Systemic Functional Hypertexts (SFHT):
Modelling Contexts in Hypertexts

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Abstract: Despite the fact that texts exist in social contexts, models of hypertext authoring – and the tools derived from them – generally exclude this important aspect of the structure and function of texts. The inevitable result is an almost total exclusion of information con-cerning the situational and cultural aspects of textual units. Authors (writers) and users (readers) require situational and cultural contexts in order to understand the meanings ne-gotiated in and by (hyper)texts. These aspects of (hyper)texts are generally ignored be-cause most models of language do not provide formal relationships between texts and their contexts. In this paper we describe how Systemic-Functional Linguistics (SFL), a semiotic model of language, can be used to create a dynamic hypertext model referred to as Systemic Functional Hypertexts (SFHT). This n-level hypertext model, the compo-nents of which are described using an ER Diagram, includes many aspects omitted from conventional hypertext models including: (i) text forming resources, (ii) intra- and inter-textual relations between texts and constituent text segments, occurring within their im-mediate (iii) situational and cultural contexts.

Key words: Systemic Functional Linguistics, Situational Context, Cultural Context, Systemic Func-tional Hypertexts, Hypertexts

1. INTRODUCTION

Information retrieval systems, document management systems, office automation systems, and most intranet technologies are deployed in organisations to provide the necessary infrastructure for authoring,

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gathering, mining, organising, processing, searching, retrieving, viewing, sharing, and delivering textual information often as documents in the form of hypertexts. Arguably, most organisations use these technologies to support intra-organisational workpractices and communication with the aim of applying relevant information to situations and contexts that could not have been foreseen or envisioned at the time the information was gathered. This aim is often what is meant by the term 'knowledge management', while the means for achieving it is often viewed as a 'knowledge representation' issue (Farquhar 1995). The relevance and appropriateness of information and its associated infrastructure in organisations involves processes of production and consumption of meanings in organisations, institutions and society (Clarke 2000), and is central to semiotics defined by Eco (1976, 8) as the study of "all cultural processes as processes of communication".

Any communication, document or hypertext - referred to here as text - is only meaningful in far as specific situational and cultural contexts exist from which it can be interpreted as meaningful for a specific community at a given point in time. Yet despite the centrality of context to communicative processes in organisations, text-processing technologies, like those identified above, never explicitly include this aspect of text representation. The aim of this paper is to apply semiotic theory that includes a theory of context in order to define a hypertext representation that can be gainfully applied creating more effective systems to support intra-organisational workpractices, communication and knowledge management.

A semiotic model of language called Systemic Functional Linguistics or SFL (Halliday 1985; Martin 1992) is applied here to construct a new model of hypertext authoring. Within this model of language meaning arises when a dynamic and open social system becomes *stratified*- that is distinctions in value within the social system emerge or otherwise become evident. The technical term for the relationship that results from stratification is *realisation* which Lemke (1984) describes using the term *metaredundancy*- a kind of semantic "... analogue of the cause and effect [in] ... classical physical systems" (Halliday and Martin 1993, 17). A similar concept to metaredundancy is the concept of *redounding*, which describes how one semiotic system (language) realises a more abstract one (context). Redounding refers to the fact that language construes social context, language is construed by social context, and language re-construes a social context, where the two are bound together in a relationship of mutual determination and interdependency. In SFL, a *text* or a hypertext is a functional, semantic unit *realised* (or expressed) in patterns of wordings and grammar. A text, whether written or spoken, is simultaneously an instance of a product and a process. A text is a product in the sense that it is an output or an object with an analysable structure. A text is also a process in that it is

interactive and social. The term 'systemic' in SFL refers to the fact that texts are viewed as being formed by a continuous process of semantic choice, where each choice establishes the environment for further choices. Formally, paths through networks constituting the linguistic system represent these choices. The 'functional' part of SFL is not limited to the particular uses of language, but rather to consider function or use as a fundamental organising principle in all languages. In order to create a useful dynamic and contextual model of hypertext authoring, the theory of language being used as its foundation must specify explicit relationships between a text's features and its situational and cultural contexts (Clarke and Mehler 1999). Context (see §2) and its relationship to text (see §3) in SFL is established prior to describing the interrelations that exist between them (in §4 and 5) which forms the basis of a dynamic hypertext model called Systemic Functional Hypertexts (SFHT) described in the remainder of the paper.

2. CONTEXTS

Context forms a bridge between the social world and the text. Texts are produced or consumed in social occasions and in social settings. These social occasions and settings have an important effect on texts themselves. Within SFL, 'context' is theorised using a distinctive bi-stratal organisation of register and genre.

Register describes how the immediate situational context of the language event affects language use. Register has three identifiable variables referred to as field, tenor and mode. The *field* of a text is defined as "the topic or focus of the activity" (Hasan 1985). Following Martin's (1994) bistratal model of context, the field of a text is primarily recovered through the use of words, or so-called *lexical items*. Particularly useful are those lexical items known as *indexical lexical items* (Eggins 1994, 25) that can be used to uniquely disambiguate the topic or focus of activity of the text. In situations where many texts can be observed in a given Context of Situation, it may be possible to construct a *field taxonomy*. Field taxonomies document the observed or inferred field options available to text readers or hypertext users in specific situational contexts, and may represent a partial or a complete record of these options. *System networks* are used to represent field taxonomies. The lexis (words) associated with the field is (are) ordered into convenient or observed groups. Possible selection options can therefore be shown as sub-networks within the system network. System networks are organised and read from the left-hand side, the so-called least delicate, to the right-hand side, the so-called most delicate.

The *tenor* of a text is defined as "the social *role relationships* played by interactants" (Hasan 1985). Following Martin's (1994) bistratal model of context, three continua are involved in characterising the tenor of a text: power, affective involvement, and contact. Eggins (1994) emphasises that these continua are more than just interesting descriptions of interpersonal aspects of situations because there is a direct claim being made about language and situational context. The *Power Continuum* is used to classify situations according to whether the roles are those in which equal or unequal power is being exercised. The *Contact Continuum* is used to classify situations by whether the roles being played bring interactants into frequent or occasional contact. The *Affective Involvement Continuum* is used to classify situations by whether the roles being played bring interactants into high or low affective involvement (high or low emotional levels).

Mode is defined as the role language is playing in an interaction. Following Martin's (1994) bistratal model of context, two continua are used to specify the distance between language and situation: spatial/interpersonal distance, and experiential distance. *Spatial/Interpersonal Distance* is a continuum based on the possibilities of immediate feedback between interactants. *Experiential Distance* is a continuum based on classifying different situations according to the distance between language and the social process. At one extreme, language can be viewed as action generally associated with spoken language, while at the other extreme language can be viewed as reflection generally associated with writing.

Genre refers to the kind of conventional text patterns or staging that are recognisable in particular cultural contexts. Genre theory within SFL has been particularly concerned with identifying in texts, the "staged goal oriented social processes which integrate, field, mode and tenor choices in predictable ways" (Halliday and Martin 1993, 36). Social occasions are always conventional to a greater or lesser degree, and therefore produce conventionalised forms of texts (for example: memos in organisations, essays at university, service encounters in shops). There have been two major models of genre within systemic-functional linguistics. Hasan (1985) developed the first model, while Martin (see Eggins 1994) has developed a more recent model. While providing a rich notation with which to describe syntagmatic structure, Hasan's model of genre – unlike that of Martin – does not recognise the paradigmatic range of genres that are available.

Martin's stratified model of genre recognises the existence of *agnate* systems of *canonical genres*. These canonical genres frequently occur precisely because they provide a ready-made means for organising and expressing commonly required sets of meanings. Agnate systems of canonical genres include the Narrative and Factual Group of genres. The Factual genres are concerned with the way things are and are commonly

found in 'scientific' uses of language. A subset of this family (Martin 1992, 563), includes genres which are activity structured, and can be used to deduce some workplace activity of interest. They include [Factual] Recounts, Procedures, Explanations, and Explorations. Non-activity structured factual genres include Descriptions, Reports, Expositions, and Discussions. The Narrative genres include [Narrative] Recounts, Anecdotes, Exempla, and Narratives (Martin 1992, 566-568). In addition, *higher-order genre structures* (or so called *macrogenres*) can also be identified, for example the Report genre often occurs prior to one or more Instructional Procedure genres in computer documentation. In both SFL genre models, a text can only be a member of a genre by virtue of it having the full range of genre defining 'obligatory elements'. However, several authors have shown that actual texts may have one or more 'obligatory elements' missing and still function as a member of a specific genre in a given social context (Clarke 2000). Therefore our use of genre differs from Martin's model in that a canonical genre is a prototype for a fuzzy set of structurally related genres, and this concept also applies to higher-order genre structures as well. This change in the underlying genre model influences the recomputing of contextual relations when texts are being processed into hypertexts.

3. TEXTS

Unlike most semiotic systems, the meanings in language (content) are not directly realised into sound or letters (expression). Language is a three level semiotic system- see Figure 1. *Content* in language utilises two levels: meanings are realised in wordings (words and structures). Wordings are subsequently realised by means of sounds and letters. SFL is organised to reflect this three-level or *tri-stratal* semiotic model of language. The level of *discourse-semantics* accounts for meanings, which are then realised at the level of *lexico-grammar* to account for wordings, which are subsequently realised as expression in sounds or letters at the level of *phonology or graphology.*

At the first *content* level in SFL, *discourse semantics*, three kinds of meaning are conveyed simultaneously in texts: ideational, interpersonal, and textual meanings. These distinct types of meaning or semantic function, become a significant organising principle of the grammar, and are collectively termed the *metafunctions* of language. The *ideational metafunction* can be resolved in language as two distinct components, experiential and logical. Experiential meanings in language are "... the expression of the processes and other phenomena of the external world, including ... the speaker's own consciousness" (Halliday 1974, 95) while

logical meanings involve the mapping between these in language. Through the *interpersonal metafunction* social groups are constructed and the individual is reinforced. The *textual metafunction* refers to "...the way the text is organised as a piece of writing (or speech)" (Eggins 1994, 12).

At the second *content* level in SFL, *lexico-grammar*, the metafunctions of discourse semantics are rendered into selections of words (lexis) and grammar. The ideational metafunction is realised in lexico-grammar by Transitivity. Transitivity expresses "... who is doing what to whom when where why and how" (Eggins 1994, 77). The interpersonal metafunction is realised in lexico-grammar by Mood. Mood involves "... types of clause structure (declarative, interrogative), the degree of certainty or obligation expressed (modality), the use of tags, vocatives, attitudinal words, ...expressions of intensification and politeness markers..." (Eggins 1994, 77). The textual metafunction is realised in lexico-grammar by Theme. Theme expresses "... patterns of foregrounding and continuity in the organisation of the clause" (Eggins 1994, 77). Lexico-grammar is subsequently realised in sounds or letters, as expression at the level of *phonology or graphology*.

Metafunctions are a way of integrating across the strata and are used to identify parts of the language system that are concerned with realising each type of contextual information. The register variable of Field is realised in the experiential meanings at the level of discourse-semantics. Experiential meanings are realised on the level of lexico-grammar by Transitivity. The register variable of Tenor is realised in the interpersonal meanings at the level of discourse-semantics. Interpersonal meanings are realised in the level of lexico-grammar by Mood. The register variable of Mode is realised in the textual meanings at the level of discourse-semantics. Textual meanings are realised in the level of lexico-grammar by Theme. Language (Lexico-grammar) is structured to realise its metafunctions using Transitivity, Mood, and Theme. These metafunctions in turn are related in a predictable and systematic fashion to each situational variable, refer to Figure 1.

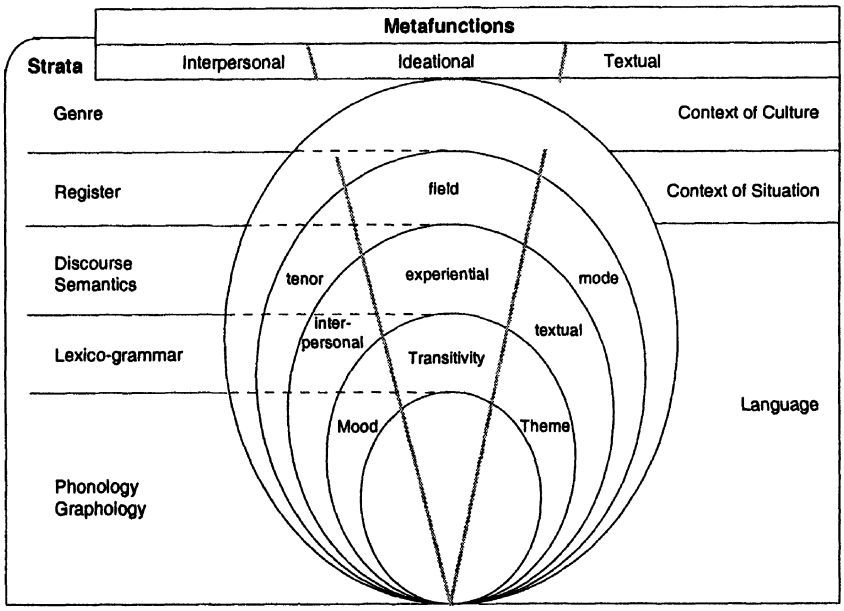

Figure 1. Metafunctions and the Stratal SFL Model of Language (after Clarke 2000)

4. DYNAMIC MODELING OF TEXTS AND CONTEXTS

In this section we specify dynamic aspects of the relationships between texts and their contexts. We first define and describe three groups of text-forming resources – collectively referred to as *texture* – that bind and relate (hyper)texts to their contexts and also those, which create the internal consistency within the (hyper)text. These types of texture are referred to as *coherence*, the intersentential resources of *cohesion*, and the intrasentential resources of *theme and information*. We then describe the dynamic relationships between texture, register and genre prior to proposing Systemic Functional Hypertexts (SFHT) in §6.

The first major group of text-forming resources is collectively referred to as *coherence*. Coherence describes how clauses relate to the context in which they occur. As SFL has two types of context, there are two types of coherence – situational coherence and generic coherence. *Situational coherence* involves the identification of field, tenor and mode for relevant collections of clauses, while *generic coherence* involves recognising that a text belongs to a particular genre (identifying its culturally specific, staged unfolding; its so called Schematic Structure).

The second group of text-forming resources is called *cohesion* or intersentential resources. Cohesion involves how clauses in a text interrelate

to each other to give the appearance of a unity. Different types of cohesion can occur in texts; lexical cohesion, reference, conjunction, and conversational structure (beyond the scope of this paper). *Lexical cohesion* refers to how lexical items (nouns, verbs, adjectives, adverbs) and event sequences (chains of clauses) are used to consistently relate a text to a particular topic. *Reference* refers to how participants are introduced and 'managed' as the text unfolds. Reference patterns can be presented in the form of Reference Chain Diagrams. *Conjunction* refers to the logical relations between parts of a text. Different types of conjunction can occur in texts; elaboration, extension and enhancement. *Elaboration* involves relationships of restatement or clarification. *Extension* involves relationships of addition or variation, where meanings are added or altered by contrast or qualification. *Enhancement* is the extension of the meanings in a clause by other clauses.

The third and final group of text-forming resources is called intrasentential or structural resources and involves the systems of Theme and Information (in this discussion we exclude information resources that are found exclusively in spoken language). (Hyper) text authors have a limited range of choices in starting clauses, and the choice is important in that it represents a point of departure for the unfolding of a text. The theme of a clause includes all lexical items up to and including the first participant, circumstance or process. Another important linguistic resource is called the information unit involving a relationship between what is 'new', unfamiliar and unpredictable with what is 'given'. Having defined and described the text-forming resources of texture, we now turn our attention to *dynamic interrelations* between social and language systems.

5. DYNAMIC MODELLING OF TEXTS IN CONTEXTS

So far, structural aspects of text semiosis have been described with reference to SFL. We construe the dynamic relationship resulting from the *redounding* of text and context (see §1) in terms of *covariation* of contextual and textual features as well as in terms of *co-instantiation* of context types by means of situations and of text types by means of texts. It is a central insight of SFL that any linguistic communication does not only instantiate linguistic, but also social (contextual) regularities. Since these regularities are seen to be stratified on the basis of social context, a co-instantiation of text and context types can be assumed. Furthermore, since SFL construes the relation of instantiation in terms of realisation, and thus as a dynamic rather

than a synoptic concept, co-instantiations serve as a starting point for the co-variation (or co-evolvement) of the linguistic and contextual types involved.

According to this view, changes in context are correlated with changes in texture so that a twofold variation of patterns of linguistic realisation can be observed: these patterns vary across genres (and generic/schematic structures) as well as across registers (and register variables, respectively). In any of these cases, the change of a contextual unit – i.e. a genre, stage, register, or register variable – correlates with a change of lexico-grammatical choices. On this background Hasan (1985) can state that what elements co-occur where, in which order, and how often, (*we add:* stochastically) depends on the social context.

The concept of co-variation has dramatic consequences for any context semantics. Work conducted in the field of Situation Semantics (Barwise and Perry 1983) states that linguistic units cannot be interpreted independent from context. On the other hand, what has to be considered as a relevant context depends in turn on processes of text semiosis. Thus, context is a semiotic concept, which has to be construed from the perspective of its evolvement. Halliday (1978, 3) explains this as follows: "... context plays a part in determining what we say; and what we say plays a part in determining the context. As we learn how to mean, we learn to predict each from the other." Furthermore, as co-variation is not a deterministic, rule-based process, this view is tantamount to a quantitative, probabilistic concept of text: frequencies of text components and their relations are seen to instantiate probabilistic dispositions of the lexico-grammatical and semantic system. Thus, texts function as fuzzy, probabilistic systems, too.

The relation of instantiation between text and language system is mediated or *stratified* by social context, see §1. There exists a relative (in-)stability of linguistic realisation patterns dependent on the variation of genre, generic staging, register, and register variables. This relative instability is best observed on the lexical level: In case that we perceive a sequence of words, e.g. "...team...referee...goal...", without their syntactic relationships, we can often nevertheless predict the presumptive topic (field) of the text in which this sequence occurs, and vice versa: knowing the field, some lexical choices become more probable, others more improbable. But if we slightly change context, for example from sports to commercialisation of sports, the expectancy of lexical occurrences changes, too, and this change will be the stronger, the stronger the context change. Clearly, the interdependency of lexical choice and field is neither deterministic, nor static: it evolves in the course of language use.

In Figure 2a-b, commuting diagrams are used for illustrating this covariation in abstract terms. First, registers are linguistically *realised* by means of patterns of text forming resources, which are in turn *realised* by a

countless number of text events, see Figure 2a. As outlined above, SFL views the relation of realisation as an instance of redounding. That is registers are not only instantiated, but also constituted by means of texts. On the other hand, texts are not only produced or received (in discourse situations, thereby referring to *reference situations*) dependent on registers, but participate in constituting these contextual units. Analogously, genres are realised by means of schemata of texture forming resources which again are realised by text events as co-instances of social activities instantiating genres, see Figure 2b.

The interdependence of genre, register and texture is exemplified in Figure 2c and 2d. For example, suppose a register for a specific set of print media documents has *civil war* as its field, *unequal* tenor, and *non-interactive* mode. With respect to English, elements of a lexical field including lexemes like *war*, *crime*, *army*, *human rights*, etc. are expected to be preferred as constituents of the lexical organisation of texts instantiating the register in question. Since redounding is not deterministic, the register's textual realisations may correspond or deviate from this preference relation, thereby confirming or modifying the interdependence of lexical field and register. In case of genres, an analogous argumentation is exemplified in Figure 2d: an oral presentation of a psycholinguistic experiment is likely structured by an introductory section, a description of the experiment and its results, a concluding section, etc. With respect to English, these stages are probably realised as well as linked by means of discourse markers as occurring in phrases like "it is shown", "as a consequence", "we conclude", etc. Thus, in case of a concrete lecture of this type, there will be a high expectancy regarding the occurrence of such markers and phrases. In the long run, this expectancy changes, as styles of giving presentations are modified.

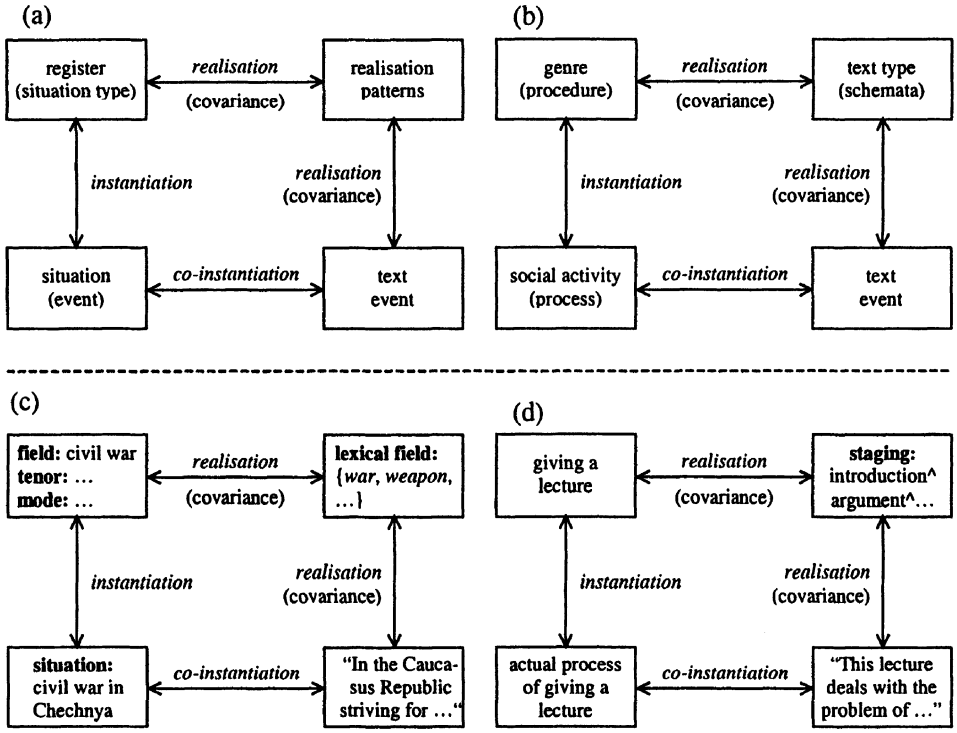

Figure 2. Above: Realisation, covariation, and instantiation of register (a), genre (b), language and text. Below: examples of the covariance of register and texture (c) based on schema (a) as well as of genre and texture (d) based on schema (b).

The mutual dependence of context and text system is neither deterministic nor purely stochastic. It underlies the ability to predict contextual features from knowledge about texture, and vice versa. Thus, the evolving interdependence of both kinds of systems enables the efficiency of language processing.

5.1 Effects of Covariance of Genre, Register, and Texture

The effects of covariance of genre, register, and texture relate to *intratextual* as well as *intertextual* relations. With respect to intratextuality, at least three domains of effects can be distinguished:

1. *Text identity:* clearly, the occurrence, recurrence and co-occurrence of texture forming resources determines the membership of a text to one or more genres or registers, which on their turn influence processes of text production and reception.
2. *Text segmentation, text organisation:* the change of occurrences of texture forming resources associated with different contextual units may indicate the existence of text segment boundaries, and vice versa. In this

sense, there is a mutual expectancy of generic staging, register variation, cohesion, and text segmentation.

3. *Text interpretation:* the textual realisation of contextual units (pre-)activates "neighbouring" (related, similar, dependent, etc.) textual realisations of the same contextual unit as potential interpretants of the text segment under consideration, while instances of dissimilar contextual units are suppressed. Clearly, this domain already comprises intertextual relations, which, for example, hardly go beyond register boundaries, if the registers in question are not or only loosely linked.

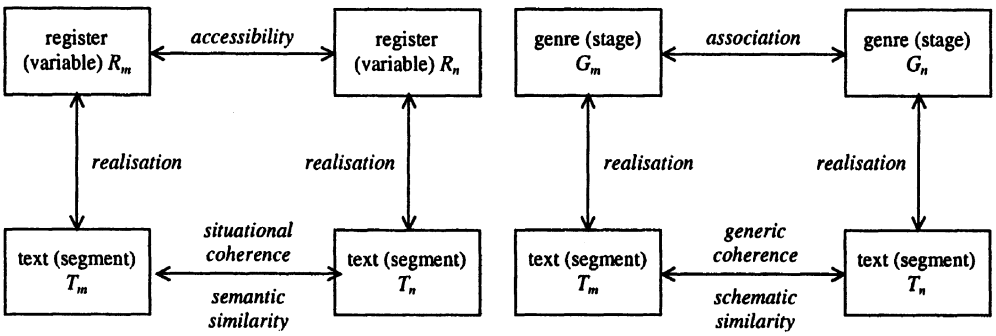

Figure 3. The realisation of contextual relations of registers (left) and genres (right) by means of intertextual dependencies.

With respect to *intertextuality*, covariation is exemplified as follows. Suppose two related registers R_m and R_n describing mutual accessible situation types, as shown in Figure 3, left, R_m refers to the field of *foreign policy* while R_n refers to the field of *domestic policy*. Because of the interdependence of context and language, a semantic, field based similarity of textual realisations of R_m and R_n is expected. The closer the fields are to each other, the greater will be the interdependency between these registers. More generally, two aspects of interdependence of context and text relations are distinguished:

- *Structural parallelism:* The dependence of registers R_m, R_n (or genres G_m, G_n in Figure 3, right) is *paralleled* by the intertextual relation of their textual instances T_i and T_j.
- *Dynamics:* Intertextual relations are *realisations* of genre and/or register relations: they do not only instantiate contextual relations, but also participate in constituting, confirming or modifying them.

As texts are probabilistic systems, intertextuality can be seen as a gradual phenomenon: texts realising the same or similar registers/genres have a higher probability of being intertextually dependent than texts realising different registers/genres. Although there is covariation between context,

language, and text, these different systems are clearly neither isomorphic nor deterministically related:

1. *Vagueness and polyfunctionality:* there exist (proto-)typical, atypical, preferred or inhibited texture forming resources, which are (i) associated as linguistic dispositions with genres/registers and (ii) nondeterministically realised by textual units tolerating some degree of deviation. The uncertainty of the relation of text, language and context is reflected by the general polyfunctionality of natural language signs: whereas the same sign may be used for different purposes, the same purpose may be realised by different signs.
2. *Variability:* beyond this, linguistic and contextual relations vary diachronically. In the course of language use, genres may be merged or split up, register networks may be refined or clustered. The merging or splitting of genres as well as the association or dissociation of registers correlates with the emergence, break and variation of intertextual relations with respect to their strength and function. The merging of clusters of contextual units is outlined in Figure 4.

To summarise: genres, registers, texture forming resources, and texts are correlated in the course of language use. From the perspective of hypertext authoring it is the *probabilistic* interdependence of language and context which serves for *predicting intertextual relations*, and hence as a *criterion for text linkage*:

- The more similar two registers R_m, R_n (or genres G_m, G_n), the stronger their dependence, the higher the probability that their textual realisations T_i, T_j are intertextually related.
- The more often textual realisations of registers R_m, R_n (or genres G_m, G_n) are intertextually linked, the stronger the interdependence (similarity) of those registers (genres).

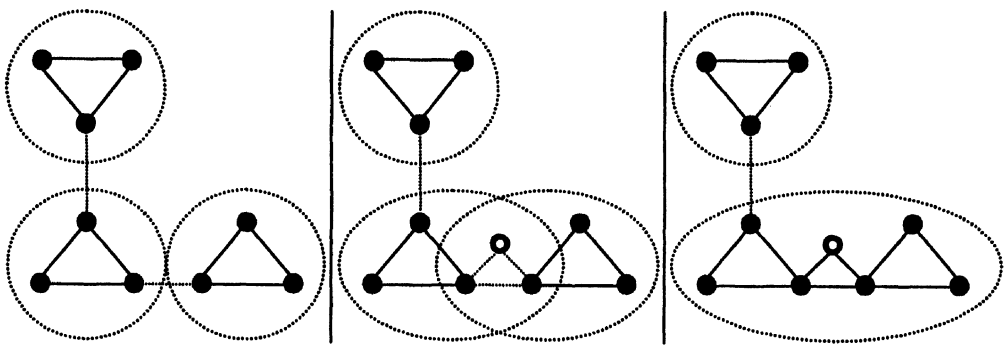

Figure 4. From left to right: merging of clusters of contextual units (represented by dotted ovals surrounding their textual realisations represented by filled circles) after a new text (unfilled circle) is processed: the processing of this text initiates a recomputing of contextual

as well as of intertextual relations. Unbroken (dotted) lines represent intertextual relations of texts belonging to the same (or different) contextual cluster(s, respectively).

6. SYSTEMIC FUNCTIONAL HYPERTEXTS

It is a commonplace that nonlinearity and interactivity are two fundamental characteristics of hypertext. Nonlinearity is observed on two levels. (i) Hypertexts are organised on the basis of the principle of multiple ramification mathematically represented by means of n:m-relations: the same text can be accessible *from* as well as having access *to* several nodes of the text base. In this sense, *links* are the fundamental organisation unit on *microstructural level*. (ii) The principle of nondeterministic ramification correlates with the principle of polyhierarchical or polysequential organisation of *paths* as the fundamental organisation unit on *macrostructural level*: because of the existence of branching links, in the course of hypertext reading, the same text module can be embedded into different path contexts. As a consequence, the same text base can be explored (more technically: *sequentialised*) by means of different paths coding different readings.

The question arises, what is the linguistic basis of micro- and macrostructural organisation of hypertext. Applying systemic functional linguistics to hypertext, properly embedded into the framework of computational semiotics, relates to the question of *how to support which links of which textual units on the background of which linguistic and social semiotic structures*. To be more concrete: a theory is needed which describes links as (hypertextual) linguistic manifestations (realisations) of intertextual relations, which in turn realise the dependencies between contextual units. In order to approximate a possible answer, the concept of systemic functional hypertext is introduced.

6.1 Definition

A *Systemic Functional Hypertext* (SFHT) is an n-level hypertext, $n \in N$, $n > 3$, which includes but is not limited to four levels:

1. The *genre layer* models (macro) genres, their constituents (stages) as well as their relations and network structure (staging).
2. The *register layer* models (macro) registers, their constituents (with respect to the variables of *field*, *tenor* and *mode*), their assemblages to networks as well as their relations (accessibility constraints).

3. The *texture layer* models types (or classes) of texture forming resources, their (abstract) syntagmatic and paradigmatic dependencies as well as their linguistic realisations.
4. Finally, the *text layer* models intratextual and intertextual relations of texts and their segments – possibly parallelised by dependencies of contextual units and realised by texture forming resources – as links in hypertext.

Whereas the first three layers describe different resources for linking texts and their components, the last layer deals with the organisation of links between given textual units. Genres and registers are social semiotic resources of text linkage. Though they serve to bridge between the semantic and the social semiotic system, into which language is embedded, they are no linguistic units, but only linguistically realised by texture forming resources. Thus, a third layer is needed, which explicitly organises these resources, e.g. types of cohesion relations or linguistic schemata. Decoupling the texture layer from the layers of genre and register networks serves to model links of texts and their components, which are neither supported by generic staging or interrelations of register variables. The need for this decoupling immediately arises from the fact that genres and registers emerge as semiotic entities from processes of language use: the continued realisation of certain intertextual relations by means of certain cohesion (or coherence) relations may be the reflex of emerging genre or register structures. As a consequence, a layer is needed for the organisation of texture forming resources which linguistically support otherwise unsupported links in hypertext.

We can now formulate a typology of links that make explicit the intra- and intertextual relations of contextual units and texture forming resources. Three types of links can be proposed for SFHTs:

1. *Generic links* that link those texts, which realise different stages of the same or different genres connected by generic relations,
2. *Register links* that link those texts, which realise related registers or register variables, and finally
3. *Cohesive links* that link those texts, which are similar in their lexicogrammatical organisation.

6.2 Constitutive Modules of SFHTs and their Interrelations

From a synchronic point of view, the fundamental components of systemic functional hypertexts and their interrelations can be modelled with the help of simple ER diagrams as shown in Figure 5. The constitutive building blocks are SFHT, SFLINK, TEXT BASE, CONSTITUENTS, NODE,

RESOURCE, and DEPENDENCE: an SFHT has n (binary) SFLINKs built out of pairs of NODEs (i.e. TEXTs or text COMPONENTs serving as references or referents of links, respectively; anchors are omitted for the sake of clarity). (Text) COMPONENTs are (hierarchically) structured by means of CONSTITUENCY that can be seen as a (far too coarse) model of text structure. SFLINKS constitute STEPs as constituents of homogeneous SFTRAVERSALs (of systemic functional hypertexts) typed by RESOURCE (modelling divergent sources of SFLINKS; see below). Further, TEXTs constitute TEXT BASEs of SFHTs thereby realised by means of DEPENDENCE relations.

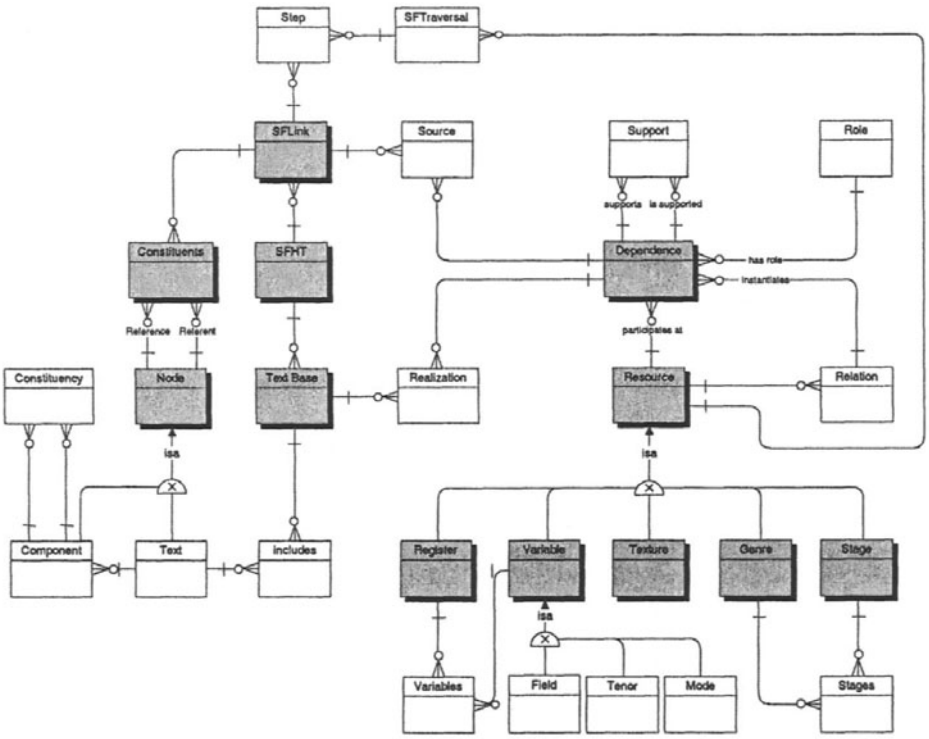

Figure 5. Modules of SFHTs and their interrelations.

Now, the more interesting part of the model is reached: entity types RESOURCE, RELATION, DEPENDENCE and ROLE serve for modelling networks of (macro) GENREs and generic STAGEs, REGISTERs and register VARIABLEs (i.e. FIELD, TENOR, and MODE) as well as of networks of TEXTURE forming resources. Because in all these cases network structures are constituted by means of possibly heterogeneous relations of any arity as well as between entities of different types, RESOURCE is introduced as a super type of contextual and linguistic units. Networks are built out of RELATIONs typed by entities of type RESOURCE (e.g. a given genre), whose arguments (typed by instances of ROLE) are collected by DEPENDENCE (e.g. the genre's stages which are structured by an instance of entity type

RELATION). This abstraction permits the existence of entity dependence relations of different subtypes (e.g. correlations of registers and genres or register variables and generic stages). Besides dependence relations, similarity relations are modelled by means of DEPENDENCE, too. SUPPORT models the support relation introduced above. Finally, SOURCE maps SFLINKs and corresponding DEPENDENCE relations, if available. Clearly, the model shown in Figure 5 has many abundant properties, leaving at the same time many details for a more clear specification. In this sense, it only serves as a first outline of the most fundamental constituents of SFHTs.

7. CONCLUSIONS AND FURTHER RESEARCH

Systemic semiotic theory was used to develop a new dynamic hypertext model called Systemic Functional Hypertexts (SFHT). Unlike conventional hypertext, SFHT is an n-level hypertext model that includes the following aspects: text-forming resources, intra- and inter-textual relations between texts and constituent text segments, as well as the situational and cultural contexts associated with a text. These aspects are usually missing from text processing technologies and the conventional hypertext models upon which they are based. Significantly, the theory has led to a fundamental critique of text linkage from which a typology of systemic functional links has been outlined that can be used as a guide in the process of hypertext authoring as well as to evaluate the quality of already established links.

Further research will involve at least five areas: (i) A detailed typology of systemic functional links which includes the different types of cohesion providing resources, (macro) genres and registers in the area of print media will be explored. (ii) Procedures will be established which allow to delegate the reconstruction of systemic functional links to a computer. At least, these procedures should support hypertext authoring as a semi-automatic process. (iii) In order to be able to adequately separate the concept of systemic functional hypertext and its constituents from alternative approaches proposed in the literature, its complete formalisation is needed. This will be done using XML as a general annotation language for SFLinks. (iv) A browser technology will be developed in order to implement the systemic functional concepts described here. (v) Finally, the `browser technology` will be evaluated with respect to its practicability and usability as a means for navigating within non-linear texts.

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