

Typological consequences of ABCD constraint forms¹

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1 Introduction

Much recent work on consonant (dis)harmony uses the theory of Agreement-by-Correspondence ('ABC', with 'D' for dissimilation). While proposals within this theory share several key components, variations have proliferated in the literature (Rose & Walker 2004, Hansson 2010, 2014, Gallagher & Coon 2009, McCarthy 2010, Bennett 2013/2015, Shih & Inkelas 2014, Inkelas & Shih 2014, Walker 2015, McMullin 2016, etc.), resulting in numerous formulations of CON, based on different ideas of the possible central ABCD constraint types and definitions.

In this paper, we analyze a set of systems using different logical combinations of distinct versions of two main ABCD constraint types, CORR and CC.ID. The typologies of these systems are analyzed both extensionally (in terms of the languages predicted) and intensionally (the rankings that produce these languages). The former connects to the empirical predictions generated by the different ABCD theories. The latter connects to the theoretical mechanisms responsible for those predictions, allowing us to compare not just the outputs, but the theories themselves and the reasons for their converging or diverging typological predictions.

Analyzing full typologies rather than case studies allows us to understand the typological consequences of each theory of CON. We find significant symmetries between systems that make seemingly opposite assumptions. While the extensional typologies show *where* the systems' predictions converge and diverge, to understand *why* they do so, the typologies' intensional ranking structures are analyzed in Property Theory (Alber & Prince 2015, in prep., Alber, DelBusso & Prince 2016). The Property Analyses (PAs) of the systems deduce the crucial constraint interactions (the properties) giving rise to the extensional forms. We show that the same set of extensional languages is produced by all systems in which some correspondence constraint type is restricted, such that failing its precondition allows for vacuous satisfaction. It is not crucial which *constraint* type bears this restriction, but that it be instantiated in the *system* as a whole, underscoring the importance of examining full, defined systems rather than individual constraints. This shared characteristic frames a bigger-picture result for ABCD theories: we show that some theories not only share the same empirical predictions, but give rise to those predictions in parallel ways. Despite seemingly deep differences in their assumptions about CON, the theories are fundamentally similar at extensional and intensional levels.

¹Acknowledgments: Bennett was supported in this work in part by grants from the American Philosophical Society, the Rhodes University Research Committee, and the National Research Foundation of South Africa. The project benefited from interactions with Alan Prince, Stephanie Shih, Eric Baković, Jaye Padgett, and Paula Houghton. Authors' names are in alphabetical order.

We first define the objects of the theory, fixing GEN and varying CON according by system (§2), then develop and exemplify the mechanics of Property Theory necessary for understanding the results (§3). The typologies are analyzed both extensionally—the possible mappings in the languages—and intensionally—the structure of their property analyses (PAs) (§4), and compared across these dimensions (§5).

2 The systems

2.1 GEN

To compare distinct variations of CON, GEN is held constant across systems. GEN is defined (2) as the space of combinations of two segments representing all combinations of two features, $[\pm\text{cont}]$ and $[\pm\text{voi}]$, yielding the segmental inventory in (1). Inputs are all possible segmental form; outputs for each input are those same segmental forms, with correspondence indices added to each consonant. The consonants either correspond (matching indices) or do not (non-matching indices). We follow Bennett (2013/2015) in taking surface correspondence to be a transitive, symmetric, and reflexive equivalence relation over consonants in output forms.

(1) *Segmental inventory*

		[voi]	
		+	-
[cont]	+	z	s
	-	d	t

(2) *GEN*

Inputs: $/C\dots C/$, where $C \in \{t, d, z, s\}$ (n = 16 inputs)
 Outputs: $[C\#\dots C\#]$, where $C \in \{t, d, z, s\}$, and $\# \in \{1, 2\}$ (correspondence indices) (n = 32 outputs per input)

The majority of candidate sets (csets) are non-informative: they either have a single possible non-harmonically-bounded optimum, or a small set of possibilities that are predictable from other inputs. While all typologies are calculated using the full 16 possible csets, a minimal Universal Support (Alber, DelBusso & Prince 2016) for all systems consists of just two inputs, which have segments differing in the value of only one feature: $/t d/$ and $/d z/$ (or their reverses).

2.2 CON

All systems share the same three essential constraint types, characterized informally below. What makes them all ABCD theories is that they recognize both CORR constraints that demand correspondence, and CC.ID constraints that require agreement based on that correspondence.

(3) *ABCD Constraint types*

- a. CORR: violated by non-correspondence between output segments.
- b. CC.ID: violated by non-agreement of features between surface correspondents.
- c. f.IO.ID: violated by non-agreement of features between input-output (IO) correspondents.

The dimension of difference is the kind of CORR and CC.ID constraints employed, summarized in (4). There are two variations of CORR, one general and one restricted to segments sharing the feature F. For CC.ID, there are three variations: general, feature-specific, and feature-restricted. The systems realize different logical combinations of these. All also include two IO faithfulness constraints, f.IO(c) and f.IO(v) (c and v abbreviate [cont] and [voi], respectively). The systems are named [CORR type]-[CC.ID type], where G stands for **g**eneral, S for feature-**s**pecific and R for feature-**r**estricted. The five systems filling non-gray cells are analyzed in detail below; the sixth (Restricted-Restricted) is not examined here (see Bennett & DelBusso, in prep.); its typology is equivalent to that of the fifth system (R.S).

(4) *CONS of the systems*

		CORR	
		General: CORR	Restricted: CORR(α F)
CC.ID	General: CC.ID	G.G	R.G
	Specific: CC.ID(F)	G.S	R.S
	Restricted: CC.ID(F)/ α G	G.R	R.R

Formal definitions of all constraints are given in (5), in logical and prosaic forms. To level cross-theory comparisons, w reference to feature values is always to [+v] and/or [-c].

(5) *CON definitions*

<i>Constraint</i>	<i>Type</i>	<i>Dfn: for segments X, Y</i>	<i>Assigns violations to each pair of:</i>
CORR	G	*X1.Y2	non-corresponding output segments
CORR(α F)	R	*X1.Y2: α F \in X & α F \in Y	non-corresponding [α F] output segments
CC.ID	G	*X1.Y1: X \neq Y	surface correspondents differing in feature values
CC.ID(F)	S	*X1.Y1: α F \in X & β F \in Y	surface correspondents differing in [\pm F]
CC.ID(F)/ α G	R	*X1.Y1: α G \in X, α G \in Y & α F \in X & β F \in Y	surface correspondents that are [α G] differing in [\pm F]
f.IO(F)	(S)	*X _{in} , X _{out} : α F \in X _{in} & β F \in X _{out}	IO correspondents differing in [\pm F]

The G.G system includes only two ABCD constraints: general CORR, and general CC.ID. The former is violated by non-correspondence between any pair of output segments; the latter by any feature mismatch between correspondents – i.e. any non-fully identical pairs of correspondents. All subsequent systems are refinements of G.G, in that they use multiple, more specific versions of one or both constraint types. In system G.S, CC.ID is split into two feature-specific CC.ID(F) constraints: these evaluate candidates for harmony between correspondents on a feature-by-feature basis, violated for lack of agreement for the specified feature, F. with each such constraint only violated by non-agreement for the specific F. G.R further narrows this constraint

type by adding another feature restriction, the $CC.ID(F)/\alpha G$ constraints. These also assign violations based on non-agreement for $[\pm F]$, but only for pairs of correspondents with agreeing values of another feature, $[\alpha G]$. The distinction between *feature-specific* and *feature-restricted* exemplified by these two variations of $CC.ID$ is significant: the second, but not the first, has parallel effects in the typology as a feature-restricted $CORR$, shown in more detail below.

The system $R.G$ diverges from $G.G$ in the opposite way, maintaining the single general $CC.ID$ constraint, but using two feature-restricted $CORR$ constraints, $CORR(F)$. Correspond is preconditioned by feature (value): the constraints assign violations only to those non-corresponding pairs sharing the $[\pm F]$. The final system examined, $R.S$, combines the $R.G$ and $G.S$ systems, using both restricted $CORR$ and feature-specific $CC.ID$ constraints.

This system, $R.S$, is most similar to the ‘standard’ theory (Rose & Walker 2004, Hansson 2010, Bennett 2015, etc.), which recognize distinct families of $CORR(\alpha F)$ and $CC.ID(\alpha F)$ constraints. The systems with generalized versions of the constraints also derive from extant proposals in the ABCD literature. A general $CORR$ follows a proposal by McCarthy (2010) to unify $CORR$ into a single constraint (‘MAX-CC’) requiring correspondence between any two segments regardless of feature similarity. Systems with a generalized $CC.ID$ constraint follow a proposal by Gallagher & Coon (2009), which has only one $CC.ID$ constraint (‘IDENTITY’) that is satisfied only when correspondents are fully identical (see also MacEachern (1999) for an earlier proposal with a similar constraint). Changing this constraint type in the other direction by featurally-restricting it as in the $CC.ID(F)/\alpha G$ constraints, derives from a recent proposal in Walker (2016), which adopts McCarthy’s single- $CORR$ proposal, and instead locates the feature restriction on constraints that enforce agreement. While these proposals provide the inspiration for specific constraint formulations, the systems here are not designed to model them, but to be a systematic investigation of the effects of varying the constraints along these lines.

Feature-restriction on a constraint has the effect of narrowing the set of candidates within a cset to which it assigns violations by a precondition: only segments bearing the given feature (value) are evaluated for correspondence (by $CORR(\alpha F)$) or for $[\pm F]$ agreement (by $CC.ID(F)/\alpha G$). As a result, a candidate can vacuously satisfy constraints by failing the precondition: not being $[\alpha F/G]$. In the case of $CORR(\alpha F)$ constraints, this amounts dissimilation to support non-correspondence, as previous work has noted (Bennett 2013/2015; see also Walker 2001, Gallagher & Coon 2009). We show that the same interaction obtains for $CC.ID(F)/\alpha G$ constraints, in the same way: they are satisfied by dissimilation for $[\alpha G]$.

3 Property Theory

In comparing the typologies generated by the different ABCD theories above, we must consider not only the languages predicted to be possible in each, but also how the grammars of those languages arise under each set of assumptions about CON . Within a limited typological space, it is not necessarily surprising if two theories make the same extensional predictions. The point of greater significance is *why* they make those predictions, which requires understanding the *intensional ranking structures* of the typologies. Property Theory (Alber & Prince 2015, in prep., Alber, DelBusso & Prince 2016) is a formal framework for analyzing intensional structures of OT typologies and their relationship to the extensional traits of the languages of the typology.

3.1 Property Theory preliminaries

A *property analysis* (PA) of a typology analyzes it into a set of *properties* (Ps): pairs of mutually exclusive ranking conditions. It formalizes a familiar theme in linguistic theory of a (binary) ‘choice’ made by a grammar. Choice of a *value* of a property—one ranking or its converse—can have diverse repercussions for both the input-output mappings found in a language, and for the other ranking structure that are possible or impossible.

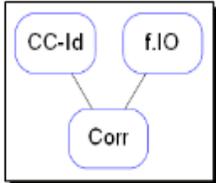
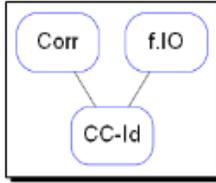
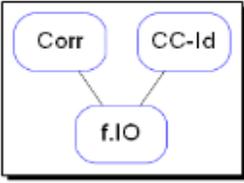
Each property antagonizes two sets of constraints, $X < > Y$. The two values of a property, P, are the rankings under either order of domination between the antagonists: either α . $X \gg Y$, or β . $Y \gg X$. Each property partitions the typology into two sets of grammars, which share one ranking order (P. α) vs. those that share the other order (P. β). For example, all grammars in which X crucially dominates Y have the value P. α , while all with the opposite ranking have P. β . Each grammar in a typology is defined by distinct set of property values, formally encoding choices about ranking relations that derive that grammar and differentiated it from others in the typology.

While the antagonists of a property, X and Y, may be single constraints, such as CORR < > CC.ID, it is often necessary to refer to *classes* of constraints that interact in parallel ways in a typology. Grammars share the property of having some constraint in this class as dominant/subordinate, but differ in which constraint in the class is so ranked. A specific constraint is picked out by the operators *dom* and *sub*, which select the *dominant* or *subordinate* member of the class in the particular grammar, respectively (Alber & Prince 2015, in prep.). For example, for a P1: {CORR, CC.ID}.sub < > f.IO, the values rank f.IO relative to the *subordinate* (the lowest-ranked) member of the set {CORR, CC.ID} in the ranking between them, which may differ across grammars. If CORR \gg CC.ID in grammar G1, then f.IO is ranked relative to CC.ID.

3.2 PA(T_{Core})

To further show both the mechanisms of PAs and the way they explicate ABCD systems, we develop the PA of a simplified ABCD system, ‘Core’, which has unified forms of each of the constraint types, CORR, CC.ID, and f.IO (a coarsening of the G.G system, by using a general f.IO constraint). Its typology, T_{Core}, contains three languages, whose rankings are shown in (6), along with the optimal mapping of the input /td/ for that language.

(6) T_{Core}

Grammar	noc	cor	har
Extensional type	no correspondence	correspondence	harmony
	Faithful		unfaithful
Ranking structure			
/td/ →...	[t1d2]	[t1d1]	[t1t1] or [d1d1]

In all three grammars, one constraint is crucially dominated by the other two (a 'bot' form, with a single *bottom*-ranked constraint) – a ranking structure characteristic of grammars in ABCD typologies (Bennett 2015, Bennett, DelBusso & Iacoponi 2016).

While T_{Core} is a three-way partition, an internal binarity in its structure is brought out by the PA. Two of the languages have segmentally-faithful mappings, and differ only in whether disagreeing segments correspond or not; we call these *cor* and *noc*. The third language, *har*, has unfaithful mappings, with harmony among corresponding segments. The property P1 characterizes the intensional ranking choice aligned with the (un)faithfulness distinction – the ranking of f.IO relative to the class of both correspondence constraints. In the faithful languages (*cor*, *noc*), f.IO dominates *one* of these (P1.β); either is sufficient to guarantee faithful mappings. In the unfaithful language (*har*), *both* dominate f.IO (P1.α). These rankings are generated by referring to the *subordinate* member of the class of {CORR, CC.ID}, as in (7).

- (7) $PA(T_{Core}) P1: \{CORR, CC.ID\}.sub < > f.IO$
 α. {CORR, CC.ID}.sub \gg f.IO = CORR & CC.ID \gg f.IO WeL & eWL
 • *the subordinate member of {CORR, CC.ID} dominates f.IO, so both do by transitivity.*
 β. f.IO \gg {CORR, CC.ID}.sub = f.IO \gg CORR or CC.ID LeW | eLW
 • *f.IO dominates only the subordinate member of {CORR, CC.ID}.*

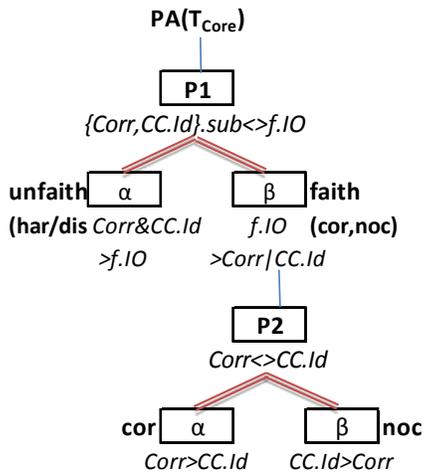
The two grammars classified together in P1.β differ in the ranking of CORR and CC.ID – the two constraints in the class in P1. These constraints are the antagonists of the second property, P2 (8), whose values align with the extensional choice of whether faithfully-mapped segments correspond (P2.α; *cor*) or not (P2.β; *noc*). The grammar with value P1.α (*har*) lacks a value of P2, as the antagonists are not crucially ranked in this grammar: both dominate f.IO, but either order between them is possible. The choice of a value of P2 depends on the choice made in P1; its *scope* is only those grammars with the value P1.β.

- (8) $PA(T_{Core}) P2: CORR < > CC.ID$ *Scope: P1.β.*
 α. CORR \gg CC.ID WLe
 β. CC.ID \gg CORR LWe

The PA structure is represented in graphic form in the *treeoid* below. Double red lines indicate mutually exclusive choice of values of a P; single blue lines indicate scope: any grammar having a given P value must also have a value of all Ps that this value dominates in the treeoid. The treeoid in (9) is annotated with the properties (italic font, below the nodes) and the extensional trait correlating with the P values (bolded font, next to the value)². Each possible value combinations, α₋, β_α, and β_β, defines a grammar of T_{Core} : *har*, *cor*, and *noc*, respectively.

² We include the 'dis' type' under P1.α because in the systems in which such a mapping is possible, languages having either *har* or *dis* in optima are classified together under this value.

(9) $PA(T_{Core})$ treeoid



The ranking relations distilled in $PA(T_{Core})$ occur in all typologies analyzed here, with various refinements discussed below.

4 The typologies

Full typologies of the five systems defined in §2 were calculated in OTWorkplace (Prince, Tesar & Merchant 2007-2017), using automated candidate generation and constraint evaluation. We first examine the extensional languages of the various systems and then show the rankings producing these by giving the PA of each system.

4.1 Overview of the extensional languages

The extensional languages are classified into four types of mappings that occur in their optima: *cor* (faithful mappings, with correspondence); *noc* (faithful, with no-correspondence); *har* (unfaithful mapping, harmony between correspondents); and *dis* (unfaithful, dissimilation) (see also Bennett, DelBusso & Iacoponi 2016). These mappings are shown for input /td/ below.

(10) 4 mapping types for /td/

Type	/td/ → ...	Faithful
<i>cor</i>	[t1d1]	yes
<i>noc</i>	[t1d2]	yes
<i>har</i>	[t1t1] / [d1d1]	no
<i>dis</i>	[t1z2] / [s1d2]	no

Languages are characterized by how they map inputs that disagree in one feature, but not the other. For example, the segments in input /td/ share [-cont] but differ in [±voi], while segments in /dz/ share [+voi] but differ in [±cont]. The rankings determining the mapping of the first define the *voi-subsystem*; those of the second define the *cont-subsystem*. These two subsystems have structures familiar from the simpler ‘Core’ system in §3 above. The table below maps the complete extensional typologies of all systems on these two dimensions.

(11) *Languages of the typologies*

<i>Subsystem</i>																
[cont]	har				dis				cor				noc			
[voi]	har	dis	cor	noc												
G.G	X		X	X					X		X		X			X
G.S	X		X	X					X		X	X	X		X	X
G.R		X	X		X		X		X	X	X	X			X	X
R.G		X		X	X			X			X	X	X	X	X	X
R.S		X	X	X	X		X	X	X	X	X	X	X	X	X	X

While all typologies select from the same set of types, they differ in which and their possible combinations for the two subsystems. Not all systems produce languages with dissimilation: these are lacking in systems in which neither constraint type is feature-restricted (G.G and G.S). Additionally, which unfaithful types (*har*, *dis*) can co-occur with which faithful types (*cor*, *noc*) varies across systems. In this regard, G.R and R.G are mirror images: *har* and *dis* in one subsystem are only possible with *cor*, not *noc*, in the other for G.R, while the reverse holds for R.G.

4.2 Overview of the intensional structure

The PAs of all systems share a basic structure, refined from that of PA(T_{Core}). Each is the interaction of two PA(T_{Core})-like sets of properties, one for each feature-defined subsystem. The properties of each govern ranking of a subset of the constraints in the characteristic ranking structures above. These ranking choices correlate with particular types of extensional mappings.

Feature-specification and/or restriction affects both the possible mappings and their possible combinations for the subsystems. When a CORR or CC.ID constraint is specified for a particular feature (or feature value), it interacts only with constraints of one subsystem. If a constraint is *not* specified for a particular feature, it interacts with the constraints of both subsystems. The systems thus differ in how much overlap there is between the constraints involved in one subsystem, and the constraints involved in the other. The more overlap there is between the set of constraints in the subsystem properties (those occurring in both), the less freedom of combinability of types across the subsystems. A pair of constraints can only be ranked in one way in a grammar. For example, *cor* mappings are produced only if CORR \gg CC.ID. But if this ranking relationship holds in one subsystem, the other subsystem cannot have the reverse ranking, CC.ID \gg CORR – a ranking necessary to produce a *noc* mapping. However, when CC.ID is split into CC.ID(c) and CC.ID(v), then CORR can be ranked above one and also below the other, thus allowing the co-occurrence of *cor* and *noc* mappings in the same grammar. The same freedom also emerges if CORR is split instead of CC.ID. In this way, an effect of feature-specificity is greater independence between the subsystems, which leads to freer combinability between them.

The presence or absence of dissimilation in the typologies also depends on feature restriction on CORR or CC.ID. A *dis* candidate is a possible optimum when such a mapping offers an escape from either the requirement to correspond (CORR) or to agree (CC.ID). For example,

CORR(+v) is vacuously satisfied by all pairs of segments not sharing [+v], regardless of whether they correspond. Unfaithfulness for a [+v] feature therefore offers a way to satisfy CORR(+v), by removing similarity between segments. However, a general CORR constraint, as in G.G and G.S systems, is violated by non-correspondence for any pair of segments, regardless of their features. It cannot be satisfied (vacuously or otherwise) by dissimilation, requiring correspondence even between segments that do not share [+v] or [-c]. A parallel argument holds for CC.ID(c)/+v and CC.ID(c): unfaithfulness for [+v] can satisfy the first version, but not the second.

The CTs below exemplify for CORR constraints. Candidate /dz/ → [d1s2] (dissimilating the [+v] feature of one segment)³ is a possible optima in R.G (12b) but not in G.G (12a), where it is harmonically bounded (Samek-Lodovici & Prince 1999) by the noc candidate.

(12) *Effect of featural-restriction: CTs*

a. G.G: input /dz/: harmonically bounded by noc

Winner	Loser	CORR	CC.ID	f.IO(v)	f.IO(c)
dis:[d1s2]	har: [d1d1]	L		L	W
	cor: [d1z1]	L	W	L	
	noc: [d1z2]			L	

b. R.G: input /dz/: possible optimum

Winner	Loser	CORR(+v)	CORR(-c)	CC.ID	f.IO(v)	f.IO(c)
dis:[d1s2]	har: [d1d1]				L	W
	cor: [d1z1]			W	L	
	noc: [d1z2]	W			L	

As the PAs below show, when a constraint is feature-restricted in this way, both subsystems involve *both* faithfulness constraints. This makes for a four-way choice of the ‘bot’ constraint in their ranking structures, and the possibility of dis candidates as optima.

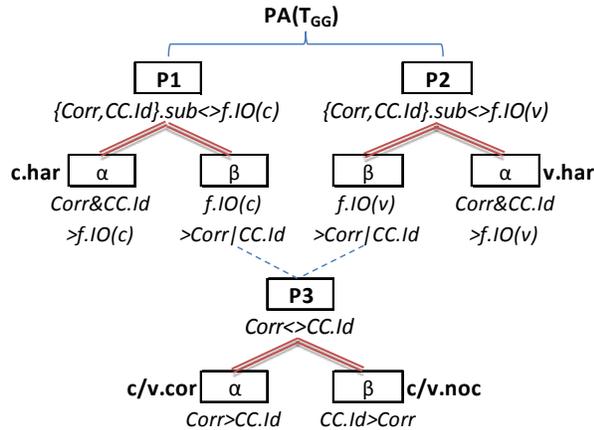
4.3 T_{GG}: general CORR and general CC.ID

T_{GG} is the smallest and most basic typology, consisting of 7 languages. The lack of feature restrictions on either CORR or CC.ID limits the possible languages in both ways noted above: (i) cor in one subsystem is incompatible with noc in the other, as these types require contradictory rankings of CORR and CC.ID; and, (ii) dissimilation candidates are harmonically bounded.

In PA(T_{GG}), each subsystem determines the ranking between CORR, CC.ID, and the f.IO(F) constraint for feature F. Property P3, which ranks CORR and CC.ID, is included in both subsystems. The treeoid annotated with properties and extensional traits is shown below. The dotted lines dominating the P3 node indicate a disjunctive scope: a value of P3 is needed under *either* of the dominating values, P1.β or P2.β; under either, one of {CORR, CC.ID} is dominated, requiring that a ranking between them be established.

³ Since the constraints are all blind to relative order of segments, [d1s2] is co-optimal with [t1z2], omitted for simplicity. Similarly, candidates [d1d1] and [z1z1] are co-optima for a harmonic mapping of /dz/.

(13) $PA(T_{GG})$



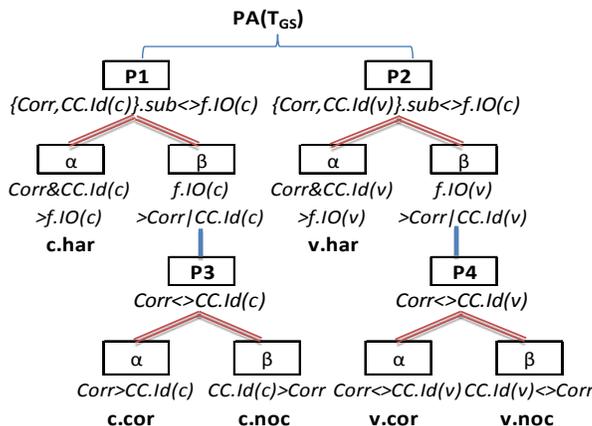
$PA(T_{GG})$ shows how using single generalized versions of both constraint types limits the kinds and combinations of possible extensional types in the typology. Each of the subsequent systems splits one or both of the constraint types.

4.4 T_{GS} : general CORR, feature-specific CC.ID

$G.S$ differs from $G.G$ in using feature-specific versions of $CC.ID$ constraints. It derives from the proposal by McCarthy (2010), which uses a single general $CORR$ constraint but maintains multiple $CC.ID$ constraints. The typology of this system, T_{GS} , refines T_{GG} by adding languages that combine cor and noc types (9 languages), since the separate $CC.ID$ constraints, keyed to each feature, can be ranked independently with $CORR$. It has a 3×3 structure: all possible combinations of the three types $\{har, cor, noc\}$ in each subsystem. Dissimilation candidates are harmonically bounded as in $G.G$.

$PA(T_{GS})$ (14) parallels the structure of $PA(T_{GG})$ but crucially differs in that $P1$ and $P2$ involve different $CC.ID$ constraints ($CC.ID(c)$, and $CC.ID(v)$) and consequently, $P3_{GG}$ has two correlates, $P3_{GS}$ and $P4_{GS}$. The properties of the subsystems overlap in only a single constraint— $CORR$ —and this increased independence allows for free combinability of the property values, and correlated extensional types, in each.

(14) $PA(T_{GS})$

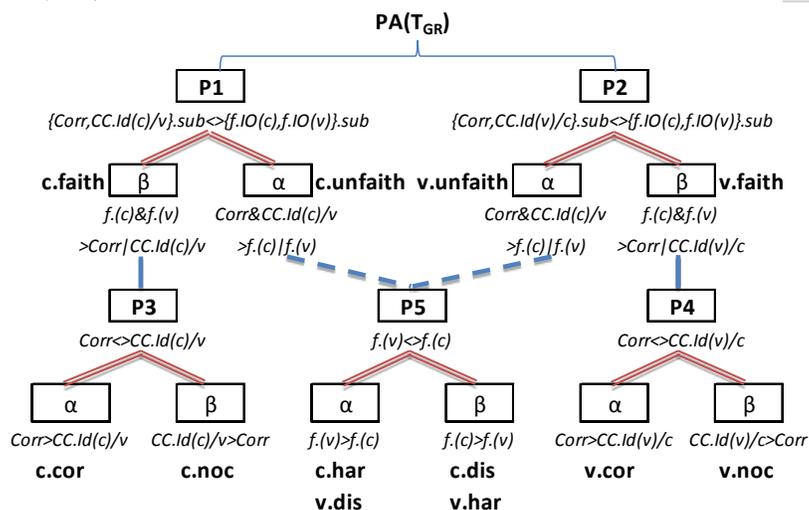


4.5 T_{GR}: general CORR, feature-restricted CC.ID

The G.R system a general CORR constraint but adds additional feature restrictions to CC.ID, based on a proposal by Walker (2016). The typology, T_{GR}, has 10 languages, and notably includes *dis* as a possible type, unlike T_{GS}. In this typology, *har* or *dis* mappings in one subsystem are incompatible with *noc* in the other. Both *har* and *dis* satisfy CC.ID(F)/αG: *har* by agreeing in F value (violating f.IO(F)), *dis* in failing to be αG (violating f.IO(G)). This runs parallel to the feature-restricted CORR shown above in (12): agreement is obtained by assimilation to match values, or dissimilation to remove one segment from the scope of the agreement requirement. Unlike in subsequent systems, *dis* entails correspondence between interacting segments, due to the general CORR, which prefers *dis* candidates with correspondence over those without; no other constraint distinguishes these.

The intensional structure of T_{GR}, shown in PA(T_{GR}), differs from the preceding typologies in that subsystems involve the interaction of *four* constraints instead of three, as both f.IO constraints are in both subsystems. The ranking structures remain the same—a single constraint dominated by the others. Types *har* and *dis* differ in which f.IO constraint is dominated. Both subsystems share P5, antagonizing f.IO constraints, thus making *har.har* and *dis.dis* impossible. PA(T_{GR}) is shown below.

(15) PA(T_{GR})



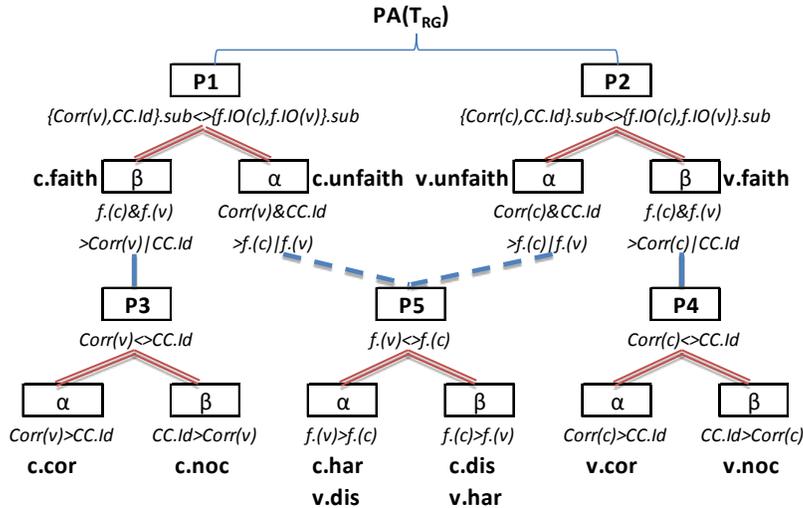
4.6 T_{RG}: feature-restricted CORR, general CC.ID

The R.G system uses a unified CC.ID, and feature-restricted CORR(αF) constraints, deriving from a proposal by Gallagher & Coon (2009) for a single CC.ID constraint requiring total identity, instead of multiple feature-specific constraints. It is the mirror image of G.R: T_{GR} produces dissimilation by restricting the CC.ID constraints; T_{RG} by restricting the CORR constraints.

T_{RG} also has 10 languages. It is the (non-)correspondence inverse of T_{GR}: while dissimilation entails correspondence in T_{GR}, in T_{RG} it entails non-correspondence. Like CC.ID(F)/αG, CORR(αF) is vacuously satisfied by candidates that are not αF, making *dis* candidates possible optima. The general CC.ID distinguishes between corresponding and non-corresponding *dis*

candidates, satisfied only by the second. The extensional symmetries of T_{GR} and T_{RG} are matched in isomorphic intensional structures. PAs differ only in which constraint in Ps 1-4 is restricted and which general, but all involve just one restricted constraint.

(16) $PA(T_{RG})$

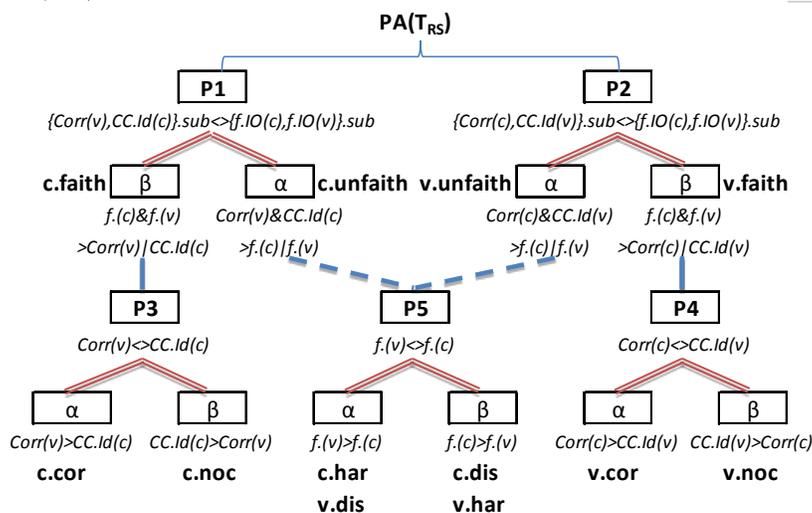


4.7 T_{RS} : feature-restricted CORR, feature-specific CC.ID

The R.S system, with feature-restricted CORR (like R.G) and feature specific, not restricted, CC.ID (like G.S), represents a ‘standard’ version of ABCD theory (Rose & Walker 2004, etc.). The typology, T_{RS} , is a superset of T_{RG} , adding combinations of **noc** in one subsystem and $\{cor, har, dis\}$ in the other, with 14 languages. Dissimilation is possible in T_{RS} for the same reason as in T_{RG} . The feature-specific CC.ID constraints does not increase the set of mappings possible, but allows for freer combinations of types across subsystems, due to the smaller overlap of the sets of constraints interacting in each.

$PA(T_{RS})$ shares the same basic structure as $PA(T_{GR/RG})$, differing in that the antagonist sets of P3 and P4 are entirely distinct, with different CORR and CC.ID constraints. The only interdependence between the subsystems is a shared P5.

(17) $PA(T_{RS})$



5 Comparisons and conclusions

There have been multiple proposals for specific formulations of CON for ABCD theories. To understand the variations' typological ramifications, we systematically analyzed systems defined by different combinations of constraint forms, diverging in which constraints were unified or restricted. However, some opposing changes make equivalent typological predictions, the reason for which is brought out by analysis of the intensional ranking structure: feature-restriction on *either* constraint type allows for the same range of extensional coverage, and results in intensional symmetry. The results provide a way of classifying ABCD CON proposals; their predictions can be understood based on how the constraints refer to features, as shown in the table in (4).

These insights are only obtainable through analysis of full typologies. While proposals hypothesize changes to particular constraints, a constraint cannot be studied in isolation, nor with a handful of selected constraints and candidates deemed relevant, but only in the context of a fully defined CON and GEN. Property Theory provides a theoretical framework for analysis of typological structure. The Property Analyses draw out the key interactions and their alignment with the extensional mappings in the languages of the typologies, allowing for understanding not only of the individual systems, but also of symmetries and differences across systems.

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