, making their effects difficult to distinguish. In any case, these findings add to the evidence that strong positions supported by salience from non-phonetic sources can be phonologically privileged, and that emergent effects of strong positions can be found in languages where the relevant positional-faithfulness effects are not directly evident in the language's non-blend phonological grammar. Such emergent effects indicate that an awareness of potential strong positions is universally available, beyond evidence from individual languages' phonological systems.

**Appendix**

The complete set of experiment materials is listed here, with the stimuli ordered by the number of conforming responses (in parentheses) in the by-response analysis (see §4.2). In the experiment, each definition was presented to participants in the frame *Un(a)* ________ *es* [definition] 'A ________ is [definition]'.

**sepultura** 'tomb' + *tortuga* 'turtle' → **sepultu*r***tuga* | **sepul*t***ortuga* (58)

Left-headed: *hecho para una tortuga y es un tipo de sepultura*
'made for a turtle and is a type of tomb'

Right-headed: *un tipo de tortuga que sólo vive en sepulturas*
'a type of turtle that only lives in tombs'

**mariposa** 'butterfly' + *pesadilla* 'nightmare' → **maripo*sa***dilla* | **mari*p***esadilla* (57)

Left-headed: *visto sólo en las pesadillas y es un tipo de mariposa*
'seen only in nightmares and is a type of butterfly'

Right-headed: *un tipo de pesadilla y tiene que ver con mariposas*
'a type of nightmare and has to do with butterflies'

**vitamina** 'vitamin' + *manzana* 'apple' → **vitami*n***zana* | **vita*m***anzana* (56)

Left-headed: *algo con sabor a manzana y es una especie de vitamina*
'something with apple flavor and is a type of vitamin'

Right-headed: *una especie de manzana que contiene muchas vitaminas*
'a type of apple that contains many vitamins'

**hipopótamo** 'hippopotamus' + *tomate* 'tomato' → **hipopota*m*ate** | **hipopo*t*omate** (54)

Left-headed: *algo que sólo come tomates y es un especie de hipopótamo*
'something that only eats tomatoes and is a type of hippopotamus'

Right-headed: *un tipo de tomate que sólo los hipopótamos comen*
'a type of tomato that is only eaten by hippopotamuses'

**pergamino** 'parchment' + *monasterio* 'monastery' →
**pergami*n*asterio** | **perga*m*onasterio** (53)

Left-headed: *algo hecho por un monasterio y es un tipo de pergamino*
'something that is made in a monastery and is a type of parchment'

Right-headed: *un tipo de monasterio que hace pergamino*
'a type of monastery that manufactures parchment'

**pirámide** 'pyramid' + *medicina* 'medicine' → **pirami*d*icina** | **pira*m*edicina** (50)

Left-headed: *donde los egipcios ejercían la medicina y es un tipo de pirámide*
'where the Egyptians practiced medicine and is a type of pyramid'

Right-headed: *un tipo de medicina y tiene la forma de una pirámide*
'a type of medicine and is in the shape of a pyramid'

**ratón** 'mouse' + *túnel* 'tunnel' → **ratón*n*el** | **ra*t*únel** (50)

Left-headed: *algo que vive en un túnel y es una especie de ratón*
'something that lives in a tunnel and is a kind of mouse'

Right-headed: *una especie de túnel en que viven los ratones*
'a type of tunnel that mice live in'

**saxófono** 'saxophone' + *fantasma* 'ghost' → **saxofo*n*tasma** | **saxo*f*antasma** (48)

Left-headed: *algo que suena a fantasmas y es un tipo de saxófono*
'something that sounds like a ghost and is a type of saxophone'

Right-headed: *un tipo de fantasma que toca el saxófono*
'a type of ghost that plays the saxophone'

**pimentón** 'pepper' + *tenedor* 'fork' → **pimento*n*edor** | **pimen*t*enedor** (44)

Left-headed: *algo que tiene la forma de un tenedor y es una especie de pimentón*
'something that is in the shape of a fork and is a type of pepper'

Right-headed: *una especie de tenedor que sólo se use para comer pimentones*
'a type of fork that is only used to eat peppers'

**chimpancé** 'chimpanzee' + *pingüíno* 'penguin' → **chimpa*n*güíno** | **chim*p*ingüíno** (43)
Left-headed: *algo que caza pingüínos y es una especie de chimpancé*
'something that hunts penguins and is a type of chimpanzee'
Right-headed: *una especie de pingüíno que los chimpances cazan*
'a type of penguin that chimpanzees hunt'

**hospital** 'hospital' + *telegrama* 'telegram' → **hospita*l*egrama** | **hospi*t*elegrama** (39)
Left-headed: *algo que envia telegramas y es un tipo de hospital*
'something that sends telegrams and is a type of hospital'
Right-headed: *un tipo de telegrama y es enviado por un hospital*
'a type of telegram and is sent by a hospital'

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