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Introduction
Current issues in optimality theoretic syntax*

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1. Introduction to OT syntax

General tendencies that hold in or across languages are easy to find. For example, sentences in English usually have a subject. The subject often is the first element in the sentence. In many cases, the subject is the agent of the action expressed by the verb. Crucially, these statements are mere tendencies, not absolute laws. It is very difficult to find observable properties that hold without exception across languages. If we were to formulate these general statements as rules, these rules would often have to be broken because of a number of exceptions. In standard generative syntax, constraints are assumed to be inviolable, i.e., they must be satisfied in a grammatical sentence. In order to ''save'' generalizations (rules) from apparent violations (counterexamples) in the linguistic data, generally three strategies are applied:

1. assume empty structure to satisfy the constraint (invisibly);
2. assume an abstract level at which the constraint is satisfied (invisibly);
3. modify the constraint, making it less general, so that it is satisfied by the data.

In Optimality Theory (OT), grammatical constraints are also assumed to be universal, but crucially, they *may be violated* in order to satisfy other, ''stronger'', constraints. Thus, in OT general statements take the form of violable constraints. Because these constraints express very general statements with respect to language, they are often in conflict. Conflicts among constraints are resolved because the constraints differ in strength. The constraints can be ordered in a constraint hierarchy according to strength. In OT, the output (the grammatical structure) is determined through optimization over a ranked set of constraints.

Initially applied to phonology, OT has proved to be a fruitful tool of analysis in syntax (and semantics) as well. Although the field is too young

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to be able to speak of a "standard" model of OT syntax, there are a number of assumptions that play a role in much of the core work, such as the following:

A. The competitors in a constraint evaluation procedure are (syntactic or phonological) representations, rather than derivations. Therefore, OT is more compatible with representational models of grammar than with derivational models.
B. Crosslinguistic variation is the result of constraint reranking. In principle, any constraint ranking corresponds to a possible grammar (although different constraint rankings can result in identical grammatical patterns); there are no fixed rankings.
C. There is a strict separation between the evaluation of syntactic representations on the basis of a hierarchy of syntactic constraints and the evaluation of phonological representations on the basis of a hierarchy of phonological constraints. There is no "mixing" of constraints that pertain to different modules of grammar.
D. Related to this, syntactic evaluation is also separated from semantic evaluation. Semantic identity is the defining criterion in determining which syntactic representations are in competition with one another. Whether or not this semantics is the optimal one for all the syntactic representations involved plays no role.
E. The constraint ranking is absolute, in the sense that, in case of conflict, higher constraints always take priority over lower ones. If two representations differ in their violation of a higher constraint, the one that violates this constraint least blocks the other one. No number of violations of a lower constraint or a combination of violations of more than one lower constraint can alter this.

All these assumptions have been the subject of debate, and the papers in this special issue all contain challenges in some form or another to one or more of them. In some cases, the authors argue that the core of an assumption is correct, but that new data require a modification of the theory. In other cases, it is argued that a particular assumption should be abandoned altogether. In this introduction, we will give a brief overview of the issues discussed in the various contributions and how they relate to these general theoretical assumptions.

2. Representational models versus derivational models

Traditional generative syntax contains a mix of derivations and representations. Syntax consists of a number of derivational steps, which link one

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level of representation to the next (D-structure — S-structure — LF and PF). There are conditions on what legitimate derivations are (restrictions on movement such as island conditions and the cycle) and conditions on what proper representations are (such as the theta criterion and the *that*-trace filter). Various authors have argued that a more parsimonious theory does not have this mixed nature, and that all syntactic constraints should be recast either as restrictions on derivations (e.g., Epstein et al. 1998), or, on the contrary, as well-formedness conditions on a single level of syntactic representation (e.g., Brody 1995).

At first sight, it may seem that models adopting an OT-style interaction between conflicting constraints fit more naturally into a representational model. The constraints in OT are usually taken to say something about the wellformedness of representations, so it is different representations that compete for grammaticality. Note, however, that this as such does not say anything about how these representations are built — this may be via a series of derivational steps just as well as via a one-step representational mechanism. In fact, many models of OT syntax assume that there is a derivational generator, subject to inviolable principles, that produces representations that are then subject to the OT-style evaluation of violable constraints (cf. Grimshaw 1997; Müller 1997; Ackema and Neeleman 1998; Broekhuis and Dekkers 1998). If we allow for derivations, we may also allow the possibility that the violable constraints say something about these derivations, and compare derivations rather than representations.

This issue is addressed in Silke Fischer's paper. She integrates binding theory — which belongs to the core of the standard generative syntactic enterprise — into a derivational OT syntactic framework. The approach she develops can account for crosslinguistic variation by restricted constraint reranking as well as for optionality, which is argued to follow from tied constraints. Binding theory is quite interesting from the point of view of the representational — derivational debate. If we opt for a derivational theory, we should try to avoid any appeal to the relevance of representations in the form of constraints that say something about the overall wellformedness of the derived structures, otherwise we still have a mixed theory. The derivational constraints must therefore be extremely local — they can only allow or prohibit single derivational steps. At least at first sight, binding appears to be a typically *non*local relation. The antecedent of a pronoun, in particular, can be quite far away from that pronoun.

Fischer argues that an anaphoric element introduces a "realization matrix" in the derivation, which gets transported up the tree in each step of a derivation. She introduces a family of constraints that have the effect that, when certain phrases (acting as particular binding domains) are passed in

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the derivation, some realization options for the anaphoric element are deleted from this matrix. When the antecedent is introduced in the derivation, the shape of the anaphoric element is determined by another constraint that forces this element to receive the most anaphoric realization allowed by the current realization matrix. The account makes crucial use of the OT-device of competition between conflicting constraints, but within a derivational model. On the one hand, there is the general constraint that says that anaphoric elements should be realized as anaphorically as possible (where a *self*-anaphor is more anaphoric than a simplex anaphor, which in turn is more anaphoric than a pronoun). On the other hand, there is the equivalent of principle A: if no antecedent is found within a particular domain, the anaphoric element must *not* be maximally anaphoric. The latter is in fact a family of constraints, one per possible binding domain (cf. Wexler and Manzini 1987 on the idea that binding domains come in different sizes).

Reranking the relevant constraints accounts for language variation with respect to where *self*-anaphors are allowed, where simplex anaphors are allowed, and in which domains we see pronouns. At the same time, the family of principle-A-like constraints is ranked in accordance with a universal subhierachy. After all, in all languages it is the case that the larger the domain without an antecedent, the more important it is that we do not get realization as an anaphor, so the constraints that regulate this should not be rerankable. It is the boundaries between the domains where we see the different realizations (anaphor or pronoun) that differ from language to language.

Interestingly, whereas many representational versions of OT have been argued to show a ''derivational residue'' (cf. Hermans and van Oostendorp 2000), Fischer acknowledges that within this radically derivational OT model there is what may be called a ''representational residue''. This is because at the point of the derivation where the realization matrix reaches the domain in which the antecedent can be found, this matrix determines the realization of an element that is positioned in a lower domain, sometimes in a much lower domain.

3. Crosslinguistic variation and universal hierarchies

We noted that in Fischer's paper, there is a family of constraints whose mutual ranking is universally fixed, which interacts with other, freely rerankable, constraints. The possibility that there are such universal markedness subhierarchies was already proposed in the earliest work on OT (Prince and Smolensky 2004), also in OT syntax (e.g., Bakovic 1998).

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Interestingly, whereas the papers in this issue range over a large variety of syntactic topics, many of them deal with the question of how to accommodate universal tendencies within crosslinguistic variation, and argue for the existence of some fixed constraint subhierarchy within a larger system of rerankable constraints.

In an influential series of papers on differential case marking, Aissen (1999, 2003) has proposed a number of such markedness constraint subhierarchies, based on person/number/animacy hierarchies such as that of Silverstein (1976). Aissen proposes these constraint families in order to deal with the universal tendency that ''marked'' subjects and ''marked'' objects can be marked differently for case (and/or agreement) than ''unmarked'' ones. The interaction of the families of markedness constraints with other, rerankable, constraints accounts for crosslinguistic variation in where the boundaries between what counts as a ''marked'' subject or object and what counts as an ''unmarked'' one are drawn. Two papers in this issue (Trommer and Brown) refer directly to the constraints and constraint hierarchies proposed by Aissen, arguing that they need to be modified for different reasons. However, the idea that the tension between crosslinguistic variation and universal tendencies can be properly accounted for by the interaction of rerankable constraints with families of markedness constraints whose internal ranking is universal can be applied to different domains of syntax and morphology than to case/agreement systems, as we will now discuss first.

Linguistics is the study of language (as a cognitive faculty) and the study of languages (as particular realizations of the language faculty). Within the field of linguistics, there is always a tension between the search for unification (''universal grammar'') and the empirical diversity of language phenomena. In OT, variation among languages follows from differences in constraint rankings. Typological analyses, especially those dealing with ''competing motivations'', are perfectly compatible with OT. Andrej Malchukov recasts the driving forces behind transcategorical operations, in particular nominalizations, in an OT framework. In nominalizations, morphosyntactic properties arise from the interaction of (conflicting) constraints, some of which are functional, some structural. Functionally based hierarchies of nominal and verbal categories interfere with structural factors such as morpheme order and category cumulation.

Malchukov argues that deverbal nominalization consists of both ''decategorization'' and ''recategorization''. This means the loss of verbal properties and the acquisition of nominal properties are seen as two separate processes, which are both involved in cases of nominalization. In both processes, a universal hierarchy plays a crucial role. One of these expresses which verbal properties will be lost first, and in which order other

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verbal properties will be lost. The other hierarchy expresses which nominal properties will be acquired first and the order in which other nominal properties are acquired.

Malchukov proposes that there are two general constraints of the "faithfulness" type that determine how nominal or verbal a nominalization will be. The first, FuncFaith, links the discourse function of a phrase to its lexical category: a phrase that expresses an event is preferably expressed by a verbal category, whereas a phrase that can express a participant in an event is preferably expressed by a nominal catgory. So a nominalization that expresses a participant is preferably nominal. Opposing this is the constraint LexFaith, which demands that the lexical category of a phrase is determined by the semantic class of the root of its head. Since the root in a nominalization is of the semantic class "event", a nominalization should be verbal according to this constraint. Such general constraints can be split into a family of constraints, based on the universal hierarchies of decategorization and recategorization mentioned above. The mutual ranking of all these constraints then determines how nominal or verbal a nominalization in a particular language is.

Note that in this type of analysis the "decategorization" (losing verbal properties) aspect of nominalziation and the "recategorization" (acquiring nominal properties) aspect are really independent. In Malchukov's model, the various degrees to which decategorization takes place in nominalizations crosslinguistically are the result of gradually demoting LexFaith constraints ("be verbal if your root has the semantics of a verb") along the universal FuncFaith constraint subhierarchy ("don't have illocutionary force if you function as a participant" > "don't have subject agreement if you function as a participant" > "don't have Mood if you function as a participant", etc.). The various degrees to which recategorization takes place crosslinguistically result from demotion of LexFaith constraints along a FuncFaith hierarchy that now mentions "do have nominal characteristics if you function as participant" ("don't lack case if you function as a participant" > "don't lack a determiner if you function as a participant", etcetera). Since the FuncFaith constraints that preclude verbal characteristics for a participant do not directly interact with the FuncFaith constraints that demand nominal characteristics, it is possible in principle that many verbal qualities are lost (if most verbal FuncFaith constraints outrank LexFaith), without low-level nominal properties being acquired (if only the highest nominal FuncFaith constraints outrank LexFaith). This is an interesting difference with the idea that nominalization results from a "switch" in the functional structure above a category (e.g., Marantz 1997). The latter usually implies that, when we "switch" from verbal to nominal, all nominal functional structure is

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present above the point where verbal functional structure is lost. An important question therefore is whether nominalizations can lack certain functional elements altogether, instead of showing either a nominal or a verbal functional element at a particular level of the structure.

In general, Malchukov's paper illustrates again the important role of universal constraint subhierarchies, within a larger set of rerankable conflicting constraints, in giving a proper account of certain types of crosslinguistic variation (in this case how nominal or verbal nominalizations are) that are subject to universal characteristics (in this case of the type "if nominal property A is acquired then so is nominal property B" and "if verbal property A is lost then so is verbal property B"). (Of course, there can also be language-internal variation in how nominal or verbal a nominalization is — compare, for example, the English nominal and verbal gerunds. How to deal with such variation is a different matter).

Let us now turn to the papers, already briefly mentioned above, that deal with Aissen's (1999, 2003) analysis of differential case marking. Sometimes, not all subjects (or objects) of transitive clauses are case marked, but only those phrases that are "less typical" as a subject (or as an object). A functional explanation for this is that overtly marking a less typical subject with "subjective case marking" or a less typical object with "objective case marking" helps to tag the grammatical function of one argument with respect to the other, and so to ease the parsing of the sentence (cf. Silverstein 1976; Comrie 1989). Two papers in this special issue test Aissen's framework against evidence from lesser studied languages.

In a number of genetically unrelated languages, agreement is not tied to the roles of subject or object, but rather to the argument which ranks higher in a prominence hierarchy. Jochen Trommer investigates person and number agreement in Dumi (spoken in Eastern Nepal). At first sight, the agreement system in Dumi appears to be of the type just mentioned. Usually, the two arguments in a transitive sentence compete for the status of controller of a single agreement slot on the verb, and it is the argument that ranks highest on the prominence hierarchy that determines the form of agreement marker. The first complication is that two different hierarchies play a role: a person hierarchy ($1 > 2 > 3$) and a number hierarchy (plural $>$ dual $>$ singular). It is possible that the argument that is highest in one hierarchy is lowest in the other one. This can still be dealt with in a system like Aissen's, by adding number markedness constraints to the person markedness constraints and having these compete in the usual OT fashion. However, Trommer shows that there is a phenomenon in Dumi that makes a more radical modification of Aissen's model necessary. For a particular combination of person and number on subject and object, there suddenly is agreement with *both* on the verb, rather than competition for

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a single agreement slot. Trommer argues that this cannot be captured by Aissen's model, in which there is a fixed hierarchy of markedness constraints that interact with a general "don't have structure" (so don't have agreement or case) constraint. Trommer argues that constraints must be "binary" instead, in the sense that each constraint that determines whether a feature demands marking by agreement refers to features *in the context of other features*. So there are different constraints for, say, second person subjects in the context of a first person object and second person subjects in the context of a third person object. The correct results then follow from ranking such constraints with respect to the general constraint that excludes double agreement (akin to the "don't have structure" constraint).

Interestingly, Trommer argues that, given this "binary" nature of the relevant constraints, there is no longer a need to assume a fixed, universal, subhierarchy of the markedness constraints. The constraints can be freely reranked with respect to each other, all rankings resulting in a potentially possible grammar. The universal feature hierarchies are instead built into the definition of the constraints themselves.

It might in fact be possible to extend Aissen's model in a natural way to accommodate the type of interaction between subject and object features discussed by Trommer. This is because Trommer's binary constraints may be translatable into conjunctions of constraints of Aissen's type. In fact, most of Aissen's constraints are themselves derived by constraint conjunction. Case marking in Aissen's system is determined by conjoined constraints of the general type "do not have a caseless subject *and* do not have a subject with feature F" (where F is 1st person, 2nd person, . . .). The conjoined constraint penalizes a caseless subject with particular features. Crucially, these conjoined constraints can be ranked in a different position with respect to a general "don't have case" (or, in Trommer's case, agreement) constraint than the single constraints they are derived from. Now, to account for certain ergative case patterns, in which the subject of a transitive clause is case marked, but a subject with the same features in an intransitive clause is not, Aissen argues that we need another instance of constraint conjunction (cf. also Brown's paper, this issue): we must conjoin the constraints that want a subject with particular features to be case marked with a constraint *Obj/Person that simply says "don't have an object (with any person features)". Again, these conjoined constraints can be ranked differently with respect to the "no structure" (no case or agreement) constraint than the constraints they are derived from. Thus, a ranking (*Caseless-subject & *Sub/3 & *Obj/Person) > NoCase > (*Caseless-subject & *Sub/3) results in case on 3rd person subjects in transitive clauses but not in intransitive clauses.

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If we split *Obj/Person into the constraint family *Obj/3, *Obj/2 and *Obj/1 and allow for these to be conjoined with the constraint family pertaining to subject case and object case we derive constraints much like Trommer's (as we would get constraints like "do not have a caseless 2nd person subject if there is a 3d person object", "do not have a caseless 1st person object if there is a second person subject", and so on), and these can all be ranked differently with respect to the "no structure constraint", as required by the Dumi data.

The effect the presence of an object can have on the case marking of the subject is also addressed in J. C. Brown's paper. Brown tests Aissen's typology of constraint rankings against "quasi object constructions" in Halkomelem (spoken in British Columbia, Canada). He argues that Aissen's constraints pertaining to case marking in transitive constructions, in particular the conjoined constraints mentioned above that penalize non-case-marked subjects (with particular features) in the presence of an object, cannot deal with constructions in which there is a "restricted" object. These constructions behave like intransitives, in particular with respect to the case marking on the subject, but nevertheless they do contain what appears to be a genuine object. (They have been analysed as antipassives, in which the apparent object is really an oblique adjunct, but Brown puts forward a number of arguments against such an analysis). Brown's solution is to make a distinction between two different types of objects. Based on an LFG-style classification of arguments in terms of the features [+/−restricted] and [+/−object], Brown argues that the object in a "quasi-object construction" differs from other objects in being [+restricted] (it is indeed restricted in the semantic properties it can have). The relevant constraints can then be made sensitive to whether or not an object has the [+restricted] feature or not. This means the different case marking in transitives versus intransitives can be dealt with in the same way that Aissen does, but with different constraints "don't have an object in addition to a caseless subject" and "don't have a restricted object in addition to a caseless subject", with the latter ranked below the former (and the former not pertaining to restricted objects) and the "no case" constraint in between. The core features of Aissen's model are thus preserved, although it has to be extended with a construction-specific type of constraint.

4. Cross-modular OT and word-order phenomena

In English, sentences tend to display the basic word order subject-verb-object, but when there is a *wh*-expression present in a *wh*-question, this

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activates a constraint that is even stronger than the constraint that determines canonical word order. This greater force requires *wh*-words such as *what* to appear in sentence initial position. These data can be explained adequately by the competition among violable constraints in an OT framework (see e.g., Ackema and Neeleman 1998). In this example, we may argue that basically two syntactic constraints are in conflict, one that preserves canonical word order (Grimshaw 1997), and one (or two) that trigger *wh*-movement. The trigger for wh-fronting presumably has a semantic motivation (overt marking of the scope of the wh-phrase and/or overt marking of the illocutionary force of a sentence). This brings up the question how OT should deal with "interface" phenomena: linguistic phenomena and processes that are the result of the interaction among different linguistic modules (Blutner et al. 2006). Assuming that grammar is modular, the question is whether we should assume there are separate hierarchies of constraints that pertain to different modules, with a serial evaluation procedure in which the output from one module is taken as input to the evaluation procedure in the next module. Or should we allow some amount of "mixing" of constraints from different modules, and have a single evaluation procedure at the interface that looks at representations from different modules in parallel? Two articles in this issue (Vogel and Zeevat) focus on this type of interaction between different modules of grammar.

Ralf Vogel discusses weak function word shift in the Mainland Scandinavian languages. This phenomenon has been argued to have a prosodic motivation (there should not be prosodically weak elements at the right edge of a phonological phrase; Selkirk 1996), but it is also subject to some syntactic constraints (most famously, Holmberg's generalization, which says that the underlying order between shifted element and main verb should be preserved). Vogel argues that neither a purely phonological account nor a purely semantic-syntactic account can adequately describe the phenomenon. Vogel's approach is instead to allow for direct interaction between prosodic constraints and syntactic constraints, where prosodic constraints are argued to be in between syntactic constraints of varying strength in the cross-modular hierarchy of constraints. In this OT model of the syntax-phonology interaction, the input to the evaluation procedure is a syntactic structure, whereas the output is a correspondence between the syntactic structure and a prosodic structure. In this way, typical "correspondence" constraints of the type "align a (right) edge of a particular syntactic phrase with the (right) edge of a particular phonological phrase" can interact with constraints that determine the wellformedness of the syntactic structures.

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5. Bidirectionality

Obviously, not every syntactic structure should compete with every other syntactic structure in OT syntax. There must be restrictions on what is the so-called "candidate set" in an evaluation process. One of the defining factors that determine whether two structures are in competition or not has been taken to be a semantic one: they must have the same semantics. (In other syntactic models that allow for competition between derivations and/or representations, this is also usually taken to be the criterion that determines whether two derivations/representations compete).

If this is correct, it predicts that a sentence with interpretation A can never block a sentence with a different interpretation B. But precisely that seems to happen in cases of *freezing*, the phenomenon at the centre of Henk Zeevat's contribution. Freezing is said to occur when in the absence of disambiguating morphological or syntactic clues, variation in word order is not allowed. Hence, canonical word order determines the optimal interpretation as long as it is not overruled by other, stronger constraints on interpretation such as case marking. For example, in the V2 language Dutch in principle any constituent can be fronted to the first position, in front of the finite verb in the V2 position — including the object. This means that, in Dutch, a sentence like *Jan slaat Piet* 'Jan hits Piet' is in principle ambiguous: *Jan* could be the subject or the fronted object, and *Piet* could be the object or the inverted subject. But in actual fact this sentence is interpreted such that *Jan* is the subject (the agent of 'hit') and *Piet* is the object (the patient of 'hit'). Apparently, the sentence with the "Jan is agent" interpretation blocks the sentence with the "Jan is preposed patient" interpretation (at least when both are pronounced with identical intonation). In the V2 languages where it is possible to unambiguously distinguish the object from the subject on the basis of their morphological case marking, on the other hand, the effect disappears, and an OVS sentence is just as allowable as an SVO one.

It has been proposed that this is an effect of an evaluation procedure "in the other direction", from syntax to semantics. A sentence is optimal not just if its structure is the optimal one for a particular interpretation; in addition, its interpretation must be the optimal one for its structure. The interpretation of *Jan slaat Piet* in which Jan is a preposed topic is suboptimal compared to the interpretation it has with canonical subject-verb-object order, and hence loses out. Since optimality therefore seems to depend simultaneously on syntactic evaluation and semantic evaluation, it has been proposed that we have to allow for "bidirectional" evaluations, that is, simultaneous evaluations of pairs of syntactic and semantic

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structures and the correspondences between them (compare this with Vogel's proposal to evaluate pairs of syntactic and phonological representations and the correspondences between them simultaneously). Zeevat notes, however, that there are several problems with a truly bidirectional model, and adheres to a monodirectional syntactic OT model, in which just the syntactic structures compete with each other. He proposes instead that the "bidirectional" aspect needed to deal with freezing should be built into some of the constraints that evaluate the syntactic representations. In particular, Zeevat argues that that there must be a "marking" type of constraint family. Such marking constraints state that a syntactic structure is penalized if a particular aspect of interpretation, such as the distribution of theta roles across its arguments, or information what the topic of the sentence is, is not unambiguously encoded by it. These constraints then interact with constraints that purely deal with syntactic well-formedness (such as the "*wh*-phrase first" constraint) in regular OT-syntactic fashion.

6. Cumulativity

Optimality theory has its source in connectionism, or parallel distributed processing, a view on cognition that emerged in the 1980s as an alternative to what is nowadays known as the classical or symbolic view. Mental representations are either conceived of as a kind of symbolic structures (language of thought) or as connectionist patterns of activation. Connectionist models are neurally inspired, computation on such a system can be called "brain-style" computation. Basically, a connectionist approach takes something like an abstract neuron as its processing unit and computation is carried out through simple interactions among such units. The idea is that these processing units communicate by sending numbers along the lines that connect them.

From many corners it has been doubted that a connectionist model can handle complex cognitive processes such as language processing. Smolensky and Legendre (2006) argue, however, that connectionist principles are in fact essential to account for certain fundamental properties of language and grammar. Optimality theory has become a popular trend in linguistics after its introduction in 1993 by Alan Prince and Paul Smolensky (Prince and Smolensky 2004). The most revolutionary innovation in OT was the fact that the constraints are soft, which means that an output can still be grammatical if constraints are violated. Violations have to be minimal, however, such that a constraint may be violated, but only in order to satisfy a higher ranked constraint. The fact that the well-formedness

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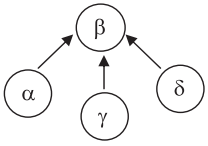

Figure 1. *A connectionist network*

constraints in OT are soft and potentially conflicting is a direct consequence of principles of connectionist computation.

In OT as well as in its predecessor harmonic grammar, the linguistic notion of well-formedness and a connectionist notion of *well-formedness* or *harmony* are brought together. The harmony of an activation pattern is a number that measures the degree to which the pattern is well-formed according to the connections in the network (see Figure 1).

A connection between two units can be interpreted as a constraint: e.g., if α is active, then β should not be active, or if γ is active, then β should be active. Thus, β can be subject to conflicting constraints. The prediction is then that the strongest constraint will win. This means that the network settles at an activation pattern that has maximal harmony with respect to its connections. Note that harmonic grammar as a numerical theory that centers around the concept of harmony, crucially differs from its nonnumerical counterpart optimality theory, a theory that deals with strict dominance hierarchies of constraints instead of weight values. In optimality theory no number of weaker constraints can override a stronger constraint. In harmonic grammar, on the other hand, two weaker constraints combined can override one stronger constraint. Also, the degree of activation of the constraints matters. If two constraints compete and one is weaker than the other but activated to a higher degree, this one can still win.

Whether the OT perspective of strict domination of constraints is to be preferred over harmonic grammar is still an open issue, as far as we are concerned. The shift from harmonic grammar to optimality theory was mainly empirically motivated by data found in the domain of phonology, while the only application of Harmonic Grammar was situated in the domain of syntax and semantics (Smolensky and Legendre 2006).

Gerhard Jäger and Anette Rosenbach explicitly argue against the standard OT view on the basis of clear cumulativity effects found in the grammatical variation of genitive constructions in English. Cumulativity can come in two types. There can be "ganging-up" cumulativity, which means that violations of a combination of lower constraints can together override violation of a higher constraint, and there can be "counting"

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cumulativity, which means more violations of a lower constraint can override a violation of a higher constraint. Jäger and Rosenbach argue that the data concerning the choice between possessive *-s* or *of*-construction in English possessives show both types of cumulativity effect. They draw the conclusion that probabilistic harmonic grammars do a better job in modelling grammatical variation in syntax and semantics than a probabilistic version of standard OT.

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Note

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