

HUMMING, WHISTLING, SINGING, AND YELLING IN PIRAHÃ CONTEXT AND CHANNELS OF COMMUNICATION IN FDG¹

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Abstract

This paper addresses the systematic influence of contextual factors on the form of linguistic utterances for the different speech channels of communication in Pirahã within the framework of Functional Discourse Grammar (FDG). It is shown that context plays an important role in the choice of a particular speech channel and the associated phonological or phonetic alteration of the underlying linguistic form. A representational system for the description of contextual factors which interact with the grammar and the influence of these contextual factors upon the grammar in Pirahã is then proposed within and elaborating upon the model of FDG. The implications of the speech channels in Pirahã for FDG and for linguistic theory in general are lastly examined.

Keywords: Channels of Communication; Context and Grammar; Humming; Whistling; Singing, Yelling; Functional Discourse Grammar; Pirahã.

1. Introduction

Traditional Irish music draws a clear distinction between ‘songs’ and ‘tunes’. A song consists of both words and a melody, whereas a tune consists solely of a melody. Needless to say, a song may be stripped of its words leaving only a melody, in which case it becomes a tune, and a tune may be married to words, in which case it becomes a song. Although tunes are usually played on a traditional instrument, they may also be hummed, whistled, and even ‘lilted’ to a series of nonsense syllables. The distinction between songs and tunes in Irish music is thus clear in that songs always contain lexical material which conveys (linguistic) meaning, while tunes are totally devoid of (linguistic) meaning. Linguistic utterances in the Pirahã language of the Brazilian Amazon may be likened to songs in Irish music. The language makes such extensive use of tone, syllable weight, and stress that normal utterances may be considered to be not merely spoken but also ‘sung’. What is more interesting is that, unlike songs in Irish

¹ I am very grateful to Daniel Everett, Daniel García Velasco, and Kees Hengeveld for commentary and discussion on (various aspects of) this paper as well as to the editors of this special edition and the members of the FDG Workshop 2011 in Barcelona for comments on earlier versions of this paper.

music, the ‘melody’ of Pirahã utterances carries a relatively high functional load. Utterances in Pirahã may thus be embellished and be properly sung or may alternatively be stripped of lexical material and be hummed, whistled, and yelled, whilst at the same time retaining the exact same meaning. The different ‘channels of communication’ (Hymes 1974: 58) are categorically associated with specific phonological and/or phonetic features as well as with specific contextual factors.

This paper examines the interplay between context and channels of communication in Pirahã within the model of Functional Discourse Grammar (FDG). The phonology and speech channels of Pirahã are first outlined (§ 2). An adapted model of FDG is then proposed in order to account for the speech channels (§ 3). The impact of contextual factors on the linguistic form for each speech channel is subsequently described within the adapted model of FDG (§ 4). The paper closes with a discussion of the results and some implications for FDG and for linguistic theory in general (§ 5).

2. Phonology and channels of communication in Pirahã²

2.1. Segments and suprasegments³

Pirahã exhibits not only a comparatively simple consonant inventory, and the unusual distinction of a particular consonant within the phonemic repertoire of males, but also a predilection for stop consonants. The basic Pirahã consonant inventory consists of the phonemes /p, b, t, k, g, ʔ, h/ for both males and females, with males further exclusively distinguishing the phoneme /s/.⁴ The vowel inventory of Pirahã is also relatively simple and consists of the phonemes /i, a, o/ for both males and females. These monophthongs may further be lengthened or may combine to form diphthongs.

Pirahã is a tonal language and distinguishes two phonemic tones. A vowel may receive either a low tone or a high tone.⁵ This also applies to lengthened vowels where the vowel may consist of either a single tone or a mix of two tones. This further applies to diphthongs where the individual vowels may again receive the same or different tones. The placement of word stress is related to syllable weight, with the rightmost token of the heaviest syllable within the final three syllables of the word receiving the stress. Syllable weight is determined by the nature of the segments (consonant versus vowel), the nature of the consonants (voiced versus voiceless), and the number of segments (two versus three) in the syllable. Five syllable weights are distinguished in decreasing relative order of weight: CVV > GVV > VV > CV > GV.⁶ These five

² The information on phonology and channels of communication in Pirahã comes from (a selection of) various relevant publications by Daniel (and Keren) Everett which are included in the references.

³ The term ‘segments’ refers to individual phonemes (consonants and vowels) and ‘suprasegments’ to phonological elements greater than phonemes (tone, syllable weight, and stress) in this paper.

⁴ /ʔ/ is represented orthographically as ‘x’ although Everett has used ‘?’ (such as Everett 1985).

⁵ A low tone is not distinguished in the orthography but a high tone is with an acute accent. A low tone has occasionally been marked in Pirahã with a grave accent (cf. Everett 1979).

⁶ C = voiceless consonant, G = voiced consonant, and V = vowel. The individual weight of each segment and thus the accumulative weight of a syllable is based on the weight ranking V > C > G (Everett 1979: 53). Long vowels count as VV in this ranking.

syllable weights correspond to the following relative syllable lengths: Semibreve > dotted half note > half note > dotted quarter note > quarter note as in Table 1.

Table 1: Syllable weight and length in Pirahã

Syllable weight	CVV	GVV	VV	CV	GV
Syllable length	◦	◡	◡	◡	◡

A typical Pirahã utterance thus contains not only the consonants and vowels of each word, but also the tones, syllable weights, and stress patterns as in (1)⁷. The

(1) Orthography:	Káixihí		xaoxaagá			gáihí.		
Syllable:	kai.	ʔi.	hi	ʔao.	ʔa:.	ga	gai.	hi
Tone:	1J	J	1	JJ	J	1	1J	1
Syllable weight:	CVV	CV	CV	CVV	CVV	GV	GVV	CV
Stress:	'				'		'	
Gloss:	paca			exist			there	
Translation:	'There is a paca there.'							

consonants and vowels (with or without a length symbol) may be shown in syllables (implicitly indicating syllable weight) with the tones and stress patterns in phonemic script or the syllable lengths may be shown (implicitly indicating syllable weight) with the tones and stress patterns in quasi-musical notation (following Everett) as in (2)⁸.

(2) Orthography:	Káixihí		xaoxaagá			gáihí.		
Phonemic script:	'kaʔi:J.	ʔi:J.	hiʔ	ʔaʔo:J.	ʔa:J.	gaʔ	'gaʔi:J.	hiʔ
Musical notation:								
	^			^		^		
Gloss:	paca			exist			there	
Translation:	'There is a paca there.'							

⁷ I have represented *xaoxaagá* as a single unit following Everett (2009: 182) although this is not uniform (cf. Everett 2004: 152; 2005: 32) and have given the simple translation 'exist' (cf. Everett 1986: 204).

⁸ The type of note indicates the length, the relative height indicates the tone, the caret ^ indicates stress, a musical tie \ indicates movement from one tone to another, and the bar | indicates a word boundary.

2.2. Functional load of (supra)segments

Linguistic utterances in Pirahã utilise both segments and suprasegments to express a communicative intention. The suprasegments seem, however, to carry a relatively higher functional load than the segments. This is evidenced by the so-called ‘sloppy phoneme effect’ whereby free variation is regular between voiceless stops and between fricatives. The voiceless stops /p, t, k, ʔ/ are interchangeable in various positions and to varying degrees depending on the idiolect as in (3). The fricatives /h, s/ are similarly

- | | | | | | |
|--------|----------------|----|----------------|----|----------------|
| (3) a. | xapapaí | b. | kapapaí | c. | papapaí |
| | ʔaJ.paJ.'paJiŋ | | kaJ.paJ.'paJiŋ | | paJ.paJ.'paJiŋ |
| | 'head' | | 'head' | | 'head' |
| d. | xaxaxaí | e. | kakakaí | | |
| | ʔaJ.ʔaJ.'ʔaJiŋ | | kaJ.kaJ.'kaJiŋ | | |
| | 'head' | | 'head' | | |

interchangeable depending on the male idiolect as in (4). Although there is variation

- | | | | | | |
|--------|--------------------|----|--------------------|----|--------------------|
| (4) a. | xísiihoái | b. | kísiihoái | c. | písiihoái |
| | ʔiŋ.'si:J.hoJ.aŋiŋ | | kiŋ.'si:J.hoJ.aŋiŋ | | piŋ.'si:J.hoJ.aŋiŋ |
| | 'liquid fuel' | | 'liquid fuel' | | 'liquid fuel' |
| d. | píhiihoái | e. | kíhiihoái | | |
| | piŋ.'hi:J.hoJ.aŋiŋ | | kiŋ.'hi:J.hoJ.aŋiŋ | | |
| | 'liquid fuel' | | 'liquid fuel' | | |

between voiceless stops and fricatives, this is not to say that there is no underlying phonological form for each word. There is a clear basic form which occurs as the most frequent realisation both inter-idiolectally and intra-idiolectally as in (3a) and (4a). The sloppy phoneme effect is more frequent in children’s speech and additionally involves free variation among voiced stops (Everett 1985: 413). The existence of the sloppy phoneme effect implies that the distinction of place of articulation may be relatively redundant in Pirahã, with the manner of articulation and the suprasegmental features bearing the functional load of the utterance. The fact that “Pirahã children control the prosodic features of a given lexical item or utterance before its (basic) segmental manifestation” (Everett 1985: 413) and the existence of channels of communication which are characterised by a reduced phoneme inventory further emphasises the relative redundancy of segments and the high functional load of suprasegments in Pirahã.

2.3. Channels of communication⁹

The term ‘channel of communication’ refers to the “medium used to carry a linguistic message from the source (speaker) to the receiver (hearer)” (Everett 1985: 412). Pirahã distinguishes five speech channels, namely ‘normal speech’, ‘hum speech’, ‘whistle speech’, ‘musical speech’, and ‘yell speech’. Normal speech refers to the default standard speech consisting of consonants and vowels arranged in syllables with tone, syllable weight, and word stress as in (2). Each of the non-normal speech channels is employed strictly according to specific contextual factors and is identified by an alteration of the (supra)segmental features of the default utterance which would be used in normal speech as in Table 2.¹⁰ This is in line with the assertion that “the greater the

Table 2: Channels of communication in Pirahã

Speech channel	Context	Realisation
Normal speech	default unmarked speech	/p, b, t, k, g, ʔ, h, (s), i, a, o/ tone, syllable weight, stress
Hum speech	for privacy for intimacy disguising identity of speaker oral obstruction to speech signal between caregiver and child	/m̃ (, ã)/ tone, syllable weight, stress low volume
Whistle speech	males hunting in forest males play hunting and warring aggressive play between males	/m̃↓/ tone, syllable weight, stress
Musical speech	for important new information communication with/by spirits when flirting when dancing	/p, b, t, k, g, ʔ, h, (s), i, a, o/ tone, syllable weight, stress (arbitrary) pitch exaggerated (changed) rhythm

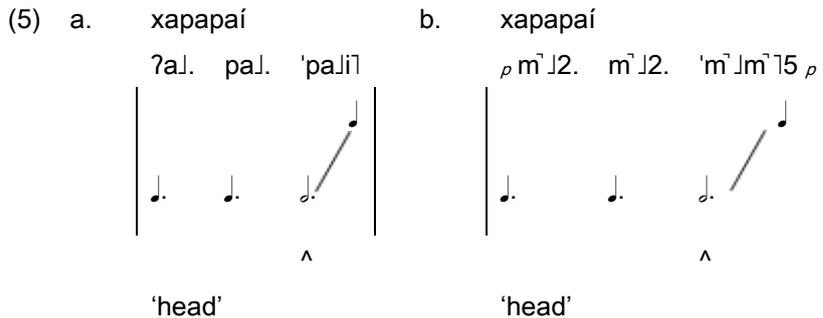
⁹ For audio/video examples of the channels see <http://daneverttbooks.com/radio-publications/film-clips>.

¹⁰ The activation of the non-normal speech channels by specific contextual factors is systematic in the sense of being statistically significant but does not appear to be strictly obligatory (Daniel Everett p.c.). Whereas Hengeveld & Mackenzie (2008) regularly employs the term ‘systematic’ but does not explicitly distinguish degrees of systematicity of interlevel or intercomponent relations, Hengeveld & Mackenzie (this volume) employs a stricter definition of the term for the influence of context on grammar and disregards statistically significant relations in favour of rule-governed relations. The ramifications of this stricter definition for other interlevel and intercomponent relations is unclear: How would this apply for instance for the possible expression of a single conceptualisation by multiple grammatical means (intercomponent) or the possible mapping of the same pragmatic and/or semantic representations onto multiple morphosyntactic and/or phonological forms (interlevel)? It may well be that the answer lies in the nature of the relations between the individual levels and components. For the purposes of this article I divide systematicity into obligatory (absolute) relations versus statistical (tendential) relations and consider the influence of contextual factors on speech channels in Pirahã to be of the latter category.

Yell speech	interlocutors located far apart physical obstruction to speech signal during rainstorms/thunderstorms	/k, ʔ, ā/ tone, syllable weight, stress high volume begins at high pitch rises to falsetto
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the communicative dependence on a particular channel, the greater the number of contrastive features needed for that channel” (Everett 1985: 412). The non-normal speech channels in Pirahã are not restricted in their communication of content and are equally as productive as the normal speech channel. Utterances in normal speech may further be productively ‘translated’ into the other channels.

Hum speech is used in home and village situations when close, emotional, and physical proximity is recognised by the interlocutors, and is usually used for privacy (disguising what is being said), intimacy, disguising the identity of the speaker, talking when there is an oral obstruction (such as when eating), and between caregiver (usually but not always the mother) and child. Hum speech involves humming the suprasegmental features of the utterance at a low volume without the respective consonants and vowels (and less often instead of the humming, may involve a nasalised and slightly breathy open front vowel) as in (5).¹¹ All syllables are thus systematically



reduced in hum speech to a voiced orally unreleased bilabial nasal /m̃/ which may carry both tone and stress. Each hum in hum speech consists of an individual articulation.

Whistle speech is used solely by males when hunting in the forest, play hunting and warring, and in aggressive play. Whistle speech involves whistling the suprasegmental features of the utterance using an ingressive airflow as in (6).¹² All

¹¹ I consider both forms to be humming in the sense that they are nasally released. The representation of hum speech following IPA conventions poses a problem as the loss of phoneme differentiation results in the fivefold distinction of syllable weight in normal speech (voiced versus voiceless consonants with short versus long vowels) becoming a twofold distinction in hum speech (short versus long hums). The syllable weight of each syllable is retained in hum speech and thus needs to be visually represented for descriptive adequacy. This has been achieved by removing the vowel length symbol and instead assigning each syllable a syllable length number: CVV = 5 > GVV = 4 > VV = 3 > CV = 2 > GV = 1. I have represented the quietness associated with humming with an IPA subscript italicised ‘p’ *p* before and after the utterance. The utterance would also be placed between curly brackets {} following IPA convention.

¹² The problem with the representation of the hum speech channel similarly applies for the whistle speech channel where the loss of phonemic representation and thus the loss of syllable weight

(6) a. xapapaí b. xapapaí
 ?aJ. paJ. 'paJiĩ m̩↓J2. m̩↓J2. 'm̩↓J m̩↓J5

'head' 'head'

syllables are systematically reduced in whistle speech to an ingressive rounded bilabial whistle /m̩↓/ which may again carry both tone and stress. Each whistle in whistle speech consists similar to a hum in hum speech of a single articulation

Musical speech is primarily used for communicating important new information, for communicating with or as Pirahã spirits¹³, for flirtation, and when dancing. Musical speech differs from normal speech in that it is produced by exaggerating the relative pitch differences between low and high tones and by a possible change in the rhythm to produce a more concrete (and often idiosyncratic) melody.¹⁴

Yell speech is lastly used when the interlocutors are located (relatively) far apart, when there is a physical obstruction to the speech signal, and during loud rainstorms and thunderstorms. Yell speech differs from normal speech in that it begins at a much higher pitch and rises to a falsetto, with the original consonants being replaced with either a voiceless velar stop /k/ or a glottal stop /ʔ/ and with the vowels being replaced with a (slightly) nasalised open front vowel /ã/ as in (7).¹⁵ All syllables are thus systematically replaced in yell speech with either the syllable /kã/ or /ʔã/ whilst at the same time retaining the original tone, syllable weight, and stress of the syllable.

representation need to be recovered by the addition of syllable length numbers for representational adequacy.

¹³ Everett observed members of the Pirahã community taking on the role of the spirits and communicating with other members of the Pirahã community (Everett 2009: 138-141).

¹⁴ Musical speech would not be represented by relative notes in quasi-musical notation but by absolute notes in musical notation. I have not represented musical speech due to its highly idiosyncratic nature.

¹⁵ The loss of voicing in yell speech results in a threefold distinction in yell speech (voiceless consonant with short versus long vowels). It is unclear whether syllable weights involving voiced consonants are indeed retained in yell speech. Contextual disambiguation would likely result in the case of non-retention. I have chosen the former interpretation following Everett. Syllable length numbers may again be used to visually capture the syllable weight. I have represented the loudness associated with yelling with an IPA subscript italicised 'f' placed before and after the utterance. The IPA does not mark falsetto phonation.

I further argue that the single level of representation for the processes involved in Phonological Encoding does not adequately capture the (complexity or order of the) phonological processes associated with channels of communication in Pirahã. It seems apparent that the fundal phonological forms must first be inserted from the Fund before a speech channel may be selected. The activation of a non-normal speech channel may result in the application of associated phonological processes before further phonological processes may be executed. I thus follow O’Neill (2012: 125-128; in prep.b) splitting Phonological Encoding into two sequential sub-operations. Underlying Phonological Encoding deals with the insertion and possible channel modification of the underlying phonological form and is represented at the Underlying Phonological Level. Although the relevant phonological processes affect phonemes and syllables, they are in fact applied globally to all phonemes and syllables within utterances. Channel modification at the Underlying Phonological Level may therefore be represented by channel operators which apply at the layer of the Utterance. This applies for the Hum Speech operator (HUM), Whistle Speech operator (WHIS), and Yell Speech operator (YELL). Surface Phonological Encoding deals subsequently with creating the surface phonological form and is shown at the Surface Phonological Level. The representations from Surface Phonological Encoding form the input for Articulation which carries out the necessary modifications and phonetic rules to create the acoustic utterance. The underlying and surface phonological distinctions for each speech channel of communication in Pirahã may be summarised as in Table 3¹⁸.

Table 3: Underlying and surface phonological distinctions

Phonology	Speech channel	Syllable	
		Consonants	Vowels
Underlying phonology	Not applicable	/p, b, t, k, g, ʔ, h, (s)/	/i, a, o/
Surface phonology	Normal speech	//p, b, t, k, g, ʔ, h, (s)//	//i, a, o//
	Hum speech	//m̃(, ā)//	
	Whistle speech	//m̃↓//	
	Musical speech	//p, b, t, k, g, ʔ, h, (s)//	//i, a, o//
	Yell speech	//k, ʔ//	//ā//

3.2. Organisation of the Contextual Component

Functional Discourse Grammar owes its name to the fact that the theory offers a functional model of grammar which attempts to describe the function and structure of

¹⁸ Underlying phonological forms are represented between single slashes /.../, surface phonological forms between double slashes //...//, and articulatory realisations between single square brackets [...].

linguistic utterances within the communicative discourse context. The Grammatical Component is envisaged to interact with a Contextual Component which contains a description of the content and form of preceding discourse as well as the perceivable setting in which the speech event takes place and the social relationships between the speech event participants (Hengeveld & Mackenzie 2008: 6, this volume). A detailed categorisation of context within the model of FDG has been proposed by Connolly (2004, 2007, this volume) which may be represented as in Table 4¹⁹. The

Table 4: General categorisation of context

Context			
Mental / Extra-mental			
Discoursal		Situational	
		Interactional / Described	
Narrow / Broad		Narrow / Broad	
Linguistic	Non-verbal	Physical	Socio-cultural

division between discoursal and situational context has recently been incorporated into FDG.²⁰ The form-oriented function-to-form nature of the model has resulted in a restricted definition of these two types of context and a top-down stratified organisation within the Contextual Component (Hengeveld & Mackenzie this volume). Discoursal information encompasses the linguistic aspects of previous discourse-related utterances in the form of layers at four contextual strata. Situational information consists of the (properties of) participants, time, and location of the communicative event at the Interpersonal Stratum as well as (properties of) perceivable and inferable entities at the Representational Stratum. The contextual factors at a particular stratum may influence (specific) operations in the Grammatical Component, with discoursal context interfacing with both Formulation and Encoding, and situational context interfacing solely with Formulation. I argue that the current categorisation of context and the interaction of situational context with the grammar do not adequately describe the activation of the non-normal speech channels in Pirahã. I thus propose incorporating a more detailed categorisation of context and a more extensive interaction of context with the grammar as well as a representational system for contextual factors in FDG.

The normal speech channel forms the default channel of communication in Pirahã and may be considered not to be activated by the presence but rather by the absence of (specific) contextual factors. The hum speech channel, on the other hand, is used for privacy, disguising the identity of the speaker, intimacy, between caregiver and child, and talking with an oral obstruction. The concept of privacy refers to the emotional wish to exclude discourse participants from understanding an utterance and forms an 'emotional purpose'²¹ for how the utterance is communicated. Concealing the

¹⁹ A further division between discoursal context, textual context, and situational context in FDG has been proposed by Cornish (2009). This has been incorporated into the 'extended model of context' as referring specifically to the extra-mental discoursal context (Connolly this volume).

²⁰ The distinctions mental versus extra-mental context, interactional versus described context, and narrow versus broad context proposed by Connolly have not been explicitly incorporated into FDG.

²¹ The term 'emotional purpose' thus differs from Connolly's (this volume) term 'social purpose'.

identity of the speaker also forms an emotional purpose. The choice of hum speech for privacy and disguise is understandable as it is articulated at a low volume and is difficult to understand from a distance as well as being difficult to understand without paying close attention (Everett 2009: 186).²² The concept of intimacy reflects the emotional wish to express social and emotional closeness to discourse participants and again constitutes an emotional purpose. The use of hum speech by a caregiver to a child similarly reflects an intimate relationship but is activated by the roles both participants play in the discourse. Each of these contextual factors may be categorised as mental situational interactional narrow socio-cultural context. An obstruction in the mouth of the speaker (such as when eating) also triggers hum speech and may be categorised as extra-mental situational interactional narrow physical context. The obstruction impedes the oral articulation of segments but humming easily allows for the oral or nasal articulation of suprasegments.

The whistle speech channel is used by males hunting in the forest, play hunting or play warring, and playing aggressively. Hunting in the forest forms an 'occasion' of hunting while play hunting mimics this occasion. Play warring and aggressive play, on the other hand, both mimic an occasion of fighting. All four contextual factors may be classed as mental situational interactional narrow socio-cultural context. The occasions of hunting and fighting are restricted to males in Pirahã society. The sole participation of males in these occasions and the use of whistle speech solely during these occasions explain the apparent restriction of whistle speech to males. This may also explain why whistle speech may have developed into a private masculine code (Everett 1985: 414).

The musical speech channel is activated in order to communicate important new information, talking to or as the spirits, when dancing, and when flirting. Information is new in a discourse when the communicative intention has not already been introduced in the immediate discourse or may have been introduced in a previous related discourse but is no longer retrievable from memory. The concept of new information is thus related to givenness and may be categorised not as the presence but as the absence of mental discursual narrow and broad linguistic context. Communication with or as spirits involves an occasion of interaction with the spiritual world. Any situation involving dancing embodies an occasion which may or may not be accompanied by flirtation between members of the opposite sex which itself serves the purpose of expressing the speaker's romantic or sexual interest in discourse participants. Both contextual factors may be classified as mental situational interactional narrow socio-cultural context.

The yell speech channel is used for communication between distanced interlocutors, when there is a physical obstruction between interlocutors, and during loud rainstorms and thunderstorms. Communication between participants who are located too far apart for normal speech such as in the jungle, in different boats on a river, on opposite sides of a river, or between distal huts in the village involves the distanced spatial location of the discourse participants within an extended discourse environment and thus reflects properties of the participants. There may further be a physical obstruction in the way of the speech signal such as (the walls of) huts, plants, and trees. A discourse may also take place during a loud rainstorm or thunderstorm

²² Hum speech seems in this case to be used similar to whispering in other languages. A possible reason for not employing whispering in Pirahã is that the vocal cords are unable to produce different tones during whispering which would render Pirahã unintelligible due to the 'emic' status of tone (Everett 2009:186).

whereby the background noise level is relatively high. These contextual factors may all be categorised as extra-mental situational interactional narrow physical context.

The contextual factors directly responsible for the activation of a non-normal speech channel excluding givenness all represent interpersonal aspects of the situational context and are thus categorised as situational context at the Interpersonal Stratum. Givenness represents the presence or absence of discursal context and is categorised as discursal context at all contextual strata. The situational subdivision of participants is present in the model but may be further subdivided into emotional purpose, mouth, role, and distance. The situational subdivision of location is also present in the model but may be further subdivided into noise and obstruction. The situational subdivision of occasion and givenness are not present in the model but may be added. I have represented givenness as an aspect of context rather than employing the notion of pushdown stacks (Hengeveld & Mackenzie, this volume) for simplicity and legibility when implementing the model. I propose that all contextual subdivisions within the Contextual Component be assigned 'values' to represent the categorical oppositions which systematically influence operations within the Grammatical Component as in Table 5.²³ These values form the lowest nodes within the hierarchical organisation of context at the different strata within the Contextual Component. The values for a specific subdivision may be polar (such as yes versus no) or non-polar in nature (such as privacy, intimacy, disguise, and flirtation). I thus propose that it is the presence of specific contextual values which activates a resultant process in the grammar and that these values are only relevant and should be represented when they have a systematic effect upon an operation in the grammar. The representation of contextual factors as values (rather than as descriptions) is furthermore desirable for simplicity and legibility in the implementation of the model. Givenness is unique in this case as it may either have a categorical value for new information or may be filled with given linguistic or non-verbal representations from the current or preceding discourse.

The presence of discursal and situational contextual factors which are relevant to the production of an utterance is currently represented at contextual strata in the Contextual Component. There is, however, no structured stratum of contextual analysis as such but rather an arbitrary presentation of contextual factors at the different strata.²⁴ The model of FDG employs levels of linguistic analysis with a hierarchical and layered structure to represent systematic processes within the Grammatical Component. Each level is formed by a relevant operation from a set of level-specific primitives. The categorisation of context as in Table 4 allows for a structured hierarchical and layered representation of contextual factors at a contextual stratum of analysis while the stratification of the Contextual Component allows for context to be represented at different strata resulting in four contextual strata of analysis as in Figure 1. The internal

²³ The proposed contextual subdivisions and values are not claimed to be universal to all languages but simply represent those subdivisions and values which systematically affect Pirahã grammar. The model proposed is thus a contextual model of speech channels of communication in Pirahã which may serve as an initial fleshing out of contextual factors which systematically influence grammar from a crosslinguistic perspective. Whereas higher level contextual subdivisions may be expected to be crosslinguistically relevant, lower level contextual subdivisions and values may be expected to be language specific.

²⁴ This is not surprising taking into account the fact that FDG is a model of grammar and not of context.

Table 5: Contextual factors relevant to speech channels within Contextual Component

Contextual stratum	Contextual factors			
	Subdivisions		Value	
Interpersonal Stratum	Situational	participants	emotional purpose	PRIVACY
				INTIMACY
				DISGUISE
				FLIRTATION
			mouth	OBSTRUCTED
			role	CAREGIVER
		CHILD		
		distance	FAR	
		location	noise	HIGH
			obstruction	YES
		occasion		HUNTING
				FIGHTING
SPIRITS				
DANCING				
All contextual strata	Discoursal	givenness	NEW	

Figure 1: General structure of contextual strata

(C₁: [(M₁: [(D₁: [(ND₁: [(L₁: (CC_{1+N}) (L₁)) (NV₁: (CC_{2+N}) (NV₁))] (ND₁)) (BD₁: [(L₂) (NV₂)] (BD₁))] (D₁)) (S₁: [(I₁: [(NS₁: [(P₁: (CC_{3+N}) (P₁)) (SC₁: (CC_{4+N}) (SC₁))] (NS₁)) (BS₁: [(P₂) (SC₂)] (BS₁))] (I₁)) (DE₁: [(NS₂: [(P₃) (SC₃)] (NS₂)) (BS₂: [(P₄) (SC₄)] (BS₂))] (DE₁))] (S₁))] (M₁)) (E₁: [(D₂) (S₂)] (E₁))] (C₁))

structure of each of these contextual strata is inherently identical (unlike linguistic levels which are inherently different) although different strata may recognise different contextual subdivisions. Each stratum consists of a Context (C) which may consist of Mental (M) and Extra-Mental (E) context. Mental context may consist of Discoursal (D) and Situational (S) context. Discoursal context may in turn consist of Narrow Discoursal (ND) and Broad Discoursal (BD) context. Both types of Discoursal context may then consist of Linguistic (L) and Non-Verbal (NV) context. These last two types of Discoursal context may further consist of one or more (+N) subdivisions of Contextual Categories (CC) which are relevant to the linguistic analysis at hand. Situational context may in turn consist of Interactional (I) and Described (DE) context. Both types of Situational context may then consist of Narrow Situational (NS) and Broad Situational (BS) context. These two types of Situational context may further consist of Physical (P) and Socio-Cultural (SC) context. These last two types of Situational Context may finally consist of one or more subdivisions of Contextual Categories. Extra-mental context may finally be organised according to the same structure as for Mental context. The various

layers of contextual strata (unlike the layers of linguistic levels) may not be modified or carry functions but simply represent categories of context. The lowest layers may (similar to the layers of linguistic levels) take a 'head' in the form of values or 'contextemes'²⁵ relevant for the production of an utterance.

Incorporating the contextual factors which activate the non-normal speech channels of communication into the Interpersonal Stratum results in Figure 2. This

Figure 2: General structure of Interpersonal Stratum in Pirahã

(C₁: [(M₁: [(D₁: [(ND₁: [(L₁: (GIV₁: CONT (GIV₁)) (L₁)) (NV₁: (GIV₂: CONT (GIV₂)) (NV₁))] (ND₁)) (BD₁: [(L₂: (GIV₃: CONT (GIV₃)) (L₂)) (NV₂: (GIV₄: CONT (GIV₄)) (NV₂))] (BD₁))] (D₁)) (S₁: (I₁: (NS₁: (SC₁: [(SCP_{1+N}: [(EPU_{1+N}: CONT (EPU_{1+N})) (ROL_{1+N}: CONT (ROL_{1+N}))] (SCP_{1+N})) (OCC_{1+N}: CONT (OCC_{1+N}))] (SC₁)) (NS₁)) (I₁)) (S₁))] (M₁)) (E₁: (S₂: (I₂: (NP₁: [(PPA_{1+N}: [(MOU₁: CONT (MOU₁)) (DIS₁: CONT (DIS₁))] (PPA_{1+N})) (LOC₁: [(OBS₁: CONT (OBS₁)) (NOI₁: CONT (NOI₁))] (LOC₁))] (NP₁)) (I₂)) (S₂)) (E₁))] (C₁))

maximum general structure of the Interpersonal Stratum further represents the Mental Discoursal Narrow and Broad layer of Givenness (GIV), the Mental Situational Interactional Narrow Socio-Cultural layers of Participant (SCP) and Occasion (OCC), and the Extra-Mental Situational Interactional Narrow Physical layers of Participant (PPA) and Location (LOC). The Socio-Cultural Participant may subsequently be subdivided into Emotional Purpose (EPU) and Role (ROL), the Physical Participant into Mouth (MOU) and Distance (DIS), and the Location into Obstruction (OBS) and Noise (NOI). The lowest subdivisional layers may finally take a contexteme (CONT) as head representing the relevant value for a specific contextual subdivision. The activation of the musical speech channel by givenness may also be incorporated into the non-interpersonal strata as in Figure 3. Givenness forms the only contextual factor at the Representational,

Figure 3: General structure of non-interpersonal strata in Pirahã

(C₁: (M₁: (D₁: [(ND₁: [(L₁: (GIV₁: CONT (GIV₁)) (L₁)) (NV₁: (GIV₂: CONT (GIV₂)) (NV₁))] (ND₁)) (BD₁: [(L₂: (GIV₃: CONT (GIV₃)) (L₂)) (NV₂: (GIV₄: CONT (GIV₄)) (NV₂))] (BD₁))] (D₁)) (M₁)) (C₁))

Morphosyntactic, and Phonological Strata relevant to speech channels in Pirahã and may be similarly represented as for contextual factors at the Interpersonal Stratum.

²⁵ The -emic nature of the term 'contexteme' simply implies a basic abstract linguistic unit and does not necessarily entail an -etic equivalent. A contexteme is thus a representational contextual unit which systematically influences grammatical processes. The term 'contextete' may accordingly be proposed to be the actual contextual instantiation of the associated contextemic value.

4. Context and channels of communication in FDG

The normal, hum, whistle, musical, and yell speech channels in Pirahã are compared in this section on the basis of the same communicative intention *Káixihí xaoxaagá gáihí* ‘There is a paca’ as in (2).

4.1. Normal speech

The normal speech channel forms the default channel of communication in Pirahã and there is thus no activation of a channel operator as in (8)²⁶. The fundal phonological

(8)	IL:	(M _i : (A _i : [(F _i : DECL (F _i)) (P _i) _S (P _J) _A (C _i : [(T _i) (R _i) (R _J)] (C _i))] (A _i)) (M _i))
	RL:	(p _i : (ep _i : (e _i : (f _i : [(f _j : xaoxaagá (f _j)) (x _i : (f _k : káixihí (f _k)) (x _i)) _U (l _i : (f _i : gáihí (f _i)) (l _i)) _L (f _i)) (e _i)) (ep _i)) (p _i))
	ML:	(L _{e_i} : (C _{l_i} : [(N _{p_i} : (N _{w_i} : káixihí (N _{w_i})) (N _{p_i})) _{SUBJ} (V _{p_i} : (V _{w_i} : -xaoxaagá- (V _{w_i})) (V _{p_i})) (G _{w_i} : gáihí (G _{w_i}))] (C _{l_i})) (L _{e_i}))
	PL:	U (U _i : (IP _i : (PP _i : [(PW _i : -/ka ^h li ^h .ʔi ^h .hi ^h /- (PW _i)) (PW _J : -/ʔa ^h lo ^h .ʔa ^h .ga ^h /- (PW _J)) (PW _K : -/ga ^h li ^h .hi ^h /- (PW _K))] (PP _i)) (IP _i)) (U _i))
	S	(R U _i : (IP _i : (PP _i : [(PW _i : -/ka ^h li ^h .ʔi ^h .hi ^h /- (PW _i)) (PW _J : -/ʔa ^h lo ^h .ʔa ^h .ga ^h /- (PW _J)) (PW _K : -/ga ^h li ^h .hi ^h /- (PW _K))] (PP _i)) (IP _i)) (U _i))
	OL:	[ka ^h li ^h .ʔi ^h .hi ^h ʔa ^h lo ^h .ʔa ^h .ga ^h ga ^h li ^h .hi ^h]

forms are inserted at the Underlying Phonological Level and no channel modification occurs in the absence of a channel operator. The surface form is thus identical to the underlying form and may in turn be modified at the Surface Phonological Level. The modification in this case involves a Rising operator (R) for the declarative illocution.²⁷

A problem that arises with the normal speech channel is that Pirahã women do not differentiate the phoneme /s/ in their speech, as evidenced by the male and female forms of the word *sabi* ‘mean’ in respectively (9a) and (9b). It is highly unlikely that

(9)	a.	Kaoáibógi	hi	sabi	xáagahá.
		ka ^h lo ^h .a ^h li ^h .bo ^h .gi ^h	hi ^h	sa ^h .bi ^h	ʔa ^h .ga ^h .ha ^h
		evil spirit	he	mean	be.permanent
		‘Evil spirits are mean.’			

²⁶ Abbreviations in the FDG representations: C = Contextual; I = Interpersonal; L = Level; M = Morphosyntactic; O = Output; P = Phonological; R = Representational; S = Stratum/Surface; U = Underlying. Fundal Strata could if needed be distinguished from Contextual Strata by the abbreviation F. Elements between hyphens -...- may but are not deemed necessary to be analysed at lower layers.

²⁷ Declarative sentences in Pirahã are associated not only with a gradual rising intonation but also with a crescendo beginning, loud and rapid middle, and slow and diminuendo end (Everett 1991: 195-196).

b.	Kaoáibógi	hi	sabi	xáagahá.
	ka.lo].a.li].bo].gi]	hi]	'ha].bi]	'ʔa:].ga].ha]
	evil spirit	he	mean	be.permanent
	'Evil spirits are mean.'			

Pirahã females are shielded from this phoneme during language acquisition. This would suggest that they passively acquire the /s/ in acquisition but learn to replace the /s/ with /h/ in language production. This modification of the underlying form in normal speech does not qualify in the strictest sense as a channel because only a specific phoneme is altered whereby the channel is otherwise identical to the normal speech channel used by males. The alteration may instead be regarded as a type of mutation which is activated when the speaker is female. The mutation may be formally shown by a phonological operator (FEM) which applies at the Phoneme layer at the Underlying Phonological Level. The contextual activator may be captured by incorporating a physical participant gender distinction (GEN) with a contexteme value (FEMALE) which is classed as extra-mental situational interactional narrow physical context at the Contextual Interpersonal Stratum. This unusual expression of gender as in (9b) may be represented as in (10).²⁸

(10) CIS:	(C _i : (E _i : (S _i : (I _i : (NP _i : (PPA _i : (GEN _i : <u>FEMALE</u> (GEN _i)) (PPA _i)) (NP _i)) (I _i)) (S _i)) (E _i)) (C _i))
IL:	(M _i : (A _i : [(F _i : DECL (F _i)) (P _i) _S (P _j) _A (C _i : [(R _i) (R _j) (T _i)] (C _i))] (A _i)) (M _i))
RL:	(p _i : (ep _i : (e _i : (f _i : [(f _j : sabi (f _j)) (x _i : (f _k : kaoáibógi (f _k)) (x _i) _U (x _i) _U (f _i)) (e _i)) (ep _i)) (p _i))
ML:	(Le _i : (Cl _i : [(Np _i : (Nw _i : káixihí (Nw _i)) (Np _i)) _{SUBJ} (Gw _i : hi (Gw _i)) _{SUBJ} (Adj _p : (Adj _w : sabi (Adj _w)) (Adj _p)) (Vp _i : (Vw _i : xáagahá (Vw _i)) (Vp _i))] (Cl _i)) (Le _i))
PL: U	(U _i : (IP _i : (PP _i : [(PW _i : -/ka.lo].a.li].bo].gi]/- (PW _i)) (PW _j : -/hi]/- (PW _j)) (PW _k : (F _i : [(S _i : [(FEM P _i : /s/ (P _i)) (P _j : /a]/ (P _j))] (S _i)) (S _j : -/bi]/- (S _j))] (F _i), (PW _k)) (PWL: -/ʔa:].ga].ha]/- (PWL))] (PP _i)) (IP _i)) (U _i))
S	(R U _i : (IP _i : (PP _i : [(PW _i : -/ka.lo].a.li].bo].gi]/- (PW _i)) (PW _j : -/hi]/- (PW _j)) (PW _k : -/ha].bi]/- (PW _k)) (PWL: -/ʔa:].ga].ha]/- (PWL))] (PP _i)) (IP _i)) (U _i))
OL:	[ka.lo].a.li].bo].gi] hi] 'ha].bi] 'ʔa:].ga].ha]

The female gender of the speaker activates the Female operator at all Phoneme layers which have an /s/ as head at the Underlying Phonological Level resulting in the mutation of /s/ to /h/ which is represented at the Surface Phonological Level.

A similar problem in the normal speech channel is the existence of free variation or the sloppy phoneme effect. The interchangeability of phonemes due to the high

²⁸ I have not contextually represented the distinction between speaker and addressee in the FDG representations as this is implicitly assumed for speaker-produced utterances. The role of each interlocutor could be captured by a socio-cultural participant role distinction with contexteme values (SPEAKER/ADDRESSEE) which are classed as mental situational interactional narrow socio-cultural context.

functional load of suprasegments as in (11) is arbitrary. This entails that the process is

- (11) a. Káixihí xaoxaagá gáihí.
 'kaʎiʎ.ʔiʎ.hiʎ ʔaʎoʎ.'ʔa:ʎ.gaʎ 'gaʎiʎ.hiʎ
 paca exist there
 'There is a paca there.'
- b. Káixihí xaoxaagá gáihí.
 'paʎiʎ.kiʎ.siʎ kaʎoʎ.'ka:ʎ.gaʎ 'gaʎiʎ.siʎ
 paca exist there
 'There is a paca there.'

not grammatical but occurs during Articulation and only becomes apparent at the Output Level as in (12). This free variation is a more extreme form of allophony which

- (12) IL: (M_i: (A_i: [(F_i: DECL (F_i)) (P_i)_S (P_j)_A (C_i: [(T_i) (R_i) (R_j)] (C_i))] (A_i)) (M_i))
 RL: (p_i: (ep_i: (e_i: (f_i: [(f_j: xaoxaagá (f_j)) (x_i: (f_k: káixihí (f_k)) (x_i))_U (l_i: (f_i: gáihí (f_i)) (l_i))_L]
 (f_i)) (e_i)) (ep_i)) (p_i))
 ML: (Le_i: (Cl_i: [(Np_i: (Nw_i: káixihí (Nw_i)) (Np_i))_{SUBJ} (Vp_i: (Vw_i: -xaoxaagá- (Vw_i))
 (Vp_i)) (Gw_i: gáihí (Gw_i))] (Cl_i)) (Le_i))
 PL: U (U_i: (IP_i: (PP_i: [(PW_i: -/kaʎiʎ.ʔiʎ.hiʎ/- (PW_i)) (PW_j: -/ʔaʎoʎ.'ʔa:ʎ.gaʎ/- (PW_j)) (PW_k:
 -/gaʎiʎ.hiʎ/- (PW_k))] (PP_i)) (IP_i)) (U_i))
 S (R U_i: (IP_i: (PP_i: [(PW_i: -/kaʎiʎ.ʔiʎ.hiʎ// (PW_i)) (PW_j: -//ʔaʎoʎ.'ʔa:ʎ.gaʎ// (PW_j)) (PW_k:
 -//gaʎiʎ.hiʎ// (PW_k))] (PP_i)) (IP_i)) (U_i))
 OL: ['paʎiʎ.kiʎ.siʎ kaʎoʎ.'ka:ʎ.gaʎ 'gaʎiʎ.siʎ]

when unsystematically applied would also take place during Articulation.

4.2. Hum speech

The hum speech channel is used when the speaker wants to express an emotional attitude (towards the addressee) such as for privacy, disguise, and intimacy, in accordance with child language acquisition, or to avoid miscommunication due to an oral obstruction. These contextual factors may be represented by contexteme values at the Contextual Interpersonal Stratum as in (13-17) which activate the Hum Speech operator at the Underlying Phonological Level as in (18). The Hum Speech operator results in the substitution of all syllables in the underlying form with / \bar{m} / during Surface Phonological Encoding and in the utterance receiving a low volume during Articulation.

- (19) IL: (Mi: (Ai: [(Fi: DECL (Fi)) (Pi)_S (Pj)_A (EPU Ci: [(Ti) (Ri) (Rj)] (Ci))] (Ai)) (Mi))
 RL: (pi: (ep: (ei: (fi: [(fj: xaoxaagá (fj)) (xi: (fk: káixihí (fk)) (xi))_U (li: (fi: gáihí (fi)) (li))_L] (fi)) (ei)) (epi)) (pi))
 ML: (Lei: (Cl: [(Npi: (Nwi: káixihí (Nwi)) (Npi))_{SUBJ} (Vpi: (Vwi: -xaoxaagá- (Vwi)) (Vpi)) (Gwi: gáihí (Gwi))] (Cl)) (Lei))
 PL: U (HUM U: (IP: (PP: [(PW: -/kaɫiɫ.ʔiɫ.hiɫ/- (PW)) (PW_J: -/ʔaɫoɫ.ʔa:ɫ.gaɫ/- (PW_J) (PW_K: -/gaɫiɫ.hiɫ/- (PW_K))] (PP)) (IP)) (U))
 S (R U: (IP: (PP: [(PW: -/m̄ɫm̄ɫ.ɫ5.m̄ɫ2.m̄ɫ12/- (PW)) (PW_J: -/m̄ɫm̄ɫ.ɫ5.m̄ɫ11/- (PW_J) (PW_K: -/m̄ɫm̄ɫ.ɫ4.m̄ɫ12/- (PW_K))] (PP)) (IP)) (U))
 OL: [{_ρm̄ɫm̄ɫ.ɫ5.m̄ɫ12 m̄ɫm̄ɫ.ɫ5.m̄ɫ11 'm̄ɫm̄ɫ.ɫ4.m̄ɫ12_ρ}]

factors do not in this view directly affect the grammar but indirectly via the Conceptual Component during Conceptualisation. I have chosen to represent emotional purpose as a contextual feature of the speaker because I consider the emotional state of the speaker to be a contextual factor in its own right which is not directly related to the communicative intention but which may affect the grammatical encoding of a given communicative intention. The representation of a single categorical contextual factor instead of a multitude of complex contextual factors is again preferred for legibility and simplicity in the implementation of the model.

4.3. Whistle speech

The whistle speech channel is used strictly by males during the occasions of hunting, play hunting and warring, and in aggressive play. These contextual factors may be represented at the Contextual Interpersonal Stratum by two different social occasions as in (20) and (21) which directly activate the Whistle Speech operator resulting in the substitution of all syllables in the underlying form with /m̄.ɫ/ as in (22).

- (20) CIS: (Ci: (Mi: (Si: (li: (NSi: (SCi: (OCCi: HUNTING (OCCi)) (SCi)) (NSi)) (li)) (Si)) (Mi)) (Ci))
 (21) CIS: (Ci: (Mi: (Si: (li: (NSi: (SCi: (OCCi: FIGHTING (OCCi)) (SCi)) (NSi)) (li)) (Si)) (Mi)) (Ci))
 (22) IL: (Mi: (Ai: [(Fi: DECL (Fi)) (Pi)_S (Pj)_A (Ci: [(Ti) (Ri) (Rj)] (Ci))] (Ai)) (Mi))
 RL: (pi: (ep: (ei: (fi: [(fj: xaoxaagá (fj)) (xi: (fk: káixihí (fk)) (xi))_U (li: (fi: gáihí (fi)) (li))_L] (fi)) (ei)) (epi)) (pi))
 ML: (Lei: (Cl: [(Npi: (Nwi: káixihí (Nwi)) (Npi))_{SUBJ} (Vpi: (Vwi: -xaoxaagá- (Vwi)) (Vpi)) (Gwi: gáihí (Gwi))] (Cl)) (Lei))
 PL: U (WHIS U: (IP: (PP: [(PW: -/kaɫiɫ.ʔiɫ.hiɫ/- (PW)) (PW_J: -/ʔaɫoɫ.ʔa:ɫ.gaɫ/- (PW_J) (PW_K:

	-/gaɫiɫ.hiɫ/- (PW _k)] (PP _i) (IP _i) (U _i)
S	(R U _i : (IP _i : (PP _i : [(PW _i : -//m̩↓ɫm̩↓J5.m̩↓J2.m̩↓ɫ2//-(PW _i)) (PW _i : -//m̩↓ɫm̩↓J5.m̩↓J5.m̩↓ɫ1//-(PW _i)) (PW _k : -//m̩↓ɫm̩↓J4.m̩↓ɫ2//-(PW _k))] (PP _i)) (IP _i)) (U _i))
OL:	[m̩↓ɫm̩↓J5.m̩↓J2.m̩↓ɫ2 m̩↓ɫm̩↓J5.m̩↓J5.m̩↓ɫ1 'm̩↓ɫm̩↓J4.m̩↓ɫ2]

Whistle speech has been analysed as a channel in this paper because there is a clear fundal phonological form which is altered by specific contextual factors. Whistle speech (as with the other non-normal speech channels) is thus not considered a separate grammar but rather a systematic phonological adaptation within the standard grammar of Pirahã. It has been noted, however, that whistle speech may be developing independent grammatical rules whereby “there are some modifications of the syntax and lexicon as well” (Everett 1985: 414).²⁹ The existence of independent forms and rules which are clearly not systematic adaptations of forms in the standard grammar could be an initial step towards an independent grammar for whistle speech. It is unclear how extensive and independent the ‘modifications’ actually are but it is likely that there is both a productive channel for whistle speech which systematically alters the underlying phonological form of the standard grammar and a restricted semi-independent grammar for whistle speech which may be competing with the standard grammar. The degree of willingness for a private masculine code in the male Pirahã population may determine whether whistle speech ultimately develops into a fully-fledged and self-contained grammar and thus into an independent dialect or even language. It may be expected, however, that aspects of a whistle speech grammar would remain in overlap with the mother grammar for reasons of similarity and efficiency. It is possible that these initial developments of independence for the whistle speech channel in Pirahã may hold the key to understanding the origin and development of whistled languages in general.³⁰

4.4. Musical speech

The musical speech channel is used in the social occasion of communicating with or as Pirahã spirits, in the social occasion of dancing, and for the emotional purpose of flirtation between members of the opposite sex. These contextual factors may be represented at the Contextual Interpersonal Stratum as in (23-25) and contrary to the other non-normal speech channels do not activate a phonological operator as in (26).³¹

(23)	CIS:	(C _i : (M _i : (S _i : (I _i : (NS _i : (SC _i : (OCC _i : SPIRITS (OCC _i)) (SC _i)) (NS _i)) (I _i)) (S _i)) (M _i)) (C _i))
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²⁹ Pirahã is thus comparable to (other) (true) whistled languages which show the ‘transposment’ of key components of normal speech to whistle speech and which may convey a potentially unlimited set of messages (over distances) but which may also show independent features (Rialland 2005; Meyer 2008).

³⁰ The phonetic representations for musical speech do not show an adjustment in pitch or rhythm due to the highly idiosyncratic phonetic nature of the musical speech channel.

³¹ Further rigorous testing of whistle speech in Pirahã would in my opinion prove fruitful in this respect.

- (24) CIS: (C_i: (M_i: (S_i: (I_i: (NS_i: (SC_i: (OCC_i: DANCING (OCC_i)) (SC_i)) (NS_i)) (I_i)) (S_i)) (M_i)) (C_i))
- (25) CIS: (C_i: (M_i: (S_i: (I_i: (NS_i: (SC_i: (SCP_i: (EPU_i: FLIRTATION (EPU_i)) (SCP_i)) (SC_i)) (NS_i)) (I_i)) (S_i)) (M_i)) (C_i))
- (26) IL: (M_i: (A_i: [(F_i: DECL (F_i)) (P_i)_S (P_J)_A (C_i: [(T_i) (R_i) (R_J)] (C_i))] (A_i)) (M_i))
- RL: (p_i: (ep_i: (e_i: (f_i: [(f_j: xaoxaagá (f_j)) (x_i: (f_k: káixihí (f_k)) (x_i))_U (l_i: (f_i: gáihí (f_i)) (l_i))_L] (f_i)) (e_i)) (ep_i)) (p_i))
- ML: (Le_i: (Cl_i: [(Np_i: (Nw_i: káixihí (Nw_i)) (Np_i))_{SUBJ} (Vp_i: (Vw_i: -xaoxaagá- (Vw_i)) (Vp_i)) (Gw_i: gáihí (Gw_i))] (Cl_i)) (Le_i))
- PL: U (U_i: (IP_i: (PP_i: [(PW_i: -/kaḷiḷ.ʔiḷ.hiḷ/- (PW_i)) (PW_J: -/ʔaJoḷ.ʔa:ḷ.gaḷ/- (PW_J)) (PW_K: -/gaḷiḷ.hiḷ/- (PW_K))] (PP_i)) (IP_i)) (U_i))
- S (R U_i: (IP_i: (PP_i: [(PW_i: -//kaḷiḷ.ʔiḷ.hiḷ// (PW_i)) (PW_J: -//ʔaJoḷ.ʔa:ḷ.gaḷ// (PW_J)) (PW_K: -//gaḷiḷ.hiḷ// (PW_K))] (PP_i)) (IP_i)) (U_i))
- OL: [kaḷiḷ.ʔiḷ.hiḷ ʔaJoḷ.ʔa:ḷ.gaḷ gaḷiḷ.hiḷ]

The musical speech channel is characterised by an exaggeration of relative pitch differences between low and high tones and by a possible change in rhythm which creates a clearly recognisable musical melody. The musical speech channel is the only non-normal speech channel which does not involve phonological alteration in the Grammatical Component but rather phonetic alteration in the Output Component.

The musical speech channel is also used to express information that is new to the current discourse and that the speaker considers important. The conceptualisation of this information incorporates the speaker's emotional attitude towards its importance which may be reflected by the activation of an Emphatic operator minimally at the layer of the Discourse Act as in (27) and maximally at the layer of the Move. The new status of the information may be represented at all strata in the Contextual Component as in (27).³²

- (27) CIS: (C_i: (M_i: (D_i: -NEW- (D_i)) (M_i)) (C_i))
- CRS: (C_i: (M_i: (D_i: -NEW- (D_i)) (M_i)) (C_i))
- CMS: (C_i: (M_i: (D_i: -NEW- (D_i)) (M_i)) (C_i))
- CPS: U (C_i: (M_i: (D_i: -NEW- (D_i)) (M_i)) (C_i))
- S (C_i: (M_i: (D_i: -NEW- (D_i)) (M_i)) (C_i))
- IL: (M_i: (EMPH A_i: [(F_i: DECL (F_i)) (P_i)_S (P_J)_A (C_i: [(T_i) (R_i) (R_J)] (C_i))] (A_i)) (M_i))
- RL: (p_i: (ep_i: (e_i: (f_i: [(f_j: xaoxaagá (f_j)) (x_i: (f_k: káixihí (f_k)) (x_i))_U (l_i: (f_i: gáihí (f_i)) (l_i))_L] (f_i)) (e_i)) (ep_i)) (p_i))

³² See García Velasco (this volume) for discussion and incorporation of the notion of givenness in FDG.

ML:	(Le _i : (Cl _i : [(Np _i : (Nw _i : káixihí (Nw _i)) (Np _i)) _{SUBJ} (Vp _i : (Vw _i : -xaoxaagá- (Vw _i)) (Vp _i)) (Gw _i : gáihí (Gw _i))] (Cl _i)) (Le _i))
PL:	U (U _i : (IP _i : (PP _i : [(PW _i : -/ka̠i̠.ʔi̠.hi̠/- (PW _i)) (PW _j : -/ʔa̠o̠.ʔa̠:̠.ga̠/- (PW _j)) (PW _k : -/ga̠i̠.hi̠/- (PW _k))] (PP _i)) (IP _i)) (U _i))
	S (R U _i : (IP _i : (PP _i : [(PW _i : -//ka̠i̠.ʔi̠.hi̠// (PW _i)) (PW _j : -//ʔa̠o̠.ʔa̠:̠.ga̠// (PW _j)) (PW _k : -//ga̠i̠.hi̠// (PW _k))] (PP _i)) (IP _i)) (U _i))
OL:	[ka̠i̠.ʔi̠.hi̠ ʔa̠o̠.ʔa̠:̠.ga̠ 'ga̠i̠.hi̠]

It is thus the combination of the new status of the information together with the Emphatic operator expressing the importance of the information which activates the musical channel giving rise to the (phonetic) musical form.

A change in rhythm in musical speech would result in the articulatory alteration of both the syllable weight and stress of the underlying phonological forms. It may be recalled that musical speech is the only non-normal speech channel which retains the full phoneme inventory of the underlying phonological form. The other non-normal speech channels alter the segmental phonology of the underlying form but leave the suprasegmental phonology intact whereby the suprasegments carry the functional load of the utterance. Musical speech alters the suprasegmental phonology of the underlying form which leaves the segments to carry the functional load. The segmental inventory of the underlying form is necessarily retained as a result of the deviation from the underlying suprasegmental form. Both a reduction in the segmental inventory and a change in the rhythm would most likely render the musical utterance incomprehensible.

4.5. Yell speech

(28) CIS:	(C _i : (E _i : (S _i : (I _i : (NP _i : (PPA _i : (DIS _i : <u>FAR</u> (DIS _i)) (PPA _i)) (NP _i)) (I _i)) (S _i)) (E _i)) (C _i))
(29) CIS:	(C _i : (E _i : (S _i : (I _i : (NP _i : (LOC _i : (OBS _i : <u>YES</u> (OBS _i)) (LOC _i)) (NP _i)) (I _i)) (S _i)) (E _i)) (C _i))
(30) CIS:	(C _i : (E _i : (S _i : (I _i : (NP _i : (LOC _i : (NOI _i : <u>HIGH</u> (NOI _i)) (LOC _i)) (NP _i)) (I _i)) (S _i)) (E _i)) (C _i))
(31) IL:	(M _i : (A _i : [(F _i : DECL (F _i)) (P _i) _S (P _j) _A (C _i : [(T _i) (R _i) (R _j)] (C _i))] (A _i)) (M _i))
RL:	(p _i : (ep _i : (e _i : (f _i : [(f _j : xaoxaagá (f _j)) (x _i : (f _k : káixihí (f _k)) (x _i)) _U (l _i : (f _i : gáihí (f _i)) (l _i)) _L (f _i)) (e _i)) (ep _i)) (p _i))
ML:	(Le _i : (Cl _i : [(Np _i : (Nw _i : káixihí (Nw _i)) (Np _i)) _{SUBJ} (Vp _i : (Vw _i : -xaoxaagá- (Vw _i)) (Vp _i)) (Gw _i : gáihí (Gw _i))] (Cl _i)) (Le _i))
PL:	U (<u>YELL</u> U _i : (IP _i : (PP _i : [(PW _i : -/ka̠i̠.ʔi̠.hi̠/- (PW _i)) (PW _j : -/ʔa̠o̠.ʔa̠:̠.ga̠/- (PW _j)) (PW _k : -/ga̠i̠.hi̠/- (PW _k))] (PP _i)) (IP _i)) (U _i))

S (R U: (IP: (PP: [(PW: -//kãṽṽ5.kãṽ2.kãṽ2// (PW_i)) (PW_j: -//kãṽṽ5.kãṽ5.kãṽ1// (PW_j)) (PW_k: -//kãṽṽ4.kãṽ2// (PW_k))] (PP_i)) (IP_i)) (U_i))
 OL: [{/kãṽṽ5.kãṽ2.kãṽ2 kãṽṽ5.'kãṽ5.kãṽ1 'kãṽṽ4.kãṽ2/}]

The yell speech channel is used for communicating at a distance, when there is a physical obstruction to the speech signal, and in the presence of high background noise. These contextual factors may be represented at the Contextual Interpersonal Stratum as in (28-30) and activate the Yell Speech operator which results in the substitution of all consonants with either /k/ or /ʔ/ and all vowels with /ã/ during Underlying Phonological Encoding as in (31). The Yell Speech operator further results in the utterance beginning at a high pitch and rising to a falsetto which would be carried out during Articulation.

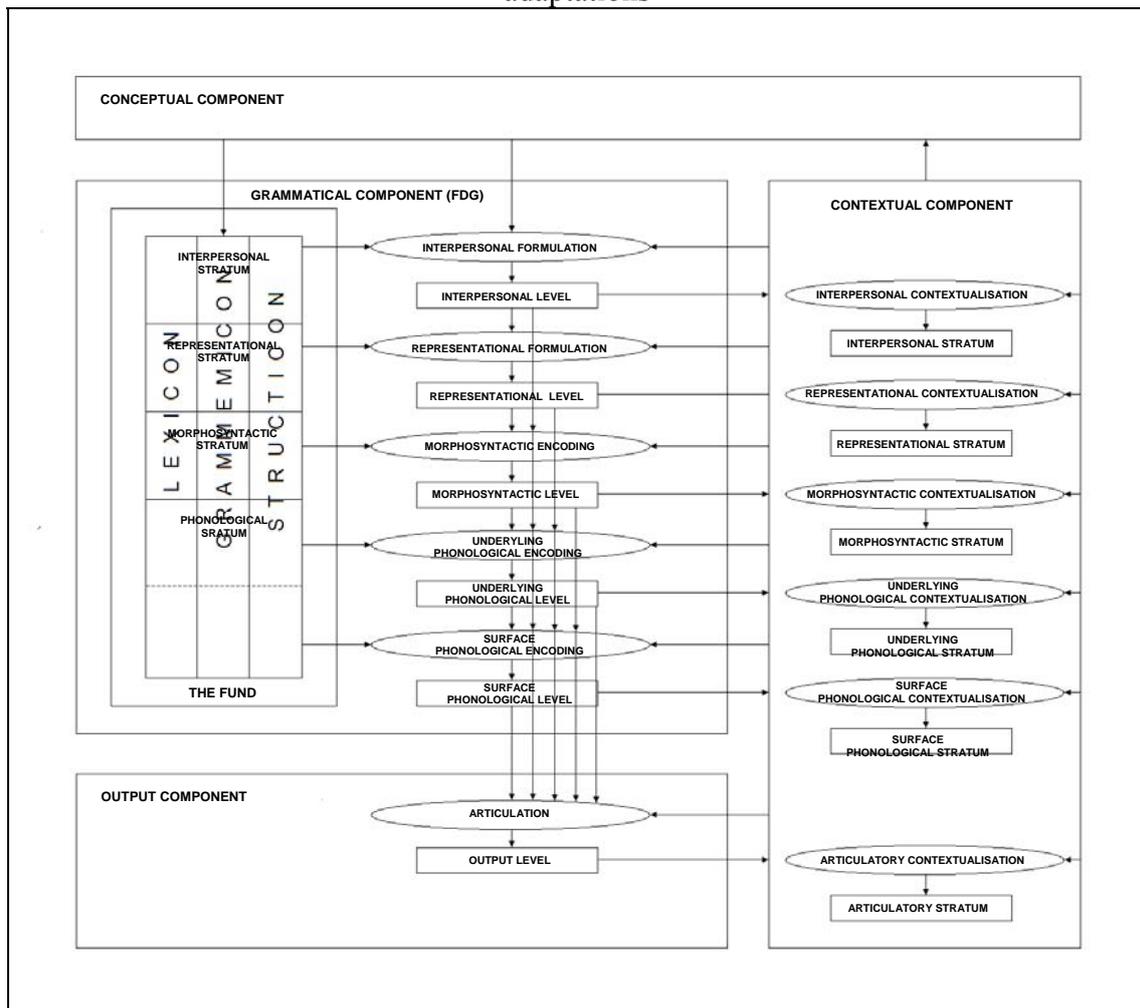
5. Conclusions

This paper investigated the effects of contextual factors on the grammar of Pirahã. The various speech channels of communication are systematically activated by specific contextual factors which may phonologically and/or phonetically alter the basic phonological forms. The normal speech channel forms the default channel and thus remains phonologically unaltered (except perhaps in female speech) but may be phonetically altered (as in free variation). The hum, whistle, and yell speech channels involve phonological (and phonetic) alterations and illustrate the direct effect of context on grammar. The musical speech channel solely involves phonetic alterations and illustrates the direct effect of context on articulation. The interaction between context and grammar may thus be further specified to include the interface between context and phonology (contexto-phonology) as well as the interaction between context and articulation (contexto-phonetics). It may thus be proposed that the normal speech channel is central to the Pirahã language and that the non-normal speech channels (which are phonological and/or phonetic alterations of this channel) developed as a result of (specific) contextual factors into (semi-)independent channels.

The adoption of an Underlying versus a Surface Phonological Level in FDG offers descriptive adequacy to the model in order to formally represent the phonological processes involved in the hum, whistle, and yell speech channels as well as the reduced (production) phoneme inventory of women in the normal speech channel in Pirahã. These channels consist of specific channel phonemes which either form the default inventory or are systematically activated and applied during Underlying and Surface Phonological Encoding. The categorisation and representation of contextual factors which have a systematic impact upon operations in the grammar and the formalisation of the Contextual Component is a necessary step in the full integration of FDG into the wider theory of verbal interaction. The proposal to represent contextual categories in a hierarchical and layered fashion as well as representing only those directly relevant contextual factors as categorical values is intended for compatibility with the general architecture of the model and for legibility in the implementation of the model. The contextual factors which activate the speech channels show that contextual strata in the Contextual Component may not only influence Formulation but also both Encoding and Articulation. Interaction between the Contextual Component and Encoding implies that the rhetorical/pragmatic and semantic representations of an utterance remain unaltered

while interaction between the Contextual Component and Articulation implies that all grammatical representations remain unaltered. Representing different contextual strata implies the existence of an underlying operation which generates the respective strata. The term 'Contextualisation' may be proposed to refer in FDG to the selection of contextual factors which have a systematic effect upon operations in the grammar. This restriction of the definition excludes the representation of contextual factors which are relevant to 'Conceptualisation' in the Conceptual Component. Contextualisation may be postulated to not only select relevant stored grammatical information from the immediate discourse and previous discourses but also relevant perceptory information from the sense organs and relevant cognitive knowledge. Contextualisation may be further subdivided into operations relevant to producing the contextual strata which may interface with operations in the Grammatical and Output Components. Any interaction between the Contextual Component and the Conceptual Component deals strictly with the selection of a particular communicative intention as a result of context. Operations in the grammar thus solely reflect the systematic grammatical production of underlying representations related to this selected communicative intention. The proposed adaptations to FDG may be incorporated with the fundal proposals by O'Neill (2012: 120-125; in prep.a) resulting in an expanded model of FDG as in Figure 4.

Figure 4: Expanded model of FDG incorporating fundal, phonological, and contextual adaptations



The analogy between songs and tunes in traditional Irish music and channels of communication in Pirahã suggests a relationship between language and music. The normal and yell speech channels are intuitively restricted to language and are not musical in the strictest sense of there being a clear melody. The hum and whistle speech channels, however, clearly involve language but are also semi-musical by association due to the fact that tunes may be both hummed and whistled regardless of the language. The musical speech channel is the only speech channel which is undeniably both linguistic and musical in nature. The difference between language and music in FDG is that whereas language refers to the product of grammatical processes which are both systematic and categorical in nature, music refers to non-grammatical articulatory processes which are continuously variable in nature. This results in language and music being able to be produced independently or in tandem in FDG. The combination of language and music in Pirahã results in the musical speech channel which takes the (supra)segmental product of grammar and then alters the suprasegments to produce a linguistic message with a(n aesthetically pleasing) variable melody. The fact that language and music intertwine in Pirahã would suggest that there is a tentative relationship between language and music in the human mind. This relationship has been shown to be more than tentative, with language and music being considered to be complex “constellations of [cognitive] subprocesses, some of which are shared, and others not” (Patel 2008: 417). Language and music would thus seem to overlap to some degree in the mind. Cognitive research into whistled languages has confirmed that native whistlers process whistle speech in the same areas of the brain as normal speech (Carreiras et al. 2005). The prediction is thus that psycholinguistic testing of native Pirahã speakers would reveal that non-normal speech is processed in the same areas of the brain as normal speech (taking slight differences into account). It is interesting that Spencer believed that the origin of music lay in (emotional) language while Darwin opposingly believed that the origin of language lay in (emotional) music (Kivy 1959; Spencer 1857, 1890). Both opinions testify to the commonly perceived overlap between language and music. It would be enlightening to ascertain how the Pirahã themselves view the relationship between language and music. Perhaps the distinction between songs and tunes which the Irish happily recognise is not as clear cut for the Pirahã?

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