Partial Class Behavior and Feature Geometry: Remarks on Feature Class Theory

Mike Cahill
Ohio State University/SIL

Frederick Parkinson
Ohio State University

Partial Class Behavior and Feature Geometry: Remarks on Feature Class Theory*

Mike Cahill and Frederick Parkinson

Ohio State University/SIL and Ohio State University

0. Introduction

In recent papers, Padgett (1995, 1996) has proposed Feature Class Theory, a model of feature organization that is intended to replace Feature Geometry (Clements 1985, 1993; McCarthy 1988; Clements and Hume 1995, and others). When a new theory is proposed, one is obliged to prove that the new model is superior to the old. In this paper, we argue that this has not been done in the case of Feature Class Theory. Specifically, it is our position that Feature Class Theory does not differ in terms of representation as claimed, that the data discussed in Padgett (1995, 1996) do not demonstrate any inadequacy of Feature Geometry, and that the benefits attributed to Feature Class Theory are instead the direct result of Optimality Theory.

Before addressing these points, we begin with a review of the basic tenets of Feature Class Theory. Feature Class Theory assumes Optimality Theory (Prince and Smolensky 1993). Both Feature Geometry and Feature Class Theory are models of feature organization, i.e., an attempt to capture the generalization that some groups of features behave as a unit in many languages and other groups do not form such a unit in any language. Padgett asserts, however, that Feature Class Theory is a substantial departure from Feature Geometry in terms of how these feature groups are represented. In Feature Class Theory, constituent features are grouped into "Classes," (i.e., sets) which are properties that the features share rather than a structural property. For example, the feature [high] is in the class *Place* because [high] has the property of "placeness."

Assimilation is expressed as a surface form in which some structure is shared between the trigger and target. Constraints may refer only to feature *Classes* and do not refer to feature geometric nodes nor to individual features. In addition, constraints referring to feature classes are gradiently violable. Thus, a higher ranked constraint may force a violation of the first constraint where the multiple linking of only a proper subset of features satisfies the constraint requiring assimilation.

* We gratefully aknowledge the comments of many people including Mary Bradshaw, Mary Beckman, Beth Hume, Bob Kasper, Paul Kotey, David Odden, Robert Poletto, and Sam Rosenthall as well as audiences at Ohio State University and NELS 27.

K. Kusumoto (ed.), NELS 27, 79-91

1. Issue of Representation—Is Feature Class Theory truly disembodied?

Padgett states that Feature Class Theory is a non-representational alternative to Feature Geometry. He does not explicitly define the terms "representational" and "non-representational" so that this claim cannot be examined. We will argue, to the contrary, that the representation of Feature Class Theory is not substantively different from that in Feature Geometry. It is claimed that Feature Class Theory "disembodies" Feature Geometry by grouping features into *Classes* (i.e., sets) rather than organizing them beneath structural nodes as per Feature Geometry.[1] In this way, the set of place features (i.e., those features beneath the Place node in Feature Geometry) are members of the *Place* class in Feature Class Theory as depicted in (1) from (Padgett 1995:399).

(1) Feature Classes as sets of features.

class	*members*
Layngeal:	{voice, asp, glot}
Place:	{Lab, Cor, Dor, Phar, ant, dist, hi, lo, back, round, ...}
Pharyngeal:	{Phar, ...}
Oral:	{Lab, Cor, Dor, ant, dist, hi, lo, back, round, ...}
VPlace:	{hi, lo, back, round, ...}
Height:	{high, low}
Color:	{back, round}

Upon examination, all of the information contained in Feature Geometry is fully recoverable from the Feature Class Theory representation in (1). The hierarchical constituents of Feature Geometry are represented via subset relations in Feature Class Theory. For example, the *Place* class in (1) may be defined in terms of its subsets (2).

(2) The class *Place* defined as a set of subsets.

$$\begin{aligned} \text{Place} &= \text{Pharyngeal} \cup \text{Oral} \\ \text{Oral} &= \{\text{Labial, Coronal, Dorsal, ant, dist}\} \cup \text{VPlace} \\ \text{VPlace} &= \text{Height} \cup \text{Color} \\ \text{Height} &= \{\text{high, low}\} \\ \text{Color} &= \{\text{back, round}\} \end{aligned}$$

The *Place* class can be considered the union of the *Pharyngeal* class and the *Oral* class in (1). Similarly the *Oral* class is the union of the *VPlace* class and the features [labial], [coronal], [dorsal], [ant], and [dist]. The *VPlace* class is the union of the *Height* and *Color* classes.

The subset relation parallels the dominance relation in Feature Geometry. The *Color* class, for example, consists of the features [back] and [round]. The features [back] and [round] are also a subset of the *VPlace* class, the *Oral* class, the *Place* class and the class containing all features.

Therefore, the *Place* class may also be represented as in (3), as a set of sets.

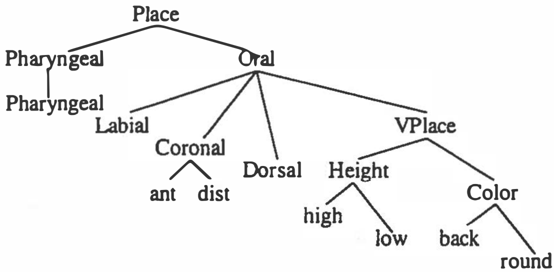
[1] Padgett (1995) does, however, allow *Coronal* to act as an organizing node hierarchically dominating the features [anterior] and [distributed].

(3) The *Place* class as a set of sets.

$$\{_{PL}\{_{Ph}\,\text{Phary}\}\{_{O}\,\text{Lab, Cor, Dor, ant, dist}\ \{_{VP}\{_{H}\,\text{high, low}\}\{_{C}\,\text{back, round}\}\}\}\}$$

The transition from (3) to (4) is one of notation only.

(4) Feature Geometry (Padgett 1995:398).



We have shown that the representation in (1) encodes all of the same information about hierarchical dependencies as the standard tree model in (4). We conclude, therefore, that Feature Class Theory is not a meaningful departure from Feature Geometry in terms of its representation.

2. Are Partial Class Assimilations Problematic for Feature Geometry?

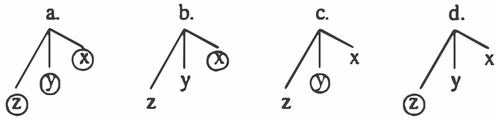
As we have shown that there are no representational grounds to abandon Feature Geometry, we now address the empirical evidence. Padgett (1995, 1996) argues that partial class assimilations—where some, but not all features of a class assimilate—are problematic for Feature Geometry. It is claimed that Feature Geometry cannot handle partial class assimilation in Turkish and Gā, and that only an appeal to Feature Class Theory allows for an adequate treatment of these langauges.

(5) **Partial Class Behavior =** an alternation in which only a proper subset of the members of a class behave as a unit.

2.1 Assimilations in Feature Geometry and Feature Class Theory

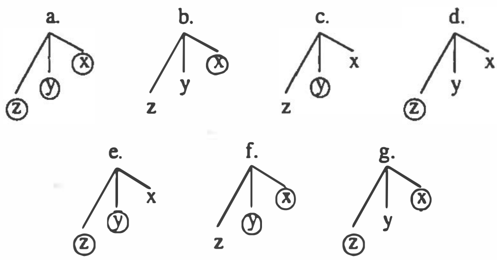
From its inception, that Feature Geometry has allowed for single-feature spreading as well as spreading of a structural node (e.g., Clements 1985:231–2, Mascaró 1983, Sagey 1990). The central tenet of most feature geometric approaches is that a grammar may manipulate one and only one phonological element (e.g., Odden 1991, Clements and Hume 1995, Parkinson 1996). Thus, given a set of three features *x*, *y*, and *z*, Feature Geometry predicts the possibility of the four assimilations depicted in (6). Feature Geometry predicts that all the features may spread as in (6a) (where the assimilating features are circled) and that any individual feature may spread (6b–d).

(6) Range of assimilations in Feature Geometry.



In contrast, Feature Class Theory allows any subset of features to spread. From the same set of three features, the seven assimilations shown in (7) are predicted. Again, all features may spread (7a) and any individual feature may spread (7b–d). Assimilations involving two, but not all features are also permitted by Feature Class Theory (7e–g).

(7) Range of assimilations in Feature Class Theory.



Feature Geometry and Feature Class Theory both allow the assimilations in (6a–d) and (7a–d). The two approaches differ in that only Feature Class Theory predicts assimilations of the type depicted in (7e–g). The claim that partial class assimilations are problematic for Feature Geometry is substantiated only by cases in which multiple feature subsets spread. Feature Geometry is inadequate only for assimilations involving *more than one* but not all features of a constituent, i.e., (7e–g). Padgett does not discuss such cases.

2.2 Turkish

Padgett (1995, 1996) focuses on Turkish vowel harmony and Gã nasal place assimilation. We examine these and other cases of partial class assimilation below. Turkish "color" harmony involves either the features [back] and [round][2]—the *Color* constituent—or just the feature [back] (Clements and Sezer 1982, Padgett 1995).

(8) Turkish vowel inventory.

	–back		+back	
+high	i	ü	ï	u
–high	e	ö	a	o
	–rd	+rd	–rd	+rd

The examples in (9.a) show that high vowels assimilate for the whole *Color* constituent since the genitive suffix agrees with the root vowel in terms of backness and

[2] Due to space considerations, we ignore several interesting questions concerning the features used to characterize Turkish vowels.

roundness. This assimilation is roughly equivalent to the assimilation depicted in (6a) since this is an assimilation of all color features.

(9) Turkish vowel harmony.

a. [back] and [round] spread from initial vowel to following high vowels.

son-un	'end (gen.)'	ip-in	'rope (gen.)'
yüz-ün	'face (gen.)'	sap-ïn	'stalk (gen.)'
somum	'loaf'	iyi	'good'
öküz	'ox'	adïm	'step'

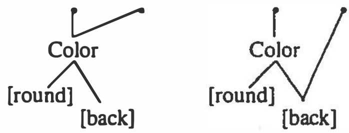
b. only [back] spreads to non-high vowels.

yüz-den	'face (abl.)'	sondan	'end (abl.)'
köpek	'dog'	uzak	'far'

The ablative suffix in (9b), which is a non-high vowel in the input, harmonizes only to the backness of the preceding vowel. The assimilation of a single feature, in this case [back], is roughly equivalent to (6b). Thus, Feature Geometry can account for vowel harmony in Turkish since either all features of the *Color* constituent assimilate (10a), or just one does (10b).

(10) Turkish vowel harmony.

a. b.



2.3 Gã

Padgett also presents nasal place assimilation in Gã as a problematic case for Feature Geometry. He states that nasals assimilate in one of two ways to a following labial-velar, completely assimilating to appear as [ŋm] within morphemes (11a) but partially assimilating to surface as [ŋ] across morphemes (11b).

(11) Padgett's description of nasal place assimilation in Gã.

a. complete assimilation

N → ŋm *ŋmkpaai* 'libation'

b. partial assimilation

N → ŋ *ŋ-kpaai* 'my cheeks'

Our fieldwork, confirmed by several sources, suggest that "partial assimilation" occurs within morphemes as well, as shown by the examples in (12).[3] In addition, velar nasals often appear before consonants that are neither velar nor labial-velar, as shown in the examples in (14).

[3] The data in (12)–(14) are from Berry 1951 (B), Kropp-Dakubu 1973 (KD), Kotey 1974 (KO), Ryder 1987 (R), and personal field work (FW). For additional discussion of Gã, see Kropp (1968) and Kotey (1969).

(12) Nasal appears as [ŋ]

across morphemes		*within morphemes*	
ŋ-kpaai	'my cheeks' R	taaŋkpee	'sisal' R, KD, FW
ŋ-gbeke	'my child' R	kpetɛŋkplɛ	'large, great' KD, FW
		ŋkpluka	'bedbug' KD, FW
		ataŋgbe	'tiger nuts' KD, FW

The morpheme corresponding to 'my' in (12) is reduced from /mi-/.

(13) Nasal appears as [ŋm]

ŋmkpaai	'libation' KD, KO, B, FW
kpɛŋmkplɛŋ	'rabbit' KD, KO

Kropp-Dakubu (1973) reports two pronounciations of the word 'libation' [ŋmkpaai] ~ [ŋkpaai]. This variation is confirmed in our fieldwork. The velar nasal [ŋ] may also appear before non-velars, even in careful speech.

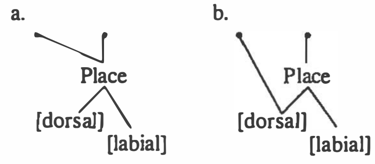
(14) Velar nasal before non-velars.

kaŋfla	'herring KD, FW
maŋsɔ	'quarrel, strife' KD, FW
ɲɔɔŋ-tsele	'moon (< *night+shine*)' KD, FW

While we are not presently in a position to offer a full analysis of nasal assimilation in Gā, it is clear that the phenomenon is more complicated than portrayed by Padgett. If future research were to reveal a dichotomy between "partial" and "complete" nasal place assimilation in Gā, an account of these facts is still possible within a standard model of Feature Geometry, and we now turn to this.

We assume that consonant place features are monovalent so that no consonants in Gā are specified for all place features (see Celements and Hume 1995 for discussion). Most consonants are specified for a single place feature (e.g., Coronal, Labial, etc.), while labial-velars are specified for both Labial and Dorsal. Therefore, nasal place assimilation in Gā involves, at most, two features. The complete assimilation to labial-velars (i.e., the within morphemes case) is depicted in (15a). The partial assimilation (i.e., across morphemes) is shown in (15b).

(15) Gā nasal place assimilation.



Neither Turkish nor Gā poses a problem for Feature Geometry. Both languages exhibit the two types of assimilation allowed by Feature Geometry: complete assimilation or the assimilation of one feature.

Again, the truly problematic cases for feature geometry are those in which two out of three features dominated by a single node spread, as in (7e-g). These types are never discussed by Padgett, and as far as we know, do not exist. Furthermore, partial class asimilation has already been analyzed within Feature Geometry, and we now tum to two such cases.

2.4 Irish and Kɔnni

In Irish, two types of nasal assimilation occur, both of which are optional. These have been analyzed by Ní Chiosáin (1994) in a feature geometry model. The same arguments used by Padgett in favor of treating Gã assimilation in Feature Class Theory should be applicable to Irish. But as we will see, the analysis of Irish is perfectly feasible within feature geometry.

Irish has a series of palatalized consonants, including the phonetically palatalized nasals [m' n' ŋ']. Ní Chiosáin (1994:96) demonstrates that a coronal nasal, /n/ or /n'/, assimilates to the C-Place of a following dorsal (but not labial) without affecting the nasal's V-Place, or secondary, articulation.

(16) Partial assimilation in Irish.

a. n' →ŋ'	ji:nhin'	'I would do'
	ji:nhiŋ'gir'əsə	'I would without it'
b. n → ŋ	sa:spən	'a saucepan'
	sa:spəŋg'al	'a bright saucepan'

However, a coronal nasal can also assimilate to both the C-Place and V-Place of a following dorsal or labial, as shown by the examples in (17).

(17) Complete assimilation in Irish.

a. nk' → ŋ'k'	ahn'i:n	'recognizes'
	ahn'i:ŋ'k'i:ro:g	'a beatle recognizes'
b. n'g → ŋg	s'l'aun'	'slippery'
	s'l'auŋgəma	'quite slippery'
c. nb' → m'b'	o:ra:n	'a song'
	o:ra:m'b'i:n	'a sweet song'
d. n'b → mb	fait'i:n'	'whiting'
	fait'i:mba:n	'white whiting'

To account for these, Ní Chiosáin (1994:96–7) proposes two distinct rules of assimilation. To account for the partial assimilation in (16a, b), she proposes Dorsal Assimilation (18a), and to account for the total assimilation in (17a–d), she proposes Place Assimilation (18b). Except for the fact that the conditions on which assimilatory process will occur are not explicitly stated, these two rules account for the facts. (We have replaced Ní Chiosáin's *Place* node with *C-Place* to be consistent with the labeling used previously, and we assume a [nasal] specification is intended for the first consonant in each rule, though not explicit in Ní Chiosáin's formulation).

(18) Partial and complete assimilation.

a. assimilation of *Dorsal* b. assimilation of *Place*

We see, then, that in a case parallel to Gã, there is a case already in the literature in which Feature Geometry has accounted for the data adequately. The question arises, what is the need for Feature Class Theory when Feature Geometry has provided a satisfactory analysis for the very type of case Padgett insists it cannot handle?

A similar case occurs in Konni (Cahill 1992, 995), which we will discuss in more detail below. In this language, a nasal assimilates to [kp gb] as [ŋ] within words, but as [ŋm] across words. Somewhat the mirror of Gã, this has also been analyzed within Feature Geometry as two processes (Cahill 1995).

2.5 A Note on Unifying Processes

The driving force of Padgett's arguments is that if at all possible, similar processes should be united under one constraint:

> "the upshot of recent phonological theory, surprisingly, is that we have no basis on which to distinguish [back] and [round] spreading constraints in Turkish. In fact, ... our goal must be to unite them." (Padgett 1995:397)

For at least some similar processes, however, it is not clear whether there would be any empirical advantage in uniting them. Turkish harmony falls in this category. While there are similar harmonies occurring with both [back] and [round], there is some evidence that each should be analyzed as a separate process, consistent with (Clements and Sezer 1982) and many other authors.

As outlined above, the spreading of [back] and of [round] occur under two distinct sets of conditions. In addition, Zimmer (1969) provides psycholinguistic evidence that Turkish speakers separate the two phenomena. Nonsense words were presented to native Turkish speakers, who judged them as acceptable or not. Interestingly, the Turkish speakers tolerated some violations of [back] harmony, but essentially *no* violations of [round] harmony. The results show that the two harmonies are separate phenomena psycholinguistically, and so it is not at all clear that the two should be united.

Even in cases in which we would want to say processes should be unified, e.g. possibly for the nasal assimilation cases of Gã and Kɔnni, it is not clear how "same process" would be expressed in Optimality Theory. Carried to the logical extreme, there could be a constraint which simply says "Align Everything Everywhere, outranked by other constraints which override particular features spreading. Such a move, we suggest, would obscure any generalizations concerning which features do and do not pattern together cross-linguistically.

3. Optimality Theory—The Real Power behind Feature Class Theory

We have claimed that Feature Geometry is capable of handling partial class assimilation, and that Feature Class Theory's representation of features is merely a notational variant of Feature Geometry. In this section, we show how a particular case, nasal assimilation in Kɔnni, may be analyzed in Feature Geometry, within an Optimality Theory framework. In doing this, we will see that the claims of distinctiveness of Feature Class Theory are actually a result of its being framed in Optimality Theory. Once Feature Geometry is also framed within Optimality Theory, we can achieve the same results as Feature Class Theory.

There are two types of nasal assimilation in Kɔnni, as illustrated in the data below. Before simplex obstruents such as /p k t/, a preceding nasal assimilates as the usual [m ŋ n] respectively. However, a nasal preceding a labial-velar stop /kp gb/ assimilates as [ŋ] within a word, and as [ŋm] across a word boundary.

(19) Partial assimilation—[ŋ] before a labial-velar within words.

a. single morpheme words.

tɪŋgbáŋ[4]	'floor'	kɔŋgbáŋ	'ant-lion'
bɪŋkpɪáŋ	'shoulder'	saŋkparíŋ	'navel'

b. compound nouns.

haŋ-gbaáŋ	'hyena ("bush-dog")'
nyɪŋ-gbáníŋ	'body ("front skin")'

c. noun-adjective.

duúŋ-kpíˈíŋ	'big horse ("horse-big")'
biŋ-kpíˈáŋ	'dry seed ("seed-dry")'

(20) Complete assimilation—[ŋm] before a labial-velar across words.

a. pronoun.

ŋm gbíéŋ	'my pot'	ŋm kpallí	'my calabash'
ŋm gbáligí-ya	'I've gotten tired'	ŋm kpátí-ya	'I've finished'

b. noun phrases.

sɪŋkpááŋm ˈkpáá ŋ	'peanut oil' (cf. *sɪŋkpááŋ* 'peanut')

c. verb phrases.

kéŋm kpátɪ	'come finish'
kéŋm gbírígɪ	'come kneel'

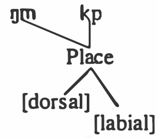
Revising the analysis of Cahill (1995), we propose a constraint similar to that proposed in Padgett (1996), which serves to assimilate any nasal to a following consonant.

(21) ALIGNPLACE = all features from the *Place* constituent are realized on both a consonant and an immediately preceding nasal.

This constraint gives the result of total assimilation of a nasal to whatever consonant follows, as happens in Kɔnni across words.

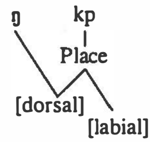
[4] [á] represents a high toned vowel, [ˈá] indicates downstep, and low toned vowels are unmarked.

(22) Assimilation labial-velars across words.



However, within words, another constraint, *C*, is active. This additional constraint prohibits the sharing of [labial] between a labial-velar and a preceding nasal. Instead, only [dorsal] is shared so that *C* is satisfied and ALIGNPLACE is minimally violated.[5] In this situation, the configuration in (23) results.

(23) Assimilation to labial-velars within words.



The tableau demonstrating the operation of these two constraints is shown below.

(24) Tableau for nasal + labial-velar sequences in Kɔnni within words.

Nkp → ŋkp	*C*	ALIGNPLACE
a. ŋmkp	*!	
b. mkp	*!	*
c. ☞ ŋkp		*
d. nkp		**!

Candidates (a) and (b) both are non-optimal because they violate C. Both have a [labial] place shared with the following consonant, as evidenced by the presence of [m] in the output. The optimal candidate (c) wins because it does not violate C, even though it incurs a violation of AlignPlace. Other imaginable candidates, such as (d), would violate AlignPlace even more than the winning (c).[6]

[5] In all languages that we know of, the velar gesture of a labial-velar precedes the labial gesture, though they largely overlap. See Maddieson (1993) for electroarticulographic studies and Connell (1994) for summary of spectrographic studies. This suggests a phonetic reason for partial nasal assimilation, and why the result of such always gives the velar and never the labial nasal as a result.

[6] One of the unresolved questions of treating Feature Geometry within Optimality Theory concerns how to count violations of Alignment constraints. In standard Optimality Theory, the further a feature is from its alignment target, the more violations it incurs. In our approach, when a node is mentioned in a constraint, the more features under that node are not aligned to the target, the more violations. Which is more important? Would it be better to align all features almost to the target, or some features all the way to the target? At this point in time, we have no answer and will leave that open to further investigation.

Crucial to the account of Kɔnni here is a central tenet of Optimality Theory: *gradient violability*. The constraint *C* prevents the complete satisfaction of ALIGNPLACE, but gradient violability allows the analysis of this assimilation to go through. This is essentially the same account as Padgett gives for Gā, except we have explicitly formulated our account in Feature Geometry terms. That this account can be carried through reinforces the point made before, that Feature Class Theory's representation is not different than Feature Geometry in its essential characteristics. The mechanisms of Optimality Theory are what give Feature Class Theory a different appearance from Feature Geometry, but we find that when Feature Geometry is put into Optimality Theory, the differences between Feature Geometry and Feature Class Theory are seen to be ephemeral at best.

4. Conclusion

To be accepted, a new theory should have significant advantages over the one it seeks to replace, either more internally self-consistent, simpler, or able to explain data that the other theory cannot. The burden of proof is on the later proposal. It goes without saying that the new theory should, in fact be, different from what it replaces. Feature Class Theory met these criteria. We have shown that Feature Class Theory does encode the same hierarchy of information that Feature Geometry does, that the cases proposed as problematic for Feature Geometry are not, and that the apparent additional power and novelty of Feature Class Theory is not a function of its being significantly different from Feature Geometry, but of being presented within Optimality Theory. We maintain that the burden of proof required of a new theory has not been sustained, and that Feature Class Theory has not been established as superior to Feature Geometry in any way.

References

Berry, J. 1951 *The Pronunciation of Gā*, Cambridge, Heffer.

Cahill, Michael 1992. A Preliminary Phonology of the Kɔnni Language, *Collected Language Notes* **20**. Legon, Institute of African Studies, University of Ghana.

Cahill, Mike 1995. Nasal Assimilation and Labiovelar Geometry, presented at 26th Annual Conference on African Linguistics, UCLA, to appear in the proceedings of that meeting, Africa World Press, Trenton, New Jersey.

Clements, George N. 1985. The geometry of phonological features, *Phonology Yearbook* **2**:225–52.

Clements, George N. 1993. Place of articulation in consonants and vowels: a unified theory, in B. Laks and A. Rialland (eds.) *Architecture des représentations phonologiques*, CNRS, Paris, 101–146.

Clements, George N. and Elizabeth Hume 1995. The internal structure of speech sounds, in J. Goldsmith (ed.) *A Handbook of Phonological Theory*, New York, Blackwell, 245–306.

Clements, George N., and Engin Sezer. 1982. Vowel and Consonant Disharmony in Turkish. In Harry van der Hulst and Norval Smith (eds.), *The Structure of Phonological Representations, Part II*, Dordrecht, Foris, 213–55.

Connell, Bruce 1994. The structure of labial-velar stops, *Journal of Phonetics* **22**:441–76.

Kotey, Paul 1969. Syntactic Aspects of the Gã Nominal Phrase, Ph.D. dissertation, University of Wisconsin.

Kotey, Paul 1974. Consonantal Labialization and Consonant Clusters in Gã, *Journal of West African Languages* **9**.1:49–56.

Kropp, M.E. 1968. An Analysis of the Consonant System of Gã, *Journal of West African Languages* **5**.1:59-61.

Kropp-Dakubu, M.E. 1973. *Gã-English Dictionary*, Legon, Institute of African Studies, University of Ghana.

Maddieson, Ian 1993. Investigating Ewe articulations with electromagnetic articulography, *Forshungsberichte des Instituts für Phonetik un Sprachliche Kommunication der Universität München* **31**:181–214

Mascaró, Joan 1983. Phonological levels and assimilatory processes, paper presented at the GLOW Colloquium.

McCarthy, John 1988. Feature geometry and dependency: a review, *Phonetica* **45**:84–108.

Ní Chiosáin, Máire 1994. Irish palatalisation and the representation of place features, *Phonology* **11**.1:89-106.

Odden, David 1991. Vowel Geometry, *Phonology* **8**:261–290.

Padgett, Jaye 1995. Feature Classes, in J. Beckman, S. Urbanczyk, and L. Walsh (eds.) *Papers in Optimality Theory: University of Massachusetts Occasional Papers in Linguistics 18*, Amherst, 385–421.

Padgett, Jaye 1996. Partial class behavior and nasal place assimilation, to appear in *Proceedings of the Arizona Phonology Conference: Workshop on Features in Optimality Theory, Coyote Working Papers*, Univerisity of Arizonz, Tuscon.

Parkinson, Frederick 1996. The representation of vowel height in phonology, Ph.D. dissertation, Ohio State University.

Prince, Alan and Paul Smolensky 1993. Optimality theory, ms. Rutgers University and University of Colorado.

Ryder, Mary Ellen 1987. An Autosegmental Treatment of Nasal Assimilation to Labial-velars, *Proceedings of the Chicago Linguistics Society* **23**.2:253–65.

Sagey, Elizabeth 1990. The representation of features in non-linear phonology, New York, Garland, published version of 1986 MIT Ph.D. dissertation.

Zimmer, Karl E. 1969. Psychological correlates of some Turkish morpheme structure conditions. *Language* **45**:309–21.

PARTIAL CLASS BEHAVIOR AND FEATURE CLASS THEORY

Mike Cahill
Department of Linguistics
1712 Neil Avenue
Columbus, OH 43210
cahill@ling.ohio-state.edu

Frederick Parkinson
Department of Linguistics
1712 Neil Avenue
Columbus, OH 43210
fparkins@ling.ohio-state.edu