

# The real cause of word-order harmonies – A reply to Hawkins

## Abstract

We answer Hawkins's question why functional grammar is 'functional', reciprocating the question to concern his processing explanation of word-order variation. Our own research uncovers a link between economy, information structure and the place of connectives. Based on this clue and background knowledge from neurolinguistic research, we found a crosslinguistically prevalent pattern which offers a simpler explanation of harmony. This gives us the opportunity to reject Hawkins's EIC principle as redundant, and to underline that both main sociobiological approaches to theory of language – Darwinian and generative linguistics – after decades of extensive research, remain without a scientific basis.

## 1. Introduction

Hawkins (1994) successfully challenged contemporary paradigms of word-order theory and has since then (2004, 2014) further developed his theory of language processing as an explanation for cross-linguistic grammatical and performance preferences. Hawkins's theory consists of a series of postulated processing principles. The overall theory is called 'The Performance–Grammar Correspondence Hypothesis' (PGCH; Hawkins 2014). The name is an apparent reaction to the generative idea that grammar is in no way affected by non-biological factors, an argument for which we fail to find any support in the research literature. We take it as granted in such circumstances that the fact that people use language as a communication tool is the default source of explanation for why languages have the properties they have.

While Hawkins spends much of his effort arguing that grammar cannot be completely innate, we find no cause for objection to this. Instead, we prefer to discuss Hawkins's principle of Early Immediate Constituents (EIC) which he renames as MiD (Minimize Domains) in Hawkins (2014). We insist on using the old term, finding it most helpful for understanding the difference to our approach.

Hawkins's work is a special case in current linguistics in that it has had a significant impact in generative grammar as well as in typology. Generativists have described Hawkins's processing hypothesis as "influential" (Abels 2015) or "very influential" (Frey 2015) even if it is yet to persuade the various frameworks to explicitly endorse an adaptational view of language.

Reception in typology has similarly been mixed positive. Although there is a long and well-known dispute between generativists and mainstream typologists (at least since Greenberg, 1979), Croft (2001/2015) places processing explanation into the orthodoxy of what he calls "functionalism". Croft does not consider the case of word order harmony as solved as such but (Croft 2003: 80) argues that it has been demonstrated to a reasonable degree that both 'diachrony' and 'processing' do play a role in explanation of word order and affix order crosslinguistically. We take these two terms, respectively, as meaning that language is a CAS (Complex Adaptive System; Beckner et al. 2009, including Croft) which adapts to an innate grammatical 'structure' (Hawkins & Gell-Mann 1992).

Hawkins believes that the cause of dominance and harmony distributions can be uncovered by looking into how a computer parses phrase structure grammars. He has been critical of topicalisation as an explanans for word-order variation, claiming that so-called functional grammar of the Prague Circle and its derivatives may not be properly 'functional' (Hawkins 1994: 116–117).

Our reply to Hawkins begins by discussing the standard meaning of functional explanation (section 2). Furthermore, to better understand differences between various approaches to theory of language that have been labelled functionalist, we will test and perform analyses of texts in four languages (section 5). We will then proceed to study the related typological data (section 6). Finally, we will reject EIC

as an explanation of word-order variation by proposing a simpler model with the same predictions (section 7).

## 2. What is a functional explanation?

The functional mode explains structures by an appeal to their functions (Couch 2011). For example, the reason why a heart has the properties it has depends on the function of the heart of pumping blood. At the same time, it is often implied that the blood-pumping function is the reason for the existence of hearts in living organisms. Explanations of this type in various sciences have been discussed extensively in philosophy of science especially since Nagel (1962). The tradition of functional explanation is however much older, dating back at least to Aristotle's concept of teleology (Allen & Neal 2019).

Traditionally, the functional mode of explanation in linguistics is the same as in biology and social sciences (Daneš 1987; see also Couch, *ibid.*). Functional linguists explain linguistic forms or structures in relation to the task, function or purpose that they serve or as a means to an end. Following Jakobson (1969), Daneš makes the case that functional explanation is equivalent to teleological finalism. Language and its structures are based on their instrumental or functional value. While language is known to have different functions, it is the communicative function that is taken as a starting point for functional-structural linguistics. Functional linguists also interpret Saussure's bilateral conception of the linguistic sign functionally: linguistic form depends on its semantic task. (Daneš 1987.)

The functional concept has made its way to modern everyday language. Functional clothing, for example, may refer to weatherproof properties: the function of the water-repellent structure in a jacket is to protect its wearer from getting wet in the rain. We understand that people design such clothing on purpose. Daneš (*ibid.*) however points out that concept of functionality itself is separate from the question of intentionality. Thus, functionalism as an explanation of the construction of language "evidently involves a high degree of unconscious components" (Daneš 1987: 8). Itkonen (2011) likewise considers functional explanation as *rational explanation*, meaning that languages are intelligently created by people to serve people's own goals; but construction processes are largely unintentional and unconscious.

Or, so one might have thought. What is said above appears to be regarded as dated information because Nichols (1984) argues that the concept of functionalism "has changed"; and that instrumentality is now associated with "structuralism". Based on Nichols, Croft (1995) further associates structuralism with Chomsky. This chain of argumentation apparently suggests that Aristotle, Darwin and the early Prague Circle were Chomskyan thinkers; and that Chomsky believes linguistic structures are best explained through their instrumental value, all which cannot be correct.

But functional explanation according to Croft (1995: 493) has changed to pertaining to phenomena *external* to what Chomsky considers as I-language ('internal'), that is: as opposed to "formal explanation". It is in other words claimed that "formalism" refers to a view of language as a non-adaptational innate phenomenon. Functionalism, along this line, refers to an idea of language as an adaptational but not innate phenomenon; just like in classical Darwinian linguistics (Darwin [1871] 1981: 60–62; Aronoff 2017).

To comment on the above, the question of innatism is difficult because language could be innate but functional, or non-innate and non-functional. This does not mean that Darwinian linguistics cannot be functional. It is rather that we want to understand why it is claimed to be functional. Functional explanation was frequently employed by Darwin (1859). But there is something that does not seem to add up. As pointed out above, the structuralist notion of functional explanation corresponds to its concept in biology. Croft (1993: 22) however argues that structuralist conception is misguided – only "a caricature of biological theory" – and proposes "an adaptational view of functionalism" which he states is furthest developed in Cognitive Linguistics (Croft 1993: 22). Croft (2001/2015) emphasises that the meaning of *functional* in linguistics is "distinct" from its use in philosophy.

Such a position has to be very challenging because discussions concerning functional explanation in philosophy of science tend to be heavily focused on the use of the term in biology. What Croft must be suggesting is that evolutionary linguists have a more correct understanding of biology than evolutionary biologists. By any means, Nichols and Croft are not alone with their views. Hopper (1987: 3)

discusses the “Functionalist Fallacy” and, Haspelmath (1999: 185), the “Teleological Fallacy”. Keller (1997:13) proposes developing a new concept of functional explanation which is “free of teleological pollution.” Pointing to functional explanations of the giraffe’s neck in biology, Keller argues that the correct formulation may not be, for instance, that the function of the length of the neck is that of reaching higher leaves for food. Instead, a workable functional explanation would be as follows:

The length of a giraffe’s neck is a function of the fact that it lives from the leaves of trees.  
(Keller 1997: 13)

Let us compare this with Darwin:

If about a dozen genera of birds had become extinct or were unknown, who would have ventured to have surmised that birds might have existed which used their wings solely as flappers, like the loggerheaded duck (*Micropterus* of Eyton); as fins in the water and front legs on the land, like the penguin; as sails, like the ostrich; and functionally for no purpose, like the *Apteryx*. (Darwin 1859: 165–166)

In other words, Keller suggests that the concept of function as we have known it, should be removed from linguistics and natural sciences alike. The ideas of Hopper and Keller have given rise to “emergent” and “invisible-hand” linguistics, respectively. Dahl (2004) identifies both as representing the same idea of cultural evolution, linking them with early Darwinian linguistics and Dawkins’s (1976) *memetics*, a theory of cultural units as “mind-viruses”.

The argument made by evolutionary linguists is two-edged. It is claimed that classical functional linguistics is misguided and should be replaced with the Darwinian concept of natural selection. At the same time, the Darwinian concept of organic function should be removed and replaced with a non-functional evolutionary explanation; and this explanation is to be rebranded ‘functional’. Why?

Let us illustrate the difference. The concept of systemic function appeals to the maintenance of a structure. A heart cannot be removed from an organism that requires it to live. The concept of natural selection, on the other hand, is meant to explain the emergence of such functional structures. The evolutionary concept suggests that a heart has evolved through a series of structural changes which became prevalent in a population through natural selection.

Darwin’s theory relies on functional explanation. The ultimate reason for hearts existing is not only the fact that there were changes, but because these changes turned out to be useful. This way they gave an evolutionary advantage to individuals with such properties, over others, in the given circumstances. However, what today’s Darwinian linguists claim is that the functional mode should be abandoned in order for the explanation to be “functional”. Certainly, things could not be looking much worse.

Let us dive deeper into the claims to understand where the problem lies. Firstly, it needs to be pointed out that the term “Darwinian linguistics” is fully justified. People commonly associate Darwin with biology, but his theory of natural selection in fact encompasses social evolution: human and non-human. Following the success of *On the Origin of Species*, the principles of natural selection were soon applied to theory of language (Schleicher [1863] 1869; Lyell 1863; Müller 1870; Darwin 1871). Although challenged by structuralists such as Durkheim and Saussure, social Darwinism enjoyed great influence until the end of World War II after which it was banished from human sciences (Aronoff 2017).

Darwinian ideas, or what is sometimes called ‘universal Darwinism’ returned in a 1970s sociobiological wave in the form of various cultural replicator theories, now most famously Dawkins’s memetics. This was eventually featured in *The Skeptic Dictionary of Pseudoscience* (Polichak 2002). Based on the scientific criticism that memetics had received, especially that the memetic concept has not been properly elucidated, linguists opted for a new model, *Complex Adaptive System* (CAS; Frank 2007). CAS purportedly enables the study of the collective behaviour of self-replicating units, such as memes (Gell-Mann 1994). This is the same model that was proposed early on by Hawkins who considers it analogous to the selfish gene schema (Hawkins & Gell-Mann 1992: 12; cf. Dawkins 1976).

The problem of functional explanation continues to trouble evolutionary linguistics. According to Haspelmath (1999), evolution cannot be propelled by the needs of the individual. He takes the example of polar fish with antifreeze proteins, pointing out that just any fish cannot start producing such proteins simply because they are useful in freezing water. Transferring natural selection to culture, Haspelmath is adamant that people are incapable of linguistic innovation. This leads to some strange conclusions. In Haspelmath's example, people can invent a bicycle saddle, but not a word for it. This is due to "obvious reasons" which he leaves without an explanation. We believe it is due to a flaw in Darwinian evolution. We understand that the evolutionary concept absolutely excludes the concepts of intelligence, design and creativity which, nevertheless, are the driving principles of cultural change (cf. Itkonen 1999, 2011).

In fact, Haspelmath's interpretation of Dawkins (1976) is incorrect: the universal Darwinian concept also covers scientific and technological innovation. Consequently, the claim should be that because people cannot invent a bicycle saddle, they will have to bike around without one until a suitable meme mutation becomes available.

As regards the compatibility of the social Darwinian and the functional mode of explanation, it is interesting to note Daneš's (1987: 8) point that people have no functions, in the sense that is meant in functional explanation, "unless they are being used (or misused or manipulated) by other humans to attain their goals." The same would seem to be true of the hypothesised replicator population. In the CAS view, language is not an instrument for communication. More precisely, communication is not *the function of* language. Language – a population of replicators – is agentive, not instrumental. As much as communication is vital for the reproductive needs of the replicators, it is actually the case that language uses people as an instrument, not vice versa. Applying Dawkins's concept of people as vessels for the needs of the selfish meme, what we people think of as speech and sensory organs are actually the replicators' genitals.

In so far as we have correctly understood the view of language advocated by Hawkins & Gell-Mann (1992), and Hawkins's (2014: 3) theoretical sources which include Haspelmath (1999) and Kirby (1999), his efficiency explanation cannot, then, be *functional* because language in this view does not have a function. It is people and communication that are functional for the needs of a language, the purported quasi-parasitic population, or "organism" as Kirby (2011) describes it. But this is not functional linguistics, it is functional humanity.

Here we come to what in the first place prompted our investigation into the schism between Hawkins and the advocates of Functional Sentence Perspective (FSP). Hawkins (1994) asks:

The Prague School theory of given-before-new ordering seems to be particularly *non-functional*: why should each sentence begin with what has already been presented, delaying the newest information till the very end? (Hawkins 1994: 116–117; italics in the original.)

We will answer Hawkins's question in detail in section 5. Here, we would like to take the opportunity to reciprocate the question. Why is Hawkins's word-order theory *functional*? Especially as a reference to standard literature on the subject (e.g. Couch *ibid.*). We propose that this type of explanation will be called 'adaptive' or 'adaptational'; but not functional.

### 3. Background of the dispute

A humanist view of language and man is different from sociobiology. Linguistic structures such as topicalisation effects on the word order depend on the speakers' communicative strategies (Hajičová 1994: 260). From this perspective, people have an agentive role in social interaction. Functional explanation implies that language is constructed by the speech community according to its needs. This is basically because it is hard to find any other scientifically plausible cause.

Hawkins's question, as quoted shortly above, appeared as a comment on pre-1990s topicalisation studies. Based on earlier insights, Mathesius, Firbas, Daneš and others developed a three-layer model of linguistic analysis that studies the interaction of syntax, semantics and pragmatics. This

analytical model is called Functional Sentence Perspective (FSP) because it is a tool for observing how formal structures convey informational functions (Firbas 1987).

Using FSP led to the reiteration that old information, in a sentence, typically precedes new. Explanation by Firbas (1971) as for why this should be so is actually 'functional' mainly as a rather general reference to language as a tool for communication. The reason for old information to appear first falls out of the premises that, as the discourse evolves, what is said first becomes established, making ground for what follows. The new information of the previous sentence is the old information of the following sentence. It is possible for sentence structure to go against the chronological grain of the story line, but since this is not the point made by Prague functionalists, the observation may not require a specific explanation. Firbas's principle of Communicative Dynamism (CD), which argues that informative value gradually rises towards the end of a sentence, does not appear to be an explanation of word-order universals, but rather, a notion arising from descriptive linguistics.

An early instance of the dispute between structural-functional and Darwinian linguists appears in Li & Thompson (1974a) who argue against economy explanation of word order change. In hindsight, this can be linked to an attempt to revive the pre-Saussurean tradition of evolutionary linguistics (cf. Aronoff 2017); especially Schleicher's extreme proto-language reconstruction (cf. Saussure 1916; Norde 2009: 48–105). The overall claim of Li & Thompson (ibid.), that Chinese has become an SOV language, is deemed as mistaken (Givón 1988). But, prompted by Thompson, Givón (1979) publishes a criticism of Saussure's separation of synchrony and diachrony. A vindictive attack on Saussure follows in Givón (1995) linking structuralism with generative grammar and thereby postulating a *second way* which he calls *functionalism*. It is only in (2002) that Givón redubs his approach as 'bio-linguistics', promoting the view of "language as a biological adaptation".

Givón (1983, 1988) expands his criticism to the Prague Circle, especially Firbas (1966, 1974), considering the classical functional approach as outdated after having been rejected by more modern research by him and his colleagues. This is a group collectively known as the 'West-Coast functionalists' (Bybee 1999).

The motivation for claiming the name functionalism is subject to speculation. Some clues are given by Aronoff (2017) who laments the Darwinian approach being banned from humanities at the end of the Second World War, blaming its downfall especially on Saussure; and Keller (1994) who likewise points to the bad reputation received by social Darwinism, prompting its modern-day followers to camouflage behind humanist terminology. Croft's (2000, 2006) evolutionary model, on the other hand, is based on Hull's universal Darwinism. Hull (1988: 448) suggests that 'a research tradition' can expand its living space by parasiting its competitor. A common reference (see e.g. Keller 1994; Haspelmath 1999; Croft 2000; Dahl 2004; Haider 2015; Fillmore & Baker 2015) for Darwinian linguistics is Dawkins (1976) who discusses mimicry as an effective parasiting strategy.

Li & Thompson's failed attempt to revive evolutionary linguistics is followed by an attempt by Givón to replace functional explanation with 'cognitive' explanation (section 3.1). This is eventually scrapped and replaced by Hawkins with a mixed cognitive-generative approach (section 3.2).

### 3.1 CTU: a second failed attempt

Givón (1988) argues that the Praguian tradition of functional explanation must be discarded and replaced "with a much more complex, cognitively-based understanding" of function. Givón questions the traditional claim that new information in sentences follows old information, finding that it is actually the other way around. This is due to a cognitive bias which he names CTU for 'Communicative Task Urgency'. In this view, there is a human tendency to arrange sentences to temporarily prioritise most important information.

A central source for Givón (1988) is Payne's (1987) study of word order in Papago (*O'odham*, Uto-Aztecan). Payne considers *O'odham* as a free-word-order language, and finds a strong tendency of placing indefinite nouns and new information pre-verbally and definite nouns and old information post-verbally, concluding that discourse factors constitute the main explanation of word order in this language and others.

Payne's overall conclusion is however different from Givón's argument. Payne finds that some North American languages rather systematically topicalise by fronting new information even if Slavic languages tend to do it reversely. This is quite interesting from a structuralist point. What is it in the language *system* that makes languages work in opposite directions? Or is it just another case of making an inevitable arbitrary choice between left and right in the linear ordering?

For a biological approach to language, however, crosslinguistic study of discourse pragmatics only leads back to the same persistent problem. If there is a human tendency of placing new information first, then why do not all languages work this way? Givón (1988) goes as far as suggesting that the whole concept of topic—focus should be abandoned in favour of cognitive grammar. Gundel (1988: 229, 234—235) however rejects CTU altogether, arguing that the 'importance' element of Givón's cognitive concept is too vague to be studied, and that both the given-before-new and the 'first things first' principle are valid concepts from a cognitive and pragmatic point.

### 3.2 EIC: third attempt successful

Hawkins's EIC (Early Immediate Constituents) is best seen as a last-ditch effort to make scientific sense of biological theory of syntax. Hawkins (1994) makes the point that both the nativist Universal Grammar and Givón's cognitive explanation have failed to account for word-order variation, and offers a working compromise between the two. The challenge is great. For one thing, there would have to be a meaningful innate element to justify the biological claim. For another, having failed biological explanation both ways, information structure would have to be discarded completely as a potential explanans of word order universals.

The detail and diligence of Hawkins's work is therefore admirable. Building on a generative tradition of processing explanation, he presents a way to explain observations made by typologists with a model which gives more accurate predictions than any other. What is more, while Payne (1988) makes the reasonable suggestion that the syntax of free-word-order languages should be understood in discourse-pragmatic terms, Hawkins justifies his claim of abandoning information structure by demonstrating that EIC works statistically even with free-word-order languages.

EIC is now a staple of Darwinian typology (Dryer 2013cd). It is of course false, as willingly demonstrated by generative syntacticians (Frey 2015; see also section 6 in this paper) but it is sufficient to buy more time than needed by evolutionary linguists to usurp territory from their arch enemy, structuralism-functionalism (Croft 1993; Aronoff 2017; cf. Saussure 1916; Sériot 1999) by replacing it with the Darwinian concept (Croft 2001/2015). Perhaps due to confusion surrounding the label functionalism, this occurs with only a few protests which fail to make waves, including Itkonen (1999, 2011), Andersen (2006) and François (2018).

Hawkins (1994) argues that Givón's CTU (new before old), rather than Prague's CD (old before new), should count as an example of functional explanation. He then continues to reject both CD and CTU on the grounds that both claim to be functional while making the opposite assumption. According to Hawkins, neither can provide a valid explanation because both types of information patterning, old-before-new and new-before-old, are *attested*.

At the same time Hawkins rejects much of the innatism claim providing a counter-example to Chomsky (1965) who argued that grammaticality questions always depend on Universal Grammar. Hawkins (1994) demonstrates that a centre-embedding structure, which is ungrammatical in English, is grammatical in Japanese. Therefore, *grammaticality* cannot be innate. Hawkins goes on to argue for his own acceptability or performance-based explanation for which he finds support from statistical significance in multilingual data.

Here, an obvious fallacy made by Hawkins lies in that EIC likewise discusses various features that are attested in the data, whether predicted by his model or not. It cannot therefore claim superiority over functional sentence perspective on such grounds. Because Chomsky's innate parameters must hold universally, they can be rejected with counter-examples, but Firbas's (1985) analysis does not suggest that CD works without exception. The claim made by Hawkins is that his solution is more *functional*; but this must be mere wordplay (cf. section 2: *What is a functional explanation?*).

In fact, it was our first task, performed on each of our four texts, to find out the ratio of given-before-new versus new-before-given structure case by case. The Prague notion proved prevalent in the four analysed languages. The share of given-before-new sentences is around 90% percent in Czech, English, Finnish and Swedish (section 5.2). FSP therefore remains a useful tool for descriptive and theoretical linguistics.

As pointed out above, FSP is an analytical device rather than a principle of functional explanation. The latter is provided by Martinet (1955) whose definition of linguistic economy, following a long tradition on the topic, suggests an unstable balance between clarity and simplicity as a universal force that shapes languages (Vincentini 2003). For this reason we combined FSP and economy to gain insight into word-order variation in our own research (section 5).

#### 4 The EIC principle

To better understand Hawkins's proposition, its methodological and theoretical implications need to be separated. Hawkins advocates a view that brings together generative sentence analysis on the methodological level, and linguistic units as cultural replicators as a theory of language (section 2). This is a major difference from Chomsky and his colleagues (Everaert et al. 2015) who consider generative grammar as the study of the hypothesised innate language faculty or language organ. But unlike others who reject innate 'structure' altogether, Hawkins does leave room for it. EIC is a marriage proposal between the generative analysis and the social Darwinian theory.

We take it that a "reduced" innate structure that Hawkins refers to concerns the generative convention of placing the object of the sentence into the verb phrase (VP) since Hawkins (1994 and elsewhere) continues to use it as a crosslinguistic point of reference.

##### 4.1 Why is the object 'in' the verb phrase?

What seems most emblematic of generative analysis is the S (NP|VP (NP)) tree (diagram 1). A canonical English transitive sentence consists of two noun phrases (NPs) and a verb phrase. For example, a tree for 'The man hit the ball' places the object (the second NP) within the verb phrase. The subject (the first NP), in contrast, is analysed as independent of the VP.

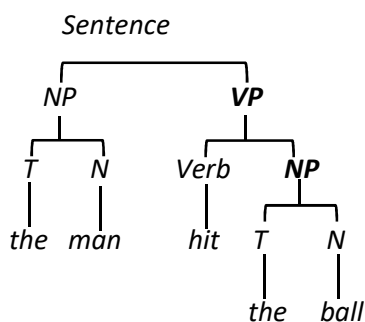


Diagram 1. Chomsky (1957: 27; bold type added) places the verb and the direct object (the second NP) into a common verb phrase (VP).

As we understand from Everaert et al. (2015), generative grammar is the study of an innate grammatical structure. The VP (NP) structure forms the core of Universal Grammar and therefore, purportedly, the core of all "natural" languages. But the decision to place the object within the VP appears to be fully arbitrary from a historical point. It was never based on research evidence at all and, in fact, the most obvious explanation for Hawkins's conception is that it is an effect caused by the analytical device itself.

The VP (NP) stipulation is found in the article *Immediate constituents* by Wells (1947) who gives the example [*the King [of England]*] [*opened [Parliament]*]. Based on Pike (1943; cf. diagram 2), and

discussions with Zellig Harris, Wells (ibid.) explains that this depends on the object being a special case of "expansion" of the verb, citing Bloomfield (1933). Pike (1943) comments his own diagram as follows:

here a layer of tagmemes may be indicated, in which the top layer is the full actor-action sequence and a lower layer is the feature of object and action. (Pike 1943: 68)

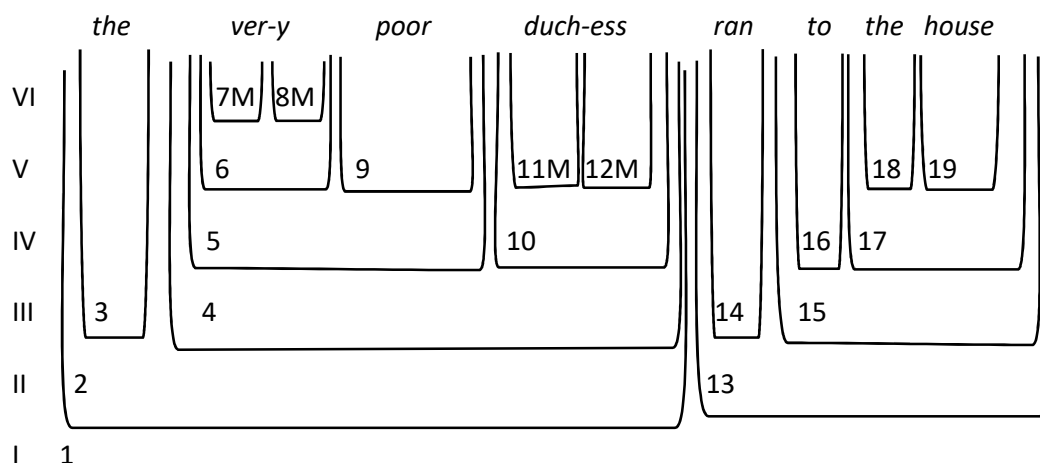


Diagram 2. Pike (1943: 70) places the verb *ran* and the prepositional phrase *to the house* into a common dependency, *tagmeme 13*.

However, what Bloomfield wrote was that:

In English, taxemes of order appear in the difference between actor-action and action-goal, as in *John ran* and *catch John*; the difference between *John hit Bill* and *Bill hit John* rests entirely upon order. (Bloomfield 1933: 197)

What we see in the early trees provided by Pike (diagram 2) and Chomsky (diagram 1) is that the lines seem to represent a standard school analysis of syntax where dependency structures are drawn under or above the text by the student. According to Seuren (2015), Pike and his colleagues, who formed a school of thought which earned the nickname "God's truth linguistics", were Protestant missionaries. Their main aim was to translate the Bible into preliterate languages, but they also believed that the described IC-structure was a psychological or, indeed, "divine" reality.

Nonetheless, the VP (NP) structure was crystallised in post-Bloomfieldian analysis. It looks as if Chomsky took whatever model was available at the time to claim it as a genetic structure. But there is admittedly something in the non-functionalist model of the Post-Bloomfieldian school that would work particularly well for Chomsky's biolinguistics. That is, the eventual proof that grammatical sentences are generated irrespective of semantics; a rejection of functional grammar. The object of the sentence is not distinguished from the subject by any other virtue than that it occupies a different node in the IC-structure; which only the trained expert can make visible.

This could be used to promote Chomsky's (1980) idea that *language* (i.e. Universal Grammar) cannot be learned by the child by deduction. It is obvious: the claim that the object, and not the subject, is in the VP is not logical. Nonetheless, it is *real*. Hence, the *logical explanation* is that it must be an innate structure and therefore universally present in all human languages.

Because Chomsky's claim was never scientifically motivated, it is unsurprising that serious issues would appear as soon as the model was applied crosslinguistically (see Croft 2001 and 2003 for a detailed account), taking its toll on the credibility of the innatism claim. It is also no great wonder that there has been a slow but steady movement from generative grammar to Cognitive Linguistics. De Bot (2015)



reports the decline of Generative Grammar in applied linguistics, revealing that universities now rarely hire Chomsky's supporters as professors. A 'usage-based' model, inspired by social Darwinism (Boesch & Tomasello 1998, with comment by Paterson), has taken over. This would have been an obvious scenario in syntax, too.

Here we come to understand the significance of Hawkins's research. Even if advocates of Chomsky's Minimalist Program remain true to innatism (Richards 2015), there are other generative models such as Lexical-Functional Grammar (Butt & Holloway King 2015), Head-Driven Phrase Structure Grammar (S. Müller 2015), Optimality-Theoretic Syntax (G. Müller 2015), Construction Grammar (Fried 2015) and more that have grown out of a rejection of some of Chomsky's claims while maintaining the VP (NP) stipulation. Chomsky (2002: 124, 2009: 36) has openly admitted that his theory has no basis in research evidence (see also discussion in S. Müller 2015: 962).

This seriously puts into question the whole meaningfulness of generative grammar which for decades has been the practice of designing solutions – "theories" – to make uncollaborative data fit the bias in the model. Like the Soviet space programme, it is not the machine that works but the genius of the engineer that *makes* it work, and it has a certain charm. Hawkins offers the generative programme a new *raison d'être* by providing crosslinguistic evidence for the cognitive reality of the VP (NP) structure, albeit with the cost of ditching the universal mode of explanation; a compromise he nicknames "functionalism".

If the desired structure is innate, then why are the data not consistent? This is where the Complex Adaptive System comes in. The language *organism* adapts to human mind, but not perfectly, leaving statistical noise around the edges (Hawkins & Gell-Mann 1992: 14). Some may not be convinced, but there are other possibilities available. Osborne (2015) emphasises that Dependency Grammar, which was tested by Tesnière (1959) with free-word-order Latin, lacks the VP (NP) bias; while Van Valin asks:

what would linguistic theory look like if it were based on the analysis of Lakhota, Tagalog and Dyirbal rather than on the analysis of English? (Van Valin 1995: 461, as cited by Butler 2003: 121)

Butler (2003) makes the point that functional grammar is unburdened by the problem of having to apply the purported VP (NP) structure to the analysis of languages where it does not fit. For example, there are OSV and VSO languages that separate the verb and the object by default, including Arabic, Filipino and Celtic languages; and some that fix the subject to the verb: Spanish, Latin, Greek, Russian, Turkish; in fact, a majority of the World's languages (Dryer 2013a). Interestingly enough, the scientific plausibility of Darwinist typology now hangs on a generative thread: the one from the VP node to the object node.

## 4.2 Hawkins's solution

Hawkins (1994) reiterates the cognitive reality of the IC tree, bringing together a tradition of processing explanation in generative grammar and a heaviness explanation in functional typology. He observes that the conventionalised English V NP PP CP order of the verb phrase increases in length from left to right. The verb is typically a single word; the NP is on average longer than the verb but shorter than the PP which adds a preposition; and the CP (clausal phrase: a subclause), is the longest dependency. This is not only a question of grammar, but Hawkins provides multiple analyses demonstrating that attested pragmatic choices in texts statistically prefer organising the VP in a way that increases in length. Hawkins explains this as being based on processing efficiency.

In this type of view, the human brain is like the generative grammarian whose first and foremost interest in a sentence is in finding out which way the object is 'in' the VP in order to draw a tree that computes. The constituency structure within the verb phrase supports it being done sooner rather than later. For example, the word order in the VP of the sentence *I* <sub>v</sub>[*gave* <sub>pp</sub>[*to Mary* <sub>NP</sub>[*the valuable book* <sub>s</sub>[*that was extremely difficult to find*]]]] (diagram 3) is efficient because its IC structure (immediate constituents within the VP) is recognised based on just four words, from *gave* to *the* (Hawkins 1994: 57). This can be seen in the diagram below, but also from the open brackets in the parsed sentence above, which all appear earlier than with any other ordering of the VP.

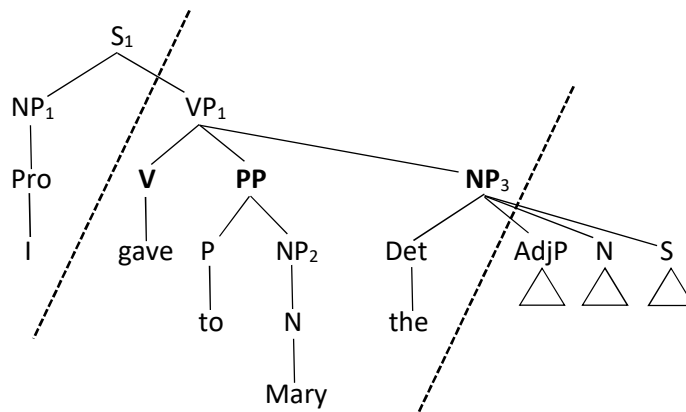


Diagram 3 (Hawkins 1994: 60; bold type added). In this ‘efficient’ word order, the IC structure of the verb phrase, consisting of the V, PP and NP nod, is recognised based on just four words between the dotted lines.

A sentence of the exact same length, *I<sub>v</sub>[gave<sub>NP</sub>[the valuable book<sub>S</sub>[that was extremely difficult to find<sub>PP</sub>[to Mary]]]]* is not so common because the ICs have been arranged in an ‘inefficient’ way (see Hawkins 1994: 60 for a diagram). One will need to read eleven words, from *gave* to *to* to figure out the IC structure of this VP (Hawkins 1994: 57). The EIC hypothesis of course requires the generative parse tree to be a cognitive reality of some kind. Hawkins concludes that, while processing efficiency does not necessarily constrain the grammar, it is an underlying factor for how word-order patterns become conventionalised and eventually grammaticalised, not only in English but in all languages.

Note that Hawkins does not discuss the possibility that the second word order is less common because it is centre-embedding which itself means more complexity (section 6.2). Yet another way to order the phrases is ‘*I gave the valuable book to Mary that was extremely difficult to find*’ which we would consider ambiguous because the pronominal connective *that* appears to refer to *Mary*. These questions relate to the economy principle (section 2), diverging from Hawkins’s processing explanation.

The EIC principle only works for less than half of the languages of the world, but Hawkins doubles its explanatory power by studying SOV languages such as Japanese which to an extent mirrors English word order. He does this by reversing the parsing order from top-down to bottom-up. This does not actually mean that the sentence is read backwards, but if we examined the *closed* brackets right to left of sentence (1a) and (1b) below, we would observe a similar effect to the above English top-down parsing sentences.

Hawkins’s Japanese example is somewhat different from the English analysis, so it may be necessary to quote the original more directly. Hawkins gives the two grammatical sentences for ‘*Mary said that John got married yesterday*’.

- (1) a.  $s_1[{}_{NP}[Mary-ga] {}_{VP}[s_2[{}_{kinoo} John-ga kekkonsi-ta] to] it-ta]]$   
} Mary-NOM [yesterday John-NOM got.married QUOTE] said
- b.  $s_2[s_1[{}_{Kinoo} John-ga kekkonsi-ta] to] {}_{NP}[Mary-ga] {}_{VP}[it-ta]]$   
} [Yesterday John-NOM got-married QUOTE] Mary-NOM said

Again, the reason for a weaker preference for (1a) is not because it is centre-embedding, but because it does not promote efficient constituency parsing. To start from the efficient (1b) alternative, Hawkins explains that the nodes

are parsed bottom-up, and once  $\hat{S}$  is constructed, the remaining ICs of the Matrix  $S_2$ , NP, and VP, are attached within a very short and rapid viewing window:  $s_2\{to_s, Mary-ga_{NP}, it-ta_{VP}\}$ . (Hawkins 1994: 66–67)

while the same does not quite occur in (1a), as indicated by the long line between *Mary-ga* and *it-ta*. Although the name EIC suggests that the constituency structure should be recognised as early as possible, it is rather the case in Japanese that the beginning of the sentence plays a minor role, leaving the vital structure to the end. Hence it is understandable that Hawkins (2014) changes the name EIC to ‘Minimize Domains’ (MiD), suggesting a closeness of IC indicators, whether towards the beginning or end of the sentence.

Hawkins does not provide diagrams, perhaps because – as we can already see by comparing how the closed brackets are arranged right to left – the structure of the Japanese examples is actually not equivalent to the English sentences. Parse trees are added here in diagram 4 for the reader’s convenience.

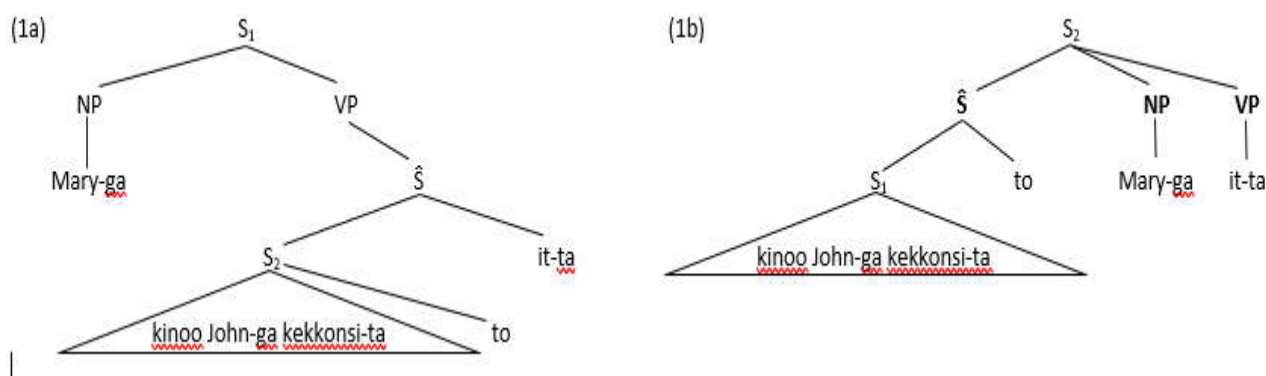


Diagram 4. A parse tree for sentence (1a) and (1b).

The first thing to observe is that the generative analysis does not work well for sentence (1b). Here the  $\hat{S}$  node is apparently meant to link the phrase in  $S_1$  with the VP node, but we do not see  $\hat{S}$  being ‘in’ the VP anyhow, like the subclause was in the English sentences. In (1a), the corresponding  $\hat{S}$  node either replaces the V node or is simply redundant. The connective *to* is given its own node although the corresponding *that* appeared as a member of the subclause. It seems to be the case that the VP (NP) analysis is substantiated with typological generalisations, and these generalisations rely on the VP (NP) analysis. Such argumentation is then circular, or to put it more simply, the findings are a mere effect of the analysis itself.

Yet furthermore, the ICs of (1b) as highlighted in the diagram are direct dependencies of the  $S_2$  node (second level), while in the English examples, they were dependencies of the VP (third level). The Japanese comparison relies on including the subject (NP: *Mary-ga*) which was not the case in English. In fact, the data purportedly supporting EIC is meant to ignore the subject altogether, linking the place of the adposition and the relative clause with the VO/OV order. But the desired effect in Diagram 4 is caused by moving the subject only.

It was Hawkins’s starting point that a simple heaviness principle will not work because the verb is statistically the shortest and the object is the longest of the three main elements (subject, object, verb). Heaviness would then predict that languages will either have the VSO or OSV order which is not correct. Therefore EIC must exclude the subject, something which works well with the typological data but is not supported by Hawkins’s Japanese examples. Suffice it to say at this point that we are not fully convinced of the accuracy of Hawkins’s model.

It could be the case that there is something else at play that could give a more plausible explanation for the observations made by Hawkins and his colleagues, especially Dryer (1992). We carried out our own text analyses in different languages to find clues of what might actually be happening

underneath (section 5). Based on our findings we examined the related typological data, defining a different principle that makes the same predictions as EIC (section 6.3). Finally, we compared the two, rejecting EIC because it is the model that makes the most complex claims with the same results (section 6.6).

## 5 Own research

We carried out an analysis and an experiment of a text available in various languages. Our first task was to find out whether CD (given before new) or CTU (new before given) was the prevalent theme—rheme order in Swedish, English, Czech and Finnish (section 5.2). As all four texts supported CD, we then performed an experiment to find out whether the given-before-new ordering is specifically functional by reversing the information structure (section 5.3).

We will present our empirical research in a relatively compact form due to our mostly theoretical orientation and given space limitations. In fact, the theoretically-inclined reader may wish to jump to section 5.4. Sections 5.1 to 5.3 may be interesting for those who want to know more about our study of information structure in discourse analysis. It becomes evident as our study progresses that functional discourse analysis based on the economy principle, our chosen approach, raises interesting questions everywhere we look and in all languages. There will nonetheless be little effort for our part to answer all of them in a scientifically rigorous way. We will limit our focus to serve our goal which is providing a reply to Hawkins's question (section 2).

### 5.1 Material

We analysed a text published by the European Commission (EC 2014) which is available in 23 languages although only four were selected for our study. The English title of the text is *Organic farming – a guide on support opportunities for organic producers in Europe*. It is a brochure which provides information especially for farmers interested in converting their animal or plant production to organic.

One of the reasons for choosing this text was because it appeared first in a list of similar brochures on an official document website and seemed to cater for our needs. We were especially interested in a text which is moderate in length but with a rather high frequency of complex sentence structures, although in a naturally flowing form. Thus we could manage the necessary amount of data in a rather compact file. Each language version provided somewhere between 170 to 200 cases when the complex sentences were split into clauses. These cases were inserted into spreadsheets to conveniently calculate sums and percentages of our analyses.

Since the early discussions had concerned Czech and English, our preliminary decision was to limit our observations to these languages. However, it was in particular the Swedish version of the text that raised our interest due to its very high frequency of the relative pronoun *som*. We used the Swedish text for sandboxing to find the most consistent way of analysis; but since the results from Swedish were also interesting, we eventually included it in our account.

Because Swedish and English seemed to form a kind of pair, a Finnish version was added to support results from a Czech analysis. This way we had two languages, English and Swedish, with a strict word order and grammatical articles, and another two, Czech and Finnish, with a flexible word order and no articles. As regards language families, English and Swedish are Germanic; Czech is a Slavic (or Slavonic; Indo-European) language, and Finnish is a Finno-Ugric language; but language structures were thought of being more important than language genealogy.

### 5.2 Counting the GN to NG ratio

We made a discourse analysis of the text(s) with the task to extract the given-before-new (GN) and new-before-given (NG) ratio. The GN versus NG ratio was analysed in the Czech, English, Finnish and Swedish material. Complex sentences were split into clauses each containing its own finite predicate. Arguments of each predicate were separated to be analysed as thematic—rhematic elements (cf. Hajičová 1994). A

precise definition of theme—rheme was ultimately not quite crucial for our analysis of the order of given and new information which were relatively easy to recognise in the text, at least in principle. Any concept having appeared earlier was marked as given information. For example, *the European Commission, organic farmers and the common agricultural policy (CAP)* first appeared in an opening summary or abstract, and were thereafter always considered as given information.

The most common type was GN, but NG sentences were also rather frequent. Question sentences were one common type to have the NG ordering, and there were a few questions in the material, e.g. “*What should organic producers know?*” The relative pronoun, on the other hand, was a frequent predictor of the GN ordering, e.g.

(2) [This regulation ...] **which** lays down *detailed rules for its implementation*.

Here, given (old) information is highlighted with bold type and new information with italics. Although all four languages have a similar information structure, sentences in the different versions are often not quite equivalent to each other because the writers of the different versions have structured the text in somewhat different ways. Below is an example of a relative GN sentence, applying the publisher’s language coding (cs = Czech; en = English; fi = Finnish; sv = Swedish).

(3)

|    |   |
|----|---|
| cs | [udržitelné zemědělské postupy,] <b>které</b> jsou prospěšné <i>pro klima a životní prostředí</i> .<br>'[sustainable agricultural practices] <b>which</b> are beneficial <i>to the climate and the environment</i> .' |
| en | [conversion] during <b>which</b> <i>the provisions concerning the organic production</i> have been applied.   |
| fi | [alat ...] <b>joilla</b> kasvaa <i>kerääjäkasveja tai typpeä sitovia kasveja</i><br>'[areas...] <b>which</b> are covered with <i>catch crops or nitrogen fixing crops</i> '   |
| sv | [kommissionens förordning...] <b>som</b> innehåller <i>närmare regler</i><br>'[an EC regulation...] <b>which</b> contains <i>detailed rules</i> '   |

There are in general many types of cases and orderings, with some English examples below.

(4)

|    |  |
|----|--|
| GN | <b>These equivalent practices</b> shall be based <i>on agri-environment schemes and certification schemes</i>  |
| NG | <i>Support for conversion to organic agriculture</i> is foreseen <b>under the CAP</b> .  |
| GG | <b>Processors and retailers</b> can also join <b>the EU organic scheme</b>   |
| NN | <i>The most relevant sub-programme, in terms of content and financing</i> , would be <i>the one on climate change mitigation and adaptation and biodiversity</i> . |

For example, the theme or topic ‘*Processors and retailers*’ in the above GG sentence was recognised as given information simply because these had already once previously appeared in the text. There are also simple G and N sentences and more complex information structures such as GGN, NGN, GNN etc. Only sentences with a clear GN or NG structure were eventually included in the main results. Furthermore, there were many incomplete sentences without a predicate, often captions, which were excluded from the GN-to-NG ratio.

While the predicate can be considered as having its own role in the theme—rheme chain (cf. Firbas 1971), there was only one instance in the text where the event was referred to anaphorically. To simplify the analysis, we decided to disregard the eventual thematic role of the verb altogether, focusing on

NPs and PPs only. This gave us a much more straightforward way of observing given and new concepts appear and reappear.

An English example of an RP referring to a verb would be “*The new Rural Development programmes have a more flexible structure which makes it easier for Member States to combine different types of rural development measures.*” In this case we simply counted the RP as referring to the noun ‘*structure*’ because there was enough ambiguity in the sentence to justify such an analysis. But there was also a genuine case, here cited from the Finnish text:

Uusi järjestelmä kannustaisi oppilaitoksia hankkimaan luomutuotteita (**mikä** on mahdollista ja käytäntönä jo nykyisessä kouluhedelmä- ja vihannesjärjestelmässä) [...]

‘The new system would encourage educational establishments to buy organic products (**which** is already a possibility and practice in the current school fruit and vegetable programme) [...]’

This was, then, not considered significant enough to necessitate a more complicated analysis. Another stipulation made to potentially ease crosslinguistic comparison was to elucidate information structure in cases where given information was clearly implied but not made visible, e.g. ‘*If you are a farmer and wish to join the European organic scheme [...]*’. Because there are two predicates, the structure is split into two sentences, repeating the theme in curly braces:

(5) GG            If **you** are a farmer  
 GN            and {**you**} wish to join *the European organic scheme*,

In the English text, for example, bracketed cases accounted for seven GN sentences out of 77 in total, or 9 percent.

Quite frankly, analysing the given versus new information structure in a real text is not always quite simple, and we admit that many sentences could be analysed differently, and that we could have made different methodological choices. We did in fact do sandboxing with a much more detailed analysis discarding the classical theme—rheme division and simply focusing on new versus old words. We then rejected this approach because it resulted in some very complex structures (GGNGGNG and the like), and we felt that the theme—rheme concept was more helpful, and that repeating the theme where it was omitted increases contextual coherence and could avoid false biases especially when applied to strongly “pro-dropping” samples. That is, in texts in languages that place the anaphora into the verb or the conjunction, or omit it altogether assuming a conventional interpretation.

In our experience, a different analysis could show a lower share of GN sentences, likely settling at around 75 percent. Our suggestion is nonetheless that, any which way, there could be no reasonable analysis of a regular text in any of these languages that could show a higher NG than GN ratio.

|         | GN (of applicable cases) | NG (of applicable cases) | All G-first cases | All N-first cases |
|---------|--------------------------|--------------------------|-------------------|-------------------|
| Czech   | 80 (88.9%)               | 10 (11.1%)               | 119 (82%)         | 36 (18%)          |
| English | 77 (91.7%)               | 7 (8.3%)                 | 102 (76.1%)       | 29 (23.9%)        |
| Finnish | 96 (93.2%)               | 7 (6.8%)                 | 120 (79.7%)       | 33 (20.3%)        |
| Swedish | 109 (94.8%)              | 6 (5.2%)                 | 136 (78.2%)       | 38 (21.8%)        |

*Table 1:* Results of the GN:NG analysis show a preference of given before new information in all four languages. GN = given-before-new information structure (sentences); NG = new-before-given information structure, with the GN:NG ratio in percentages in brackets. All G/N-first cases include sentences with simpler or more complex information structure that what were selected for the main results to the left of the table.

Results from our analysis in table 1 show that the GN ordering is clearly prevalent in all four languages. What is surprising in the results is that English shows no divergence from the other three languages. Givón (1988) considers it as having a canonical NG ordering, while Payne (1987) did not take a stance on English, but implies agreeing with Firbas (1964), that Czech has dominant GN. We expected the GN:NG ratio to be at least a little lower in English, but there is essentially no difference. Thus, it is no wonder that Givón's CTU was not taken for real in its time (section 3.1) and that it was subsequently replaced by EIC.

We will use this analysis as a basis for the next phase where we will invert the information structure of all GN sentences to NG.

### 5.3 Inversion of information structure

To recap, Hawkins (1994) asks why GN is supposed to be functional. We have discussed the meaning of 'functional' in section 2 based on standard sources on the subject. Our answer will consequently be based on demonstrating that the prevalent GN ordering supports linguistic economy.

Our approach entails examining what would happen if the word order of sentences in our text now containing a GN order was changed to NG. A conversion of the Czech text was not done at this time. We carried out an experiment to see whether economy of English, Finnish and Swedish sentences will be affected by the change. This was done simply by inverting all GN sentences to NG, e.g. "**Support** is also foreseen *for the maintenance of organic agriculture*" is changed to '*for the maintenance of organic agriculture* is **support** also foreseen'. An ordering that sounds most natural is preferred, although it will be ultimately ignored if the converted sentences seem unusual. Instead, based on the economy principle, it will be assessed whether reversing the information structure causes an increase of complexity or ambiguity in the sentence itself or in an adjacent sentence.

As expected, the analysis of English and Swedish showed an increase in complexity and ambiguity when the word order was changed. Complexity increased typically when the GN theme, which contains the 'given' subject, was moved behind the rheme, which contains the 'new' object because this requires the addition of an agent marker. The following Swedish example has the same meaning as the English sentence below, each cited from the material.

(6a) sv original: **en jordbrukare** måste odla *minst två grödor*  
 conversion: *minst två grödor* måste odlas av en jordbrukare

(6b) en original: **a farmer** must cultivate *at least two crops*  
 conversion: at least two crops must be cultivated by a farmer

The added elements are underlined. In addition to the agent-marking preposition *av* (by), and a passive -s or participial (-ed) suffix is added to the verb. English also adds the copula (be). The number and quality of any obligatory additions was however not considered as essential. Each conversion adding any element was marked as having increased complexity compared to the original.

A second way that decreased economy of sentences was the increase of ambiguity. This occurred when a relative pronoun containing given information was moved behind new information from its sentence-initial place. All such sentences became ungrammatical, e.g.

(7) original: [funding possibilities,] **which** aim to increase consumer awareness[.]  
 conversion: [funding possibilities,] to increase consumer awareness **which** aim[.]

The lower converted sentence is actually marked as being fine from the economy point. Since the plural intransitive verb *aim* cannot refer to the singular NP *consumer awareness*, ambiguity is not strictly speaking increased. In fact, moving the relative pronoun does quite typically not increase ambiguity in absolute terms, even if sentences become ungrammatical, due to various reasons such as the one above. There were many conversions nonetheless that have increased ambiguity, e.g.

(8)

original: [challenges] **that** were posed *by increased competition and fluctuations of markets*.  
conversion. [challenges] by increased competition and fluctuations of markets **that** were posed.

This particular conversion was deemed as adding ambiguity because the phrase *that were posed* now seems to refer to *markets* rather than *challenges*. While it was rather obvious from the onset that reversing the information structure would decrease economy by increased complexity and ambiguity, more surprisingly, this did not quite occur in Finnish which was clearly less affected by word-order change (table 2). To be precise, conversion of Finnish sentences did increase ambiguity, but not complexity. This was due to systematic case marking which allows word-order inversions without further marking, e.g.

(9)

original: **jäsenmaat** voivat soveltaa *myös muita käytäntöjä*  
'member states can also apply other policies'

conversion: *myös muita käytäntöjä* voivat **jäsenmaat** soveltaa  
'other policies can also be applied by member states'

|         | Unaffected | Increased complexity | Increased ambiguity | Ambiguity due to RP shift |
|---------|------------|----------------------|---------------------|---------------------------|
| English | 49 (64.5%) | 17 (22.1%)           | 12 (15.6%)          | 12/12                     |
| Finnish | 84 (85.7%) | 0                    | 14 (14.3%)          | 14/14                     |
| Swedish | 75 (68.8%) | 21 (19.3%)           | 15 (13.7%)          | 15/15                     |

Table 2. Unaffected = number of GN sentences whose economy was not affected after a conversion to NG. 'Ambiguity due to RP shift' = number of cases where ambiguity increased due to moving the relative pronoun. Ambiguity increased similarly in all three languages, but complexity only in English and Swedish. The sum of English and Swedish percentages exceeds 100 due to, respectively, 1 and 2 cases with both increased ambiguity and complexity.

The only common denominator for all three languages is shown to be limited to concerning **the relative pronoun**. Moving the relative pronoun away for its clause-initial position caused referential ambiguity frequently though not always.

## 5.4 Discussion

Based on our research above, we can now give an answer to Hawkins's question: why is the GN ordering *functional*? We linked functional linguistics with the principle of economy in section 2. Our research shows that reversing the GN ordering reduces economy. Therefore, the answer is that GN is functional in given language systems because it supports disambiguation in a way which does not increase complexity.

Many details will have to be left for further research due to the complexity of the issue. Also, results from our study are clear, but reasons causing them will be a subject of speculation or theorising. It can be said nevertheless that they do not support sociobiological approaches in any way. As regards Darwinian linguistics and generative grammar alike, there does not appear to be anything in the material to necessitate a non-intelligent cause for linguistic structure and variation.

Our study furthermore does not support the generative concept of wh-movement. In our Czech, English, Finnish and Swedish material, there was no wh-movement whatsoever. Instead, wh-words functioned as conjunctions, appearing clause-initially, whether they were question words or subordinators. Wh-words in GN sentences always carried old information. When moved behind the rheme, an experiment we carried out in English, Finnish and Swedish, relative clauses became prescriptively ungrammatical.



More interestingly, it was only this type of conversion that cause an ambiguity increase (of ca. 15 percent), while other types of GN-to-NG changes made no impact. Our conclusion based on this is that grammar supports disambiguation. It remains unclear to us why the object, for instance, when encompassed in a wh-word (e.g. *what*, *who[m]*) should be fronted, according to Darwinian linguistics and generative grammar.

Out of the three languages, only English and Swedish increased in complexity due to a GN-to-NG conversion. This however neither affected grammaticality nor disambiguation because the two languages have a mechanism of prepositional marking available for this type of word-order change. The canonical word order in these languages thus supports simplicity because the agent is only marked when necessary. The GN-to-NG conversion caused a case-by-case increase of around 20 percent of complexity, meaning it is clearly more economic than systematically marking the agent.

The concept of different languages doing the same job in different ways – that is, expressing predicate—argument-structure in an economic way, is illustrated by comparison with Finnish which systematically marks the subject—object distinction. While this would seem to be an unnecessarily costly way, Finnish subject-last sentences are clearly simpler. Such sentences seem to be equally vital to all three languages since all use the same word-order strategy to help link the relative pronoun with the correct antecedent; that is, by moving the antecedent next to the relative pronoun regardless of canonical agent—patient order.

It can be said in the current perspective that the English and Swedish strategy is optimal for simplex sentences, but the Finnish strategy is optimal for complex sentences, especially for the rather prototypical case where new information is elaborated in a relative clause. At this point however we will not proceed to examine whether one of the strategies is more optimal than the other in absolute terms. Instead, we believe to have found enough information to continue to systematically reject EIC as a useful concept for language sciences.

## 6 A rejection of EIC

In the last section we provided an answer to Hawkins's question why given-before-new ordering is functional in four European languages. In this section we will proceed to dismiss EIC as an explanation of word order harmonies in worldwide typological data by demonstrating that there is a simpler principle that makes the same predictions as EIC. Thereby EIC will be overruled per Occam's razor. We will start our quest by enumerating weaknesses of EIC.

### 6.1 Weak points of EIC

The fundamental methodological problem in Hawkins's theory is the same as in other versions of sociobiology: the absence of the concept of null hypothesis. As the objective is to explain language universals or statistical tendencies in crosslinguistic data, since the beginning of Chomsky's biolinguistic revolution, the starting point always seems to be that there has to be a biological explanation of some kind. This is despite no evidence being presented for one single linguistic form of being biologically-based.

In scientific practice on the other hand, the null hypothesis serves as a starting point and as a general reference. There is plenty of historical evidence of people having created linguistic forms, just take Shakespeare and Noah Webster as examples. Therefore, the simplest explanation for any linguistic phenomenon is that it is made by people because this requires no further sources than what we already have. Identifying language as a man-made creation is the starting point of the null hypothesis, and any biological or quasi-biological explanation (i.e. Darwinian linguistics, see section 2) is necessarily making an *alternative* hypothesis. The technical difference is that, while the alternative hypothesis must be supported by relevant evidence in order to qualify as a scientific argument, the null hypothesis in fact does not require any further evidence to be acceptable as such.

It is probably for this reason that Hawkins calls EIC a hypothesis rather than a theory. In principle, it could be the case that the innatism claim and the Darwinian theory are not backed by research evidence, but if EIC works, it would seem to contribute to these theories with *circumstantial* evidence. This

can be an interesting situation, but it will be problematic if EIC supports and is supported by the sociobiological theories when there is no other substantiation available.

Uncertainty in this respect seems to be the main theoretical weakness of EIC. It was needed when predictions made by Chomsky's innatism and Givón's cognitive explanation failed the test of crosslinguistic relevance. Hawkins's solution was to reduce the role of the innate grammar by adding a second sociobiological principle, CAS, to cater for all needs. Instead of just one unsubstantiated alternative hypothesis, there are now two. This is not standard scientific practice: the null hypothesis – that biology plays no specific role – has not been elaborated in a satisfying manner or, in fact, it has not been elaborated at all.

The main weakness of Hawkins's crosslinguistic analysis was taken up in section 4.2. The concept of EIC relies on ignoring the subject and only focusing on the hypothesised verb phrase as relevant for word order harmonies, as is today standard practice in typology (Dryer 2013acd). However, we noticed that the subject was elementary for Hawkins's analysis of Japanese, and that the analysed IC depth varied between the languages. We suggested that the full parse tree approach seemed excessive as one could have more simply just counted the open or closed brackets in the linear representation.

As regards typological predictions made by EIC, it is strongest in explaining OV/VO + adposition harmony. OV languages are clearly more likely to have postpositions than prepositions, like in Japanese, while VO languages are clearly more likely to have prepositions than postpositions, like in English (Dryer 2013c).

The second strongest prediction is OV/VO in relation to the order of the noun and the relative clause. The VO&NRel order (head noun before relative clause, e.g. English) is a very strong tendency over VO&RelN (relative clause before head noun) crosslinguistically. But same cannot be said of OV&RelN (e.g. Japanese) which can either be described as a very weak tendency or as one that is limited to Asia (Dryer 2013d).

Data concerning other harmonies such as the OV/VO order in relation to the order of adjective and noun seem more uncertain (Dryer 2013e) and will not be further discussed in this article due to space limitations, but we will be prepared to elaborate them by request.

## **6.2 What is known about language processing?**

Today's cognitive linguistics is dominated by the competition of two contrasting sociobiological approaches. Schwarz-Friesel (2012) describes two combative dogmas in the field that make extreme generalisations of how the mind and brain work. One is the Chomskyan or generative approach which claims that language is compartmentalised and thus unaffected by general processing principles. The other one is the Lakoffian-Langackerian branch which goes to the other extreme by claiming that language processing follows purely from the general principles.

We suspect that the motivation for both stipulations is to make people believe that intelligent construction of language is totally impossible, thus pretending to justify the case for 'biological' linguistics. For the Chomskyan camp, intelligent creation and intelligent learning of syntax is not possible because language and mathematics are locked in two separate mind modules, with no connection in between. Fortunately, Chomsky has been clear that his theory is not based on any evidence whatsoever (Chomsky 2002: 124, 2009: 36; cf. Robbins 2017).

For Langacker (2010), language is conceptualisation, and for Lakoff & Johnson (1999), the mind operates on cognitive metaphors. Hence, language cannot be logically motivated because mathematics is just another metaphor among all the rest (Lakoff & Núñez 2000). Mathematics or logic cannot function as a universal measure of anything, so our economy approach must be doomed to fail. In this type of 'cognitive science', even standard scientific concepts such as Occam's razor are believed to be "cognitive biases" of the human mind: there can be no general measure of complexity (Culbertson & Kirby 2016); again, undermining the economy principle.

The mind-view of so-called Cognitive Linguistics (CL; capitalised) is however counter-evidential. It is well known that, even though these are not modules, the brain has several specialised regions for language processing. Language is not just processed according to general principles, but

differently from other types of information such as visual input (Schwarz-Friesel *ibid.*); and that, though these are not the same, there is an indisputable connection between mathematical, analytical and language processing (Zhou et al. 2018). What is cognitive linguistics supposed to be, anyway? Peeters (1998) makes a reasonable conjecture.

It would seem to me that the latter is the sort of linguistics that uses findings from cognitive psychology and neurobiology and the like to explore how the human brain produces and interprets language. In other words, cognitive linguistics is a cognitive science, whereas Cognitive Linguistics [à la Lakoff and Langacker] is not. Most of generative linguistics, to my mind, is not truly cognitive either. (Peeters 1998: 226–227)

Butler (2008) urges functional grammarians to seize the cognitive wave with a synthesis of linguistics, psychology and neurology. This is easier said than done – the case we are literally witnessing in current linguistics – because, as aptly summarised by the following passage on neurolinguistics,

though progress is being made in this field, very little is known for certain about the neurological aspects of language. (Encyclopaedia Britannica 2015)

This is no wonder because neurolinguistics needs a model of language as a starting point for research, and this is typically either generative grammar (e.g. Schlewsky & Bornkessel-Schlewsky 2013) or CL (e.g. Lai, Howerton & Desai 2019). But these two models themselves are not supported by brain science. Much of today's cognitive trend cannot be based on more than speculation. Therefore, while working out our model (section 6.3), it is difficult to claim true cognitive adequacy when no one knows what that means exactly. There is however something that could be done. Guided by Schwarz-Friesel's point that both the Chomskyan and the Lakoffian-Langackerian model are *too extreme* to be supported by research evidence, the middle road would seem to be an obvious way towards a useful model of language.

From a syntactic point, this could be illustrated by the case of grammatical rules. Grammar is not just conceptualisation, but a set of conventional rules. The meaning 'rule' in generative grammar is however different from the usual meaning of the word, referring to mathematical rewrite rules (Chomsky 1957). It must be noted that these are simply the instruction of how to draw a parse tree, and it is the tree in particular that seems to be the creation of syntacticians rather than that of the unconscious mind, as far as seems possible to demonstrate scientifically (see further discussion in 6.5).

We also know that the brain is good at making associations (Eysenck 2012). Therefore, a plausible model could be one with a rather flat linear structure. The point of verbal thinking seems to be that, rather than thinking in pictures or diagrams – although they are of course capable of visualising things – people learn to use a conventionalised linear language for thinking. Parsing cognitive grammar can be based on associations. Some structure may be real, although unlikely innate, but it is not certain what centre-embedding is exactly, for example. People do not have nonlinear representations at their disposal when they hear and read language. Centre-embedding structures appear as inserts in the linear form, and this is the reality that people will have to operate with.

As regards EIC, Hawkins (1994) observes that centre-embedded structures can be grammatical, but they tend to be less common than left or right embedding. His conclusion based on this is that grammaticality questions are not governed by a universal grammar, but emerge statistically from processing preferences which are explained as placing the IC nodes of the VP closely together so that the tree can be easily constructed – hypothetically speaking. It must be noted from the economy perspective that centre-embedding structures (clauses with inserts) are more complex than left or right embedding. When the subclause is centre-embedded, the sentence structure is  $A_1 B A_2$  with the main clause  $A$  divided into two parts. This is more complex than  $A B$  or  $B A$  which only contain two parts in all. Therefore the fact that centre-embedding is less frequent is expected anyway.

A second way to address centre-embedding is by an appeal to psycholinguistic research. Papagno & Cecchetto (2019) take centre-embedded relative clauses as a standard example of the type of

syntactically complex sentences that load on short-term memory. We believe that many of Hawkins's findings are more naturally explained through this concept (section 6.3 and 6.5).

The question is, could there be a model of sentence analysis that works on flat linear structure: on language itself? And if that is possible, can this same model make the same typological predictions as EIC? It would at least make a lot of sense to say that if grammarians stopped fantasising about things that are not there, and accepted standard scientific concepts such as the null hypothesis, there should be a more solid ground for making results in both typology and neurolinguistics.

### 6.3 A non-biological explanation

We welcome EIC as the best explanation of harmony so far (Song 2010), but have raised issues on its theoretical foundation (section 2, 4 and 6) and would prefer a non-biological explanation of word-order variation, for the lack of evidence for a biological cause of linguistic forms. We studied crosslinguistic data related to OV/VO with RelN/NRel and NPostp/PrepN (order of head noun and adposition) to reiterate that, while information structure does play a role in word order variation, it is unlikely to serve as a primary principle. We did not extend our own research to Japanese, for example, but observed that Japanese lacks relative pronouns and uses a special particle for topicalisation (Kim 2012). To what extent the findings from our research on information structure can be applied to Japanese and other OV languages will be the subject of a different study.

We moved on to examine grammars of different types of languages, case studies and mass comparisons to find a pattern that indeed provides a simpler explanation for word order harmonies. This examination is guided by knowledge from neurology (section 6.2). To start with a factual statement, the pattern we have uncovered is that people around the world tend to use language in a way that places adpositions and subordinators, or what we collectively call connectives, towards the element that is referred to by the phrase this connective belongs to.

We will make the case in the following subsections that this principle alone essentially gives the same predictions as EIC. The rest of this subsection will give some examples of what is meant by it and will continue to speculate on what the observed phenomenon might depend on. As was seen in our own research, the relative pronoun is a type of connective which is preferably placed immediately after its antecedent, making the two easy to associate. But prepositions are used in a similar way.

Like Hawkins, we will use English as a starting point. In the following two examples, the open pointy brackets mark the referential direction from the phrase to its antecedent.

- (10)           a.           A man <who wears glasses is sitting in the front row.  
              b.           A man <with glasses is sitting <in the front row.

In 10b, the restrictive prepositional phrase '*with glasses*' corresponds to the relative clause '*who wears glasses*' (10a). The second PP in 10ab corresponds to informing that *sitting* is an action which occurs in the front row. The difference between the prepositional and postpositional alignment can be illustrated with English possessives, namely the preposition *of*, and the genitive suffix 's which corresponds to postpositions in typological data (e.g. Dryer 1992).

- (11)           a.           the cousin <of the landlord <of a friend  
              b.           a friend's> landlord's> cousin

These two mirroring chains can be described as being semantically logical or coherent: changing the order would change the meaning. Adpositions are used to physically link concepts with one another in a way that makes sense from an objective perspective. The order could be different: a given language may apply the same meaning for a structure resembling '*of the cousin of the landlord friend*' or '*a friend landlord's cousin's*'. Such orderings, as long as they are consistent, could also be described as 'logical'; but having the particle pointing away from their antecedent is markedly less common in the overall data.

This is of course a kind of cognitive explanation, but it is social-psychological in nature rather than biological. There does not seem to be an a priori factor to turn languages this way. A view of language as a social construct is however well-suited for explaining directing connectives towards either pole. It can be thought that people find that it makes more sense this way. But the point made here is not that the choice between adposition type is typically available in a given language. Based on the economy principle, grammars are parsimonious, favouring one solution for one or many problems. Once the place of the connective is set, it will likely become immobile.

Having the choice between a separate preposition and postposition for each case would obviously be a complication. Alternatively, simply moving the one connective may not add enough clarity to be worth the trouble. Hypothetically, a purpose clause could move its connective depending on whether it is placed before or after the main clause, e.g. '*I like swimming because it's healthy*' does not become '*It's healthy because I like swimming*', as would be confusing nonetheless.

Moving adpositions might similarly cause as many problems as they solve, e.g., ambiguity in the sentence '*Mary saw a man in the park*' could not be avoided by saying, hypothetically, \*'*Mary saw the park in a man*' for making the point that it was the man who was in the park. Instead, the sentence structure offers possibilities for disambiguation as it is. In the last case the adjunct *in the park* can be moved sentence-initially to clarify that *Mary* was in the park. Either way, the result is not perfect, so full clarity can only be reached by adding contextual information, e.g. '*From her window, Mary saw a man who was standing in the park*', and so on.

It seems at any rate that English speakers avoid placing adjuncts between the verb and the object even though it could provide a useful disambiguation strategy. From the economy perspective, the explanation would be that the object is left unmarked because it is recognised from appearing in a set location in the sentence. The relative clause (cf. section 5) however seems to demand overriding this principle relatively frequently, at least in written language, e.g. '*Mary saw a man in the park which was closed at the time*' as opposed to '*Mary saw in the park a man who was standing around suspiciously*'.

A simple heaviness principle can also be acceptable from an economy principle. It is expected especially in written language that sentence parts are ordered in ways which are considered as easier to read and understand. This is however different from EIC which additionally assumes the reality of the generative parse tree as an integral part of the explanation.

In the data (Dryer 1992) the canonical place of the PP (i.e. adverbial) is located similarly to the direct object. English is a typical language in this respect. For a transitive verb, take e.g. '*The girl whistled **a tune***' with SVO; and for the intransitive, e.g. '*The dog lay **on the couch***', with S V PP. It is the canonical place of the object that determines the alignment of the connective, pointing from the PP towards the verb as in

(12) The dog lay <**on** the couch,

connecting the NP with its antecedent in a directed manner. This is frequently unproblematic because real-life clauses are frequently intransitive. In transitive clauses the PP is typically replaced with the object or pushed towards the periphery of the clause. What causes inconsistency in the visible pattern is the fact that the English object is unmarked; and zero-marked sentence parts are normally placed in a default position which for the English SVO means that the object immediately follows the verb.

It is either that the place of the connective is a consequence of the VO order, or the other way around. But once the alignment is determined, there will be few exceptions, even when relating to pre-verbal elements like the subject. Here, the referential direction is constantly leftward although not towards the verb:

(13) The sheep <**that** is <**in** front <**of** the cow <**that** is running (...)

This is because SVO is verb-medial, so the referential direction of the preposition cannot always be towards the verb. Same is true for clause-initial adverbials of time, place and manner. It is however possible in *verb-*

*final* languages that the postposition always points towards the verb. The following Turkish SOV sentence is the translation of the above English phrase.

- (14) Koş-an ineğ-in ön-ün-de-ki koyun  
 run-(y)An cow-GEN front-POSS3sg-dat-rel sheep (Özge, Marinis & Zeyrek 2010)

The referential structure of the Turkish phrase is

- (15) V Postp> N Postp> N Postp> N (...)

linking each content word to each other with a different connective. The predicate will appear at the end of the sentence. As Hajičová (1994) argued that patterns of information structure depend on the communicative strategy chosen by the speaker, we linked information structure with the relative pronoun (section 5) which we then identified as a type of connective. But the conventionalised use of other types of connectives, to which our definition includes the adposition, can also be the result of people's effort to successfully convey their message. Thus, language may be an intelligent design made by people. What it could be alternatively, no one knows, based on the lack of evidence for any other cause.

Word order is typically free or flexible for marked sentence parts, and since the PP is marked, there could be several possibilities to place it. The problem is however in recognising which sentence part the free element refers to. In principle, there is no logical difference between saying '*The man at the shop saw the president*' or '*The man saw the president at the shop*'. However, it seems that consensus in the speech community is typically reached when the connective points to its antecedent: The man <at the shop; saw <at the shop. Apparently the way the adposition is placed gives the hearer a clue of what it refers to. This is ideally as close to the antecedent as possible, which leads to a problem of ordering complex sentences with several candidates for the closest position.

In verb-final languages the pre-verbal place typically contains a postposition, referring to the verb, e.g. in Japanese:

- (16) hikoozyoo-wa hontooni yama-no naka-ni ari-masi-te  
 airport-TOP really mountain-GEN **inside-in** exist-PLT-and  
 'the airport is really in a mountainous area' (adapted from Nakagawa 2016: 100)

This pattern may also be useful for perception and processing. Consistency in the ordering of the adposition results in a symmetry which is highlighted below with a horizontal line in front of each postposition:

I ate spaghetti | with a friend | in a restaurant.

It is most common that connectives are placed around the centre of the sentence rather than into the periphery. This phenomenon is likely to be a by-product of the verb-directed alignment, but it would seem to work particularly well for differentiating between different sentence parts, and between sentences, with the clausal connective added. The corresponding Japanese (SOV) sentence is

- (17) Watasi-wa tomodati-to resutoran-de supagetii tabe-ta-yo  
 1SG-wa friend-with restaurant-LOC spaghetti eat-PAST-FP  
 (Nakagawa 2016: 78)

Here, the postpositions *wa*, *to* and *de* divide all four NPs. The structure with a horizontal line after each postposition is

I-NOM | friend-COM | restaurant-LOC | spaghetti eat-PAST-FP

or

N Postp> N Postp> N Postp> N V

it is also seen in Hawkins's examples that connectives are placed towards the boundary of the two clauses of a complex sentence, rather than sentence-initially or sentence-finally. Below is an example of an OV subclause:

- (18) [Kinoo John-ga kekkonsi-ta **to**] mary-ga it-ta  
Yesterday John-NOM got.married QUOTE Mary-NOM said  
'Mary said [**that** John got married yesterday].'  
(adapted from Hawkins 1994: 249)

It helps differentiate between the elements belonging to the two different clauses because the Japanese *to* connective is placed subclause-finally in the OV order. The English VO translation mirrors this with the connective *that* appearing subclause-initially. But this falls from the principle of aligning the adposition with the verb. It could seem obvious, which it is, but bear in mind that there is no logical reason why the subordinator cannot appear in any which location within the sentence, and there are truly all kinds of cases found in the overall crosslinguistic data (see e.g. Lehmann 1986).

While there would be thousands of examples and counterexamples to take for or against our proposed principle, we will present no further examples here due to space limitations; but some more will appear in the following subsections. The point is just that predictions made by EIC and our economy-based principle are so similar that, since our explanation is simpler, we will be able to claim the purported evidence for EIC as actually supporting ours. Based on Dryer (1992), Hawkins argues that the preference for the following VP structure is generalisable to VO languages, with increasing phrasal length:

VP NP PP CP

The VP structure in OV languages should be correspondingly

CP PP NP VP

which is probably not quite correct since the optional PP would appear to follow the object (NP). We however accept the mirroring order as being close enough to allow a meaningful comparison. But this is not because phrases must be packed as closely together as possible for an efficient parsing of the VP. The real reason is because the connectives implied in the above structure are aligned with the verb, thus giving clues of what their head elements refer to:

VP NP <Prep NP <Conj CP

and for OV:

CP Conj> NP Postp> NP VP

This means that the findings of Hawkins and his colleagues which rely on the VP (NP) structure alternatively support our observation concerning the alignment of the connective. It is a tie because one cannot decide who is right based on the above. We do however see that our principle is simpler because it does not postulate that the NP is 'in' the VP and it neither relies on intricate parsing dependencies that we are not sure really exist nor on various unsubstantiated biological causes. Functional explanation wins per Occam's razor.

We will end this subsection by elucidating predictions made by the economy principle for each canonical word order type.

| Word order | Alignment        | Order of N and Rel | Adposition type |
|------------|------------------|--------------------|-----------------|
| SOV        | CP> NP> PP> Verb | RelN               | postpositions   |
| SVO        | Verb <NP <PP <CP | NRel               | prepositions    |
| VSO        | Verb <NP <PP <CP | NRel               | prepositions    |
| VOS        | Verb <NP <PP <CP | NRel               | prepositions    |
| OVS        | CP> NP> PP> Verb | RelN               | postpositions   |
| OSV        | CP> NP> PP> Verb | RelN               | postpositions   |

*Table 3.* Predictions concerning canonical word order in crosslinguistic data by our economy explanation. Pointed brackets indicate adposition type, < for preposition and > for postposition. S = subject, O = object, V = verb. N = noun, Rel = relative clause. Predictions towards the bottom of some rare word order languages may be partly questionable but insignificant due to very limited data available (e.g. Dryer 2013b). As is customary, a difference is essentially only made between the OV/VO order disregarding the subject.

#### 6.4 North Eurasian as a special case

Before examining Hawkins's evidence, it will be helpful to first discuss some ambiguities in the data. Finnish is included in Hawkins's research as well as in ours (section 5), and we agree that its alignment of adpositions is atypical. Finnish has a canonical SVO order which assumes prepositions and NRel (relative clause after its antecedent, like in Japanese). It indeed has NRel, like English, but postpositions (e.g. Harris & Campbell 1995).

Finnish falls into a rare *Order C* in Hawkins's table of the order of the verb and PP (reproduced in section 6.6) and is thus considered an outlier. It has the [V [NP P]] order which is not predicted by EIC because the adposition (P), by which the immediate constituent is recognised, is placed away from the verb, thus purportedly causing inefficient processing of the parse tree, whether top-down or bottom-up. From the point of our economy explanation, on the other hand, the order

##### Verb Noun Postp<

is not predicted because the connective is placed away from the verb that it refers to. The connective is left to the periphery where it will also be less useful for distinguishing between sentence parts. We believe that information structure may play a role in explaining why this is so. Finnish and other languages of northern Eurasia have borrowed the relative pronoun from Russian and other Indo-European languages (Laakso 2011; Shagal 2016 and forthcoming). Proto-Finno-Ugric had SOV with postpositions and RelN and probably no relative pronouns, similarly to Japanese and Turkic.

There may be interaction between word order and the relative pronoun. Finnish word order is free in principle with a number of more specific rules. One is that the relative pronoun *joka* is placed immediately after its antecedent (with a comma in between; Hakulinen et al. 2004a). However, in our material we found only one case where the verb functioned as the antecedent for the relative clause, and for this reason we excluded the structure from our analysis altogether, focusing on the frequent case where the relative clause relates to the NP or PP immediately before it (section 5.2).

Because the relative pronoun must directly follow its antecedent, which is typically an NP or PP and not the verb, having relative pronouns necessarily pushes the verb away from a final position. We also linked relative clauses with the (GN) information structure. It is this type of interaction between syntax, semantics and pragmatics that is studied by functional sentence perspective and functional grammar.

This is another exemplification of differences between our systemic approach and the adaptational approach which rejects the concept of systemic function (Croft 1995: 493; see also Li & Thompson 1974) or what we might call systemic equilibrium. We would, for example, suggest that the SOV



word order is optimised with postpositions and RelN because this physically links phrases with connectives in a semantically consistent way. However, the introduction of the relative pronoun may have led to a chain reaction in the system through an avoidance of verb-final ordering. From the economy point, this can be explained as being due to avoiding unclarity when the relative pronoun refers to an argument across the verb. Take the following SOV main clause in Finnish with the verb and relative pronoun highlighted:

- (19) Mies varista talon pihalla **katseli, joka** oli huonossa kunnossa  
 Man crow-**OBJ** house-GEN garden-LOC **watch-PST which** was bad-IN shape-IN  
 ?

The more precise terms for OBJ (object) and LOC (locative), respectively, are partitive and adessive. As suggested above, word order in Finnish is in principle free, but the two points can be made that (i) prescriptive grammar does not recommend the above use of the relative pronoun which should immediately follow its antecedent, and that (ii) the SOV order in the main clause is less common than the corresponding SVO order. The issue from the economy perspective seems to be that it remains unclear in the above sentence who or what is described as being in a bad shape: *the man, the crow, the house or the garden*. This problem is however absent in the canonical SVO order:

- (20) Mies katseli talon pihalla **varista, joka** oli huonossa kunnossa.  
 Man watch-PST house-GEN garden-LOC **crow-**OBJ** which** was in a bad shape.  
 ‘The man was in the garden of the house, watching a crow that was in a bad shape.’

Word order can be shifted any which way to connect the desired sentence part with the relative clause. With the referential structure highlighted, the above sentence is analysed as

N V N **Postp**> N **Postp**< N **Postp**< <**Conj** V Adj **Postp**< N **Postp**<

The first postposition is directed rightward and others leftward; the clausal boundary is double marked, and the last postposition appears clause-finally. We understand this as being a mixed ordering that may have been caused by a shift from SOV to SVO. The relative pronoun supports an SVO order with flexibility to change the order to subject-final, like in Czech, or to agent-final, as in English and Swedish (section 5.3). Based on the notion that crosslinguistic data suggests that patterns of the above kind are disfavoured, there could be now functional pressure for Finnish to convert to a prepositional language.

This is however not fully clear for reasons which will be important for the following subsection. Prototypical Eurasian relativisation with SOV&RelN does mirror the English SVO&NRel ordering to an extent, but the relativising system is essentially so different that it is a matter of debate whether they both represent relativisation in the first place. To exemplify this problem in the typological data, Finnish is taken to represent VO&NRel while Turkish has OV&RelN, which should make the two completely different. To exemplify, take the following two Turkish (SOV) examples of subject relativisation:

- (21) [kitab-ı al-an] öğrenci  
 book-ACC buy-PTCP student  
 ‘the student who bought the book’
- (22) [öğrenci-nin al-dığ-ı] kitap  
 student-GEN buy-NMLZ-3SG book  
 ‘the book which the student bought’ (Comrie & Kuteva 2013)

Nonetheless, these are translated into Finnish as follows:

- (23) kirjan ostanut opiskelija  
 book-ACC buy-PTCP student

‘the student who bought the book’

- (24) opiskelijan ostama kirja  
student-GEN buy-NMLZ book  
‘the book which the student bought’

The ACC (accusative) above is more precisely a genitive form, and the NMLZ (nominalisation) is a possible interpretation although the *-ma* ending is in this case normally analysed as another type of participle (PTCP: passive vs agentive). Finnish does indeed relativise like Turkish and many other SOV languages. Examples such as the ones above are considered as participial phrases and not as relative clauses in Finnish grammar (Hakulinen et al. 2004b). They are not irregular at all. In fact, Shagal (2015) found in her pilot study that ReIN is considered as preferable by Finnish speakers across age groups. But prenominal relativisation supports a postpositional system. An analysis of the above phrases with connective structure highlighted is

**N Postp> V Conj> N**

which is regular. Also, notice that this type of phrases are frequently longer, e.g.

- (25) opiskelijan Tallinnasta keväällä ostama kirja  
student-GEN Tallinn-ELAT spring-ADE buy-PTCP book  
‘the book which the student bought in Tallinn in the spring’

is highlighted as

**N Postp> N Postp> N Postp> V Conj> N**

Of course, Finnish grammar does not consider the participial suffix as a conjunction, but this way it works in accordance with the corresponding typological generalisations. Matsumura (1982) suggests that Finnish has a dual system of relativisation, and we would obviously suggest that this could be a consequence of a shift from the Eurasian SOV type to SVO due to Western influence whereby the language adopted a new way of relativisation while also sustaining the old one. But the old system is now considered as participial if not downright adjectival (cf. Hakulinen & Karlsson 1979: 373). Following such logic could lead to the conjecture that Turkic relativisation, then, may more precisely be described as adjectival. Alternatively, one could conjecture that all relative clauses are adjectival anyway, as implied by Dryer (2013b).

Our conclusion at this point is not that a complete reanalysis must be performed in typology, but it should be noted that the difference between relative clauses and participial phrases is not completely clear, as will become important to bear in mind below. Matsumura bases his analysis on Keenan & Comrie (1977) and Downing (1978) who showed that relative clauses, *when defined semantically*, are found under different syntactic guises in practically all languages.

But is it then so that English participles could also be analysed as relative clauses? A flying squirrel is a squirrel which flies. SOV&ReIN languages can pack much more information before the head noun, but there are English participles that entail arguments such as the object, e.g. *peace-loving* as in the phrase ‘*a calm peace-loving person*’. In such analysis we are looking at an embedded relative clause within the NP, with the full structure Det Adj [Obj V Conj] N and with the *-ing* suffix functioning as the postpositional relative subordinator. This corresponds to Hawkins’s inefficient and rare *Structure J* in table 4 below. The phrase ‘*a peace-loving young person*’, on the other hand, corresponds to Hawkins’s efficient *Structure D* which is found in Turkish. We will come back to this question in section 6.6.

## 6.5 Discussing psycholinguistic evidence for EIC



These examples make it possible for us to suggest that the preference actually concerns the placement of connectives which is towards the phrase they refer to. Placing the connective *that* (26b) to the boundary of the two clauses also helps the hearer link each phrase with the right verb.

In the typological data of Schmidtke-Bode (2009: 80; an unbiased comparison of purposive clauses), 59 out of 61 languages placed their subordinate conjunction either clause-initially or clause-finally. Conjunctions were most commonly found in VO languages, and there was a strong preference to place them in the clause-initial position. Thereby they are expected to function frequently as bi-clausal connectives, as in Hawkins’s (upper) example above. We take this as supporting our economy explanation. Our own research (section 5.3) additionally found that moving the connective from this place may result in increased syntactic ambiguity.

Regarding languages that use a subordinating affix rather than a subordinating conjunction, most typically OV languages, 76 out of 96 use the affix as a connective between the subclause and the main clause. In 74 of the cases it appears subclause-finally. As for languages using adpositions as subordinators, 33 out of 39 use it as a connective between the sentences, either as a clause-final postposition (subclause-to-main clause) or as a clause-initial preposition (main clause-to-subclause; Schmidtke-Bode 2009: 79–80).

Thus, our explanation for the preference of (b) over (a) in case 26 and 27 above is that connectives are more often placed at the intersection, directed towards the phrase they refer to because this helps the hearer associate the content words with the right sentence part. Our notion is supported by Hawkins’s material, see table 3 below. *Order A* languages, like English, place the preposition to the clausal intersection rather than the right periphery while *Order B* languages, like Japanese, place the postposition to the clausal intersection rather than the left periphery. These orders are deemed as *efficient* by Hawkins. Looking for less efficient languages, we find Finnish in *Order C* and Chinese in *Order D* (cf. Hawkins 1994: 281).

| Order        |     | Percentage |
|--------------|-----|------------|
| A [V [P NP]] | 161 | 41.4%      |
| B [[NP P] V] | 204 | 52.4%      |
| C [V [NP P]] | 18  | 4.6%       |
| D [[P NP] V] | 6   | 1.5%       |
| Total        | 389 |            |

*Table 3.* Grammaticalised  $VP\{V_{PP}\{P\ NP\}\}$  orders (Hawkins 1994: 255–257, based on his personal communication with Dryer); crosslinguistic positioning of a verb and object within VP, and the order of adposition and noun within the prepositional phrase. In the data, DO and PP are assumed to occupy the same position relative to the verb. In Dryer (1992), most VO languages (98.3%) fall within Order A while most OV languages (87.5%) fall within Order B.

As regards Finnish and similar Eurasian cases in Order C, we have discussed this somewhat unexpected feature in section 6.4 and suggested that it may have been caused by a change in the system due to a relatively recent borrowing. These languages now show a great flexibility in relativisation, but it is unknown how this affects processing efficiency.

In order D, Mandarin Chinese typically places prepositional adjuncts before the head verb, and for this reason it falls into a rare “inefficient” class.

- (28) Lao Li zai chufangli gen tamen yong daozi kai guantou.  
 Lao Li at kitchen-in with them with knife open [tin] can  
 ‘Lao Li opened a can in the kitchen with them with a knife.’ (Ernst 2014: 55)

The irregularity according to our economy explanation depends on the adpositions being placed away from the verb. It is either expected that pre-verbal PPs are postpositional, or that the prepositional PPs in the

above sentence follow the verb. According to EIC, this is because they are ‘in’ the VP, but according to our economy explanation, connectives tend to be directed towards their antecedent which here is the verb. We have argued that conventions of language use are established according to a consensus within the speech community, and that to understand differences between languages requires a systemic analysis.

Hawkins suggests that Chinese speakers have to tolerate processing difficulty due to the nature of their language, and claims that his theory is supported by psycholinguistic research. We however could not identify any such research in the cited literature (section 6.5). Conversely, we would consider it a possibility that the ordering might actually promote efficient parsing and perception. Here, the particles divide the sentence structure neatly in a symmetric way with each noun separated either by a preposition or a verb:

N |Prep N |Prep N |Prep N {V} N

The question is whether the prepositions in the Mandarin sentence really are prepositions in the Latin sense, or whether the structure we see is more like a series of verbal phrases with each noun following the subject functioning like a kind of object. As Li & Thompson (1974b) state in their article *Co-verbs in Mandarin Chinese: verbs or prepositions?*:

‘Co-Verbs’ in Mandarin occur in the position

Subject \_\_\_\_\_ NP V (NP)

They are semantically like prepositions, but many of them are homophonous with verbs. [...] there is evident similarity of certain co-verbs to verbs being due to the historical evolution of the present-day co-verbs from earlier verbs, the semantics arguments in favor of regarding co-verbs as prepositions are compelling. These arguments include the fact that co-verbs have prepositional meanings, and that sentences containing co-verbs are not two-clause sentences. (Li & Thompson 1974b: 257.)

The etymology of the above Mandarin sentence could suggest a degree of similarity to saying in English something like ‘*Li Lao attended kitchen joining them using knife (to) open the can*’. The Chinese serial verb construction seems to advance quite coherently from left to right, linking the NPs with the subject. If co-verbs are grammaticalised as proper prepositions, it would seem to predict that they will gradually become post-verbal. Of course, the interesting question from a generative point is merely how to put the construction into a VP, and this, again, seems to be the problem motivating the inefficiency claim.

As regards relativisation, Hawkins’s (1994: 272, table 5.8) analysis of a large number of languages seems to suggest that EIC makes slightly more accurate predictions than our model. The obvious problem here is that a great majority of the languages fall into *Structure ABCD* as predicted by EIC and economy alike, and the rest concerns a very limited amount of data. Thus the quick and easy way to refute Hawkins’s analysis is simply to point to minute significance of the findings.

| Structure       | EIC efficiency | Attested language numbers                |
|-----------------|----------------|--|
| A [N Adj [C S]] | 100%           | Extensive, e.g. Romance, Arabic, Ewe     |
| B [Adj N [C S]] | 100%           | Extensive, e.g. Germanic, Greek, Finnish |
| C [[S C] N Adj] | 100%           | Extensive, e.g. Basque, Burmese          |
| D [[S C] Adj N] | 100%           | Extensive, e.g. Telugu, Turkish, Lahu    |
| E [[S C] Adj N] | 83%            | Attested, e.g. Lushei, Dyirbal           |
| F [Adj N [S C]] | 83%            | Attested, e.g. Yaqui, Hurrian            |
| G [N [C S] Adj] | 63%            | None                                     |
| H [Adj [C S] N] | 63%            | None                                     |
| I [N [S C] Adj] | 63%            | None                                     |

|                 |     |                                 |
|-----------------|-----|---------------------------------|
| J [Adj [S C] N] | 63% | Marked variant in Lahu, Chinese |
| K [[C S] N Adj] | 38% | None                            |
| L [[C S] Adj N] | 38% | None                            |

Table 4. The twelve logically possible ways of ordering a relative clause ([C S] or [S C] within an NP. 'EIC efficiency' is titled *L-to-R IC-to-word ratio (aggregates)* in the original (Hawkins 1994: 272).

However, we would indeed like to elaborate why IC-to-word ratios may appear to be a potentially useful concept for analysing relativisation patterns although, in reality, they are most likely irrelevant. In table 4, we see that most languages fall into structures with 100 % efficiency according to EIC. The rest can be divided into three groups: *Structures EF* with 83 % efficiency and some examples; *Structures GHJ* with 63 % efficiency and some non-dominant examples in *J* only; and *Structures KL* with 38 % and no examples found at all.

To begin with, a persistent question throughout the work on EIC relates to the concept of centre-embedding, as discussed in section 6.2. It must be noted from the economy perspective that centre-embedding structures are more complex than left or right-embedding ones. When the subclause is centre-embedded, e.g. \*'Big, that stands on the hill, house', the sentence structure is  $A_1 (B) A_2$  with the main clause *A* divided into two parts. This is more complex than  $A [B]$  or  $[B] A$ . Hawkins has successfully demonstrated that while centre-embedding is in many cases grammatical, it is statistically less frequent. This is however expected from a scientific point in any case, so the rarity of the purported 63 % efficient group (GHJ) is more simply explained by having more complexity and load on memory. We believe that many of Hawkins's findings are more naturally explained through this concept.

Regarding *Structure J* with some non-dominant examples, on the other hand, it was suggested in section 6.4 that this particular structure may correspond to the English order '(a) calm peace-loving person'. This is only depends on what is meant with 'relative clause'. To sum up, we neither consider the absence of *Structure G, H* and *I* nor the limited presence of *J* in the cited data as specifically supporting EIC.

This leaves us with the question why *Structures EF* (83 % efficiency) are attested while *Structures KL* (38 % efficiency) are not. Starting from *EF*, the languages cited by Hawkins are SOV languages whereby we are looking at large overall data. As Dryer suggests,

relative clauses resemble adjectives in terms of their relationship to the nouns they modify, as reflected by the fact that relative clauses are often referred to as *adjective clauses*. (Dryer 2013b; italics in the original.)

in section 6.4 we linked the adjectival concept of relativisation especially with Eurasian SOV languages. But the place of the adjective does not have a strong link to the order of object and verb (Dryer 2013e). Therefore it is not highly surprising if some languages organise their participial or adjectival relative phrases in any which order. We consider Hawkins's findings, that *EF* are attested in the cited data, as expected.

This only leaves us needing to understand why *Structures KL* are not attested at all. These two mirror *Structures EF*, so they should be expected to be equally rare or common in the data of *VO languages* – unless one assumes EIC. This gives us an opportunity to take a little time to demonstrate the advantages of a systemic approach to typology which means investigating how structures work in relation to one another.

*L* implies a structure corresponding to 'who loves peace young person' for 'a person who loves peace'. To put this into a context, consider the sentence 'John is a young man who loves peace' which has the structure SVO[SVO]. The corresponding sentence along the *L* pattern would be 'John is who loves peace a young man' with the structure SV[SVO]O. It is necessarily centre-embedding and therefore more complex, anticipating a lower frequency by default.

Of course, all languages do not have relative pronouns, and some have relative particles. In a language that has relative particles, *Structure L* is rendered as 'REL loves peace young man' with the VOS

order; or '*REL peace loves young man*' with OVS. Now, it might simply be the case that we are running out of material because these are both rare canonical word orders, and only a minority of languages relativise with a relative particle anyway, according to Dryer (2013d).

All in all, it is impossible to conclude that the absence of KL in the data must be anyhow related to the purported IC-to-word ratio. Instead, what we do see in the prevalent Structures ABCD is that the relativiser typically functions as a connective in an economic way that helps link sentence parts with the corresponding semantic map. 'Economic' implies that words with a semantic function are often given an additional task of giving the hearer syntactic clues through the means of word order alone, rather than employing specific syntactic particles for the task. This gives a simpler, sufficient explanation for Hawkins's observations, making EIC redundant.

Of course, we could be mistaken; maybe the findings in Table 4 are significant after all, as strongly argued by Song (2010) who believes it is precisely these small findings that makes EIC the cutting edge in typology. His conclusion is that

Most word order studies have of late revealed a strong inclination towards processing as a major avenue of explanation. Future word order typology—along the lines of Hawkins (1994, 2004)—will increasingly be processing-based [...] This truly is the hallmark of an evolving scientific endeavour. (Song 2010: 278—279.)

But one should not jump into such conclusions before asking what it is that Hawkins has actually proved. EIC is based on the idea that the SVO verb phrase VP [NP PP CP] is mirrored by SOV languages with [CP PP NP] VP. Hawkins does not substantiate the ordering, but we suspect the PP should actually follow the NP in SOV languages. This would require the PP to be shorter than the object in order for EIC to work. According to EIC, information structure is irrelevant, but we believe that if the CP is a relative clause, it should be placed before/after its antecedent whereby it is either the CP or the NP/PP that will have to move. If correct, these questions would suffice to sink the model while the economy explanation remains unaffected.

The starting point of EIC was to focus on the VP, ignoring the subject, but Hawkins cannot resist the temptation to make a full explanatory model for the order of subject, object and verb. This is supposed to work based on his findings that the subject in SOV languages is actually longer than the object (Hawkins 1994: 334). Although we have already learned that the new-versus-given ordering does not play a role in word order, it is now claimed that

SOV languages should exhibit more new-before-given scores, correlating with long before short. Hence, subjects should be more given and definite in SVO languages, less so in SOV languages. (Hawkins 1994: 334.)

The subject—object word ratio is set to 3:2 in order for EIC to work, but Hawkins does not show us how this would actually look like. To take an SVO sentence, e.g. '*Mary saw a man from her window*', one would expect the subject of the next sentence rather likely to be *she* (Mary), *he* (the man) or even *it* (the window). But SOV languages, according to Hawkins's explanation, will instead pack a lot of new information to the subject, apparently leaving the above given candidates to the object. The reader is left wondering how such discourse might actually work.

But the biggest question mark hangs over Hawkins's concept of processing efficiency itself. It is claimed that parse trees that mix left and right branching are avoided because they cause people processing difficulty. Languages however have exceptions, and English for instance has some postpositions, too. While EIC and economy agree that this causes some irregularity in the patterning, EIC goes further by claiming that such structures are more difficult to parse. The claim is then, that English speakers have no problem parsing '*We will visit London in three weeks*', but will have difficulty with '*We visited London three weeks ago*.' Is this true?

If EIC truly is interesting, it should come back when the necessary evidence can be presented. Until then, claims of its relevance for language sciences do not seem justified anyhow, and the

sole purpose of EIC appears to be in joining all sociobiological forces together in order to survive in the academia in spite of a total lack of scientific basis.

## 7 Conclusion

We scrutinised Hawkins's explanation of word-order harmonies in crosslinguistic data, namely the EIC principle (Early Immediate Constituents; or MiD for Minimize Domains in Hawkins 2014). Our first concern was that, unlike Hawkins claims, his explanation mode does not seem to be functional although it does represent an adaptive or adaptational explanation of some kind. We linked this issue with an apparent flaw in Darwinian evolutionary theory where the same explanation mode either works for nature or culture, but not for both. We asked Hawkins for a clarification concerning his claim of advocating functional explanation with reference to standard literature on the subject.

We linked EIC with two sociobiological theories of language. One is generative innatism which suggests that the VP (NP) structure is genetically encoded. We found no evidence for this stipulation, but observed that EIC as well, like generative grammar, depends on it being a representation of cognitive reality. Based on the literature, we concluded that this idea is not supported by evidence.

The second sociobiological theory is CAS or language as a Complex Adaptive System which we further linked with memetics. CAS is a theory of the natural selection of so-called cultural replicators, similar to what Dawkins calls "mind-viruses". We could not identify any research validating language as a CAS and regretted the absence of the concept of null hypothesis in sociobiological linguistics. As the innatism claim was proven false, it should have been acknowledged that the null hypothesis, that the speech community creates its language, *is confirmed*. Instead, Hawkins patched the failed innatism hypothesis with another questionable claim, CAS, suggesting that language is a quasi-biological organism or a population of organisms that adapts to the already-refuted VP (NP) structure.

Nonetheless, EIC was successful as an explanation of word-order variation because it provided a common framework for English (VO) and Japanese (OV). Generalisations made on this basis were subsequently extended to large crosslinguistic data. We however identified asymmetries in the way VO and OV languages were analysed, suspecting that Hawkins's findings could depend on a different cause.

To properly address Hawkins's question why functional grammar is 'functional', we carried out an analysis of the information structure of Czech, English, Finnish and Swedish text, and an experiment on the last three. Our findings linked functional sentence perspective and the functional economy principle with the place of the relative pronoun whose primary function was observed to be connective. We then studied connective architecture crosslinguistically uncovering a pattern which provided a simpler explanation for observations made by Hawkins and his colleagues.

The real cause of word-order harmonies depends on the necessarily linear structure of language which demands an initially arbitrary choice of placing a linguistic element either to the left or to the right of its so-called head. In the language system, this arbitrary stipulation is systematised to make it possible for the speaker and hearer to associate the elements the same way. It then leads to further consequences relating to word order. There does not seem to be a perfect solution to the problem of conveying nonlinear meaning in linear form, but exceptions aside, this preference is shown to be very strong in crosslinguistic data of canonical word order.

It is especially connectives that are statistically placed to the boundary of the phrase and directed towards what the phrase containing them refers to, whether leftward in VO languages or rightward in OV languages. We compared EIC and our own economy explanation concluding that EIC is redundant because economy gives near-identical predictions with fewer principles. We found that a functional sentence perspective and the economy principle remain integral for explaining how language works, and endorse a systemic view of language for future research. The concept of rational explanation is important to understanding that languages are the intelligent functional creation of their speech communities even though language construction may largely occur unconsciously.

As all evidence in theoretical linguistics, our findings support the null hypothesis that language is the intelligent design of the speech community. While there remains the possibility that only



biological matters can explain a small percentage of linguistic structures, linguists are yet to learn what such structures might be and where the evidence is available for everyone to be seen.

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