Deep structure or emergence theory: contrasting theoretical foundations for information systems development

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Abstract. The linguistic conceptual distinction between deep and surface structures offers an interesting metaphor for developing new theories of information systems. However, the deep structure notion is both richer and more strongly contested in the linguistic field than can be communicated in published articles about new theories of information systems. This article explores the deep structure notion more fully, how faithful information system (IS)-related articles adhere to the original concept and the implication of alternative linguistic theories for the IS field.

Keywords: Information systems analysis and design, method, methodology, universal grammar, semantics, discourse

INTRODUCTION AND MOTIVATION

The formalist school of information systems (IS) design finds useful support from various language theories (Coyne, 1995). Several articles that have appeared in the IS literature borrow the concept of ‘deep structure’ from linguistics (e.g. Vermeir & Nijssen, 1982; Leifer et al., 1994; Wand & Weber, 1995; Thow-Yick, 1996). Typically, they characterize deep structures as rules by which surface structures are determined, and surface structures define observed behaviour of human language systems. This concept is attributed to pioneering work by linguist Noam Chomsky, and holds an intuitive appeal for helping us to understand how human beings develop systemic structures in the communication of knowledge and information. However, this simple characterization does not accurately capture Chomsky’s rather well-developed ideas in this area.

Importing such theoretical constructs from one discipline to another is intellectually stimulating and inherently healthy for expanding both the generality of the construct and the understanding within the receiving discipline. IS examples include borrowing the culture construct from anthropology (Avison & Myers, 1995) and the creativity construct from architecture (Lee, 1991). However, when such constructs are first borrowed, they must be abbreviated extensively as it is problematic to import an entire, fully developed paradigm at once. Such is the case with deep structure. The field of IS is not unique in borrowing, and then loosely redefining, the deep structure
concept from structural linguistics. This concept has inspired other academic communities to examine their obsession with surface structures, perhaps as a healthy struggle against the impact of unbridled or shallow empiricism. But, as discussed in the following sections, the concept has facets and implications that are missed because it was only partially imported from its reference discipline. In fact, these partial adaptations have been so popular, yet so disloyal to Chomsky’s original concepts, that Chomsky himself has abandoned the term ‘deep structure’ altogether: he ‘stopped using the term because it led to too much misinterpretation’. (Chomsky, 1986, p. 64, n8). He substituted the acronyms ‘D-structures’ and ‘S-structures’ to distinguish his well-delineated linguistic concepts from the various intellectual metamorphs.

The concept has only been borrowed from linguistics as a metaphor or analogy to help guide our understanding of IS development (ISD) in human organizations. Accepting this partial loan misses the fact that it is only part of a wider paradigm of structural linguistics, and that structural linguistics is only part of a wider debate about the development of human language. Initiating a debate over the use of the term deep structure in ISD without expanding our perspective of deep structure in linguistics (to include the broader paradigm and debate), we miss the rich results that the full paradigm might contribute to our understanding of IS. For that reason the purpose of this paper is to explain the meaning of deep structure as used in linguistics and identify how the notion is controversial in its own home discipline and then draw out more of the implications of the full linguistics debate for the IS discipline. This requires introducing an opposing argument, that of emergent grammar from linguistics.

This paper introduces interpretations of both structural and emergent IS that parallel the opposing positions of structural and emergent linguistics theories. After the first section, the Introduction, these interpretations and parallels are developed in six sections. The second section discusses examples of IS-related research that borrows the deep structure concept from linguistics. In the third section, we describe the basic issues in structural linguistics and in the fourth section how the linguistic field has evolved beyond these ideas. The fifth section then details the relationship (the ‘fidelity’) between the IS concept of deep structure and the linguistic concept. The sixth section moves beyond this description to suggest the implications for IS found in post-structural linguistics. To help the reader follow our arguments, Table 1 provides an issues map of the key ideas found in each section.

In this paper, we will be using the term ‘emergent’ as derived from Paul Hopper’s concept of emergent grammar (Hopper, 1987; 1993). This emergent concept shares some similarities with, yet can be distinguished from, the various systems science concepts of emergence. Systems science frames emergence within theories of evolution, catastrophe and autopoiesis (or self-referential) social systems (Jantsch, 1980; von Foerster, 1984; Malik & Probst, 1984; Ulrich, 1984; Geyer & van Der Zouwen, 1986).

The similarities with autopoiesis and self-reference are strongest. In much of this literature, the means of organizational self-making, self-continuance or autopoiesis is via the use of language and through the acts of communication. The process ‘is not obliged to follow the rules of logic. It can contradict itself. The system which uses this technique does not finish its autopoiesis and does not come to an end; it reorganizes itself as conflict to save its autopoiesis’ (Luhmann, 1986, p. 185). Emergence is a recursive and never-ending process of social organizations.
The linguistic view of emergence, as used in this paper, does embody two important distinctions from the systems science context. First, linguistic emergence assumes that unexpected behaviour entails no underlying structure, no matter how deeply embedded, that might be expressed as a set of structural equations in system simulations. Second, emergence does not entail any equilibrium-seeking behaviour or any ideal of progress. The focus of an emergent grammar is truly local, temporally anchored in the exchange of the moment, and interaction oriented with little regard for, or awareness of, how it may advance the language system.

DEEP STRUCTURE AS A CONCEPT USED IN INFORMATION SYSTEMS AND ORGANIZATIONAL THEORY

The deep structure view evolves from a recognition that systems analysts have problems discovering the essential requirements for IS. This view holds that there are multiple levels of structures that confound the work of systems analysts and designers. For some theorists, the
notion of a ‘deep structure’ enables a more powerful understanding of the relationship between ISD and the organization (e.g. Leifer et al., 1994; Wand & Weber, 1995). For some organizational theorists deep structures, as recursive applications of rules, help explain the nature of the organizational change process (e.g. Drazin & Sandelands, 1992). This understanding furthers the ability of the IS developer to ‘get the requirements right’.

**Deep structure of information systems**

Wand and Weber (1995) develop a theory of deep structure of IS that distinguishes three sets of characteristics. The first set regards the ‘surface structure’ as the interface between the information system and its users’ organizational environment. An example of surface structure is the format of a report. The second set, or ‘deep structure’, embodies the meaning of the real-world system that the information system is intended to model. This structure is assumed to be encoded in a system of professional codes of rules governing the practice, and the presentation, accounting information. An example is the set of accounting system rules that dictate how transactions must be posted to ledgers reflecting the deep structure of an accounting information system. The third set, or ‘physical structure’, refers to the technologies used to implement an information system such as the communications protocol chosen for handling message transmission. Wand and Weber motivate their models in three ways. First, they claim that deep structure characteristics help to more correctly embed the meaning of a real world system in its requirements. Second, changing social circumstances and technology tend to drive changes in the surface and physical structure, whereas good deep structure properties tend to provide inherent stability and endure through surface and physical structure changes. Third, research has focused on surface structures and neglected deep structures.

Wand and Weber apply deep structure theory by developing several formal models that analyse only the deep structure of IS. Working from the assumption that the information system is a physical-symbol system capable of representing real-world meaning, they propose a ‘representational model’ (scripts generated by grammars), a ‘state-tracking model’ (maps real world events to requisite system state changes), and a ‘good-decomposition model’ (a minimal set of state variables, losslessly reflecting the well-specified internal and external events). They demonstrate how these models can be applied to evaluate IS analysis ‘grammars’ by evaluating entity relationship diagrams. By ‘grammars’, they refer to ‘the sets of rules used to generate scripts that describe information systems’ (Wand & Weber, 1995, p. 204). These diagrams are shown to be inadequate in capturing deep structure.

**Deep structure of user requirements**

Leifer et al. (1994) focus more narrowly on the first of Wand and Weber’s motivations: the need to better capture requirements. They contend that a class of knowledge escapes systems designers because current methodologies are not designed to elicit it. Exploring the ‘deep structure’ of organizational members’ language will reveal their implicit meanings. These
meanings include values, beliefs and norms that are critical to effective organizational and IS. Misunderstandings develop between users and information system analysts because of miscommunication when surface structures are accepted without consideration of the deep structures in the two separate cultural languages.

This particular view of deep structure and surface structure is aligned with theories in use and espoused theories, meaning that the formal rules and supervisory direction depend on the subtle, unobtrusive controls of jargon, norms and beliefs. IS designers who capture only the ‘surface’ formal rules are basing their work on a limited, ineffective understanding of the organization.

Leifer et al. apply deep structure theory by analysing knowledge types and task characteristics. They associate surface structure with ‘how’ IS activities are completed, and recommend traditional interviewing, observation or questionnaire techniques. They associate deep structure with ‘why’ activities are completed, and recommend less traditional ‘understanding’ techniques for eliciting requirements, such as sociotechnical approaches, soft system methodology, cognitive mapping or organizational learning.

Deep structure and organizing

Drazin and Sandelands (1992) present a theory of organizational autogenesis (in contrast to endogenesis and exogenesis) in the context of three different types of structure the authors term deep structure, elemental structure and observed structure. These layers or levels of structure may be seen to be derived from Chomsky’s work; a point particularly evident when they refer to notions of generative grammar or rules as the means of describing deep structure and using those rules to explain the process of organizing. The work focuses on how we study the organizations in process, that is the organization in the process of organizing.

This theory proposes that structure is produced by the development and the application of rules described by a three layer architecture of structure. These structural layers are (1) deep structure consisting of rules that generate and govern individual behaviour and interactions; (2) elemental structure, consisting of interactions among individual actors; and (3) observed structure, comprising the categories and terms that apply to the perceptions of social interaction as collectives by observers. This three-level architecture operates at a different level of abstraction than we find in structural linguistics. According to this organizational architecture, the interplay of rules generates observable patterns of interaction that make up the organizing process.

As Chomsky’s work is cited a as point of reference for each of the aforementioned works, we examine Chomsky’s view of language, structure, levels, rules and deep structure differences further in the following section.

SURVEY OF STRUCTURAL LINGUISTICS

What is the nature of the native concept ‘deep structure’?
Language is a set of lexical entities and rules

The works summarized above correctly credit Chomsky (1965; 1969; 1972; 1980a, b) as the origin of the concept of deep structure. In Chomsky’s view, a grammar is an object constructed by linguists and is a description (or theory) of a language. He describes a generative grammar as a set of lexical entities and a set of rules. This rule set is used to define a set of further abstractions called a grammar. Language is a set of rules . . . that define a set of rules . . . that define a set of rules, and so on. But for Chomsky, rules do not recurse infinitely and do not cover all potential actions. Rather, they ‘. . . are rules that form or constitute a language, like Articles of the Constitution or rules of chess’. (Chomsky, 1986, p. 27) A key goal has involved the search for a set of principles, conditions and rules that are common to all human language. This essential rule set is called Universal Grammar, and is closely related to an assumption that a basic linguistic competence is inherited biologically by humans.

Linguistic structure exists in several forms

Chomsky imagined several kinds of structures that affect human grammars. These structures are distinguished from the observed forms of the language, but embody the rules by which the observed forms are derived. The surface structures form the grammar that directly determine the observed forms. However, these surface structures are themselves derived from deep structures or abstract, underlying grammatical principles. The set of rules by which deep structures are mapped onto surface structures are called transformational rules, or a transformational grammar. The deep structures are themselves determined by an even more fundamental set of rules, phrase structure rules, that have only simple categories, but generate the deep structures (Chomsky, 1986, p. 64). Underlying all of this is a basic biological linguistic competence that somehow embodies a core, and essential Universal Grammar (UG):

‘UG may be regarded as a characterization of the genetically determined language facility. One may think of this facility as a “language acquisition device”, an innate component of the human mind that yields a particular language through interaction with presented experience, a device that converts experience into a system of knowledge attained: knowledge of one or another language.’ (Chomsky, 1986, p. 3)

In their original linguistic context, both deep structure and surface structure are complex, rule-determined intermediary constructions, arising in the combination of genetic facilities and experience, that chain together to further determine how humans came to have language. But how closely do the ISD theories that adopt the concept of ‘deep structures’ mirror their linguistic sources?

Language structures exist in the mind of the user

Modern structural linguistics may be traced to Saussure (1959), who saw language as abstract structures or relations governing speech (Grisham, 1991). Language and speech were con-
sidered separate entities. The Saussurian structuralist conceives of a language as a set of rules and lexical entities that define a set of abstractions called grammar; language is described through a set of rules. These ideas have been extended by Chomsky and his followers. They still see language as a fixed inventory of reproducible categories and the rules by which those categories are created and applied but with an important different wrinkle. For the Chomskyan linguist the structure is in the language user’s mind and not externally derived. To find the structure of language one needs to look into the mind of the prototypical language user and understand the structural components that allow language use.

**Competence matters performance does not**

There is a common misunderstanding among the casual users of these terms that the difference between surface structure and deep structure is the difference between what you ‘say’ and what you ‘think’. In fact, deep structure and surface structure are part of the same model. This model characterizes the difference between competence and performance. Chomskyan linguists assume that humans possess an innate set of pre-existing mental structures that enable them to possess and use language. These ‘deep structures’ are a class of abstract underlying linguistic principles or structures that are called linguistic knowledge or linguistic competence. Rules link a deep structure to a less deep structure until the surface, e.g. the performance of language, is reached. The surface is the point at which no more rules apply. Surfaces structures are deduced on the basis of a hypothetically derived set of rules arising from the underlying innate principles of linguistic knowledge. It is important to note that these linguists believe that ‘deep structure’ is not directly observable. To the extent that it is identifiable at all, it is disclosed through iterative analysis of other structures that are inferred to have been derived from the deep structure. This view is mentalistic and holds that language consists of a set of abstractions studied as principles, rules and a generative grammar.

To understand the critical importance of competence over performance, consider the techniques used by structural linguists to derive these rules and disclose these principles. This is carried out by taking examples of grammatical and non-grammatical sentences and subjecting them to ‘intuition’, which in Chomskyan terms is equivalent to introspection. Features of the grammar are discovered by the linguist by creating statements that other competent native speakers judge to be grammatical or ungrammatical. The linguist then infers rules backwards from sets of such correct and incorrect statements. By studying those judged ‘non-grammatical’ and comparing them against those judged to be ‘grammatical’ the linguist extracts a rule about a grammar in particular language. For example, take two expressions, ‘Did John arrive today?’ and, ‘Arrived John today?’ One is recognized in a given language to be grammatically correct and the other inadmissible. From the difference we may derive a rule about the relationship of verbs and noun phrases that may be further tested in other pairs of sentences. The process continues until the point where the linguist is able to assemble a complete set of hypotheses about language. These hypotheses are always subject to empirical testing. The objective is a set of testable hypotheses about language. The output of linguistic research is sets of rules, which may be falsifiable. Rules stand until linguists find counter examples to prove them wrong.
that, in turn, leads to the development of new rule-hypotheses to be tested. Thus, the structural linguist deduces surface structures on the basis of hypothetically derived and sets of rules that can be tested.

Rules encode linguistic knowledge

But it is very important to note, however, that the Chomskyan notion of rules are not rules of linguistic performance (‘performative rules’). For Chomsky is not interested in the conduct of language (i.e. how it works in practice or in discourse) but in linguistic competence (‘rules of linguistic competence’). Accordingly, a rule is not a precept; rather it is a logical operation that characterizes the linguistic knowledge of the native speaker. These rules do not tell us how language works; they instantiate other rules. They do not describe the dynamic process of language; they point to its innate underlying structure. The Chomskyan theory is more akin to a web of interactions rather than a firm hierarchy of layers. This subtle, non-hierarchical distinction has gone largely unnoticed by people who have borrowed these notions and transported them to other disciplines (Cook & Newson, 1996, p. 35). More importantly, a failure to accommodate this distinction has led to circular reasoning and certain inconsistencies.

Explanatory adequacy is unachievable

To understand the non-hierarchical nature of structural linguistics, we should examine why Chomsky’s work makes a clear distinction between competence and performance. Theories of linguistic performance are considered to be an impossible achievement. A theory of performance must involve a theory of explanatory adequacy. For the Chomskyan linguist such a goal is an impossible task as the relationship between the surface structure and the performance are well beyond our understanding. They believe that linguists have to be content with discovering theories of observational adequacy, e.g. theories that adequately account for the observed data. A rule is observationally adequate if (when it is applied to lexical elements) grammatically correct sentences will be created. But such sentences may or may not be meaningful. Thus, such a theory of observational adequacy does not describe what speakers do when they talk. Rather, it is a logical way of characterizing the linguistic knowledge of the native speaker. This linguistic knowledge (i.e. linguistic competence) is seen as a set of mental structures that must be assumed to exist in order for people to have language, for language to do what it does and to be what it is.

Knowledge and syntax are inseparable

This raises the question: what is language? If a language is a set of rules and lexical entities (words as verbs, verb and noun phrases, nouns, etc.) that define a set of abstractions called grammar, then there must be a meta-set of rules to apply the other rules. This position takes a great deal on faith. But to bolster this position Chomskyan linguists rely on principles such as the projection principle. The projection principle integrates the syntactic properties of a sentence
with the properties of lexical items used in it. It says that the knowledge of the meaning and behaviour of a word is inseparable from the knowledge of syntax. It says that all languages integrate syntactic rules with lexical entries. This observation is used to further support the general notion of language as being a built-in, innate, biological, mental construct. After all, native speakers know how words sound, what they mean and how they go together in a sentence. But generating this set of meta-rules from language presents a problem.

**Generative grammars assign structure to language**

Linguists talk about language as an infinite set of sentences. The problem given that definition of a language is that one cannot know or study the set until it the set is finished. But as we talk about language itself the set of sentences grows. Thus, the set of sentences, and hence language itself, is never finished. For that reason the structural linguist argues that even although we cannot talk about the language as a complete set of sentences, we can talk about the structure that generates the language (e.g. the notion of a generative grammar, or the rules that generate the rules). A generative grammar is therefore a set of rules that assigns structure to sentences.

A requirement of a good generative grammar is that a rule and lexical assignment description must be rigorous and sufficiently explicit to determine how sentences of the language are in fact characterized by the grammar (Chomsky, 1980a, p. 220) This requirement for explicitness and rigor illustrates the distinction between traditional statements about grammar and the generative grammar. The traditional notion of a grammatical rule requires that the native speaker recognize the statement as being grammatical. On the other hand, generative grammatical rules are explicit and testable without making demands on the reader’s implicit knowledge of the language (Cook & Newson, 1996, p. 35)

**Language has a Universal Grammar**

This leads to the derivation of a UG as: ‘the system of principles, conditions and rules that are elements or properties of all human languages . . . the essence of human language’ (Chomsky, 1976, p. 29). The UG is concerned with the identification/derivation of universal principles rather than rules. These principles underlie the language, they are its ‘deep structure’. The interaction of these principles of a language with its lexical elements describe the rules and generate gramatically correct sentences. The universal grammar may be understood through the generative grammar.

**SURVEY OF POST-STRUCTURAL LINGUISTICS**

The work of Chomsky offers compelling explanatory and modelling power to aid our understanding of how IS evolve. This is not surprising given that Chomsky dominates the background intersection of systems science and linguistics and that his work remains central in the development of structural linguistics. Chomsky’s work is clearly ‘the theoretical standard against
which all other theories would have to measure themselves’ (Huck & Goldsmith, 1995, p. 91). However, a dialectic has arisen between structural theorists and the opposing views held by theorists of emergent linguistics. As related IS research has generally been founded only on structural linguistics, there is an important gap in our thinking: the other half of current linguistic theory. This gap represents the already developed critique and alternative assumption ground offered by emergent linguistics. The following sections present a summary of these two contradictory positions from their reference discipline.

For example, post-structural linguists claim that UG concepts are developed under circular reasoning; since the 1970s, ‘it was demonstrated that this notion contained a fundamental circularity’ (Grisham, 1991, p. 38). To create the initial rules that are tested, refined and refuted in the process of creating a generative grammar, the linguist relies on the competence of the native speaker. But a good generative grammar itself does not make demands on the implicit knowledge of the native speaker. In essence, the core of the structuralist position relies on ‘faith’ that there must be underlying ‘deep structures’ enabling innate language use.

Language is a real time social construction

Consequently, the meanings of concepts such as deep structure, surface structure, generative grammars, universal grammar, linguistic competence and linguistic performance are not accepted without question or debate within the field of linguistics. Structural linguists are themselves divided along the lines of internalized language (I-language) vs. externalized language (E-language). [The concepts of E-language and I-language are widely used in the linguistic literature (Cook & Newsom, 1996) and are often credited to Chomsky (compare Chomsky, 1986, and Chomsky, 1991).] The I-language linguists approach language as an internal property, a system of linguistic knowledge possessed by an individual speaker. Their work focuses on what a speaker knows about language and where that knowledge originates rather than on the structure of that language. E-language can be seen as something understood independently of the properties of the mind or brain. E-language linguists, on the other hand, assume language is a social event that depends heavily on context, on social knowledge and on interaction. Language is a real-world, real-time phenomena rather than a predetermined product of human biological traits.

Performance matters competence is constructed

Chomsky’s differentiation between competence and performance as described above is important to understanding the debate. Performance deals with language use (E-language). Competence deals with the innate ability to have and use language (I-language). But as already noted, Chomskyan linguists have little interest in linguistic performance. For them speech and communication is but one purpose of language including establishing human relations, clarifying thought, creative mental activity and the like. Chomsky himself sees none of these as privileged but prefers the notion that language serves ‘essentially for the expression of thought’ (Chomsky, 1979, p. 88).
Grammar is emergent rather than stable

In the linguistics community there is an alternative viewpoint that eliminates structure as a serious basis for linguistics. Those who hold this alternative viewpoint worry that structural linguists abstract only a trivial part of the communicative process and reify it, thereby making language an autonomous entity. Those favouring the emergent perspective see grammar as an evolving response to the language environment, or to discourse. These alternative linguists reject the principle assumption underlying UG, e.g. that language is a biological inheritance, an innate, natural linguistic competence in the human organism. To the emergent theorist there are no biological linguistic foundations except the ability to make vocalizations. Grammar is not based on categories of structure but on the human ability to use previous utterances as a basis of new utterances (Hopper, 1987; 1988; 1990).

Any appearance of structure in grammar arises from certain regularities in the reference to previous utterances. Language is in constant flux as it is used in practice. In this view, structure does not precede actual individual uses of the language system but is constantly being renegotiated by individual users of the language system. Modifications found to be necessary in the real-time use of the language are added to the cumulative structure of the system in a constant process of feedback. In this view grammars are not structures that are given or innate to the speaker but arise from the product of speech. These linguists are principally concerned with how speech (or language as communication) happens. As such, it is a perspective standing in direct contrast to the interests and world view of the structural linguist tradition.

Language is in flux

Emergent theory inverts the structural linguistic notion of the synchronic language in which each component can be seen simultaneously and studied independently as it interacts with other elements in a holistic fashion. Emergent theory sees structure as fragmented and distributed. Language is moving towards systematicity without ever reaching stasis. The appearance of structure is momentary regularity, distributed over time, and is not simultaneously present for all users or for study. The development of language is, therefore, a continuous, real-time process.

FIDELITY OF IS DEEP STRUCTURE TO STRUCTURAL LINGUISTICS

How accurately do the concepts adopted by the IS literature map to structural linguistics? Are these ideas faithful to the basic concepts found in field of linguistics? Given the brief description above of both the structural and the emergent attitudes towards language, we next examine the way these concepts are applied in the IS literature and how well they map into the wider debate in the linguistics community.

The deep structure concept is intentionally used in the IS literature in a fairly loose way, rather metaphorical and inspirational references to this particular linguistic theory. For example, the ISD deep structure theories assume that surface structures are observable and that deep
structures may be uncovered through them. But the nature of the deep structure as developed in linguistics writing is quite different than as described in IS articles. For example, IS and organizational theorists choose not to address the origin of the deep structures or the manner in which deep structures determine the surface structures (e.g. Vermeir & Nijssen, 1982; Thow-Yick, 1996). But these last issues are the ones that most strongly interest the originators of deep structure: the universal, generative and transformational grammars that determine the intermediate deep and surface structures. That is, what is the origin and nature of deep structure and how does it enable language? It is also these later issues in which the deeply contested views within the linguistic discipline reside. Thus, adopting one notion of a grammar that is conceived as rules describing how language is put together and the related notions of hierarchies of structures and levels of meaning formulation, IS researchers take these notions as given and as unproblematic (see Leifer et al., 1994; Wand & Weber, 1995). But, as we shall see, in so borrowing concepts that are deeply associated with a particular view of structural linguistics and that are not taken as for granted in linguistics, they also borrow the controversy.

Language and philosophy are arguably intertwined: (1) philosophy of language is the foundation of all other philosophy; and (2) that the most important task of philosophers is to create ‘...a systematic theory of meaning’ (Dummett, 1978).* In linguistics, one of the most perplexing questions about language remains the apparent ability of language users to understand and to create an infinite number of sentences that the user has never heard before. The structural and non-structural linguists tackle this question from rather different points of view. As the structural view is the one adopted by IS researchers we will first examine some of the important questions being explored in linguistics, the solutions proposed by structural linguists and the limits of these views. This will be contrasted against the parallel issues being raised in IS and related organizational research as previously discussed.

**Language is a system (fidelity)**

Because language learners are assumed to have cognitive limits on what they may learn about language, structural linguists say that this limited knowledge of language must suffice to allow the language user to both understand and create an infinite array of meaningful sentences. Understanding and constructing sentences with a limited knowledge of language requires that the language learner must have an implicit and innate grasp of the principles of language that are used to derive sentence meanings from the constituent elements of the sentence. Philosophers refer to the ability to compose and extract meaning from sentence parts using a limited set of innate constructs as, ‘transcendental deduction of the existence of a theory of meaning’ (Baker & Hacker, 1984, p. 6).

Under this theory, humans can understand the contents of a sentence never heard before by examining the meanings of its constituent elements and in determining those elements’ con-

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*Key intellectual figures contributed to the linguistic turn in philosophy. Frege’s predicate calculus was adapted to define precise statements which could be used to judge the truth conditions of well-formed sentences. That programme was undertaken by Ludwig Wittgenstein, whose *Tractatus Logico-Philosophicus* argued for a form of language as a precise, formal and correct predicate calculus.
tribution to the meaning (i.e. truth conditions) of the sentence. Language users are thought to
derive the meaning of a sentence from the meaning of its constituents and via a combinatorial
application of rules governing those constituents. The meaning thus arises from axioms and
rules and the application of those rules. We understand language because of our ‘tacit
knowledge’ of this system of rules. (Baker & Hacker, 1984, p. 316) Language is therefore a
system of wholes and parts that can be studied independently, yet a system in which the whole
is somehow greater than the individual parts themselves.

The structural branches of linguistics have adopted the notion that language is a system. Its
parts are definable and reducible and the whole is greater than the sum of those parts. It is
determinate and all components including the inter-relationships of the parts can be objects of
study. Basically, the argument goes as follows: a language is definable in terms of a set of rules
that combine to form a system (a grammar) that gives an explicit and exhaustive set of all
sentences making up a language (Baker & Hacker, 1984, p. 376). It is seen as rational,
designed and abstracted from use.

IS assumes synchronic study (fidelity)

Structural linguists study a language as an object abstracted from its use. It is a study of mental
constructs supposed to be possessed by native speakers. Moreover, it is a synchronic view of a
language. That is, it frees time by assuming that there is (1) the simultaneous presence of all the
relevant language components; and (2) a universal access by the user and observer to the
whole system at any time.

IS researchers often assume a synchronic, systemic rational perspective in which systems
components are reducible to objects that can be studied. Those components can be extrac-
ted from the whole, extracted from its use and studied ‘…independently of the way it is
developed and deployed in its organizational and social context’ (Wand & Weber, 1995, p.
205). In taking this view we also assume the ability to study the system synchronically: that
we can study the system as a language and as a systemic whole without regard to speech or
The expectation that a system specification can be precisely and unambiguously defined by
creating a proper grammar, that we can construct formal specification languages and proofs
of specification correctness are ideas that relate to the goal of Frege and the early Wittgen-
stein. That is, the goal is to define a precise, unambiguous and concise language of science.
There is an inherent consistency between the positions of structural linguists and the IS
researchers who seek to create more robust and accurate systems requirement specifica-
tions by examining system components systemically and synchronically. Vermeir and Nijssen
(1982), for example, assume that ‘there is a considerable analogy between programming and
Information Analysis or deep structure conceptualization: e.g., both result in a formal specifi-
cation’ (p. 329). For the IS researcher, the problem may be simply stated: performance mat-
ters; speech cannot be assumed to be irrelevant in the study of a language system. [Chapter
8 of Baker and Hacker (1984) provides a detailed explanation of these inconsistencies in lin-
guistics.]
IS assumes independence of surface and deep structures and that performance matters (non-fidelity)

Chomsky’s UG is concerned with the identification/derivation of principles rather than rules. For him, language consists of a set of abstractions, studied as principles, rules and a generative grammar. The generative grammar is the rule set assigning structure to sentences. But the assignment of rules to structure is *ex post*, after the categories of the sentence parts have been assigned to the human mind (Chomsky, 1980b, p. 220). The interactions of principles of a language with lexicons are the generators of rules. Chomsky notes that the theory only applies to the ‘language module’ in the human mind. He sees the language module as having sets of principles distinct from other modules and with which it does not inter-relate. This is important because he sees language acquisition and development as separate from other cognitive skills. It does not depend on the general cognitive growth of the individual, nor is it seen as dependent on other learning. In later writings he has acknowledged that there is domain or environmental contextually specific knowledge required to relate and use language *in situ*. But core, basic competence is innate and hard wired in the species. Thus, sometimes it is referred to as a biological theory of language; the Chomskyan line is that language is a biological inheritance. Because this view abstracts part of the communicative process, reifies it, calls it language and thus makes it an autonomous entity, structural linguists study language as separate from people; an impossible project if it were not for writing. To this degree, Chomskyan linguists are studying writing and not communication.

As we have seen, rules of language are not, for Chomsky, concerned with the performance of language. Rather, the construction of a rule is a means to work backwards to achieve an understanding of the presumed innate linguistic ability. Thus, the deep structure is not directly observable and, secondly, deep structure and surface structure are not independent levels. Thus, at this juncture we have an inconsistency in the IS literature as it pertains to the notion of a UG, performative interests and deep structure.

Unlike structural linguists, IS writers are often concerned with the performative aspects of language, that is, with a presupposed communicative function of rules and grammars (see Nijssen, 1982). For example, Leifer et al. (1994) seek the creation of information requirements determination methods that better communicate the deep structures or implicit values that guide organizational action at more observable levels of behaviour. Wand and Weber are concerned with ‘whether an IS grammar has the constructs that allow your model to be represented faithfully’ (R. Weber, personal communication, 1995). A grammar is complete only if it contains constructs enabling it to model any real-world phenomenon. A grammar is clear if there is a one-to-one correspondence between the grammatical constructs and specified ontological constructs. Examples of these ontological constructs include ‘things’, ‘properties’, ‘states’ or ‘events’ (Wand & Weber, 1995, p. 209). The authors insist that an IS-modelling grammar must be ontologically expressive, complete and clear if it is to completely and accurately represent an organizational reality. They define a necessary and sufficient set of conditions that must be met for a modelling ‘grammar’ to correctly represent and track
real-world organizational states. In a similar vein, analysts are described as native users who have different grammars. They wish to reduce the semantic gap by ensuring that the grammars describe equivalent phenomena at similar levels of organizational abstraction and meaning (Leifer et al., 1994). Deep structure and surface structures are independent levels in need of co-ordination.

IS assumes rules are central (non-fidelity)

Chomsky's later work decentres the rule. It says language is not a system of rules but a set of specifications or parameters in an invariant systems of principles of UG (Chomsky, 1988, p. 388). Rules are derived. They are inferred backwards from sentences. They are the artefacts of interactions between sets of principles and of lexical properties rather than as things existing in their own right. As such the role of the ‘rule’ is minimized.

The IS literature the interpretation of a rule is quite different from as used by Chomsky. When Chomsky is explicitly not interested in performative aspects of language and of rules and tends to decentralize the idea of the rule, our own literature focuses on the rule and describes rules with explicitly performative terms and examples. For example they ‘…govern action and interaction of individuals…’ (Drazin & Sandelands, 1992, p. 237), ‘guide social behaviour’ (Drazin & Sandelands, 1992, p. 238), ‘generate structure’ (Drazin & Sandelands, 1992, p. 234), ‘generates relationships and produces macro-order’ (Drazin & Sandelands, 1992, p. 235). Rules ‘indicate how transactions are to be posted…’ (Drazin & Sandelands, 1992, p. 206) and generate scripts (Wand & Weber, 1995, p. 204). Rules ‘identify sequences of words that will make sense’ and govern our ability to use language to represent and communicate (Leifer, Lee & Durgee, 1994, p. 277). They are thought to describe the mapping of sets of words to model constructs (Wand & Weber, 1995, pp. 206207).

IS isolates deep structure (non-fidelity)

For Chomsky, structure is innate. Structural dependencies exist that are the basis of all language syntax. Deep structure is an innate biological understanding of how language is put together. It is not directly observable.

To IS and organizational researchers, however, deep structure has properties that can be described and studied. For example, the three-level architecture of rule-guided human interaction as described by Drazin and Sandelands (1992, p. 237) is (1) a deep structure consisting of rules that generate and govern individual behaviour and interactions; (2) an elemental structure, consisting of interactions among individual actors; and (3) an observed structure, comprising the categories and terms that apply to the perceptions of social interaction as collectives by observers. The authors refer to the interplay of rules as generating observable patterns of interaction that make up the organizing process. They say that ‘dynamic processes can be summarized by generative rules and these rules are an efficient description of that process’ (Drazin & Sandelands, 1992, p. 237).
IS assumes deep structures are manipulable (non-fidelity)

Wand and Weber assume that a deep structure underlies all social settings and that this deep structure can be taken as ‘given’. Although surface structure and physical structures may be changed relatively easily given changes in technology and social reality, the underlying deep structure is slow to change at all, but it may be changed. The physical structure and surface structure of the information system are derivative of the deep structure. The assumption is that the deep structure can be changed by conscious intervention.

Wand and Weber say IS has focused on surface structures and computer science as a discipline has focused on physical structures. Deep structures have been under studied. They apply ontological models to deep structures. Wand and Weber view the core of ‘information systems design as ensuring the deep structure of information systems reflects the meaning of real-world systems they are intended to model’ (Wand & Weber, 1995, p. 207).

POST-STRUCTURAL LINGUISTICS AND IS

The implications of the debate in linguistics is important for our field. Thus far, our view of structure and emergence in IS has been most dramatically influenced by only part of linguistic theory: the I-language theory of structural linguistics. The contextual linguists who subscribe to E-language theory or emergence theory have not influenced IS theory to the same extent.

For example, in linguistics the notion of language as being systemically rational and synchronous can be challenged on several fronts. Wittgenstein himself gave up the notion that language can be precise and defined as a form of predicate calculus in favour of the notion of the language game. The notion of emergent grammar also challenges the idea that language can be studied in a reductionist fashion. Baker and Hacker (1984, p. 377) deny that language develops in a rational and systematic fashion. By analogy they compare the English language to the ‘system’ of Great Britain’s roadways. This ‘system’ of roads was in fact pieced together in haphazard fashion as need demanded over two millennia. It was not the product of a rational and holistic design. So too is language formed. The process is not rational but proceeds by accretion and loss of vocabulary, phrases and grammatical constructions (Baker & Hacker, 1984, p. 377). Language with its emergent grammar cannot be extracted from use and studied as an object apart from the context in which it is created. So also might one argue that an information system only has meaning in a given context as it is used. To extract the IS from its environment, only guarantees that other, possibly contradictory, meanings will be assigned to the components under study and ultimately the whole system itself.

We can further bring this point home by considering an IS as a language system. From problem formation and requirements elicitation all the way through data modelling, specification generation and code development we are dependent on creating descriptions of systems. Those descriptions depend upon forms of grammar. In a way it governs how meaning is expressed or even what is expressible. Our systems descriptions whether as English prose, data models, object models or low-level function calls all depend on or make certain gram-
mathematical assumptions. One of those assumptions is that of the inherent stability of the grammar itself. That is, that the notion of a grammar, which though we may acknowledge to be changeable over time, is in the short term, at least, fixed.

**IS idealizes stability**

This is expressed in the area of IS research and in the creation of systems development methodologies as finding ways of modelling and specifying systems that are robust and relatively immune to change. We strive to build low maintenance systems which are specified 'right'. We build systems based on data models because they are thought to be more stable and to change less often than process models of a system.

The stability ideal is understandable as a holdover from the early days of expensive, custom-built, low-level language systems. The cost of change for computer-based systems was high. This ideal helps elicit the links to structural linguistics that idealize the stability in language. Today’s organizations are demanding more flexible systems that support change. Inexpensive, package-based, high-level language systems are intended to keep the cost of change for computer-based systems low. We strive to distribute system development closer to the end users, and minimize the scale and risk of system projects. Structured system development is a problem because it demands a high investment in analysis and design, and must be compensated by a fairly long period of low-cost maintenance stability. The alternative ideal is low-cost analysis and high flexibility through maintenance activity. This ideal elicits links to post-structural linguistics that develop theories about fluidity in human language. These linguistic theories are consonant with systems development theories that centre on adaptation and flexibility.

**IS maintenance is an external language**

Structuralist thinking implies that there are ideal information structures within organizations awaiting discovery, similar to I-language structural grammar. This leads system designers to focus on analytical discovery of these structures. Once discovered, the high cost of this analytical discovery is justified by the expectation of the durability of information systems constructed to match this innate organizational grammar. Hence, current IS theory values high-cost analysis and low-cost maintenance. Post-structuralist thinking implies that information habits within organizations are socially constructed and continuously changing, similar to E-language emergent grammar. This leads system designers to focus on change and flexibility.

Thus, two general approaches to the understanding and development of systems can be distinguished. The first approach accepts units, rules and meanings as prerequisites to the construction of a stable, bounded system that functions as the basis for communication between users. A second approach is to think of the system as being in constant flux as it is used in practice. In this view of a system, structure does not precede actual individual uses of the system but is constantly being renegotiated by individual users of the system and modifications found to be necessary in practice are added to the cumulative structure of the system in a constant process of feedback.
Because structure can be viewed in this sense as constantly in the process of change, ‘structure’ is therefore an emergent property of the interaction rather than a structural pre-requisite to acts of communication. Regularities arise from interaction and not from some mindless application of underlying rule sets. Is it an emergent property rather than a structural property called emergent? In other words, the regularities we take as linguistic ‘structure’ arise from continuous interaction in discourse, the use of language (linguistic performance). The apparent structure arises from this interaction and is not an a priori element or rule. An emergent property is not a rule. Grammarians in the emergence camp argue that languages are works in progress, emerging as their actors respond to changes in the environment, interacting with each other and continually renegotiating the ‘rules of the game’. Emergence is a product of intentional human linguistic social interaction within a variety of social settings. Although these actions do not follow fixed causal patterns, they are neither wholly random because they can be influenced by interaction and reflection. In this regard, emergence theory shares Foucauldian notions that the present and the past are embedded in one another. The present cannot be predicted by the past because the past may serve both as an exemplar and as a negative model to be rejected. In this regard, emergence theory is not simply a theory of change, social progress or evolution amid an otherwise stable setting. It is a theory under which change is the norm and stability is the anomaly. This gives rise to a key question, namely which key areas of systems development are affected if it turns out that the search for stable structures, to which we anchor such notions as information requirements, entities and relationships, methods and tools, proves to be futile?

Assumptions drawn from the alternative camps of the linguistic debate would provide the theoretical basis for an opposing view of ISD. If we instead focus on the emergent nature of IS requirements (e.g. that all requirements are an evolving response to both previous requirements and the external environment), then our values shift toward an emphasis on maintenance rather than analysis of any imaginary innate structures. In other words, low-cost analysis and high-cost maintenance would profile the most successful IS.

CONCLUSIONS

The information systems discipline, like other research arenas, imports theoretical concepts from sister or ‘reference’ disciplines. Linguistic theory provides an attractive metaphorical and theoretical basis for theories about organizational information flows and the construction of organizational information systems. The application of linguistic theory in the IS field does seem to improve our understanding of how information systems evolve in human organizations. At a minimum, this improvement arises in our broadened debate over this evolution.

It also seems quite correct for such borrowed theories to be adapted to the IS field. Pure linguistic theory, in the case of the research referenced in this paper, is directed to the development of human language, and not to the development of systems. There is nothing inherently incorrect in the metaphorical use of structural linguistic theories as a basis for furthering our understanding of IS, as researchers exemplified by Wand, Weber, Leifer, Lee and Durgee accomplish.

Is it incumbent on those who borrow such theoretical metaphors from a sister discipline for
use in their own home discipline to import the entire theoretical paradigm, when only a broad stroke metaphor is necessary? Such a case arises in the import of the deep structure into information systems. On the one hand, this necessity would place an incredible burden on the publication of such research. The entire theoretical paradigm of structural linguistics could not possibly be summarized in the introductory section of a journal-length article. If we enforce such a necessity, the benefits of borrowing such metaphors might be effectively eliminated.

On the other hand, where a theoretical paradigm is contested in its home discipline, it seems likely that importing this paradigm into the IS discipline as a metaphorical basis for an further understanding of IS development will raise a similar contest in the IS discipline. Rather than reinvent the entire contest within the IS field, it may be more expedient to draw a more expansive review of the linguistic paradigm under challenge (in this case, structural linguistics), illuminate the challenges (in this case, emergent linguistics), and draw further parallels for the metaphorical use of both positions in our own understanding.

This paper has contributed such expansion and illumination. We have examined the metaphorical use of deep structure in IS theory. We have expanded the implications of this theory in the radical position of structural linguistics and illuminated the challenges levied to structural linguistics, especially focusing on the opposing radical position, emergent linguistics. By drawing parallels to emergent linguistics for IS development, we have shown that both linguistic arguments, structural and emergent, offer an improved understanding of IS development in organizations.

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REFERENCES


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