The Development of On-glides in American English

Jessica A. Barlow

Department of Linguistics
Indiana University
Memorial Hall 322
Bloomington, IN 47405

email: jabarlow@indiana.edu

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Abstract

The status of the C/y/ sequence as a consonant cluster has motivated an investigation into the representation of such sequences in comparison to C/w/ and consonant-liquid sequences in data from developing systems. Evidence from production and substitution patterns indicated that children showed different patternings for the consonant-glide sequences, such that for some children the palatal glide patterned as part of the onset of a syllable, whereas for other children it patterned as part of the nucleus. Results support the claim that the palatal glide of the C/y/ sequence patterns as part of both the onset and the nucleus of a syllable. The seemingly ambivalent behavior of glides would then follow from a complex structure and different constraint rankings.

1. Introduction

The production and development of word-initial clusters in American English has been of particular interest in the investigations of children's phonological development. Various researchers have based theoretical issues about the status of syllable structure on developmental data in general; however, the consonant + palatal glide sequence (such as in the word [kyut] 'cute') has not been given a substantial amount of attention thus far in the developmental literature, probably due to its questionable status as a consonant cluster (Davis and Hammond 1995; Giegerich 1992; Harris 1994).

There have been several different views about the status of the C/y/ sequence in American English within the fully-developed system. Some classify the sequence as a consonant cluster (in other words, the glide forms part of the onset of a syllable) (Borowsky 1984, 1986; Harris 1994). Others assume, based on phonotactic evidence, stress facts, speech errors and language games, that the /y/ in the C/y/ sequence patterns as either part of the nucleus (Halle and Mohanan 1985) or as part of both (in other words, multiply linked to) the onset and the nucleus of a syllable (Anderson 1988; Giegerich 1992). Furthermore, while some assume that the /y/ is present underlyingly in such sequences (Anderson 1988; Borowsky 1984, 1986; Davis and Hammond 1995; Giegerich 1992; Harris 1994), others assume it is inserted by rule (e.g. Clements and Keyser 1983; Halle and Mohanan 1985).

In this paper I will discuss the data of phonologically delayed children to determine which of the accounts about the patterning of the palatal glide in C/y/ sequences is most compatible with the data. It will be evident that both within and across children the /y/ can pattern as part of the nucleus or as part of the onset. By appealing to Optimality Theory (Prince and Smolensky 1993) to account for the on-glide phenomena in acquisition, we may shed some new light on an issue that has as of yet been unresolved. Through the ranking of constraints which are assumed to be universal across languages (and thus across adults and children), it has been shown that Optimality Theory can account for children's productions which deviate from the target system. By re-ranking these constraints over time, it is possible to account for the development of a given child's phonology without positing constraints that are specific to children only, and it can allow for representations that are static over time. Optimality Theory has for the most part been motivated largely by phenomena in fully-developed systems with some attention to acquisition. It is beginning to gain support in the area of acquisition due to the relative ease with which it can account for variability (which is common in children's productions) and it can account for change over time. I will appeal specifically to Correspondence theory of McCarthy and Prince 1995, which has a slightly different perspective on faithfulness than the theory developed by Prince and Smolensky.

2. The Data

The data from XX (aged 3;10) will be examined at one point in time, pretreatment. At this point, XX does produce word-initial consonant sequences correctly in many cases; however, he also tends to epenthesize a vowel between two segments, to break a sequence into two syllables. The data in (1) below illustrate this:

(1) XX (aged 3;10), pretreatment

a. Consonant sequences produced target-appropriately

twɪn	'twin'	swip	'sweep'
bloʊ	'blow'	preɪ	'pray'

b. Consonant sequences produced with epenthesized vowel

k∂yut	'cute'	f∂yu	'few'
p∂leɪ	'play'	b∂loʊwɪng	'blowing'

Note in (1b), that even the target C/y/ sequences are undergoing epenthesis, as shown in XX's productions for *cute* and *few*. This would suggest that, in this child's phonology, C/y/ sequences are behaving as other consonant clusters do by patterning as complex onsets in this child's system.

There are several constraints that are relevant for yielding the forms shown in data set (1). Two of the constraints, MAX and DEP, which are similar to the PARSE and FILL constraints of Prince and Smolensky 1993, are faithfulness constraints which require that the input (or underlying form) be identical to the output (or surface form). MAX requires that a segment in the input must have a correspondent in the output; in other words, this constraint prohibits deletion. DEP (or Dependence), on the other hand, requires that every segment in the output correspond to a segment in the input. Thus, this constraint prohibits insertion. We can determine the ranking of these two constraints with respect to one another by comparing XX's optimal (or actual) output with another possible output in Tableau 1 below.

Tableau 1. MAX >> DEP

/pyu/ 'pew'	MAX	DEP
a. ☞ p ∂.y u[1]		*
b. p u	*!	

Tableau 1 indicates that for XX's phonology, it is better to insert a segment to break up a cluster than to delete a segment from the input. Thus a fatal violation of MAX for candidate (b) allows candidate (a) to be favored, even though (a) incurs a violation of lower-ranked DEP.

Three other constraints that are relevant for accounting for XX's forms, relate to possible structures that are allowed. *COMPLEX allows onsets with no more than one segment. The other two constraints relate to possible nucleic structures. *FALLING prohibits nuclei that fall in sonority, while *RISING disfavors nuclei with rising sonority. In Tableau 2, we can compare the optimal output (candidate (a)), with another possible candidate to determine the ranking of *RISING and DEP:

Tableau 2. *RISING >> DEP

/pyu/ 'pew'	*RISING	DEP
a. ☞ p ∂.y u		*
b. py u	*!	

Tableau 2 shows that for XX, it is better to epenthesize a vowel than to allow a nucleus that rises in sonority, such as that in candidate (b). Complex nuclei that fall in sonority are allowed, however, in this child's phonology, as is apparent from the forms [blou] and [preɪ]. Thus, *FALLING must be very low-ranked in this child's system.

Compare XX's productions for *blow* and *blowing* in (1). Even for the same morpheme, his production of the /bl-/ cluster was variable. Since he produces forms with complex onsets, or epenthesizes a vowel to break up clusters--even for the same morpheme--we must assume that *COMPLEX and DEP are unranked with respect to one another. Tableau 3 demonstrates this:

Tableau 3. *COMPLEX and DEP are unranked

/blou/ 'blow'	*COMPLEX	DEP
a. ☞ bl ou	*	
b. ☞ b ∂.l ou		*

Finally, we must incorporate a sonority constraint. Gnanadesikan 1995 proposed a family of markedness constraints based on the sonority hierarchy. This family of sonority constraints require that each segment must be assigned a mora in the output. The ranking within this family is given in (2) below. This ranking shows there is a preference for the least sonorous onset.

(2) μ/a >> μ/e, o >> μ/u >> μ/i >> μ/r, l >> μ/m, n >> μ/v, z >> μ/f, s >> μ/b, d, g >> μ/p, t, k

As illustrated in Tableau 4, this ranking shows why a form like candidate (a), where the palatal glide is the onset of a syllable, is more optimal than a form like candidate (b), where it surfaces as a vowel.

Tableau 4. μ/u >> μ/i

/pyu/ 'pew'	μ/u	μ/i
a. ☞ p ∂.y u		*
b. p iw	*!	

The full ranking for all of the constraints relevant to XX’s productions of consonant sequences is provided in (3). For XX, the constraints MAX and *RISING are not crucially ranked with respect to one another, since violation of either is always fatal. Tableaus 5 and 6 follow with a demonstration of this ranking.

(3) MAX, *RISING >> μ/u >> μ/i >> *COMPLEX, DEP >> *FALLING

Tableau 5. [py u] ~ [p ∂.y u] ‘pew’

/pyu/ ‘pew’	MAX	*RISING	μ/u	μ/i	*COMP	DEP	*FALL
a. ☞ py u				*	*		
b. ☞ p ∂.y u				*		*	
c. p yu		*!		*			
d. p iw			*!				*
e. p u	*!						

Tableau 6. [b l oᴜ] ~ [b ∂.l oᴜ] ‘blow’

/bloᴜ/ ‘blow’	MAX	*RISING	μ/u	μ/i	*COMP	DEP	*FALL
a. ☞ bl oᴜ					*		*
b. ☞ b ∂.l oᴜ						*	*
c. b oᴜ	*!						*
d. l oᴜ	*!						*

The ranking given in (3) can account for the variability that is exhibited in this child’s productions for target consonant sequences, by allowing for either complex onsets or epenthesis to break up such sequences. Furthermore, it suggests that for this child at this particular point in time, C/y/ sequences are patterning similarly to other consonant clusters.

The data from Subject 13 (age 5;2) are presented in (4) below. The data are taken from immediately following treatment on /w/, /f/ and /s/. Posttreatment data suggest that Subject 13’s C/y/ sequences pattern differently than other consonant sequences. As is evident from the data, all of the target consonant + sonorant sequences are realized as singletons, with the exception of target C/y/ sequences (shown in (4b)), which are fully realized with the glide. Thus we can say that posttreatment, the palatal glide is patterning with the nucleus of the syllable.

(4) Subject 13 (age 5;2), Posttreatment

a. Target /w/, /l/ and /r/ as singletons

wɛbi	'web' (dim.)	weɪp	'wave'
weɪn	'rain'	weɪg	'leg'

b. Target C/y/ sequences

pyu	'pew'	kyu?	'cute'
vyu	'view'	myuɪk	'music'

c. Target C/w/ sequences

tɪn	'twin'	king	'queen'

d. Target C/r/ and C/l/ sequences

peɪ	'play'	faɪ	'fly'
d^mi	'drum' (dim.)	fag	'frog'

Since complex onsets are not allowed in this child's phonology, *COMPLEX must be ranked very high--higher than MAX--since clusters are always reduced. Tableau 7 demonstrates this:

Tableau 7. *COMPLEX >> MAX

/twɪn/ 'twin'	*COMP	MAX
a. ☞ tɪn		*
b. twɪn	*!	

Thus, it is evident from Tableau 7 that, in this child's phonology, deletion of a segment as shown for candidate (a) is preferable over allowing a complex onset as is the case with candidate (b). We must, however, be able to predict which segment, either /t/ or /w/, will be the optimal onset for the word such as *twin*. It is clear from Subject 13's productions that target clusters are always realized with the least sonorous segment from the input. /t/ is less sonorous than /w/, and thus it wins out over /w/ as the optimal onset. Once again, the sonority constraints are relevant for yielding this optimal onset. In Tableau 8, we can demonstrate how [tɪn] wins out over [wɪn]:

Tableau 8. µ/u >> µ/t

/twɪn/ 'twin'	µ/u	µ/t
a. ☞ tɪn		*
b. wɪn	*!	

The full ranking for Subject 13 immediately posttreatment is given in (5) below and Tableau 9 demonstrates the ranking. It is apparent from Tableau 9 that the ranking of the three constraints (*COMPLEX, MAX, and the sonority constraints) in Subject 13's phonology prohibits the occurrence of complex onsets, however it still allows for the target C/y/ forms to be realized fully, with the glide. This is possible because for this child at this point in time, the palatal glide was occurring within the nucleus of the syllable, rather than in the onset.

(5) *COMPLEX >> MAX >> μ/u >> μ/i >> μ/v >> μ/f >> μ/p, t

Tableau 9: *COMPLEX >> MAX >> μ/u >> μ/i >> μ/v >> μ/f >> μ/t

/vyu/ 'view'	*COMP	MAX	μ/u	μ/i	μ/v	μ/f	μ/t
a. vy u	*!			*	*		
b. ☞ v yu				*	*		
c. v iw			*!		*		
d. v u		*!			*		
f. y u		*!		*			

Data from YY (age 6;4) will be examined at two points in time. The data in (6) below indicate that pretreatment, as with Subject 13, in YY's phonology *COMPLEX is ranked very high: consonant + sonorant sequences are always reduced to singletons. However, unlike Subject 13, the singleton that is realized usually is not one of either of the segments that are in the input. In order to avoid violating *COMPLEX, YY coalesces the clustered segments, remaining faithful to *COMPLEX. These forms in (6) show how C/w/ and consonant + liquid sequences are coalesced.

(6) Examples of coalescence from YY (age 6;4), pretreatment

a. Target C/w/ sequences

fɪn	'twin'	fɪng	'queen'
bɪm	'swim'	bip	'sweep'

b. Target C/l/ and C/r/ sequences

be	'play'	gaɪm	'climb'
g^vi	'glove' (dim.)	faɪ	'fly'
bowɪn	'growing'	fo	'throw'

Coalescence also does not incur a violation of MAX. Since there is a preference in YY's phonology to coalesce segments rather than delete one of the segments from the input, MAX must also be ranked very high. Coalescence does, however, violate a low-ranking constraint, NO-COAL, which prohibits coalescence. Two segments coalesce such that the resultant segment has the sonority of one segment with the place feature of another. In all cases, the sonority of the least sonorous segment is retained. This is a result of the ranking of the sonority constraints that were relevant for XX and Subject 13.

For target C/y/ sequences, coalescence does not occur at this point in time. Instead, the glide is realized, patterning as part of the nucleus. Relevant data are provided in (7).

(7) YY's target C/y/ forms

byut∂o	'beautiful'	gyut	'cute'
fyu	'few'	vyu	'view'

To account for this child's data, another constraint must be introduced, IDENT[F], following McCarthy and Prince 1995. It requires that if an input segment has the feature [aF], then the corresponding output segment must also have the feature [aF]. For YY's productions, this constraint is exploded into the constraints IDENT[L], IDENT[D] and IDENT[C], ranked in that order.

The sonority constraints must be ranked lower than the IDENT[F] constraints, and NO-COAL must be ranked even lower. Tableau 10 demonstrates this ranking with a few possible output forms. Here subscript indices are used to indicate the correspondence between the input and the output forms. In the input, the consonant + sonorant sequence is /d_1w_2/ which has possible corresponding coalesced outputs of the form [w_{12}], [d_{12}] and [b_{12}]. /s/ is never produced by this child: instead it is always realized with [d]. Therefore, it is assumed that /d/ is the underlying representation for target /s/. (The constraint μ/Y across the top of Tableau 10 refers to the family of the sonority constraints, where Y stands for any segment.)

Tableau 10: IDENT[F] >> μ/Y

/d_1w_2ɪm/ 'swim'	IDENT[L]	IDENT[C]	μ/u	μ/b d	NO-COAL
a. w_{12}ɪm		*	*!		*
b. d_{12}ɪm	*!			*	*
c. ☞ b_{12}ɪm		*		*	*

The final ranking is given in (8). Since violation of either *COMPLEX or MAX is always fatal, the two constraints are not crucially ranked with respect to one another. Tableaus 11, 12, 13, and 14 follow, providing the full rankings of the constraints for the words *swim*, *growing*, *glove*, and *few*, respectively.

(8) *COMPLEX, MAX >> IDENT[L] >> IDENT[D] >> IDENT[C] >> μ/Y >> NO-COAL

Tableau 11: [bɪm] ‘swim’

/d$_1$w$_2$ɪm/ ‘swim’	*COMP	MAX	ID[L]	ID[C]	μ/u	μ/i	μ/b d	NO-CO
a. d$_1$w$_2$ɪm	*!				*		*	
b. d$_1$ɪm		*!					*	
c. w$_2$ɪm		*!			*			
d. d$_{12}$ɪm			*!				*	*
e. w$_{12}$ɪm				*	*!			*
f. y$_{12}$ɪm			*!			*		*
g. ☞ b$_{12}$ɪm				*			*	*

Tableau 12: [bowɪn] ‘growing’

/g$_1$w$_2$o../ ‘growing’	*COMP	MAX	ID[L]	ID[D]	μ/u	μ/b g	NO-CO
a. g$_1$w$_2$o...	*!				*	*	
b. g$_1$o...		*!				*	
c. w$_2$o...		*!			*		
d. g$_{12}$o...			*!				*
e. w$_{12}$o...				*	*!		*
f. ☞ b$_{12}$o...				*		*	*

Tableau 13: [g^vi] ‘glove’ (diminutive)

/g$_1$l$_2$^vi/ ‘glove’ (dim.)	*COMP	MAX	ID[D]	ID[C]	μ/i	μ/l r	μ/g	NO-CO
a. g$_1$l$_2$^vi	*!					*	*	
b. g$_1$^vi		*!					*	
c. l$_2$^vi		*!				*		
d. ☞ g$_{12}$^vi				*			*	*
e. l$_{12}$^vi			*!			*		*
f. y$_{12}$^vi			*!		*			*

Tableau 14: [fâyu] ‘few’

/$f_1y_2u_3$/ ‘few’	*COMP	MAX	ID[L]	ID[C]	μ/u	μ/i	μ/f	NO-CO
a. $f_1y_2\ u_3$	*!					*	*	
b. ☞ $f_1\ y_2u_3$						*	*	
c. $f_1\ i_2w_3$					*!		*	
d. $f_1\ u_3$		*!					*	
e. $y_2\ u_3$		*!				*		
f. $f_{12}\ u_3$				*!			*	*
g. $w_{12}\ u_3$				*!	*			*
h. $y_{12}\ u_3$			*!			*		*
i. $y_{12}u_3$			*!			*		*
j. $i_{12}w_3$			*!		*			*

In Tableau 13, we see an example of vacuous coalescence, for the target word *glove* in the diminutive form. Since IDENT[D] is ranked higher than IDENT[C], we get both the sonority and the place features of the /g/, and nothing of the /l/. This does not happen with *growing* in Tableau 12, because YY’s underlying representation includes a labial glide, rather than /r/. Since IDENT[L] is ranked higher than IDENT[D], we see coalescence occurring overtly, yielding [bowɪn].

To summarize, YY’s productions pretreatment indicated that C/y/ sequences patterned differently. While C/w/ and consonant + liquid sequences were coalesced, the C/y/ sequences were realized fully: coalescence did not occur. Thus, the palatal glide was patterning as part of the nucleus rather than the onset.

For YY posttreatment, however, target C/y/ sequences now pattern more like clusters in onset position. After receiving treatment on an affricate, YY’s phonology is only slightly different. For target C/y/ sequences, the /y/ is no longer realized. However, /y/ is still realized in singleton forms (thus it is present in the inventory). Coalescence is still the strategy this child employs for avoiding violations of *COMPLEX and MAX, and it is assumed that at this point in time, the C/y/ sequences are coalesced as well. The data in (9) below demonstrate that coalescence is occurring for all the consonant + sonorant sequences:

(9) YY, Posttreatment

a. Target C/w/ sequences

fɪn	‘twin’	vin	‘queen’
bɪm	‘swim’	bip	‘sweep’

b. Target C/y/ sequences

bu	‘pew’	fu	‘few’
vu	‘view’	mutɪk	‘music’

c. Target C/r/ and C/l/ sequences

b^do	‘brother’	fo	‘throw’
g^v	‘glove’	faɪ	‘fly’

It is not necessary to provide tableaus for all of the forms listed, as most of them remain unchanged. What has changed, however, are the C/y/ forms, and thus a tableau for *few* is provided below. The μ/u and μ/i constraints are now ranked higher than the IDENT[F] constraints, while the remaining sonority constraints are ranked lower than IDENT[F]. Here we assume that /y/ is patterning as part of the onset, and thus coalescence has occurred vacuously. Since /y/ is coronal, the place feature of the first segment will always be more optimal.

Tableau 16: *COMPLEX, MAX >> μ/u >> μ/i >> IDENT[L] >> IDENT[D] >> IDENT[C] >> μ/f, s >> μ/b, d, g >> μ/p t k >> NO-COAL

/$f_1y_2u_3$/ ‘few’	*COMP	MAX	μ/u	μ/i	ID[L]	ID[C]	μ/f	NO-CO
a. $f_1y_2\ u_3$	*!			*			*	
b. $f_1\ y_2u_3$				*!			*	
c. $f_1\ i_2w_3$			*!				*	
d. $f_1\ u_3$		*!					*	
e. $y_2\ u_3$		*!		*				
f. ☞ $f_{12}\ u_3$						*	*	*
g. $w_{12}\ u_3$			*!			*		*
h. $y_{12}\ u_3$				*!	*			*
i. $y_{12}u_3$				*!	*			*
j. $i_{12}w_3$			*!		*			*

Tableau 16 shows how the ranking of the relevant constraints for YY’s productions posttreatment can allow for C/y/ forms to undergo coalescence. Note that this child’s phonemic inventory did not change over time. In other words, his underlying representations remained the same. What did change, however, was the production of target C/y/ forms. This was naturally accounted for by reranking the relevant constraints over time; and this can still account for those forms that remain unchanged.

3. Discussion

I have presented evidence that the differential behavior of the palatal glide in C/y/ sequences is due to the nature and relative rankings of the relevant constraints, both within a given child's system over time, and across children's systems. The findings here raise some questions regarding the issue of markedness in development.

Demuth 1995 and Gnanadesikan 1995 both appeal to Optimality Theory to account for the productions of young children. They both argue that in the early stages of first language acquisition, markedness constraints are ranked higher than faithfulness constraints, yielding forms which are unmarked or least marked. Thus, output forms often do not correspond to target (adult) forms. As children's phonologies develop, faithfulness constraints become more highly ranked in order to achieve more contrasts in their systems.

Based on the findings in the present study, the question arises about whether development always proceeds from unmarked to marked productions. As demonstrated, children differ in their development of C/y/ sequences, and, furthermore, a given child may change from one output that seems more marked to another output that seems less marked. What remains to be resolved is which of the surface representations of the C/y/ sequence is least marked. Still we would not be able to determine why children show such variation in their development of these sequences. The emergence of the unmarked may not be relevant in some cases where no markedness can be established. The problem with markedness arises here if we assume ambient-like underlying representations for the relevant consonant sequences. Perhaps development does proceed from unmarked to marked, but this will probably require modifying our assumptions about underlying representations.

In conclusion, it has been difficult to determine in the adult grammar whether the palatal glide in C/y/ sequences is associated with the onset or the nucleus of a syllable. The data presented in this paper indicated that the patterning of this glide is also questionable in developing systems. It is apparent that the palatal glide can pattern differently across children, even across time for a given child. By appealing to Optimality Theory I have attempted to account for variability and change over time without any change in the complexity of the underlying structure of the target C/y/ forms. The specific nature of the underlying representation of the /y/ (in other words, whether it is a vowel or a glide) may not matter, since it is the nature of the constraints which determine how it patterns with respect to syllable structure. Furthermore, given the nature and possible relative rankings of these constraints, it is not surprising that we have surface forms which are ambiguous in fully-developed American English. Optimality Theory actually can predict such ambiguity.

Endnotes

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[1] Periods denote syllable boundaries, while spaces denote subsyllabic boundaries. For example, in [p ∂.y u], [p] and [y] are both in onset position, while [∂] and [u] are both in nucleus position. A phonetic output such as [py u] would indicate that [py] forms the onset of the syllable, while in [p yu], the [yu] sequence is part of the nucleus.

The following symbols will be used: [∂] is schwa, [ng] is eng, [^] is wedge.

References

Anderson, J. (1988) “More on Slips and Syllable Structure”, *Phonology* 5, 157-159.

Borowsky, T. (1984) “On Resyllabification in English”, *Proceedings of the West Coast Conference on Formal Linguistics* 3, 1-15.

Borowsky, T. (1986) *Topics in the Lexical Phonology of English*. Doctoral dissertation, University of Massachusetts.

Clements, G. N., and Keyser, S. J. (1983) *CV Phonology: A Generative Theory of the Syllable*. MIT Press, Cambridge, MA.

Davis, S., and Hammond, M. (1995) “On the Status of On-glides in American English”, *Phonology* 12, 159-182.

Demuth, K. (1995) “Markedness and the Development of Prosodic Structure”, *Proceedings from the Northeastern Linguistic Society* 24.

Giegerich, H. J. (1992) *English Phonology: An Introduction*. Cambridge University Press, Cambridge.

Gnanadesikan, A. E. 1995. Markedness and Faithfulness Constraints in Child Phonology. Unpublished ms, University of Massachusetts, Amherst. (Available from Rutgers Optimality Archives.)

Halle, M., and Mohanan, K. (1985) “Segmental phonology of modern English”, *Linguistic Inquiry* 16, 57-116.

Harris, J. (1994) *English Sound Structure*. Blackwell, Cambridge, MA.

McCarthy, J. J., and Prince, A. S. (1995) “Faithfulness and Reduplicative Identity”, *Papers in Optimality Theory University of Massachusetts Occasional Papers 18*, ed. by J. N. Beckman, L. W. Dickey, and S. Urbanczyk, 249-384. GLSA, University of Massachusetts Press, Amherst, MA.

Prince, A., and Smolensky, P. (1993) *Optimality Theory: Constraint Interaction in Generative Grammar. Technical Report #2 of the Rutgers Center for Cognitive Science*, Rutgers University.