

PHONOLOGICAL CONSTRAINTS ON CONSTITUENT ORDERING

Arto Anttila
Stanford University

1. Introduction

- (1) Does phonology influence the ordering of meaningful elements (morphemes, words, phrases)?
- (2) The answer is usually taken to be no (see e.g. Pullum and Zwicky 1989), but a quantitative investigation of the English Dative Alternation tells a different story.
- (3) The double object construction:
 - (a) Celebrity status gave [Schwarzenegger] [options]
 - (b) She was recommending [me] [designs] and I gladly listened
- (4) The prepositional construction:
 - (a) Man gave [names] [to all the animals]
 - (b) I am assigning [it] only [to my advanced 5th graders]
- (5) The Heavy NP Shift construction:
 - (a) A staff sergeant is explaining [to the men] [the rules of the Geneva Convention]
 - (b) I'm going to reveal [to you] [the terms of the wager]
- (6) Main conclusions:
 - (a) Prosody plays a role in constituent linearization in English.
 - (b) The prosodic effects are mostly gradient and variable, yet entirely systematic.
- (7) Goals:
 - (a) Present a phonological model that predicts, for each input, what the possible orderings are as well as the quantitative preferences among them
 - (b) Test the model on quantitative data from 1,580 prosodically annotated dative constructions extracted from www.blogspot.com (The Blogspot Corpus). [Thanks to Philipp Angermeyer, Rahul Balusu, and Peter Liem for compiling the corpus.]

2. Could phonology play a role in constituent ordering?

- (8) Periphrastic *do* in Shakespeare's plays:

In a quantitative analysis of a corpus [...] Stein [1986] found that the rate of use of *do* in questions correlated with the complexity of the consonant clusters [...]. When the use of *do* would eliminate a phonotactically marked sequence of consonants [...] its appearance is favored. (Kroch 1989:238)

- (9) showed → showedst [-d-st] is bad
 stopped → stoppedst [p-t-st] is worse

(10) English possessives (Kirke 2004, numbers are Google hits)

(a)	streets of Dallas	650	Dallas's streets	0	(0%)
	streets of Indianapolis	175	Indianapolis's streets	1	(1%)
(b)	streets of Austin	471	Austin's streets	58	(11%)
	streets of Cincinnati	290	Cincinnati's streets	38	(12%)
(c)	restaurants of Dallas	119	Dallas's restaurants	6	(5%)
	restaurants of Indianapolis	17	Indianapolis's restaurants	3	(15%)
(d)	restaurants of Austin	13	Austin's restaurants	21	(62%)
	restaurants of Cincinnati	14	Cincinnati's restaurants	10	(42%)

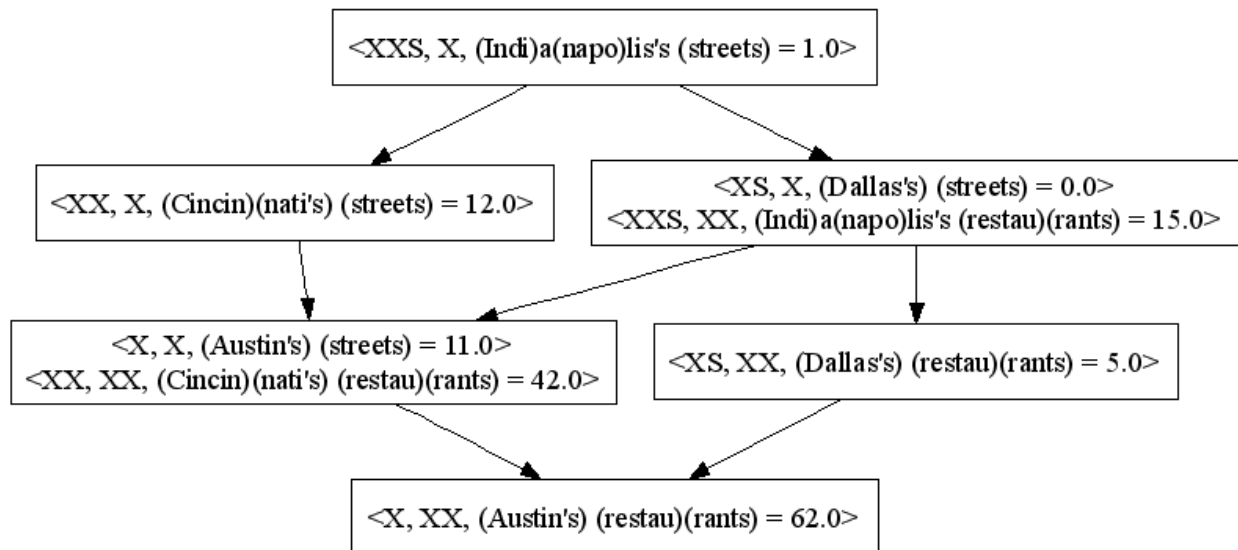
(11) Constraints:

- (a) *S-S Avoid ss-clusters
 streets of Dallas (100%) > Dallas's streets (0%)
- (b) END-WEIGHT Heaviest noun last (weight = number of feet)
 Austin's restaurants (62%) > Austin's streets (11%)
- (c) FOCUS(PSR) Put possessor last.
- (d) FOCUS(PSM) Put possessum last.

(12) OT tableau

		*s-s	END-WEIGHT	FOCUS(PSR)	FOCUS(PSM)
XS, X	(Dallas's) (streets) = 0%	1		1	
	(streets) of (Dallas) = 100%				1
XXS, X	(Indi)a(napo)lis's (streets) = 1%	1	1	1	
	(streets) of (Indi)a(napo)lis = 99%				1
XS, XX	(Dallas's) (restau)(rants) = 5%	1		1	
	(restau)(rants) of (Dallas) = 95%		1		1
XXS, XX	(Indi)a(napo)lis's (restau)(rants) = 15%	1		1	
	(restau)(rants) of (Indi)a(napo)lis = 85%				1
X, X	(Austin's) (streets) = 11%			1	
	(streets) of (Austin) = 89%				1
XX, X	(Cincin)(nati's) (streets) = 12%		1	1	
	(streets) of (Cincin)(nati) = 88%				1
X, XX	(Austin's) (restau)(rants) = 62%			1	
	(restau)(rants) of (Austin) = 38%		1		1
XX, XX	(Cincin)(nati's) (restau)(rants) = 42%			1	
	(restau)(rants) of (Cincin)(nati) = 58%				1

(13) T-order (only *s*-genitives shown), precision: 0.76, recall: 0.339



(14) Will the result improve if you include more cities?

3. The Dative Alternation

(15) Three observations suggest that phonology plays some role in the Dative Alternation:

- Unstressed pronouns behave differently from other NPs (*me* vs. *designs*)
- The “weight” of the NP matters (*the men* vs. *the rules of the Geneva Convention*).
- The foot structure of the verb matters (*give* vs. *èxpláin*)

3.1 The unstressed pronoun generalization

(16) Lexically unstressed pronouns have special ordering properties.

(17) Lexically unstressed pronoun themes usually do not occur in double object constructions:

- Pat gave [food] [to Chris] ~ Pat gave [Chris] [food].
- Pat gave [it] [to Chris] ~ *Pat gave [Chris] [it].

(18) In dialects where lexically unstressed pronoun themes are found in double object constructions they preferably occur after lexically unstressed pronoun goals (Erteschik-Shir 1979, Hawkins 1994):

- ?I gave [her] [it]
- *I gave [my sister] [it]

- (19) Lexically unstressed pronoun goals are commonly found in double object constructions with verbs like *lower*, *mutter*, *donate*, and *return* where other NPs are usually banned (Bresnan and Nikitina 2003, henceforth B&N 2003; Grimshaw 2005):
- (20) (a) *I lowered John the box.
 (b) Buddha lowered him the silver thread of a spider. (B&N 2003)
- (21) (a) *Susan muttered Rachel the news.
 (b) She muttered him a hurried apology. (B&N 2003)
- (22) (a) *John donated the charity money.
 (b) They can get the gullible ones to donate them money. (Google)
- (23) (a) *John returned the government the money.
 (b) Judas returned them the money (Google)
- (24) Even with verbs like *give*, lexically unstressed pronoun goals are favored in the double object construction. This quantitative asymmetry emerges in the Blogspot Corpus:
- | | | |
|-----|-------------------------------|--|
| (a) | I gave [her] [the book] | 94.3% of all realizations are double objects |
| (b) | I gave [my sister] [the book] | 26.6% of all realizations are double objects |
- one-foot verb + pronominal goal + non-pronominal theme: 94.3% double objects
 - one-foot verb + non-pronominal goal + non-pronominal theme: 26.6% double objects
- (25) Constraints:
- (a) Every XP forms a prosodic phrase (see e.g. Truckenbrodt 2007).
 (b) Unary unstressed prosodic phrases are avoided.
- (26) *Pat gave Chris (it). lexically unstressed, unary.
 Pat gave it (to him). lexically unstressed, binary
 Pat gave Chris (food). lexically stressed, unary
 Pat gave Chris (some food). lexically stressed, binary
- (27) Constraint: Stress clashes are avoided within a prosodic phrase.
- (28) (a) *John (returned the government) (the money). stress clash
 (b) Judas (returned them) (the money). no stress clash
- (29) With war still looming in Iraq and Santa having to deliver presents to every good child in the world by 24 hrs, I wonder if this year his sleigh will get shot down by a SAM (Surface-to-Air Missile) when he's delivering them presents over Iraq. (Google)
- (30) Clash avoidance also provides a rationale for the quantitative asymmetry in (24):
- | | | |
|-----|-------------------------------|--|
| (a) | I (gáve her) (the book) | 94.3% of all realizations are double objects |
| (b) | I (gáve my síster) (the book) | 26.6% of all realizations are double objects |

3.2 The end weight generalization

(31) The Principle of End Weight: “Heavy” constituents come last (see e.g. Wasow 2002).

(32) Example: Heavy NP Shift

(a) A staff sergeant is explaining [to the men] [the rules of the Geneva Convention]

(b) I'm going to reveal [to you] [the terms of the wager]

(33) Constraint: Phrasal stress attracts lexical stress.

(a) Sentence stress falls on the rightmost constituent (The Nuclear Stress Rule).

(b) Word stress and sentence stress preferably coincide.

(34) The Nuclear Stress Rule: The most prominent syllable of the rightmost constituent in a phrase P is the most prominent syllable of P (Selkirk 1995:562, paraphrasing Chomsky and Halle 1968:15-24).

(35)

				x
			x	x
	x	x	x	x

((volunteer firemen) (save lives))

(36) Constraint (Stress-to-Stress): Word stress implies phrasal stress (gradient).

	STRESS-TO-STRESS
x	**!
x x x	
a. Robertson gave [critical backing] [to <u>Bush</u>]	
x	*
x x x	
b. → Robertson gave [<u>Bush</u>] [critical backing]	

(37) Stress-to-Stress has the effect of maximizing the number of lexical stresses in the constituent under sentence stress.

(38) Prediction 1: Only the relative weight of the arguments should matter (Wasow 2002, cf. Jäger and Rosenbach 2004):

(a) Goal < Theme: *gave (my síster) (twénty dóllars)*

(b) Goal > Theme: *gave (the móney) (to my líttle síster)*

(c) Goal = Theme: *gave (my síster) (the móney) ~ gave (the móney) (to my síster)*

(39) Another possibility (Jäger and Rosenbach 2004): length effects are additive

(a) *verb [wórd]_{Go} [wórd wórd]_{Th}* Theme prefers the right edge.

(b) *verb [wórd]_{Go} [wórd wórd wórd]_{Th}* Theme prefers the right edge even more.

- (40) Prediction 2: The weight effect should disappear if nuclear stress is lured away:
- (a) Robertson gave [critical backing] [to Bush] last year
 - (b) not to give [children] [it] to avoid possible allergies (B&N 2003:19-20)
 - (c) never send [someone] [them] in the mail either (B&N 2003:19-20)
 - (d) showing [people] [him] through our life (B&N 2003:19-20)
- (41) Prediction 3: Function words (*a/an, the, of,...*) should not count for weight. Compare this to “syntactic weight” where the number of syntactic nodes matters (see Wasow 2002).
- (42) This prediction is not made by
- (a) the various syntactic hypotheses where weight is calculated in terms of (orthographic) words or syntactic nodes (see e.g. Wasow 2002)
 - (b) the alternative phonological hypothesis that calculates weight in syllables
- (43) Prediction 4: Languages where nuclear stress falls on the left should exhibit leftward Heavy NP Shift. One potential example is Japanese (McCawley 1977:273, cited in Cinque 1993:271, Yamashita and Chang 2001).
- (44) Do both primary and secondary stresses matter? At this point, I have no idea (but see Cohan, Kager, Quené, and Nootboom 2001, for evidence from Dutch.)

3.3 The verb length generalization

- (45) Dative Alternation is restricted to verbs dominated by a single foot (Fraser 1998, Grimshaw 2005).
- (46) (a) They (gave) the church money
 (b) *They (do)(nated) the church money.
- (47) Some alternating one-foot verbs:
- | | | | | |
|-----------|---------|--------|---------|-----------|
| a(ccord) | (bring) | (lend) | (phone) | (cable) |
| ad(vance) | (give) | (loan) | (send) | (forward) |
| a(lloit) | (grant) | (mail) | (show) | (offer) |
| a(llow) | (hand) | (owe) | (teach) | (promise) |
| a(ssign) | (lease) | (pass) | (tell) | (signal) |
| a(ward) | (leave) | (pay) | (write) | (xerox) |
- (48) The verbs in the leftmost column appear to have an initial extrametrical vowel, witness reduction. (See Downing 1998 for the prosodic misalignment of onsetless syllables.)
- (49) Some non-alternating two-foot verbs (Levin 1993):
- | | | |
|-------------|-------------|--------------|
| (con)(vey) | (en)(trust) | (re)(mit) |
| (de)(liver) | (ex)(plain) | (re)(turn) |
| (dic)(tate) | (pre)(sent) | (trans)(fer) |
| (do)(nate) | | |

(50) Some alternating two-foot verbs. Note that in all these verbs the initial foot is disyllabic.

(allo)(cate)	(reco)(mmend)
(cata)(pult)	(sate)(llite)
(conse)(crate)	(sema)(phore)
(guaran)(tee)	(tele)(cast)
(nomi)(nate)	(tele)(graph)
(radi)(o)	(tele)(phone)

(51) Why should the number of feet matter? Grimshaw 2005 explicitly identifies the one-foot constraint, but suggests that it is only an arbitrary learnability cue with no real connection to the prosodic system of English.

(52) Constraints:

- (a) A verb and its complement form a prosodic phrase (Inkelas and Zec 1995).
- (b) Prosodic constituents are preferably binary.

(53) (a) ((give) (my sister)) (the book) binary phrase
(b) *((do)(nate) (my sister)) (the book) ternary phrase

(54) Assumption: Double object and prepositional constructions have different phrasings:

(55) (a) *((do)(nate) (my sister)) (the money) a ternary constituent
(b) ((do)(nate)) (the money) (to my sister) no ternary constituents

(56) This may reflect a syntactic difference between the two constructions.

(57) Constraint (ParseGoal): The goal NP must be prosodically parsed together with its syntactic head.

(58) ParseGoal is satisfied by the prosodic parsing (*gave my sister*) where the head is the verb as well as by (*to my sister*) where the head is the preposition.

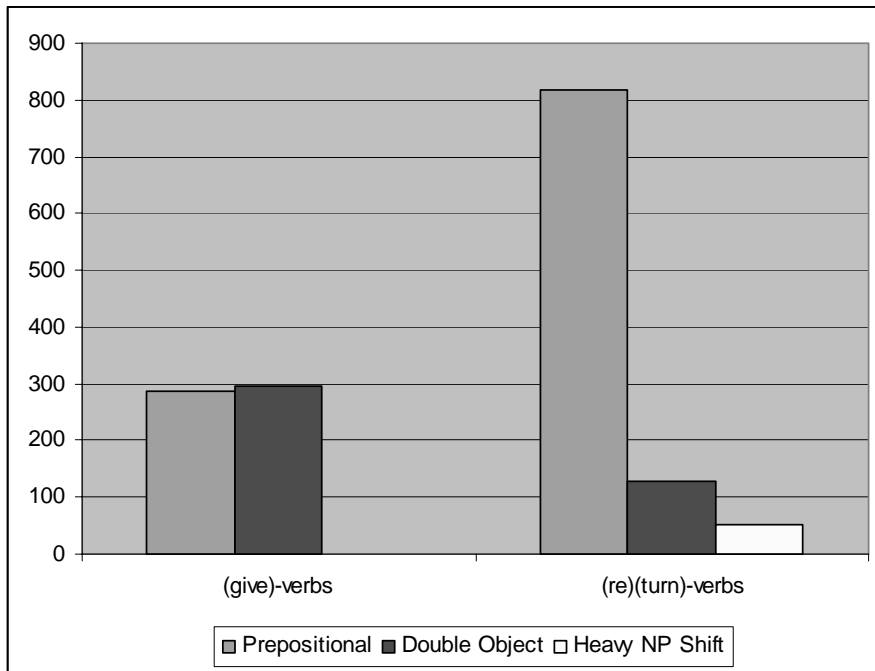
(a) (gave my sister) head = *gave*
(b) (to my sister) head = *to*

(59) Prediction: Only the number of feet in the verb should matter. Thus, *donate* and *donated* are correctly predicted to show the same alternation pattern (Fraser 1998).

(60) Data from www.blogspot.com (16 verbs, 1,580 sentences):

- One foot verbs: *assign, award, bring, give, offer, promise*
- Two foot verbs: *administer, bequeath, concede, convey, deliver, donate, explain, guarantee, recommend, reveal*

CONSTRUCTION	TOKENS	EXAMPLE
Prepositional Construction	1,103	<i>I returned the book to my little sister.</i>
Double Object construction	425	<i>I gave her the book.</i>
Heavy NP Shift	52	<i>I returned to her the old book.</i>



$df = 1, X^2 = 251, p \leq 0.001$ (Heavy NP Shift omitted)

(61) Heavy NP Shift only occurs with two-foot verbs. Why?

4. The phonological model

4.1 Inputs and outputs

- (62) (a) Input space: 8 possible types of VPs
 (b) Output space: 4 orderings, 2 phonological phrasings

VERB	GOAL	THEME	OUTPUT CANDIDATES
one foot	stressed	stressed	<i>(give) (the book) (to my sister)</i> 3 phrases preposition
			<i>(give) (to my sister) (the book)</i> 3 phrases heavy NP shift
			<i>(give) (the book) (my sister)</i> 3 phrases
			<i>(give) (my sister) (the book)</i> 3 phrases double object
			<i>(give the book) (to my sister)</i> 2 phrases preposition
			<i>(give to my sister) (the book)</i> 2 phrases heavy NP shift
			<i>(give the book) (my sister)</i> 2 phrases
			<i>(give my sister) (the book)</i> 2-phrases double object
one foot	stressed	--	<i>(give) (it) (to my sister)</i> etc.
one foot	--	stressed	<i>(give) (the book) (to her)</i>
one foot	--	--	<i>(give) (it) (to her)</i>
two feet	stressed	stressed	<i>(return)(the book) (to my sister)</i>
two feet	stressed	--	<i>(return)(it)(to my sister)</i>
two feet	--	stressed	<i>(return)(the book)(to her)</i>
two feet	--	--	<i>(return) (it)(to her)</i>

- (63) Undominated constraints (for most dialects of English):
- (a) PARSE(Goal) Goal NP must be parsed together with its head.
 (b) *(x) Avoid lexically unstressed unary constituents.
- (64) Dominated constraints:
- *TERNARY No ternary prosodic phrases.
 *CLASH No stress clashes within a prosodic phrase.
 WS \supset PS Word stress implies phrasal stress.
 *PHRASE No prosodic phrases (gradiently evaluated).
 FOCUS(Go) Focus goal, i.e. put the goal NP under phrasal stress.
 FOCUS(Th) Focus theme, i.e. put the theme NP under phrasal stress.
 *to No preposition.

(65) The tableau for the input ‘give(my sister, the book)’. Four possible winners (a, b, e, h).

	PAR(Go)	*(x)	*TERN	*CLA	F(Th)	F(Go)	WS \supset PS	*to	*PHR
a. (give)(the book)(to my sister)					*		*	*	***
b. (give)(to my sister)(the book)						*	*	*	***
c. (give)(the book)(my sister)	*!				*		*		***
d. (give)(my sister)(the book)	*!					*	*		***
e. (give the book)(to my sister)				*	*		*	*	**
f. (give to my sister)(the book)				*		*	*	*	**
g. (give the book)(my sister)	*!			*	*		*		**
h. (give my sister)(the book)				*		*	*		**

(66) The tableau for the input ‘give(my sister, it)’. One possible winner (e).

	PAR(Go)	*(x)	*TERN	*CLA	F(Th)	F(Go)	WS \supset PS	*to	*PHR
a. (give)(it)(to my sister)		*!			*			*	***
b. (give)(to my sister)(it)		*!				*	*	*	***
c. (give)(it)(my sister)	*!	*			*				***
d. (give)(my sister)(it)	*!	*				*	*		***
e. (give it)(to my sister)					*			*	**
f. (give to my sister)(it)		*!		*		*	*	*	**
g. (give it)(my sister)	*!				*				**
h. (give my sister)(it)		*!		*		*	*		**

(67) All inputs and predicted outputs (9-12 add the gradient weight effect):

INPUT	DOUBLE OBJECT	NP + PP	HNPS
1. /give(my sister, the book)/:	yes	yes	yes
2. /return(my sister, the book)/:	yes	yes	yes
3. /give(her, it)/:	--	yes	--
4. /return(her, it)/:	--	yes	--
5. /give(her, the book)/:	yes	yes	--
6. /return(her, the book)/:	yes	yes	yes
7. /give(my sister, it)/:	--	yes	--
8. /return(my sister, it)/:	--	yes	--
9. /give(my sister, the old book)/:	yes	yes	yes
10. /return(my sister, the old book)/:	yes	yes	yes
11. /give(my little sister, the book)/:	yes	yes	yes
12. /return(my little sister, the book)/:	yes	yes	yes

(68) Summary of categorical predictions:

- (a) 7 inputs (1-2, 6, 9-12) allow three outputs (double object, NP + PP, HNPS), e.g.
 - give my sister the book
 - give the book to my sister
 - give to my sister the book
- (b) 1 input (5) allows two outputs (double object, NP +PP)
 - give her the book
 - give the book to her
 - *give to her the book
- (c) 4 inputs (3-4, 7-8) only allow one output (NP + PP), e.g.
 - give it to her
 - *give her it
 - *give to her it

(69) Can we say more? How about the preferences among the three variants?

4.2 Deriving the quantitative patterns

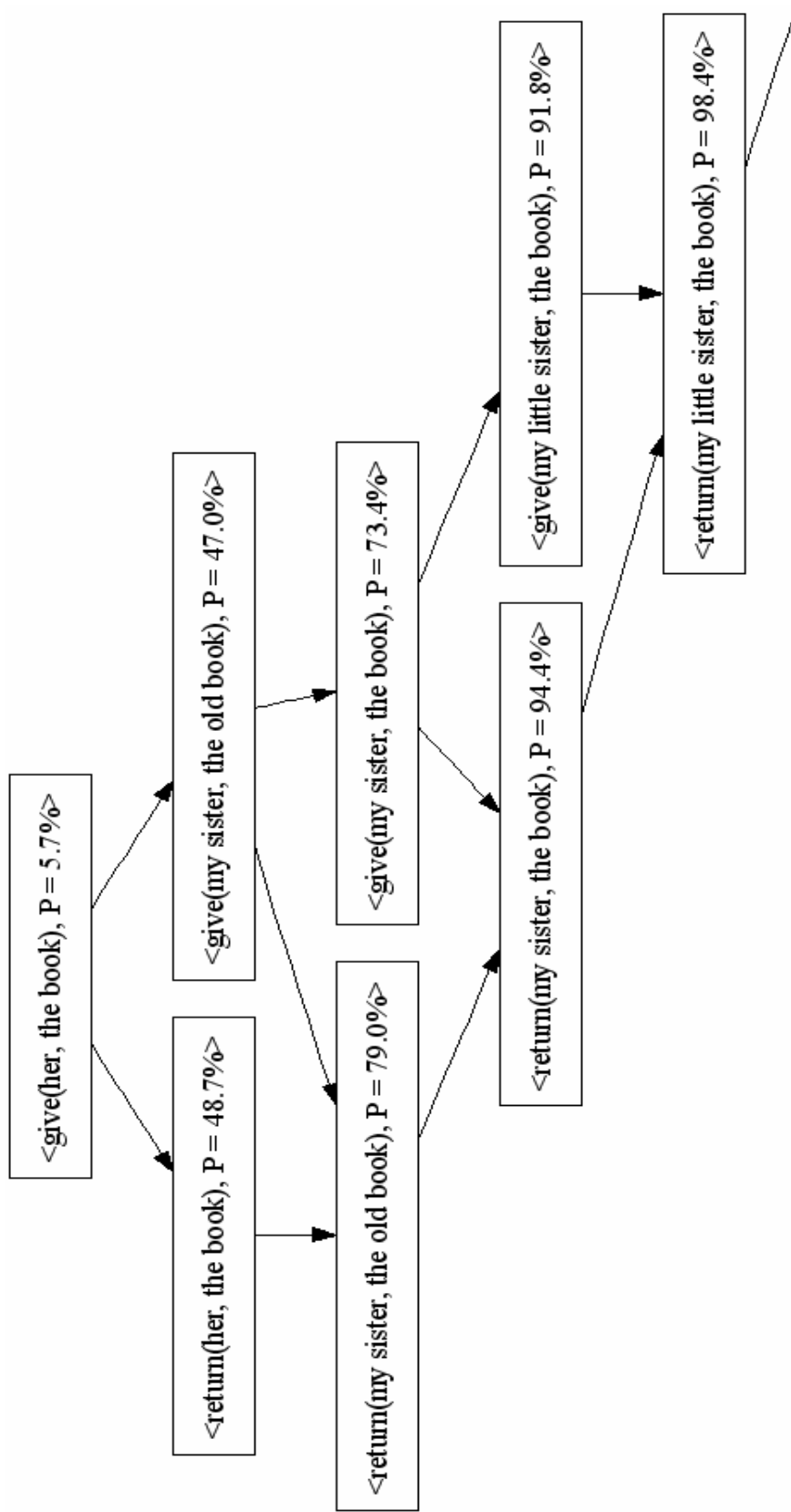
(70) The factorial typology computed by OTSoft (Hayes, Tesar & Zuraw 2003) contains 30 languages. D = double object construction (shaded), P = prepositional construction, H = heavy NP shift.

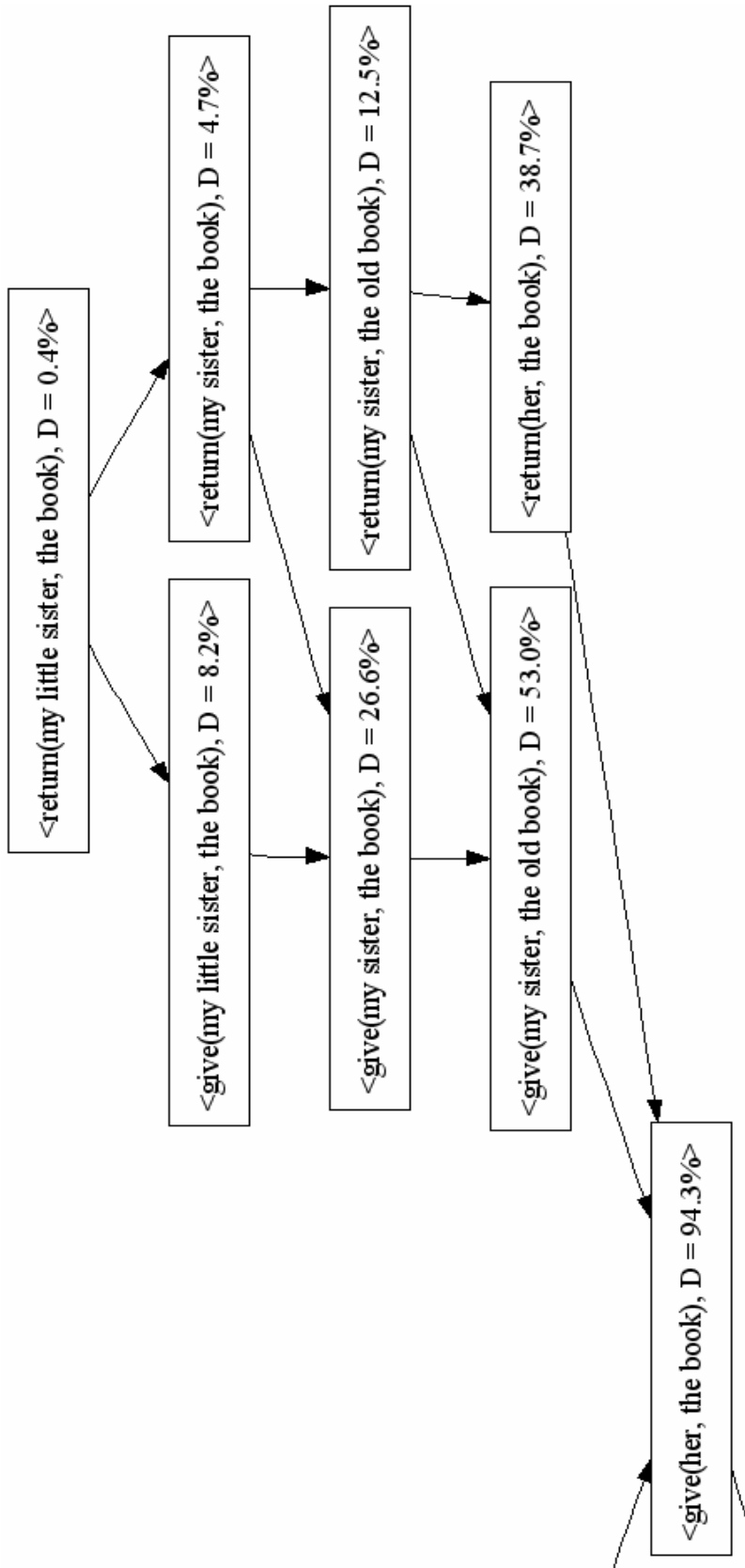
There were 30 different output patterns.

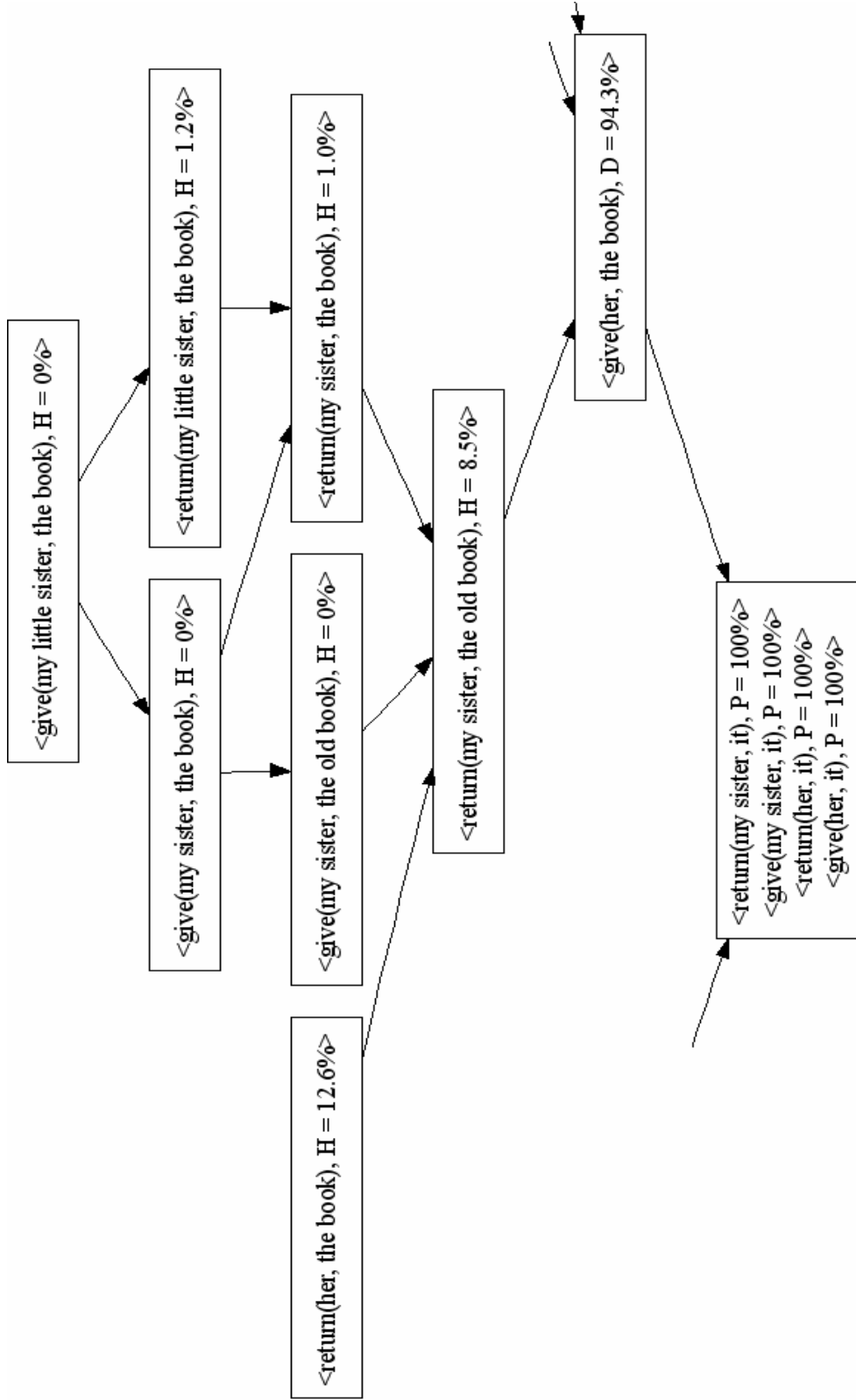
		1	2	3	4	5	6	7	8
A	'give(my sister, the old book)':	P	H	D	P	H	D	P	H
B	'give(her, the book)':	D	D	D	D	D	D	P	D
		9	10	11	12	13	14	15	16
A	'give(my sister, the old book)':	H	H	H	P	D	D	P	P
B	'give(her, the book)':	D	D	D	D	D	D	P	D
		17	18	19	20	21	22	23	24
A	'give(my sister, the old book)':	D	P	D	D	D	D	D	D
B	'give(her, the book)':	D	P	D	D	D	D	D	D
		25	26	27	28	29	30		
A	'give(my sister, the old book)':	D	D	D	D	D	D		
B	'give(her, the book)':	D	D	D	D	D	D		

(71) T-order (168 edges) [SLIDE]

- (a) Precision = 0.988, i.e. 99% of the predicted edges are correct.
- (b) Recall = 0.491, i.e. 49% of the correct edges are predicted.







5. Specific predictions

5.1 HNPS and verb length

(72) Prediction: Long verbs are predicted to exhibit more Heavy NP Shift than short verbs.

(73) Heavy NP Shift in the blogspot corpus:

(a)	return [to her] [the book]	N = 31
	return [to my sister][the old book]	N = 17
	return [to my little sister] [the book]	N = 3
	return [to my sister][the book]	N = 2
(b)	give [to her][the book]	N = 0
	give [to my sister] [the old book]	N = 0
	give [to my little sister][the book]	N = 0
	give [to my sister] [the book]	N = 0

(74) With two-foot verbs, *TERNARITY favors Heavy NP Shift:

(a)	??(<i>revealed him</i>)(<i>the truth</i>)	Dative Shift dispreferred
(b)	(<i>revealed</i>)(<i>to him</i>)(<i>the truth</i>)	Heavy NP Shift preferred

	*TERNARITY	*PHRASE	*to
→ a. [(re)(veal)] [to him] [the truth]		***	*
→ b. [(re)(veal)(him)] [(the truth)]	*	**	

(75) With one-foot verbs, Heavy NP Shift is unnecessarily complicated:

(a)	(<i>give her</i>)(<i>the book</i>)	Dative Shift preferred
(b)	??(<i>give</i>)(<i>to her</i>)(<i>the book</i>)	Heavy NP Shift dispreferred

	*TERNARITY	*PHRASE	* to
a. #[(give)] [to her] [the book]		***	*
→ b. [(give)(her)] [the book]		**	

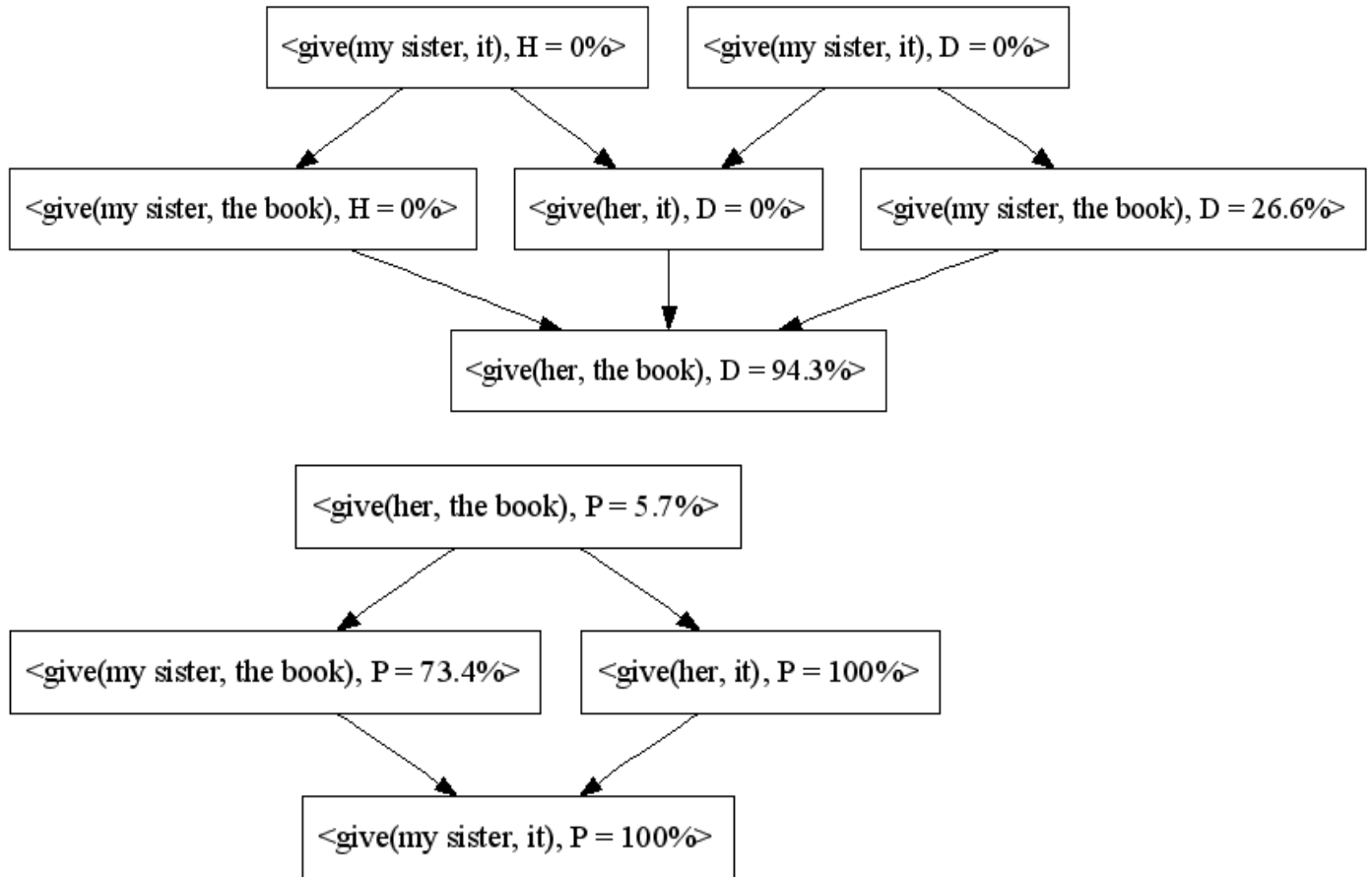
(76) The comparative nature of well-formedness: The well-formedness of an expression depends on the well-formedness of alternative expressions for the same meaning.

5.2 Pronoun sequences

- (77) DIALECT 1 DIALECT 2 DIALECT 3
 I gave her it *I gave her it *I gave her it
 *I gave my sister it *I gave my sister it I gave my sister it
 (Hawkins 1994:312) (Erteschik-Shir 1979:452) no such dialect

- (78) (a) In Dialect 1, *(x) ‘Avoid lexically unstressed unary constituents’ is dominated.
 (b) Dialect 3 violates an implicational universal.

- (79) T-order



- (80) The reason for the pronoun vs. NP asymmetry is *CLASH:

- I (gáve my sístér) (it) *CLASH violation
- I (gáve her) (it) --

- (81) The prosodic analysis predicts a parallel grammaticality contrast between I gave her the book > I gave my sister the book. This contrast emerges quantitatively in the blogspot data:

- I (gáve my sístér) the book *CLASH violation 26.6%
- I (gáve her) the book -- 94.3%

6. Beyond the dative alternation

- (82) The Verb-Particle construction:
- | | | | |
|-----|---------------------------|---|---------------------------|
| (a) | it slows the machine down | ~ | it slows down the machine |
| (b) | it slows me down | | *it slows down me |
- (83) Ternarity avoidance: verbs longer than one foot do not combine with particles at all.
- | | | |
|-----|------------------|-------------------------------|
| (a) | I called him up. | *I telephoned him up. |
| (b) | I offered it up. | *I presented it up. |
| (c) | I gave it up. | *I donated it up. |
| (d) | 'fess up | *confess up (Harley 2007, 25) |
- (84) The complementarity of *re-* and the verb particle (Banfield 2007):
- | | | |
|-----|-------------------------------------|--|
| (a) | John shipped off his prizes. | *John reshipped off his prizes. |
| (b) | Let's build up our defenses. | *Let's rebuild up our defenses. |
| (c) | You should write down the response. | *You should rewrite down the response. |
| (d) | It's time to count out the money. | *It's time to recount out the money. |
- (85) The possessive construction (cf. Anttila and Fong 2004):
- | | | |
|-----|------------------------|---------------------------------|
| (a) | the cat (of my síster) | lexically stressed complement |
| (b) | the cat (of míne) | lexically stressed complement |
| (c) | *the cat (of me) | lexically unstressed complement |

7. Conclusion

- Prosody plays an active role in constituent linearization in English.
- The prosodic effects are mostly gradient and variable, yet absolutely systematic.

Appendix

- (86) A summary of the data extracted from www.blogspot.com, reported as absolute numbers.
[Preliminary counts which need to be double-checked.]

	INPUT	D	H	P	TOTAL
1.	give(her, the book)	182	--	11	193
2.	give(my sister, the old book)	79	--	70	149
3.	return(her, the book)	92	30	116	238
4.	give(her, it)	--	--	1	1
5.	give(my sister, the book)	25	--	69	94
6.	return(my sister, the old book)	25	17	158	200
7.	return(my sister, the book)	10	2	203	215
8.	return(her, it)	--	--	36	36
9.	give(my little sister, the book)	11	--	123	134
10.	return(my little sister, the book)	1	3	243	247
11.	give(my sister, it)	--	--	12	12
12.	return(my sister, it)	--	--	61	61
		425	52	1,103	1,580

- (87) Percentages out of the total number of constructions ordered by decreasing frequency of double objects / increasing frequency of prepositional constructions:

	INPUT	D %	H%	P%
1.	give(her, the book)	94.3	--	5.7
2.	give(my sister, the old book)	53.0	--	47.0
3.	return(her, the book)	38.7	12.6	48.7
5.	give(my sister, the book)	26.6	--	73.4
6.	return(my sister, the old book)	12.5	8.5	79.0
9.	give(my little sister, the book)	8.2	--	91.8
7.	return(my sister, the book)	4.7	1.0	94.4
10.	return(my little sister, the book)	0.4	1.2	98.4
8.	return(her, it)	--	--	100
4.	give(her, it)	--	--	100
11.	give(my sister, it)	--	--	100
12.	return(my sister, it)	--	--	100

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email: anttila@stanford.edu