Four dimensions of complexity in language

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Recent functionalist work on complexity in language (e.g. Trudgill 2011) has focussed largely on semantic wordfields and closed-set grammatical items (e.g. noun classes, morphology and agreement). Structuralist/generative work has focussed on attempted refutations of Chomsky's claim that recursion is the defining property of human language (e.g. Everett 2009). Though justice cannot be done to the field (cf. Dahl 2004; Miestamo & al. 2008; Sampson & al. 2009), it is fair to say that the premises of much of the discussions have been formally rather inexplicit. In a step towards remedying this, complexity is defined here as a four dimensional quality space: *syntagmatic complexity* (compositionality of words, sentences and discourse), *paradigmatic complexity* (of phoneme, morpheme, word, idiom lexical inventories), *hermeneutic complexity* (interpretation at the semantic interface), *hypostatic complexity* (realisation at the modality interface).

Paradigmatic complexity will be dealt with in more detail in the full paper. Briefly, it encompasses the depth of inference involved in generalisation hierarchies in lexical inventories (cf. part of speech hierarchies; hyperonymy; phonological feature geometry).

Syntagmatic complexity in language relates to the three kinds of compositionality in language, each with different time and space processing requirements (Jäger & al. 2012; cf. below, Figures 1-3, p.2), in low-to-high order: (1) right/left branching linear iteration of units of different sizes, requiring finite memory and linear time in relation to the length of the sequence (/s-p-l-ɪ-n-t-s/; *anti-dis-establish-ment-ari-an-ism*; *very very ... extraordinary ...* ; *sausages, cheese, ... , and milk*; *we went to Rome, then we visited Florence, ... , and then we saw Venice*); (2) centre-embedded hierarchical recursion of logical expressions and modifier clauses, requiring – in principle – unlimited memory and cubic time in the general case (*if the man who John met goes home then Jane will smile*); (3) cross-serial dependency (in coordination; rare in the languages of the world in subordinating and other constructions), where constraints across hierarchies exist as 'structural copies' with equal-cardinality branchings, requiring unlimited plus complex-structured memory and more than cubic time (*June, Jane and Jean love Mick, Dick and Nick, respectively*).

Everett (2009) rightly or wrongly proposed that the Pirahã language lacks recursion. Close reading shows that his claim can be re-stated in terms of both *syntagmatic* and *hermeneutic complexity*: *Pirahã has no syntagmatic recursion but it has hermeneutic (semantic) recursion*. Similarly in English word-formation: words may be arbitrarily linearly concatenated to form compound words but their semantic interpretation requires hierarchical structuring (below, Figure 4). Arguably, the same applies to the cross-serial conjunction example shown above.

However, *hypostatic complexity* in speech and gesture modality interpretation is essentially linear, and departs from strict single-stream linearity only in permitting multiple associated linear streams in the speech and gesture modalities, and in the sub-modality of prosody of speech.

The full paper discusses application of the four-dimension complexity model to complexity invariance in prosodic typology with reference to intonation (discourse/sentence-level modality interface complexity), morphosyntactic tone (phrasal-level syntagmatic complexity) and lexical tone (word-level multilinear complexity).

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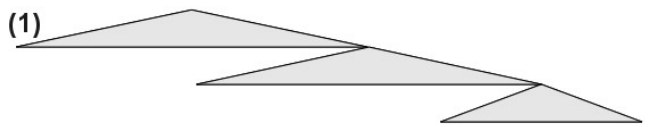
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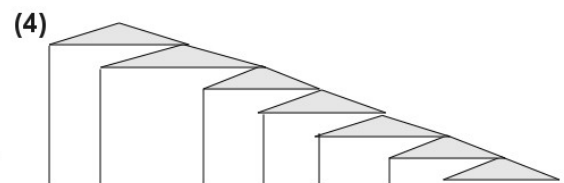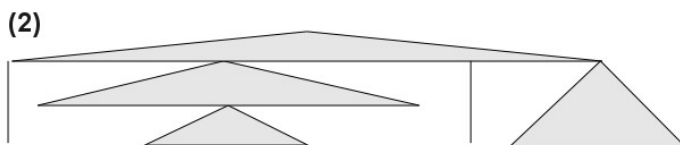
Figures

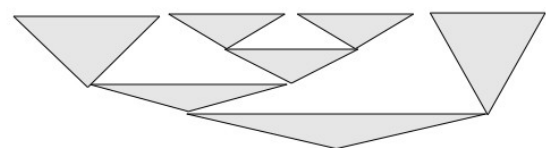*Syntagmatic complexity* *Syntagmatic vs. hermeneutic complexity*

(1)

This is the dog that chased the cat that ate the mouse …
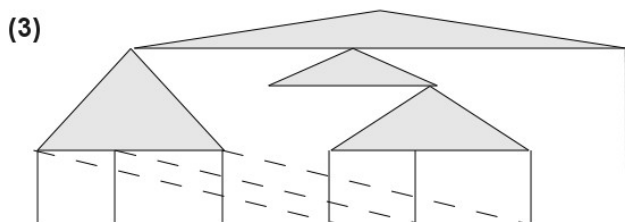*Right-branching linear recursion / iteration.*

(2)

If the man who John met goes home then Jane will smile
Centre-embedding hierarchical recursion.

(3)

June, Jane and Jean love Mick, Dick and Nick, respectively
Recursive cross-serial dependency.

(4)

twin cylinder over head cam shaft motor bike

Mismatch between linear syntagmatic and hierarchical hermeneutic recursion.