Mutation in Welsh: Syntactic mutation without empty categories

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Abstract

The XP Trigger Hypothesis is a widely accepted account of syntactic mutation in Welsh which states that mutation, a regular alternation in form of the initial segment of a word, occurs if a word is positioned after the right edge of an XP (with some additional framework-specific structural constraints). The XP Trigger Hypothesis poses a problem for Lexical-Functional Grammar (LFG) because it presupposes the existence of empty categories. Null subjects and *wh*-traces both 'count' as XPs for the purposes of the XP Trigger Hypothesis, and therefore must be represented in the tree structure. Such empty categories are generally not represented as XPs in the tree in LFG, being represented only at f-structure. In my analysis, I show that it is possible to account for the data of the XP Trigger Hypothesis without presupposing the existence of empty categories, instead using phrase-structural rules and f-structural relationships between words to predict mutation.

1 Introduction

Welsh is a language with initial mutations, regular alternations in word-initial phonemes according to a word's environment.[†] A mutation 'target' is a word whose initial segment undergoes such an alternation. The type of alternation is determined by the mutation 'trigger' which may be a preceding word that is lexically-specified to have this effect, or the target's syntactic environment. This paper considers the latter type of triggers, and how these might be captured in Lexical-Functional Grammar (LFG). Crucially, the analysis presented here shows that it is possible to account for the data without positing empty phrases or words in the tree structure, thus showing that the Welsh data is not evidence that these types of linguistic objects must exist.

In this paper, I set out some background on mutations in Welsh and provide some examples of typical mutation triggers. Then, I discuss the core data that relates to the issue of syntactic mutation in Welsh, and how the 'XP Trigger Hypothesis' aims to account for such data. I show that the XP Trigger Hypothesis has important implications for LFG, because it presupposes the presence of empty phrases in the tree, and additionally posits further null elements to account for certain exceptions. The use of empty categories is controversial in LFG: Falk (2007) considers them to be a "last resort" within the framework. Hence, the remainder of the paper is dedicated to setting out an alternative account of syntactic mutation. The analysis extends previous work on Welsh mutations within the LFG framework (Mittendorf & Sadler 2006) by reducing the amount of redundancy in the lexicon and establishing a general rule for syntactic mutation, at the same time showing that empty categories are not required in an account of syntactic mutation in Welsh. The new analysis proposes two mechanisms via which syntactic mutation is triggered; this more fine-grained approach avoids over-predicting mutation and eliminates the need to provide special mechanisms for dealing with certain exceptions.

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2 Mutations in Welsh

2.1 Types of mutation

There are three principal types of mutation in Welsh: soft, nasal and aspirate; in this paper we are primarily concerned with the first, which is also the most common. Unmutated forms are referred to as radical forms. Different lexical and syntactic triggers cause different types of mutation. The type of mutation determines the alternations that the initial phoneme of the target word undergoes. Table 1 lists the changes according to mutation type (standard Welsh orthography on the left, IPA transcription on the right).[1] Blank cells indicate that a letter is not affected by a particular mutation type. Some segments are never mutated (such as /s/) and, consequently, are not included in the table. Words beginning with segments that do not undergo (a particular) mutation can still occur in (those particular) mutation environments; they simply exhibit no change when they do so.

Radical		Soft		Nasal		Aspirate	
p	[p]	b	[b]	m	[m̥ʰ]	ph	[f]
t	[t]	d	[d]	nh	[n̥ʰ]	th	[θ]
c	[k]	g	[g]	ngh	[ŋ̊ʰ]	ch	[χ]
b	[b]	f	[v]	m	[m]		
d	[d]	dd	[ð]	n	[n]		
g	[g]	∅	–	ng	[ŋ]		
m	[m]	f	[v]				
rh	[r̥ʰ]	r	[r]				
ll	[ɬ]	l	[l]				

Table 1: Changes to (radical) initial segments in the principal mutation environments of Welsh (Borsley et al. 2007: 20)

I augment standard Welsh orthography using superscript capital letters (R = radical, S = soft, N = nasal, A = aspirate) to label the word forms as necessary. Radical forms are labeled only where they are unexpected or otherwise pertinent. Vacuous application of a mutation (e.g., to a word beginning with an immutable segment) is indicated by a strike through of the superscript letter; such forms are identical to radical forms, but the marking indicates a mutation would be expected were a different initial segment to occur in that position.[2] Where a particular word can be identified as a trigger, the trigger word is underlined.

2.2 Typical mutation triggers

The prototypical mutation trigger is a word which is lexically-specified to trigger mutation on any immediately following word. These types of mutation triggers provide

[1]The entry for *g* under soft mutation indicates that the segment is deleted under soft mutation.

[2]The following glossing abbreviations are also used in this article, in addition to those found in the Leipzig Glossing Rules: IMPF = IMPERFECTIVE; IMPRS = IMPERSONAL, S = SINGULAR, P=PLURAL, FOC.INT = FOCUS INTERROGATIVE PARTICLE, PRT = PARTICLE. Clitic boundaries are marked = as in the Leipzig rules, but clitics are separated from their host for greater clarity.

important context to how syntactic mutations are accounted for under the XP Trigger Hypothesis, as they demonstrate the significance of linear adjacency in accounting for at least some mutations.

Although the origins of mutation in Welsh are phonological (Hannahs 2014: 121–126 and Ball & Müller 1992: 53–77, among others), examples (1)–(4) demonstrate that neither being a trigger nor the type of mutation triggered is predictable from the synchronic phonology; and (1)–(3) and (5) show that it is also not predictable from the category of the trigger word.

(1) eu $^{\mathbf{R}}$cath nhw
/i kaθ n̥^{h}uː/
3P cat 3P
'their cat'

(2) ei $^{\mathbf{A}}$chath hi
/i χaθ hiː/
3S.F cat 3S.F
'her cat'

(3) ei $^{\mathbf{S}}$gath e
/i gaθ ɛː/
3S.M cat 3S.M
'his cat'

(4) i $^{\mathbf{S}}$gath
/i gaθ/
to cat
'to a cat'

(5) fy $^{\mathbf{N}}$nghath i
/və ŋ̊^{h}aθ iː/
1S cat 1S
'my cat'

There are sometimes generalizations to be made above the level of the individual word. For example, all feminine singular nouns trigger mutation on following words, as exemplified in (6) and (7) by the phrases containing the feminine noun *agwedd* 'aspect' (from Mittendorf & Sadler 2006: 346). Note the strict adjacency requirement demonstrated by (7), which is considered typical of mutation. The soft mutation triggered by the feminine singular noun *agwedd* affects *dra* but not *phwysig*, which has undergone the aspirate mutation lexically triggered by *dra*.

(6) agwedd $^{\mathbf{S}}$bwysig
aspect.S.F important
'an important aspect'

(7) agwedd $^{\mathbf{S}}$dra $^{\mathbf{A}}$phwysig
aspect.S.F extremely important
'an extremely important aspect'

Example (7) establishes the importance of linear-adjacency relationships in accounting for at least some types of mutation, which the XP Trigger Hypothesis (discussed below) aims to maintain even for instances of syntactic mutation.

Finally, it is useful to note that, contrary to the representation in Table 1, whether a target word is susceptible to mutation is not purely determined by phonology. There are some words which never undergo mutation such as *gêm* 'game' or *dy*, the 2s agreement clitic (Borsley et al. 2007: 25). For this reason (among some others) mutation in Modern Welsh is treated in this paper as a morphological rather than phonological phenomenon (for further discussion on this matter, the reader is directed to Breit 2019).

2.3 Syntactic mutation

2.3.1 Mutation of verbal objects

Some mutations are not triggered by a particular lexical item, or type of lexical item, but are triggered by something more abstract. There is debate about how such abstract triggers should be captured. The variable mutation behaviour of verbal objects has been particularly central to these discussions: objects soft-mutate if the lexical verb is finite, but do not undergo any mutation (they are in their radical form) if the lexical verb is non-finite, as in sentences where an auxiliary verb conveys tense/aspect/mood:

(8) Pryn-odd dyn ^{S}feic.
buy-PST man bike
'A man bought a bike.'

(9) Roedd dyn wedi prynu ^{R}beic.
be.IMPF man PERF buy.NF bike
'A man had bought a bike.'

An account of syntactic mutation in Welsh must predict the mutation of the direct object *feic* in (8), at the same time as ensuring that mutation is not incorrectly predicted on *beic* in (9). One particularly compelling solution to this problem is the 'XP Trigger Hypothesis' (Tallerman 1987; Borsley 1999; Tallerman 2006, among others).[3] The XP Trigger Hypothesis is a generalization which proposes that syntactic phrases *of all types* (hence, ***X***P) trigger a soft mutation at their right edge, affecting whichever word follows.

Under the XP Trigger Hypothesis, the reason for the variable mutation behaviour of *feic/beic* in (8) and (9) has to do with word order and constituency. In both cases, the NP *dyn* triggers a soft mutation at its right edge, but it is only in the former that the direct object *feic* is situated immediately after the right edge of the NP. In (9), *wedi* is positioned here, and vacuously absorbs the mutation because it begins with an immutable segment, /w/:

(8′) Pryn-odd [dyn $_{NP}$] ^{S}feic.
buy-PST man bike.
'A man bought a bike.'

(9′) Roedd [dyn $_{NP}$] ^{S}wedi prynu beic.
be.IMPF man PERF buy.NF bike
'A man had bought a bike.'

The XP Trigger Hypothesis is compelling because it uses the same mechanism to also account for some other instances of mutation in Welsh: (10) below shows that the object of an impersonal verb does not usually mutate; (11) shows that it nevertheless does when an adverb phrase precedes it. Under the XP Trigger Hypothesis, the explanation is that the right-phrase-boundary of the adverb phrase is responsible for the mutation of *feic* in (11).

(10) Pryn-wyd ^{R}beic.
buy-PST.IMPRS bike
'A bike was bought.'

(11) Pryn-wyd [hefyd $_{ADVP}$] ^{S}feic.
buy-PST.IMPRS also bike
'A bike was also bought.'

Hence, the XP Trigger Hypothesis is able to account for a wider range of data, not simply that presented in (8) and (9).

2.3.2 Constraining the XP Trigger Hypothesis

There are some additional constraints which form part of the XP Trigger Hypothesis. These are formulated differently depending on the framework within which the hypothesis is implemented; for example:

[3] For an extensive overview of the XP Trigger Hypothesis and competing accounts of syntactic mutation, including Case-linked accounts, consult Borsley et al. (2007) and Breit (2019). For a phonological approach see Hannahs (1996). Space precludes discussion of alternatives here.

A. Principles & Parameters (Borsley & Tallerman 1996; Borsley 1999)

A constituent bears soft mutation at its left edge if it is immediately preceded by a c-commanding phrase, provided the c-commanding phrase has lexical content or Case (thus including null subjects or *wh*-traces, but not PRO or NP-trace).

B. Head-Driven Phrase Structure Grammar (Borsley 1999)

A complement (which in this context includes subjects) bears soft mutation at its left edge if it is immediately preceded by a phrasal sister, including phrasal sisters that are null subjects or *wh*-traces (thus providing evidence that these empty categories, but not PRO or NP-trace, exist). CPs are excluded from this.

C-command/complement relationship requirements account for the lack of mutation in the following positions indicated by the superscript R (for radical, i.e. unmutated).

(12) [Yn sydyn $_{ADVP}$], ^{R}dechreu-odd y môr ^{S}ferwi.
PRED sudden, start-PST the sea boil.NF
'Suddenly, the sea started to boil.' (Borsley et al. 2007: 230)

(13) [mor ^{S}wyntog $_{AP}$] ^{R}dydd
so windy day
'as windy a day'[4]

(14) [mwyaf gwyntog $_{AP}$] ^{R}dydd
most windy day
'the windiest day'[5]

(15) bwrdd [mawr $_{AP}$] ^{R}[crwn $_{AP}$] ^{R}brenin
table big round king
'a king's big round table'

(12) shows an adverb phrase failing to trigger mutation on the next word; (13) and (14) the failure of a prenominal adjective phrase to trigger mutation, and (15) the failure of post-nominal adjectives to trigger mutations on each other or the possessor of the noun phrase; in each case the assumption is that the XP in question fails to trigger mutation on the following word because it does not c-command, or is not a sister of, the next word.

There is also the matter that conjuncts do not mutate each other. Note how only the first conjunct undergoes soft-mutation in (16). (The aspirate mutation on *chaws* arises because *a* is a lexically-specified aspirate mutation trigger.)

(16) Bwyt-ais i [^{S}fara $_{NP}$] [^{R}menyn $_{NP}$] ^{S}a [^{A}chaws $_{NP}$].
eat-PST.1s 1s bread butter and cheese
'I ate bread, butter and cheese.'

The lack of mutation on *menyn* cannot be restricted via the requirement for a c-command relationship proposed by Borsley & Tallerman (1996), who instead account for the data in (16) by proposing an empty element (a null conjunct particle), positioned

[4] *Mor*, an intensifying adverb, is a lexically-specified soft-mutation trigger; this explains the soft mutation of *wyntog* in (13).

[5] This and the preceding example are cited in Borsley (1999) and attributed to an unpublished paper by Maggie Tallerman. Although most APs follow the head noun, equative, comparative and superlative APs may precede it.

directly after *fara*, which absorbs the soft mutation that the NP *fara* would otherwise trigger on *menyn*, in much the same way that *wedi* does in (9′). As Borsley (1999) points out, this null particle must be restricted to non-initial and non-final conjuncts, and there are no other known examples of such a particle in other languages to corroborate it. In contrast, the complement restriction in Borsley (1999: 294) accounts for the non-mutation of non-initial, non-final conjuncts in a less stipulative way, because whilst "a conjunct may be part of a complement, it is not itself a complement". Only the left edge of the whole complement will undergo mutation, and thus conjuncts positioned later will be unaffected.

As apparent from the formulation of the XP Trigger Hypothesis above, some proposed empty/null phrases act as XPs under the hypothesis, whilst others do not. On the basis that the mutation facts are invariable irrespective of whether subject pronouns are overt (17, 18) or null (19, 20), the latter pair of sentences receive the analyses outlined in (19′) and (20′) respectively.

(17) Pryn-och [chi$_{\mathbf{NP}}$] $^{\mathbf{S}}$feic.
buy-PST.2P 2P bike
'You bought a bike.'

(18) Pryn-a [di$_{\mathbf{NP}}$] $^{\mathbf{S}}$feic.
buy-IMP.2S 2S bike
'Buy (you) a bike.'

(19) Pryn-och $^{\mathbf{S}}$feic.
buy-PST.2P bike
'You bought a bike.'

(20) Pryn-a $^{\mathbf{S}}$feic.
buy-IMP.2S bike
'Buy a bike.'

(19′) Pryn-och [*pro* $_{\mathbf{NP}}$] $^{\mathbf{S}}$feic.

(20′) Pryn-a [*pro* $_{\mathbf{NP}}$] $^{\mathbf{S}}$feic.

Similarly, the presence of soft mutation after the 'extraction site' of subject long-distance dependencies is taken as evidence that '*wh*-traces' or copies are also XPs in the string:[6]

(21) Pwy $^{\mathbf{S}}$bryn-odd [t_{wh} $_{\mathbf{NP}}$] $^{\mathbf{S}}$feic?
Who buy-PST bike
'Who bought a bike?'

(22) Y dyn [$_{\text{CP}}$ $^{\mathbf{S}}$bryn-odd [t_{wh} $_{\mathbf{NP}}$] $^{\mathbf{S}}$feic]...
the man buy-PST bike
'The man who bought a bike...'

The status of other empty phrase types posited by Principles & Parameters analyses is different. Big PRO and NP-traces fail to either trigger (23, 24) or block (25, 26) mutation:

(23) Mae [Ed $_{\text{NP}}$] yn disgwyl [[PRO $_{\mathbf{NP}}$] $^{\mathbf{R}}$prynu beic].
be.PRS Ed PROG expect.NF buy.NF bike
'Ed expects to buy a bike.'

(24) Mae [Ed $_{\text{NP}}$] yn dechrau [[∅ $_{\mathbf{NP}}$] $^{\mathbf{R}}$beicio].
be.PRS Ed PROG start.NF cycle.NF
'Ed starts to cycle.'

[6] I set aside discussion of the mutation on *bryn-odd* in these examples, which depends on the grammatical function of the fronted phrase, and is not automatic.

(25) Disgwyliodd [Ed NP] [[PRO NP] S brynu beic].
expect.PST Ed buy.NF bike
'Ed expected to buy a bike.'

(26) Dechreuodd [Ed NP] [[∅ NP] S feicio].
start.PST Ed cycle.NF
'Ed started to cycle.'

The data in (23) and (24) is the reason for the Case restriction in Borsley & Tallerman's (1996) formulation of the XP Trigger Hypothesis, although this does not explain why the phrases fail to block mutation in (25) and (26). Borsley (1999) uses this data to argue that, unlike *pro* and *wh*-traces, big PRO and NP-trace do not exist, which is in keeping with independently-reached conclusions in HPSG.[7]

2.3.3 Some exceptions

There are some further data points that seem to constitute exceptions to the XP Trigger Hypothesis: the lack of mutation at the beginning of embedded interrogative CPs, such as that in (27), and the lack of mutation on the lexical verb in a negative imperative sentence, such as (28).

(27) Hol-a [di NP] R mab i bwy yw =r llanc.
ask-IMP.2S 2S son to who is =the lad
'Ask whose son the lad is.'

(28) Paid [ti NP] R meiddio chwerthin.
NEG.IMP.2S 2S dare.NF laugh.NF
'Don't you dare laugh.' (Very informal)

The data in (27) is accounted for via the Case requirement in version A of the XP Trigger Hypothesis, and via a specific stipulation that CPs are impervious to mutation in version B. However, not all possible CPs are impervious to mutation, which presents further complications. Tallerman (2006: 1771, fn. 19) provides the following example:

(29) Gwn i [CP fod Mair yn mynd yfory].
know.1S 1S be.NF Mair PROG go.NF tomorrow
'I know that Mair is going tomorrow.'

In spoken Welsh there is variability as to whether even interrogative embedded CPs are actually impervious to mutation or not (Tallerman 2006: 1769–1771).

It is also possible to develop an approach which uses empty categories to block the mutation predicted by the NP-edges in (27). An empty element could be posited before *mab*, which absorbs the predicted soft-mutation, and triggers no mutation of its own, much like *wedi* in (9′). An overt element which behaves in exactly this way, specifically the interrogative focus particle *ai*, can appear here in formal registers, lending support to this approach.

[7] These empty categories have also been proposed elsewhere in HPSG, and so are not included solely to account for mutation facts. However, this treatment of *pro* and *wh-trace* is controversial within the framework (Müller et al. 2021: 1470).

(27′) Hol-a [di $_{\text{NP}}$] ^{S}**ai** mab i bwy yw =r llanc.
ask-IMP.2s 2s INT.FOC son to who is =the lad
‘Ask whose son the lad is.’ (Very formal)

This approach can be extended to (28) as well. *Â* is a preposition-like element or particle which typically accompanies *paid*, the negative imperative auxiliary, and appears after the subject NP, as in (28′). *Â* vacuously absorbs the predicted soft mutation, and triggers aspirate mutation of its own, just like *dra* in (7). The overt expression of the article has become optional in some colloquial varieties, generally without affecting the mutation behaviour of the following verb, giving us (28). In some instances, aspirate mutation has also now been lost, but, crucially, soft mutation does not arise.

(28′) Paid [ti $_{\text{NP}}$] $^{S\to}$**â** $^{A\to}$meiddio chwerthin.
NEG.IMP.2s 2s PRT dare.NF laugh.NF
‘Don’t you dare laugh.’

2.3.4 Implications of the XP Trigger Hypothesis for LFG

The XP Trigger Hypothesis, and in particular its reliance on empty phrases, poses challenges for LFG because of the proliferation of empty categories it entails. Empty categories in LFG have either been entirely eschewed (e.g. Dalrymple et al. 2019) or have been perceived as a “last resort” (Falk 2007) within the framework, meaning that, at most, they should only be incorporated into an analysis when all alternatives have been exhausted. The crux of the problem is that the XP Trigger Hypothesis is a c-structural generalisation, but null pronouns and ‘*wh*-traces’ or ‘copies’ are represented at f-structure only (Toivonen 2023: 566–572, Kaplan 2023: 428–436, among others). Furthermore, additional empty categories are employed on a case-by-case basis (albeit fewer of them in the HPSG version) for dealing with apparent exceptions to the XP Trigger Hypothesis. These are also undesirable from an LFG perspective. The Welsh data on phrasal mutation raises the question as to whether LFG must accept empty phrases and words in its c-structures, in at least some instances; in this paper, I show that this “last resort” is not required for Welsh mutation.

3 An LFG approach to syntactic mutation

3.1 Existing analyses of Welsh mutation in LFG

The existing account of mutation in LFG, from Mittendorf & Sadler (2006), is one that has been developed in the Xerox Linguistic Environment (XLE; Crouch et al. 2017) as part of the ParGram project (Butt et al. 2002). It currently captures simple linear-lexical mutation triggers (such as the mutation triggered by *i* in (4)), the behaviour of adverbs and adjectives modifying singular feminine nouns, as in (6, 7), as well as mutation at the beginning of negative clauses, which I do not discuss here. It does not account for all of the data presented for discussion in this paper, and provides no overall generalisation for syntactic mutations equivalent to the XP Trigger Hypothesis.

The analysis assumes that words can be decomposed into a linear string of features, somewhat contrary to mainstream LFG assumptions but possible within XLE/ParGram, which uses finite-state-transducers in the morphology (Kaplan et al. 2004: 11–20, Bögel et al. 2019: 417–438). Mittendorf & Sadler (2006) model mutation as a constraint on this string of features. Both the initial and final positions of a word's decomposition string are occupied by values for a mutation, and a concatenated string of words in a sentence must pass a grammaticality test such that adjacent mutation values match. A word like *i* 'to' in (4) carries a final SOFT morpheme. The form *gath* carries an initial SOFT morpheme. The phrase *i gath* is correctly predicted to be grammatical since the adjacent mutation morphemes match:

(30) A simplified representation of *i gath* (4) according to Mittendorf & Sadler (2006):
... [+RAD *to* **+SOFT**] [**+SOFT** *cat* +F +SG +RAD] ...

Final and initial morphemes are both 'radical' by default, with the consequence that one word does not mutate the other unless specified to do so. To prevent words from being blocked from occurring after a trigger that only vacuously applies to them, all words are listed with every possible initial mutation morpheme, even if there is no corresponding change in surface form. To some degree, this is undesirable, as it means there is significant redundancy in the lexicon.

As well as entering the structure at the end of a particular lexical item, mutation triggering morphemes can also enter into the structure via phrase-structure rules (PSRs). For example, a +SOFT morpheme is introduced in the 'post-subject' position by a PSR, so that soft mutation occurs here. This removes the need for a *wh*-trace or null pronoun in the c-structure, but the approach is not a general one. Each type of syntactic mutation, whether there is an overt phrase or not, would have to be individually coded in annotated c-structure rules. It is not easy to see how the approach could be generalized without over-generating mutation and requiring yet further phonologically null morphemes to enter into the phrase structure to block this.

This paper therefore moves the LFG analysis of mutation forward, considering not only how mutation can be accounted for without breaking down words into a linear string of morphemes (thus showing that such assumptions are not essential) and without redundancy and over-generation in the lexicon, but also by offering a generalization with the predictive power of the XP Trigger Hypothesis.

3.2 A new approach to Welsh mutation in LFG

The generally linear and lexical behaviour of mutation can be captured by positing mutation as a feature of the units of the s(yntactic)-string. Following Mycock & Lowe (2013), Lowe (2016), and others, the s-string in LFG is a linearly-ordered string of attribute-value matrices (AVMs), each one corresponding to a syntactic word. Words are not decomposed into a linearly-ordered string of morphemes in this approach; instead, features are associated with whole words. I propose that one feature (in Welsh) of these AVMs is the feature 'MUT', which in turn has several possible values, including S, N, A and R, of which it can bear only one at any one time. It is desirable to avoid representing mutation, a very restricted phenomenon cross-linguistically, at f-structure, as this is a level of representation which is cross-linguistically stable.[8]

[8]With thanks to Miriam Butt for first bringing this consideration to my attention.

A lexical mutation trigger, such as *i* in sentence (4), contains a specification in its entry that defines the mutation value of whatever string element comes next as *soft*: (⋗MUT) = s. The symbol ⋗ designates the result of the application of the *N* function, as defined in Asudeh (2009), to the current s-string unit, meaning that it picks out the next string-element.

In fact, this is not sufficient, because possessor phrases (including any adjuncts in them) are immune to soft mutation. Consider that *merch* and *gwir* are unmutated despite immediately following a feminine noun, which ordinarily would trigger soft mutation on a following word—cf. (6, 7).

(31) cath **R**merch
cat.F.S girl.F.S
'a girl's cat'

(32) gweithred **R**gwir ffrind
act.F.S true friend.M.S
'an act of a true friend'

In light of this, I propose the following soft-mutation triggering template, which is called on all lexical triggers of soft mutation:

(33) @S-TRIGGER := $\succ \neq (((\text{ADJ} \in)^{*} \wedge)\ \text{POSS}\ (\text{ADJ} \in)^{*})$
$\Rightarrow (\succ\ \text{MUT}) = \text{S}$

Following Asudeh (2009), ≻ designates the f-structure of the next s-string unit i.e., $\varphi(\pi(N(\bullet)))$ or $\varphi(\pi(\succ))$. I also introduce ∧ to refer to the f-structure of the *current* string unit, i.e. $\varphi(\pi(\bullet)))$. This replaces the common practice of extending the use of ↑ to abbreviate $\varphi(\pi(\bullet))$ alongside its existing use as an abbreviation for $\varphi(\hat{*})$ (Dalrymple et al. 2019: 411). Thus, the template in (33) states that, if the next string unit's f-structure is not the possessor, nor an adjunct (possibly itself within an adjunct) inside the possessor, of the current s-string unit—or a '(grand)parent' f-structure of the current unit's, if the current unit is itself (an adjunct embedded in) an adjunct—then the next string unit must have an s value for its MUT feature. This template captures the fact that possessors and their adjuncts are always immune to soft mutation by their possessum or its adjuncts. The template provides structure to the lexicon by collecting information that repeatedly occurs together into a 'bundle' that can be used across multiple lexical entries. I now extend this approach from lexical triggers to the syntactic triggers at issue in this paper.

3.3 The XP Trigger Hypothesis re-imagined

Rather than considering the c-structural relationships between phrases to be the predictive factor for syntactic soft mutation in Welsh, I instead propose that the mutations predicted by the XP Trigger Hypothesis arise in one of two ways: via a lexically-supplied template, or via phrase-structure rules (PSRs).[9] What is lost in not providing a single generalisation is gained through not having to propose multiple exceptions. It also avoids the need to posit empty elements in the c-structure, and makes concrete the way the mutations are introduced into the structure. Consider the following mini-fragment of Welsh grammar, for which lexical entries are included, alongside relevant examples,

[9] Both lexical and phrase-structural mechanisms are used to trigger mutations in Mittendorf & Sadler, but only the latter are used for syntactic mutations.

in the next section. As is standard in LFG, all nodes on the right-hand side of each rule are optional (Belyaev 2023: 69–71).[10]

(34) Mutation-triggering template, called on all words:

$$
\begin{array}{lll}
@\textsc{all} := & (((\textsc{gf}\ (\in))^{+} \curlywedge)\ (\textsc{gf}\ (\in))^{+}) = \succ & \textit{if the f-str. I'm in contains the next word's,} \\
 & \wedge\ (\curlywedge\ (\textsc{gf}\ (\in))^{*}) \neq \succ & \textit{\& my f-str. doesn't contain the next word's,} \\
 & \wedge\ (\succ\ (\textsc{gf}\ (\in))^{*}) \neq \curlywedge & \textit{\& the f-str. of the next word doesn't contain mine,} \\
 & \wedge\ (\in \curlywedge) \neq (\in \succ) & \textit{\& my f-str. and the next word's aren't in the same set,} \\
 & \Rightarrow\ @\textsc{s-trigger} & \textit{then } @\textsc{s-trigger} \textit{ is called}
\end{array}
$$

(35)
$$
\mathrm{CP} \rightarrow \begin{array}{c} \mathrm{XP} \\ (\uparrow \textsc{dis}) = \downarrow \end{array} \quad \begin{array}{c} \mathrm{C}' \\ \uparrow=\downarrow \end{array}
$$

(36)
$$
\mathrm{C}' \rightarrow \begin{array}{c} \mathrm{C} \\ \uparrow=\downarrow \end{array} \quad \begin{array}{c} \mathrm{IP} \\ \uparrow=\downarrow \end{array}
$$

(37)
$$
\mathrm{IP} \rightarrow \begin{array}{c} \mathrm{I} \\ \uparrow=\downarrow \end{array} \quad \begin{array}{c} \mathrm{S} \\ \uparrow=\downarrow \end{array}
$$

(38)
$$
\mathrm{S} \rightarrow \begin{array}{c} \mathrm{NP} \\ \left\{ (\uparrow \textsc{subj}) = \downarrow \;\middle|\; \begin{array}{c} (\uparrow \textsc{obj}) = \downarrow\} \\ \neg(\uparrow \textsc{subj}) \end{array} \right\} \end{array} \left(\left\{ \begin{array}{c} \mathrm{XP} \\ (\Swarrow \textsc{mut}) = \textsc{s} \end{array} \;\middle|\; \begin{array}{c} \mathrm{CP} \\ (\uparrow \textsc{comp}) = \downarrow \\ (\uparrow \textsc{type}) =_c \mathrm{Q} \end{array} \;\middle|\; \begin{array}{c} \mathrm{VP} \\ \uparrow=\downarrow \\ (\Swarrow \textsc{mut}) = \textsc{a} \\ (\uparrow \textsc{mood}) =_c \textsc{imp} \\ (\uparrow \textsc{pol}) =_c \textsc{neg} \end{array} \right\} \right) \quad \begin{array}{c} \mathrm{AdvP} \\ \downarrow = (\textsc{adj} \in \uparrow) \end{array}
$$

(39)
$$
\mathrm{XP} := \left\{ \begin{array}{c} \mathrm{VP} \\ \uparrow=\downarrow \\ \neg \left(\begin{array}{l} (\uparrow \textsc{mood}) = \textsc{imp} \\ \wedge\ (\uparrow \textsc{pol}) = \textsc{neg} \end{array} \right) \end{array} \;\middle|\; \begin{array}{c} \mathrm{AdjP} \\ (\uparrow \textsc{predlink}) = \downarrow \end{array} \;\middle|\; \begin{array}{c} \mathrm{PP} \\ (\uparrow \textsc{obl}_{\theta}) = \downarrow \end{array} \;\middle|\; \begin{array}{c} \mathrm{CP} \\ (\uparrow \textsc{comp}) = \downarrow \\ (\uparrow \textsc{type}) \neq \mathrm{Q} \end{array} \right\}
$$

(40)
$$
\mathrm{VP} \rightarrow \begin{array}{c} \mathrm{V}^0 \\ \uparrow=\downarrow \end{array} \left\{ \begin{array}{c} \mathrm{CP} \\ \uparrow \textsc{comp} = \downarrow) \end{array} \;\middle|\; \begin{array}{c} \mathrm{VP} \\ (\uparrow \textsc{xcomp}) = \downarrow \\ \vee\ (\uparrow \textsc{comp}) = \downarrow \end{array} \;\middle|\; \begin{array}{c} \mathrm{NP} \\ (\uparrow \textsc{obj}) = \downarrow \\ (\uparrow \textsc{subj}) \end{array} \;\middle|\; \begin{array}{c} \{\, \mathrm{NP} \mid \mathrm{PP} \,\} \\ (\uparrow \textsc{obl}_{\theta}) = \downarrow \end{array} \right\}
$$

(41)
$$
\mathrm{V}^0 \rightarrow \begin{array}{c} \widehat{\mathrm{Neg}} \\ \uparrow=\downarrow \end{array} \quad \begin{array}{c} \widehat{\mathrm{Asp}} \\ \uparrow=\downarrow \end{array} \quad \begin{array}{c} \mathrm{V}^0 \\ \uparrow=\downarrow \end{array}
$$

The template in (34) states that, if a particular set of f-structural relationships hold between one word and the next (essentially that they belong to different phrases), then the latter will undergo soft mutation, via the calling of the @s-trigger template. Specifically, the first line expresses the set of possible paths that can be taken to connect the f-structure of the current string-element to the f-structure of the following string-element. (∈) is included in brackets because it is not always needed (the f-structures of the string-elements in question may not belong to sets) but it can be: a single string-element does not typically correspond to sets of adjuncts or sets of conjuncts but rather a single member of such a set, and in these cases (∈) is required to navigate through the structure correctly. The subsequent two lines of the template express that neither f-structure can be contained by the other, and the penultimate line that neither f-structure can belong to the same set as the other. If this relationship holds, the @s-trigger template is called.

The rule in (38) makes use of the notation $\Swarrow$, defined by Mycock & Lowe (2013) to identify the string element associated with the left-most node underneath the current

[10]The annotation $(\uparrow \textsc{obj}) = \downarrow$ on the NP in (38) and (40) is accompanied by a constraint (either $\neg(\uparrow \textsc{subj})$ or $(\uparrow \textsc{subj})$) to indicate that the position of the object is conditioned by the presence or absence of a subject in the f-structure. This means that the objects of impersonal verbs appear outside of VP (one of the possible instantiations of XP). For further discussion and an example, see (46) below. In the trees themselves, these annotations have been simplified so that only the relevant disjunct is shown. For information on non-projecting categories such as those found in (41), see Toivonen (2003).

node. Hence, in this rule, the annotation (⫽ MUT) = s specifies that the left-most string element that falls under 'XP' (defined in (39)) must have the mutation value 's' i.e., that it must be soft-mutated. This rule is necessary because words in this position mutate regardless of their f-structural relationship with a preceding subject, and regardless of whether the subject is actually present at all.[11]

In the next section, I provide some examples of these rules in action, showing how the template in (34) and the PSR in (38) together predict all the mutations of the XP Trigger Hypothesis, at the same time avoiding redundancy, and without the use of empty categories.

3.4 LFG syntactic mutation in action

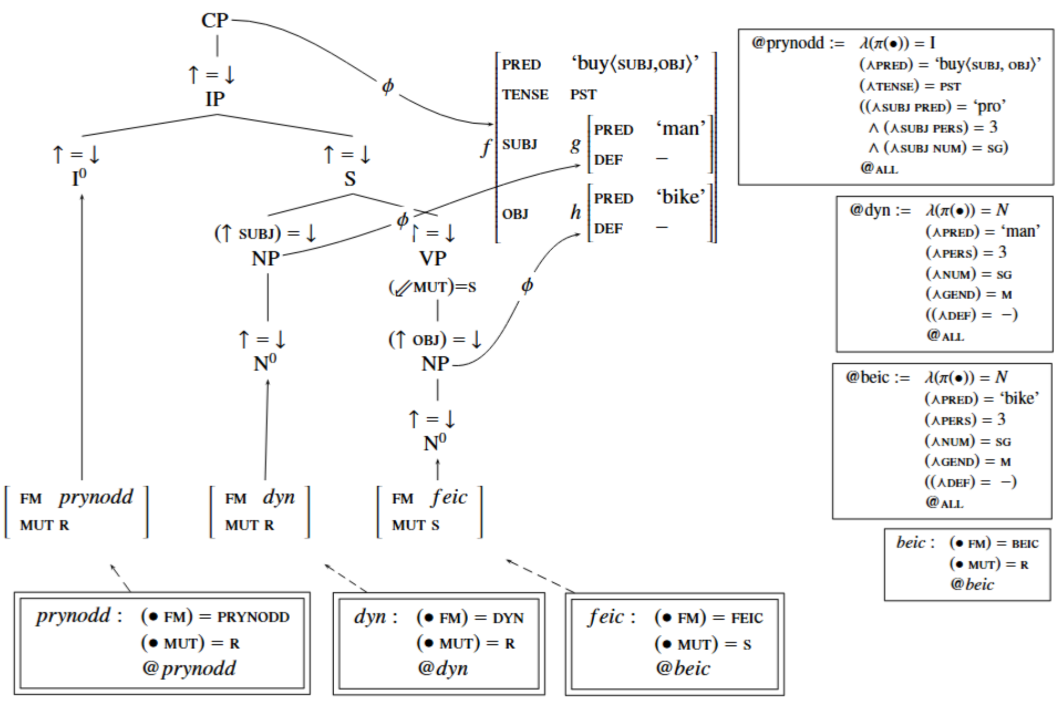
Recall the sentences (8) and (9), which were used to demonstrate the variable mutation behaviour of verbal objects.

(8) Pryn-odd dyn ^{S}feic
buy-PST man bike
'A man bought a bike.'

(9) Roedd dyn ^{S}wedi prynu ^{R}beic.
be.IMPF man PERF buy.NF bike
'A man had bought a bike.'

The f-structure, c-structure, string and some relevant lexical entries and templates for (8) are provided in (42). Mutated forms of the same word share a lexical template containing all the information which is constant across mutation forms. The lexical entry for unmutated *beic* is included for comparison.

(42) *analysis of (8)*

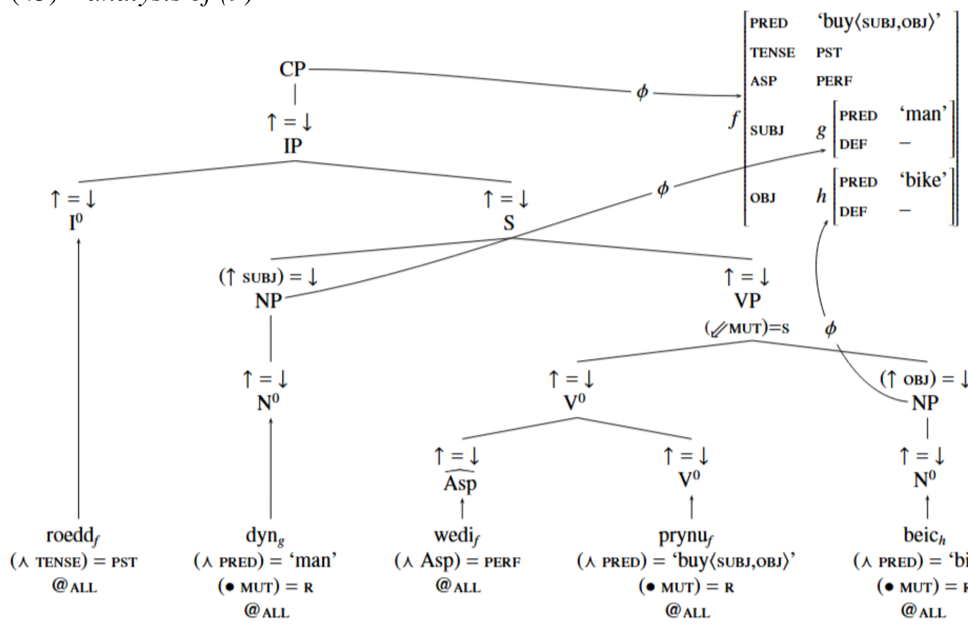


[11]This kind of PSR specification can also be used to capture soft-mutation at the beginning of negative clauses, and the optional soft-mutation of adverb phrases regardless of their relative position to other phrases, phenomena which there is not space to discuss further here.

In this analysis, unmutated *beic* cannot appear in the object position of sentence (8) because occupants of this position are limited to words that bear the value [MUT S]. In (8), this constraint arises twice (see (44)): once because of the annotation on the XP in (38), which here is instantiated as VP; and once because of the template @ALL, defined in (34), called on the word *dyn*. The @ALL template on this word has its requirements to call soft mutation met: as shown in (42), *dyn* projects to g, *feic* to h, and $((\textsc{subj}\ g)\ \textsc{obj}) = h$ is in the set of possible paths generated by $((\textsc{gf}\ (\in))^{+}\ \curlywedge)\ (\textsc{gf}(\in))^{+} = \succ$. Within LFG, it is not an issue that two places in the grammar separately state the mutation value for *feic*; the values unify in the attribute-value matrix, because none of the specifications contradict one another.

(43) shows that the change in word order in (9), resulting from the periphrastic expression of tense, means that the string-element in the left-most position of XP (which is again instantiated as VP) is now *wedi*.[12] *Wedi* can appear with any mutation value in its AVM, and so is compatible with the (⫽ MUT) = S specification. *Beic* does not undergo mutation because it is not in the left-most-in-XP position, and *prynu* triggers no mutation on it because the requirements for the @ALL template to trigger mutation are not met: the path between *prynu*'s f and *beic*'s h is not in the possibilities specified by @ALL, and, furthermore, the constraint that one f-structure not contain the other fails too because f contains h.

(43) *analysis of (9)*



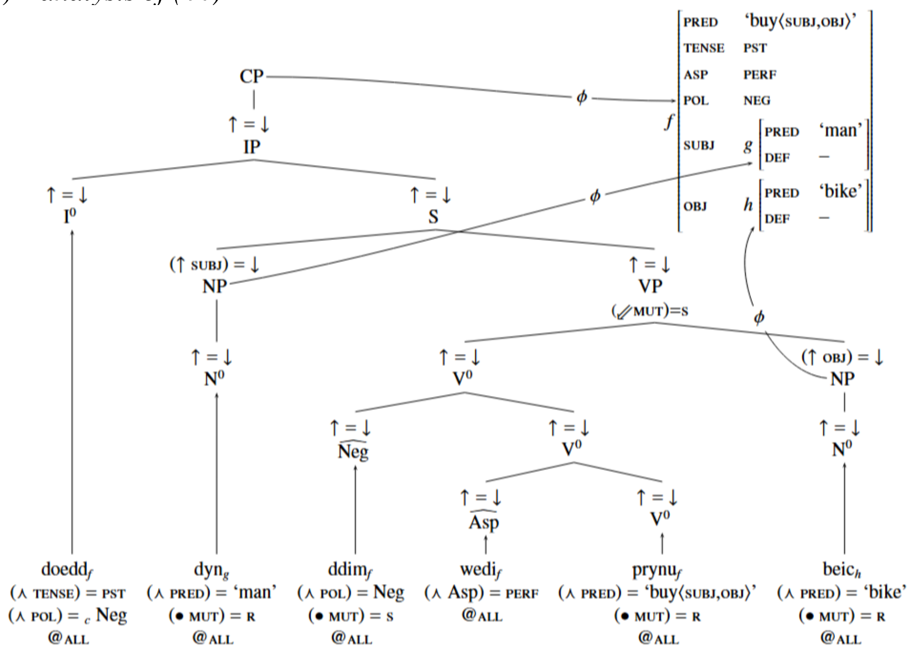
Other elements that appear at the left-edge of the VP, such as the negation marker *ddim* overtly show the predicted soft mutation:

(44) Doedd dyn [S]ddim wedi prynu beic
NEG.be.IMPF man NEG PERF buy.NF bike
'A man had not bought a bike.'

---

[12]In this and all subsequent examples, I simplify the representations, setting aside the distinction between an s-string element (which is an AVM containing at least a form and mutation value) and a lexical entry which corresponds to it. I also include only particularly pertinent parts of lexical entries.

(45) *analysis of (44)*



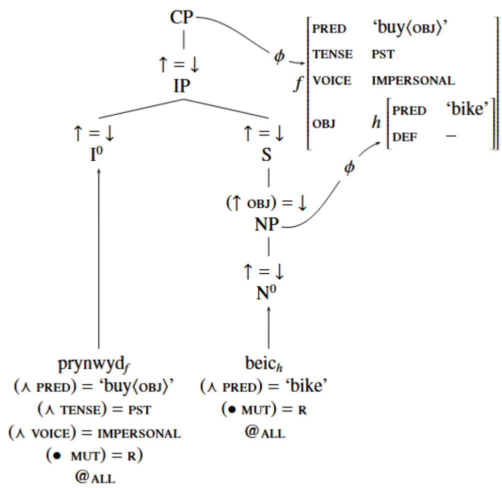
For the pair of impersonal sentences considered, the analysis successfully predicts the lack of mutation in (10) and the triggering of mutation in (11′):

(10) Pryn-wyd beic.
buy-PST.IMPRS bike
'A bike was bought.'

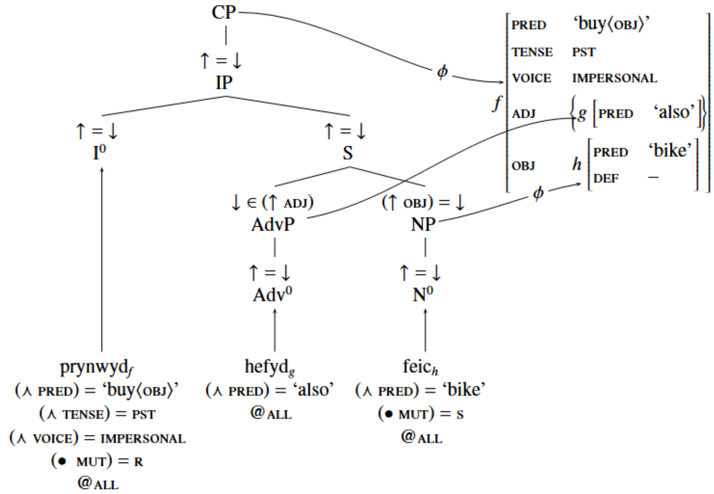
(11′) Pryn-wyd hefyd ^{S}feic.
buy-PST.IMPRS also bike
'A bike was also bought.'

I assume that impersonal verbs only select for an object, which is a fairly standard assumption in Welsh syntax based on the agreement behaviour of the argument (Borsley et al. 2007: 232). This object appears before XP (here, VP), and is therefore not subject to the (⫽ MUT) = S constraint: this is captured by the annotation on the NPs in the PSRs (38) and (40), which state that the OBJ appears before XP (VP) if there is no subject at f-structure, but inside XP (VP) otherwise. Hence the PSR (38) does not trigger mutation in either of these impersonal sentences.

(46) *analysis of (10)*



(47) *analysis of (11′)*



The differences arise from the interactions of word order and the @ALL template. In (10), *prynwyd* precedes *beic*. Since the f-structure of *prynwyd* (*f*) contains that of *beic* (*h*), the @ALL template on *prynwyd* does not trigger mutation on *beic*. However, in (11), *hefyd* precedes *feic*, and the soft-mutation trigger template *is* called by the @ALL template on *hefyd*, because *hefyd*'s f-structure is related to *feic*'s by the path ((ADJ ∈ *f*) SUBJ) = *h*. This illustrates the inclusion of optional ∈ in the path between f-structures specified in @ALL.

The behaviour of the adjunct in (11′), can be contrasted with that in (12′). The lack of mutation after the adjunct in (12′) is because the adjunct precedes the main predicate of the sentence, not an argument. The main predicate cannot be mutated by an adjunct in the sentence, because its f-structure contains that of the adjunct, and so the requirements in the @ALL template for calling the @S-TRIGGER template are not met. There is no need to posit a null blocking element or use Case to restrict the XP Trigger Hypothesis.

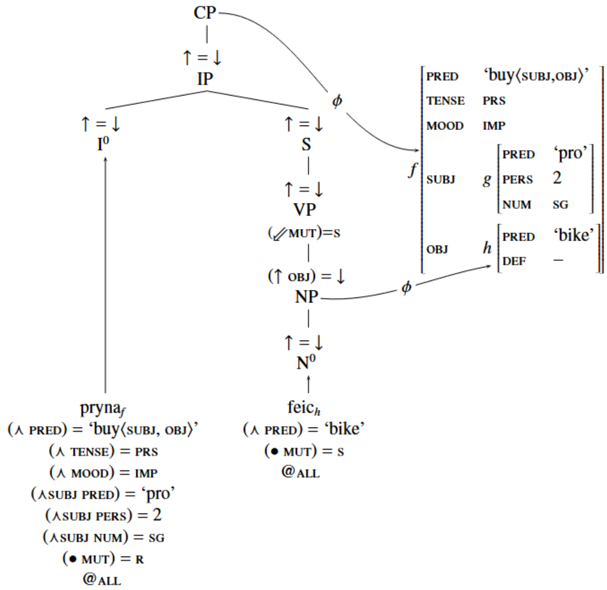
(12′) Yn sydyn, $^{\mathbf{R}}$dechreu-odd y môr $^{\mathrm{S}}$ferwi.
PRED sudden, start-PST the sea boil.NF
'Suddenly, the sea started to boil.' (Borsley et al. 2007: 230)

3.4.1 Mutation after empty subjects

In sentences where the subject is not overtly realised, the need for the PSR to also introduce mutation becomes apparent. For instance, in sentence (20), the (⫽ MUT) = S constraint in the PSR is the only thing that triggers the soft mutation of *feic*, due to the lack of any subject in the string.

(20) Pryn-a $^{\mathrm{S}}$feic.
buy-IMP.2S bike
'Buy a bike.'

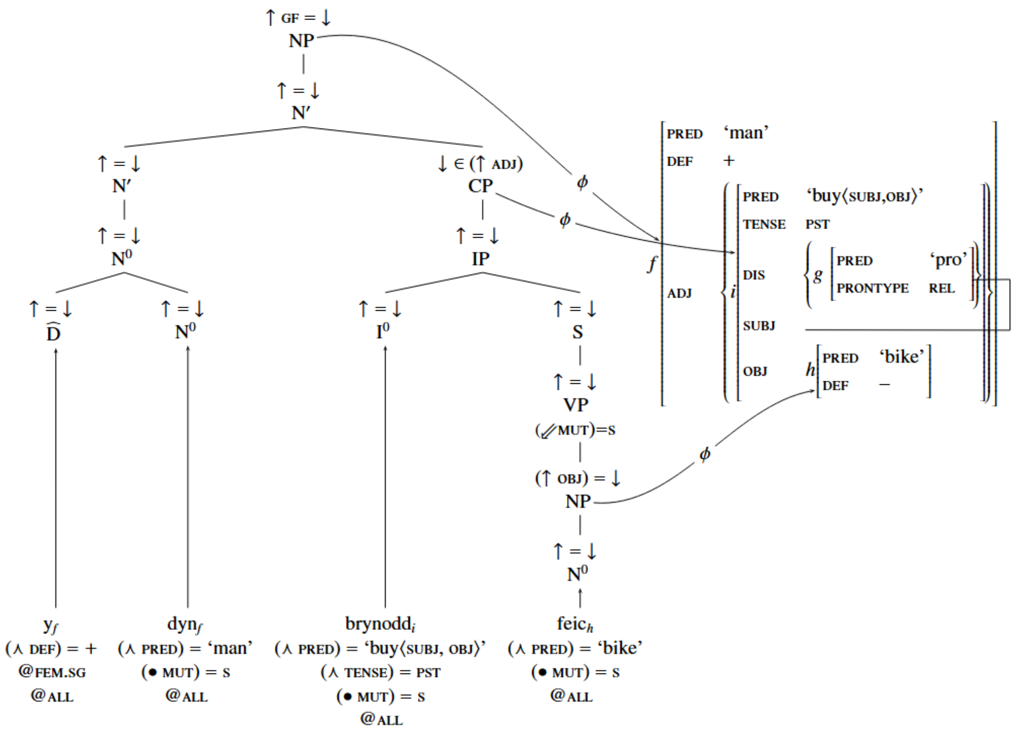
(48) *analysis of (20)*



The PSR also triggers the mutation in sentence (22):

(22) Y ^{S}dyn [^{S}brynodd ^{S}feic]...
the man buy-PST bike
‘The man who bought a bike...’

(49) *Analysis of (22)*



As with the above null subject example, the mutation on *feic*, is triggered by the left-edge constraint on the VP in (38), and not by *brynodd*, since the f-structure of *brynodd (f)* contains that of *beic (g)*.

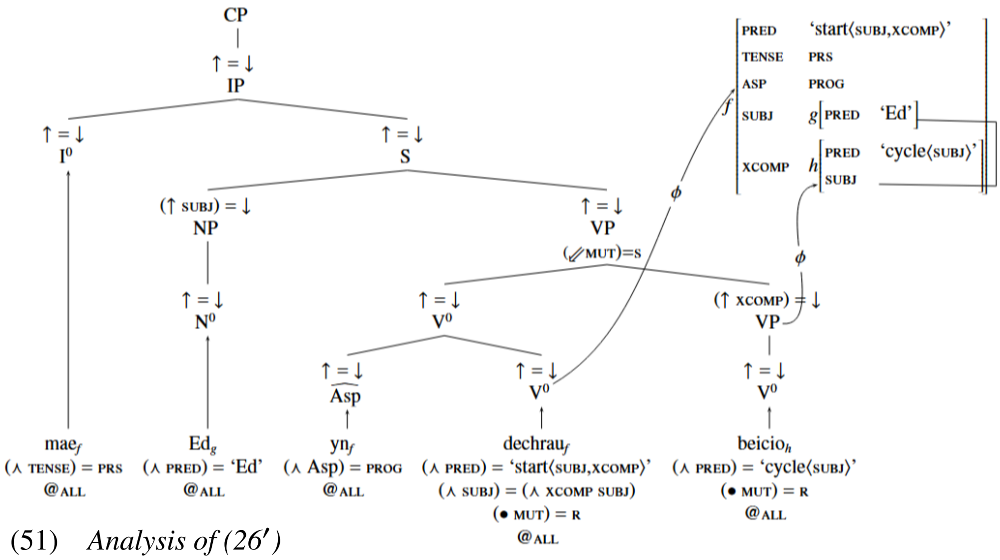
3.4.2 PRO and NP-trace

Recall that LFG does not posit the existence of either PRO or NP-trace. In sentences like (23) and (24), the reason for the lack of mutation is that a VP embedded in another VP does not bear the (⫽ MUT) = S annotation; this is captured by rule (40). In contrast, the verb *feicio* in (26) is subject to this annotation because it falls at the left-edge of the highest VP, which is embedded in S and thus governed by rule (38). It also mutates because the path from *Ed*'s f-structure to *feicio*'s f-structure in (26′) is ((SUBJ ∧) XCOMP) = ≻, meaning @ALL calls @S-TRIGGER. There is no such path in (24′).

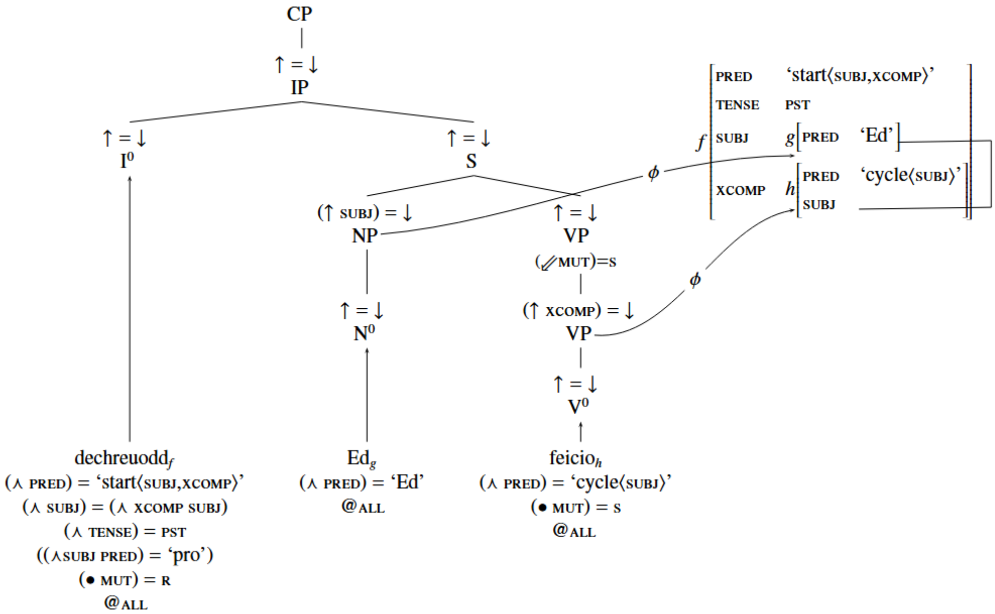
(24′) Mae Ed yn dechrau beicio.
be.PRS Ed PROG start.NF cycle.NF
'Ed starts to cycle.'

(26′) Dechreuodd Ed ^{S}feicio.
start.PST Ed cycle.NF
'Ed started to cycle.'

(50) *Analysis of (24′)*



(51) *Analysis of (26′)*



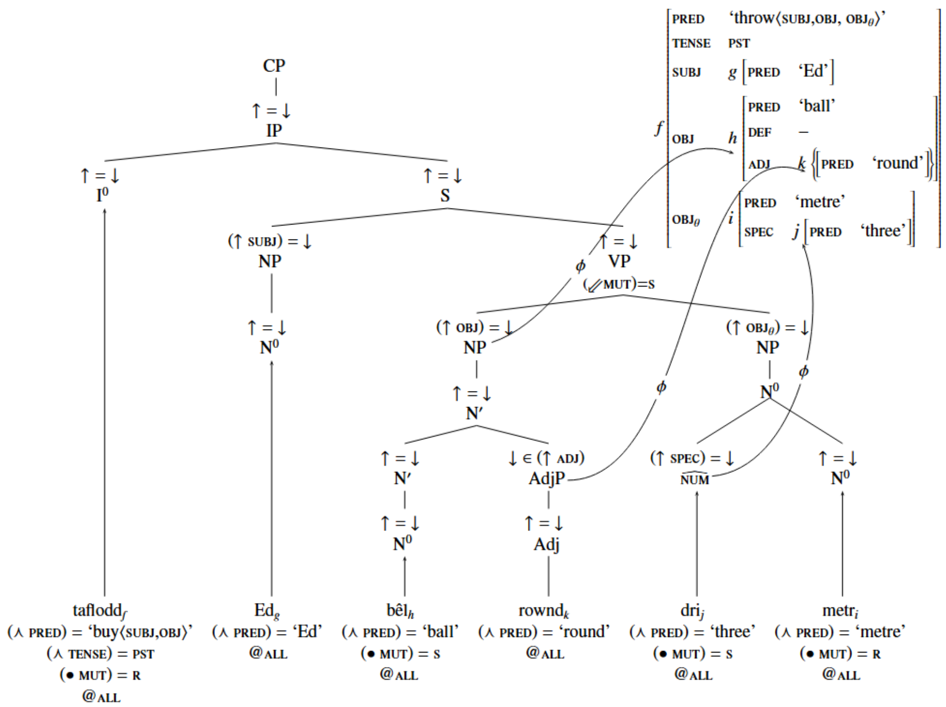
The LFG analysis proposed here thus does not rely on the presence of empty phrases that are required in other theories, because the PSRs and the @ALL template successfully account for the data. The insight of this analysis is that only one of two possible requirements must be met for soft mutation to be triggered: a particular (f-)structural relationship with a preceding word or a particular position in the sentence.

3.4.3 Multi-argument verbs

The @ALL template is also useful in dealing with multi-argument verbs, the mutation facts for which the existing LFG analysis does not cover. Consider the following example:

(52) Taflodd Ed ^{S}bêl rownd ^{S}dri metr.
throw-PST Ed ball round three metre
'Ed threw the round ball three metres.'

(53) *Analysis of (52)*



As is by now familiar, the object's mutation is triggered by the @ALL on the subject, and by the PSR for the VP (XP). The mutation on *dri* is triggered by the @ALL called on *rownd*.

3.4.4 Adjuncts and coordination

This LFG analysis does not face a problem with the lack of mutation by one conjunct or adjunct to another in its set, because of the requirement that the @S-TRIGGER template only be called when the next word's f-structure does not belong to the same set as the current word's f-structure:

(16′) Bwytais i $^{\mathrm{S}}$fara, $^{\mathbf{R}}$menyn, a $^{\mathrm{A}}$chaws.
eat-PST.1s 1s bread butter and cheese
‘I ate bread, butter and cheese.’

(15′) bwrdd mawr $^{\mathbf{R}}$crwn $^{\mathrm{R}}$brenin
table big round king
‘a king’s big round table’

Recall that the lack of mutation on the possessor is part of the @S-TRIGGER template, and is therefore part of a more general rule.

3.4.5 Interrogative CPs

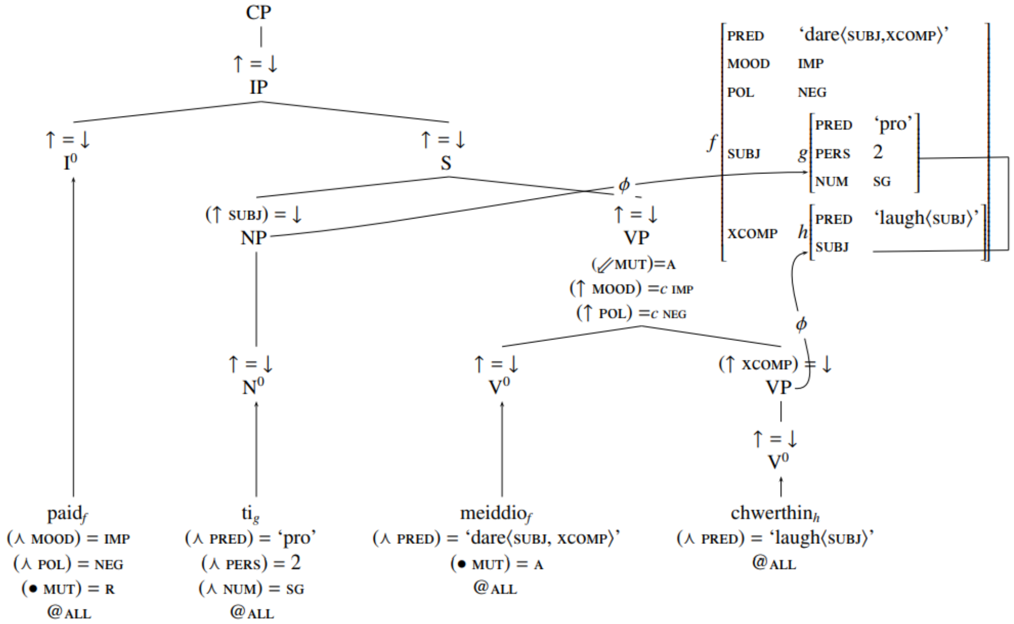
Interrogative CPs are considered separately to non-interrogative CPs in the PSRs above; unlike non-interrogative CPs, they are not one of the possible instantiations of XP. This gives us the mutation facts in (27) without the need to propose an empty blocking element. At some point an association between interrogative CPs and lack of mutation was established, and new generations of (native) learners list such CPs separately to XP in (38) because it is not subject to the soft mutation requirement.

Tallerman (2006) reports that some speakers soft-mutate interrogative CPs. This suggests that not all speakers now distinguish two types of CPs as shown in this fragment. For some speakers, all CPs are subject to the XP generalization, and thus they have acquired a simpler S rule (38) and definition of XP (39).

3.4.6 Negative imperatives

The explanation for the aspirate mutation on verbs after the subject in negative imperatives is very similar. The VP in a negative imperative is not part of XP, and so not subject to the (⫽ MUT) = S constraint; instead it has its own (⫽ MUT) = A constraint. The @ALL template provides no competing soft-mutation requirement, because *meiddio* is treated as the main predicate, with *paid* simply contributing mood and polarity information. This has the result that the f-structure to which *meiddio* projects contains that of the preceding word, the subject *ti*, preventing @ALL calling @S-TRIGGER and thus avoiding a clashing value. Hence, although the word order of the negative imperative is superficially similar to a control context like (26) (finite verb – subject – lexical verb) the mutation facts are different, because it is only in the control sentence that the lexical verb is positioned inside XP (and thus has mutation imposed on it by the PSR in (38)), and only in this sentence that it is subject to the @S-TRIGGER template via @ALL, because there is no raising structure for an auxiliary like *paid*, compared to a control verb. In the negative imperative, the PSR imposes aspirate mutation instead.

(54) *Analysis of (28)*



4 Conclusions and future directions

This analysis captures the mutation facts of Welsh using well-established formal tools within the LFG framework, such as PSRs and templates. The latter formally abbreviate information that is repeated across lexical entries. Significantly for the LFG framework, this account shows that empty phrases are not necessary to account for mutations in Welsh; instead PSRs such as that in (38) trigger relevant mutations. Furthermore, by listing certain categories which sit outside XP in the S rule in (38), it is possible to avoid positing sometimes otherwise-unmotivated empty categories in the structure to absorb a predicted mutation.

In terms of future research, a question arises as to whether the f-structural relationship required by the @ALL template, or perhaps sub-parts of it like the 'lack of containment' relationship, i.e. $(f\ (\text{GF}\ (\in))^{*}) \neq g \wedge (g\ (\text{GF}\ (\in))^{*}) \neq f$, or the 'not in same set' relationship, i.e. $(\in f) \neq (\in g)$, have more general applications or not. Lack of containment, in one direction, i.e., $(f\ \text{GF})^{*} \neq g$, is specified in the f-command relation (and true in the second direction, i.e., $(g\ \text{GF})^{*} \neq f$, but redundant) (Dalrymple et al. 2019: 238–240), but is here extended to deal with members of sets. The 'not in same set' relation, or its complement, 'same-set membership', may be useful because it distinguishes the relationship between adjuncts and conjuncts in a set from that between say, a subject and object, or object and oblique. The full relationship specified in @ALL has some parallels to XP boundaries without repeating them directly (recall the lack of boundary between the subject and main predicate in (54), for example). Although not essential, it would certainly lend further weight to the analysis presented here if it could be shown that the relationship specified in @ALL, which is not unlike f-command in some respects, is applicable in other analyses. I leave this matter to future research.

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