The Generalized Upper Model 2.0

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This document describes the latest version of the **Generalized Upper Model**, *a general task and domain independent 'linguistically motivated ontology' that supports sophisticated natural language processing while significantly simplifying the interface between domain-specific knowledge and general linguistic resources. We also expect the proposed ontology to provide a solid basis for domain modelling in general, not only where natural language is concerned.*

The Generalized Upper Model 2.0 is a further evolution of the Generalized (English,German,Italian) Upper Model first described in [7] and [1], which was in turn an outgrowth of the **Penman Upper Model** *[6] and the* **Merged Upper Model** *for English and German [20, 21]. We also now incorporate aspects of the theoretical basis articulated at length by [19], thus bringing the Generalized Upper Model more closely in line with the* Ideation Base.

The Generalized Upper Model is presently used in the Multilingual Generation Environment KOMET-PENMAN developed at GMD/IPSI. Currently the system generates coherent text in English, German and Dutch. Extensions to other languages are under development.

This report provides a complete description of the Generalized Upper Model as released as an integral part of the KOMET-PENMAN *text generation system. It includes descriptions of all the concepts defined, their interrelations, and their consequences for surface realization.*

Contents

Chapter 1

How to read this document

This document is an experiment in open hyper-documentation. Our intention is that it *opens up wider access* to the ongoing work on a generalized upper model.

IT IS THEREFORE IN NO SENSE TO BE READ AS A FINISHED 'PRODUCT'. PLACES WHERE THERE ARE ONGOING DEBATES ARE USUALLY MARKED IN THE TEXT. FEEDBACK CONCERNING THE IDEAS AND TREATMENTS PROPOSED HERE ARE ACTIVELY SOUGHT. WE ARE INTERESTED IN EXPERIENCES WITH ATTEMPTING TO USE AN ORGANIZATION SUCH AS THE KIND WE PROPOSE HERE: ONLY IN THE LIGHT OF SUCH EXPERIENCES CAN THE MODEL EVOLVE FURTHER.

Apart from the introductory section, the structure of the document reflects the structure of the upper model hierarchy. This should be an aid to navigation. Suggestions for improvements on the navigation strategies available are also very welcome.

We shall occasionally adopt in the figures the graphical convention of marking dimensions (i.e., disjoint coverings) by a grey area among them (e.g. Inherently-bound, Non-Inherently-bound), disjunctions with a vertical line near the concept being specialized (e.g. Nondirect-Doing, Nondirect-Happening), and partitions with a thick vertical line.

Chapter 2

Introduction to the Generalized Upper Model: what, why and who for

2.1 What is the Generalized Upper Model

The Generalized Upper Model is, in the terms of [4], an *interface ontology*. It occupies a level of abstraction midway between surface linguistic realizations and 'conceptual' or 'contextual' representations. It enables abstraction beyond the concrete details of syntactic and lexical representations, while still maintaining close enough contact with linguistic realizations to be solidly founded on objective criteria. That is: if there is no specifiable *lexicogrammatical* consequences for a 'concept', then it does not belong in the Generalized Upper Model. More information about how this works is given in the section on **Motivations**.

The motivations are important, since without fully understanding these it is easy to misinterpret or misunderstand the import of the definitions. Some common misconceptions, that were sometimes supported by inadequacies in previous documentation, are the following:

- MISCONCEPTION: The Upper Model is *theory specific*.
- MISCONCEPTION: The Upper Model is a *lexical semantics*.
- MISCONCEPTION: The Upper Model is *language specific*.
- MISCONCEPTION: The Upper Model is an *interlingua*.

For more details on the theoretical position that allows us to side-step the language-specific and interlingua distinction, see [9].

2.1.1 Common Misconceptions concerning the Upper Model

The misconceptions can be characterized in greater detail thus:

- MISCONCEPTION: The Upper Model is *theory specific*.

  As described in the motivations, we rely very heavily on a particular theoretical view of the lexicogrammatical systems of languages in order to argue for Upper Model organization. However, this is used simply as a tool for *uncovering semantic distinctions*. Once the distinctions have been revealed, they hold for any theoretical account—they cannot be made to go away by using a different linguistic theory. The patterns of linguistic behavior we describe are objectively observable in the languages under study. The resulting Upper Model organisation is thus a candidate for semantic organization regardless of the theoretical positions taken.

- MISCONCEPTION: The Upper Model is a *lexical semantics*.

  The Upper Model does not describe the semantics of *words*. It is our belief that this would be precisely the wrong place to start looking for a generic account of semantics. In contrast to this, the Upper Model is a *grammatical semantics*. The concepts proposed in the Generalized Upper Model are accounts of the semantics that may be expressed in grammatical units such as clauses, nominal groups, circumstantial phrases, etc. It is then, strictly speaking, not possible to talk about the position of some *word* in the Upper Model. One should only talk of the position of some semantics expressed by some words functioning in some grammatical context. That grammatical context can range across the entire lexicogrammar of a language. We do not restrict (and must not restrict if we want maximum genericity) our attention to narrow areas of syntax.

  Note: if there are still vestiges of earlier formulations in the current document that suggest that we are talking about the semantics of words, please let us know! These must be removed!

- MISCONCEPTION: The Upper Model is *language specific*.

  It is commonly supposed that since the Upper Model is motivated on the basis of particular languages, then it is language specific. This is only true to a certain extent. Since the tool we are using to uncover Upper Model distinctions is a functional grammar that defocuses linguistic 'structure', we find that there is a much higher degree of cross-language generalization already built in. Certain generalized functions observable in the grammar of English are equally observable in the grammars of German, Italian, Dutch, Chinese, Japanese, etc. To this extent, the claim that the Upper Model is language specific is overstated.

  Another common cause for mistake in believing that the Upper Model is language specific (or English-biased, for example) is the former misconception. It is necessary to avoid comparing 'words' across languages: one must always ask what the function of the grammatical forms are in which those words occur: that form could well include features distributed across grammatical units such

as the verbal group, various adjuncts, as well as participants. This fact, which is particularly important multilingually, often leads to simple mistakes in analysis if ignored.

- MISCONCEPTION: The Upper Model is an *interlingua*.

  It is commonly supposed that, since we occasionally (for comprehensibility) describe the Upper Model as similar to an 'ontology', the Upper Model is language independent. However, given its roots in the functional lexicogrammatical distinctions made in individual languages this cannot be so. There may always be distinctions that are semantically relevant in one language that are not relevant in another. We do not include unrestrictedly the union of semantic distinctions in the Upper Model; nor do we ignore distinctions that are not relevant for all languages. The Generalized Upper Model is a *multilingual description* in the sense of [9], not an interlingual description.

2.2 Intended Uses of the Generalized Upper Model

The Generalized Upper Model is intended to be a domain and task-independent general organization of information. It is, therefore, in certain senses, an 'ontology' as currently being discussed in the context of shareable knowledge resources

Since, however, the motivations for Generalized Upper Model concepts are drawn from linguistic evidence, the Model itself is very well suited to Natural Language Processing applications.

Intended uses of the Generalized Upper Model are therefore:

- a proposal for domain model organization,
- a level of organization for interfacing between domain models and natural language components.

The most extensive use of the Generalized Upper Model and its predesessors to date has been in the context of text generation; first monolingual for English, and now increasingly multilingual.

2.3 Motivations for the Generalized Upper Model design

The genericity of the Generalized Upper Model is founded in its source of motivations: the lexicogrammatical systems of natural languages. Since we can talk about any domain, an organization that supports such activity is guaranteed a certain degree of genericity. This also means that there is a very high degree of *re-usability* for certain classes of task. Thus, for example, if language generation is required there is

typically 100% re-usability across domains for organizations such as the Upper Model (in contrast to the 50% described by [39] for the, largely non-linguistically motivated, LILOG ontology.) This is simply because a linguistically motivated ontology is bound to the semantics of a *grammar* and not to general, possibly domain-transcendent knowledge.

Linguistically motivated ontologies and non-linguistically motivated ontologies should therefore be seen as performing different kinds of work. For extensive motivations for maintaining a linguistically motivated ontology, see [19, 4].

One good introduction to the kind of motivations that are used for determining membership in the Generalized Upper Model is the following description of cryptotypes and reactances from [43, p88ff], quoted at length by [19]:

> An overt category is a category having a formal mark which is present (with only infrequent exceptions) in every sentence containing a member of the category. The mark need not be part of the same work to which the category may be said to be attached in a paradigmatic sense; i.e., it need not be a suffix, prefix, vowel change, or other 'inflection', but may be a detached word or a certain patterning of the whole sentence. ...
>
> A covert category is marked, whether morphemically or by sentence pattern, only in certain types of sentence and not in every sentence in which a word or element belonging to the category occurs. The class membership of the word is not apparent until there is a question of using it or referring ot it in one of these special types of sentence, and then we find that this word belongs to a class requiring some sort of distinctive treatment, which may even be the negative treatment of excluding that type of sentence. This distinctive treatment we may call the *reactance* of the category. ... A covert category may also be termed a *cryptotype*, a name which calls attention to the rather hidden, cryptic nature of such word-groups, especially when they are not strongly contrasted in idea, nor marked by frequently occuring reactances such as pronouns. They easily escape notice and may be hard to define, and yet may have profound influence on linguistic behaviour. ...Names of countries and cities in English form a cryptotype with the reactance that they are not referred to by personal pronouns as objects of the prepositions 'in, at, to, from'. We can say 'I live in Boston' but not 'That's Boston–I live in it'.

More specifically, we can narrow down the class of cryptotypes that form the basis for motivating Generalized Upper Model concepts as follows.

Several methodologies have been pursued for uncovering the organization and contents of a level of meaning such as an upper model; Figure 2.1 sets out most of them, with examples of approaches that have adopted them, along the continuum of abstraction introduced in the previous section. While the problem of being too bound to linguistic form has been mentioned, there are also severe problems with attempts to construct an upper model independent of form and motivated by other criteria, e.g., a logical theory of the organization of knowledge *per se*. Without a strong theoretical connection to

nonlinguistic	reality	ontological — 'logical'	Weischedel (1989)
	knowledge	cognitive — 'psychological'	Langacker (1987)
		situational — 'socio/psycho-logical'	Steiner (fc)
linguistic	meaning	grammatical semantics inquiry semantics clause-based	Halliday & Matthiessen (fc) PENMAN UPPER MODEL
		lexical semantics word senses word-based	Jackendoff (1983), LFG Mel'čuk & Žholkovskij (1970)
	form	syntactic realization classes syntax	Steiner *et al.* (1987) LFG

Figure 2.1: Sources of motivations for upper model development

the linguistic system the criteria for organizing an abstraction hierarchy remain ill-specified; there is very little guarantee that such systems will organize themselves in a way appropriate for interfacing well with the linguistic system.

(This table is drawn from [3]; full references are also provided there.)

An alternative route is offered by the approaches in the middle of the continuum, i.e., those which abstract beyond linguistic form but which still maintain a commitment to language as a motivating force. This is further strengthened by the notion, now resurgent within current linguistics, that the organization of language informs us about the organization of 'knowledge' (e.g., [16, 24, 26, 32, 42]): that is, *the relation between grammar and semantics/meaning is not arbitrary.* Detailed theories of grammar can then be expected to provide us with insights concerning the organization that is required for the level of meaning.

We have found that the range of meanings required to support one particular generalized area of the lexicogrammars of natural languages provides a powerful set of organizing constraints concerning what an upper model should contain. This area corresponds with the Systemic Functional Linguistic notion of the *experiential metafunction* [32], one of four generalized meaning types which are simultanously and necessarily made whenever language is used.

Any sentence must contain contributions to its function from all four 'metafunctions' — each metafunction providing a distinct type of constraint. The value of this factorization of distinct meaning types as far as the design of an upper model is concerned can best be seen by examining briefly what it *excludes* from consideration for inclusion within an upper model: i.e., all information that is controlled by the remaining three metafunctions should not be represented.

- The *logical metafunction* is responsible for the construction of composite semantic entities using the resources of interdependency; it is manifested in grammar by dependency relationships such as those that hold between the head of a

phrase and its dependents and the association of concepts to be expressed with particular heads in the sentence structure. The removal of this kind of information permits upper model specifications to be independent of grammatical constituents and grammatical dominance relations.

This relaxes, for example, the mapping between objects and processes at the upper model level and nominals and verbals at the grammatical level, enabling generalizations to be captured concerning the existence of verbal participants in nominalizations, and permits the largely textual variations shown in (1) and (2) (Example taken from [35].) to be removed from the upper model coding.

```
(1) It will probably rain tomorrow
    It is likely that it will rain tomorrow
    There is a high probability that it will rain tomorrow

(2) independently
    in a way that is independent
```

No change in upper model representation or classification is required to represent these variations.

This can be seen more specifically by considering the following semantic specification for generation systems using the Penman Sentence Plan Language input specification. This specification only uses upper model terms:

```
((c0 /  cause-effect
   :domain   discharge  :range  breakdown)
 (discharge / directed-action
   :actee  (electricity /  substance))
 (breakdown /   nondirected-action
   :actor (system / object)))
```

This states that there are two configurations of processes and participants — one classified as an upper model *directed-action*, the other as a *nondirected-action* — which are related by the upper model relationship *cause-effect*. Now, the assignment of concepts to differently 'ranked' heads in the grammar governs realization variants including the following:

> *Electricity being discharged resulted in the system breaking down.*
> *Because electricity was discharged, the system broke down.*
> *Because of electricity being discharged the system broke down.*
> *. . . the breakdown of the system due to an electrical discharge. . .*
> *Electricity was discharged causing the system to break down.*
> *. . . an electrical discharge causing the breakdown of the system. . .*
> etc.

Many such 'paraphrase' issues are currently of concern within the text generation community (e.g., [35, 23, 10]).

- The *textual metafunction* is responsible for the creation and presentation of text in context, i.e., for establishing textual cohesion, thematic development, rhetorical organization, information salience, etc. The removal of this kind of information allows upper model specifications to be invariant with respect to their particular occasions of use in texts and the adoption of textually motivated perspectives, such as, e.g., theme/rheme selections, definiteness, anaphora, etc. Thus, with the same input specification as above, the following variations are supported by varying the textual constraints:

  > *It was the electricity being discharged that resulted in the system breaking down.*
  > *The discharge of electricity resulted in the system breaking down.*
  > *The system breaking down — the electricity being discharged did it!*
  > etc.

  And similarly, the following variation is supported within nominal phrases:

  > *... the discharge of electricity...*
  > *... a discharge of electricity...*
  > *... some particular electrical discharge...*
  > *... it...*
  > etc.

  These textual variations are controlled during the construction of text (cf. [32, 12, 22, 36, 8]) and, again, are factored out of the upper model.

- The *interpersonal metafunction* is responsible for the speaker's interaction with the listener, for the speech act type of an utterance, the force with which it is expressed, etc. Thus, again with the same input specification, the following variants are possible:

  > *Did electricity being discharged result in the system breaking down?*
  > *Electricity being discharged resulted surprisingly in the whole damn thing breaking down.*
  > *I rather suspect that electricity being discharged may have resulted in the system breaking down.*
  > etc.

This leaves the upper model with the task of representing the speaker's experience in terms of generalized linguistically-motivated 'ontological' categories. More specifically, the following information is required (with example categories drawn from the Generalized Upper Model):

- abstract specifications of process-type/relations and configurations of participants and circumstances (e.g., NONDIRECTED-ACTION, ADDRESSEE-ORIENTED-VERBAL-PROCESS, ACTOR, SENSER, RECIPIENT, SPATIO-TEMPORAL, CAUSAL-RELATION, GENERALIZED-MEANS),

- abstract specifications of object types, for, e.g., *semantic* selection restrictions (e.g., DECOMPOSABLE-OBJECT, ABSTRACTION, PERSON, SPATIAL-TEMPORAL),
- abstract specifications of quality types, and the types of entities which they may relate (e.g., BEHAVIORAL-QUALITY, SENSE-AND-MEASURE-QUALITY, STATUS-QUALITY),
- abstract specifications of combinations of events (e.g., DISJUNCTION, EXEMPLIFICATION, RESTATEMENT).

The metafunctional factorization thus permits the upper model to specify experiential meanings that are invariant with respect to the linguistic alternations driven by the other metafunctions. That is, a specification in upper model terms is consistent with a set of linguistic realizations that may be regarded as 'experiential paraphrases': the specification expresses the 'semantic' content that is shared across those paraphrases and often provides just the level of linguistically decommitted representation required for nonlinguistically oriented applications. Generation of any unique surface realization is achieved by additionally respecting the functional constraints that the other metafunctions bring to bear; particular surface forms are only specifiable when a complete set of constraints from each of the four metafunctions are combined. The application of these constraints is directly represented in the PENMAN grammar, which provides for the perspicuous and modular integration of many disparate sources of information. The interdependencies between these constraints and their conditions of applicability are also directly represented in the grammar. This organization of the grammar allows us to construct a rather abstract upper model while still preserving the necessary mapping to linguistic form. The value of achieving the abstract specification of meaning supported by the upper model is then that it permits a genuinely form-independent, but nevertheless *form-constraining*, 'conceptual' representation that can be used both as a statement of the semantic contents of an utterance and as an abstract specification of content for application domains that require linguistic output. Furthermore, given its detail and consistency, the organization appears appropriate for enforcing ontological consistency in general domain modelling.

2.4 Development History

The Generalized Upper Model is a result of continuing evolution beginning with the Penman Upper Model [28, 29, 37, 6]. A main shaping force of the original Upper Model was also the 'Bloomington Lattice' of Halliday and Matthiessen begun also in 1985.

In the context of the Penman project it was found that the definition of a mapping between knowledge and its linguistic expression is facilitated if it is possible to classify any particular instances of facts, states of affairs, situations, etc. that occur in terms of a set of general objects and relations of specified types that behave systematically with respect to their possible linguistic realizations.

The Penman Upper Model was implemented (first in NIKL, subsequently in LOOM) and has been used continuously ever since in the Penman text generation system. Since then a number of variants of the Upper Model have appeared, usually with slight extensions to the original.

In parallel, Halliday and Matthiessen have continued their investigations into a general level of semantics and this now appears as [19].

The Generalized Upper Model attempts to re-combine these developments drawing on the experiences that have been gained with it and its descendents use over the past 10 years.

2.5 Overall organization of the Upper Model Hierarchy

The Upper Model is split into two hierarchies. The first one contains all the concepts and has as a top entity the concept **um-thing**. The second one contains all the roles and has a top entity the role **um-relation**. Upper model concepts are written as **concept**; these concepts may have roles defined for them, the roles are written as **role**. Domain concepts, where used for illustrative purposes, are written as `domain-concept`.

(In an SPL term concepts correspond to types and in an SPL term roles correspond to modifying slots.)

This document describes in detail both these hierarchies, but for organizational purposes, it will be centered around the concept hierarchy. For each concept, where appropriate, links will be given to the roles which could be used to modify it.

The top node of the concept hierarchy, **um-thing**, corresponds to the most general abstract entity posited in the semantics of the Upper Model. It corresponds to "Phenomena" or "Situation" in [19]. There are three major subtypes of "Phenomena":

1. As a configuration of elements all partecipating in some activity or state of affairs. This is represented by the concept **configuration**.
2. As a single, "stand-alone", object or conceptual item. This is represented by the concept **element**.
3. As a complex situation where various activities or configurations are connected by some relation to form a sequence. This is represented by the concept **sequence**.

These or equivalent classes are relatively common in ontology proposals. An analogy is often drawn between them and the familiar linguistic notions of noun, verb, and adjective/adverb: **Simple-Things** are those things that are typically classified as nouns, **processes** correspond to verbs, and **qualities** to adjectives or adverbs. This

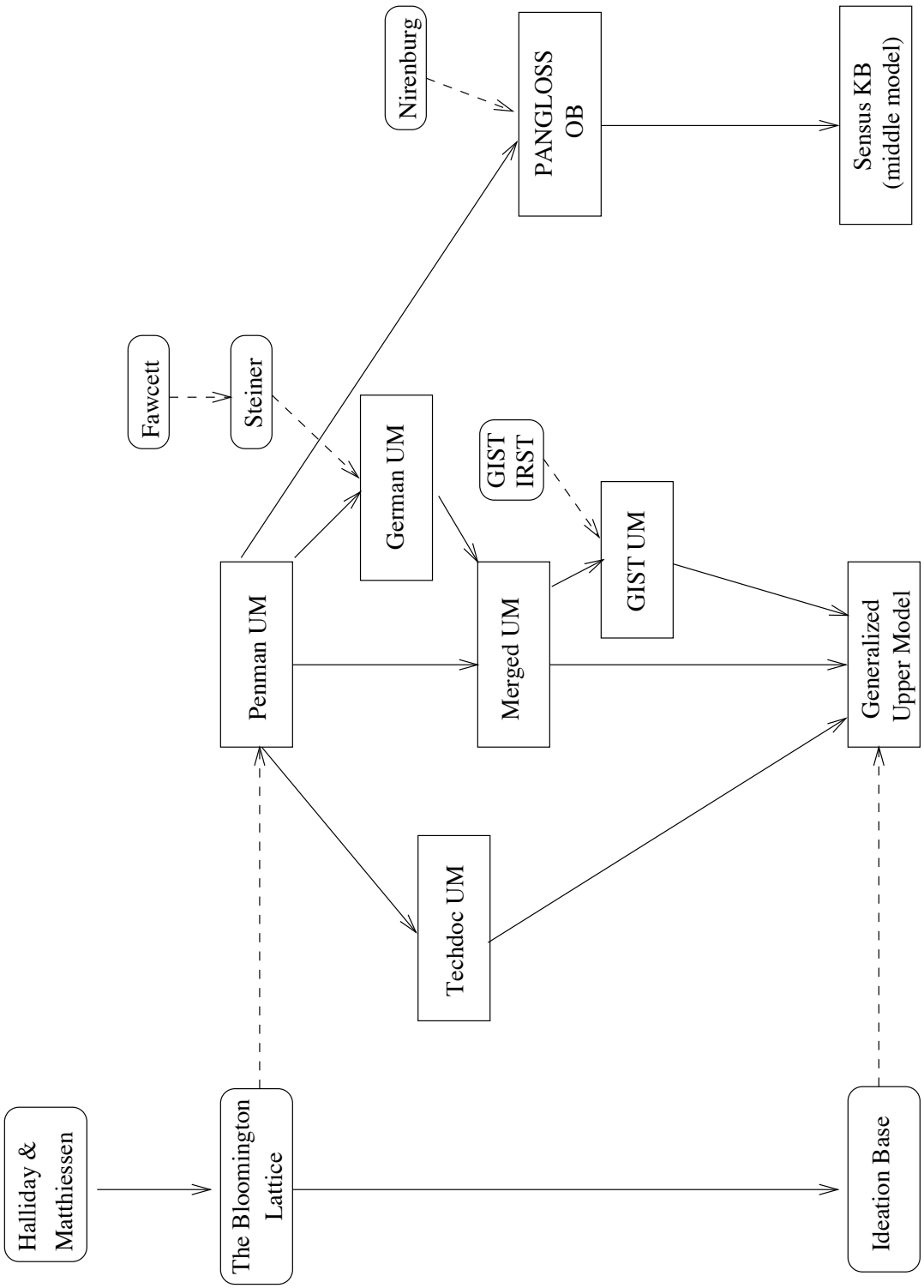


Figure 2.2: History

can be misleading, however, as noted in the misconceptions described in Section2.1.1; it too readily suggests a surface linguistic lexical classification scheme instead of the semantic classification actually provided.

Where the analogy does serve is to help give a sense of the connection between placement in the upper model and classes of linguistic realization. If we replace noun, verb and adjective/adverb by *nominal group*, *clause* and *adjectival/adverbal group* then we are on firmer ground. However, most concepts call both for much finer constraints on their possible realizations and for a broader range of possible realizations. Examples of this are given later in the document.

2.5.1 The Concept Hierarchy

The complete conceptual hierarchy is shown in the figure at pag.16.

2.5.2 The Relational Hierarchy

The complete relational hierarchy is shown in the figure at pag.17.

2.6 Introduction to configurations

The central organization of the Generalized Upper Model is provided by **configuration**.

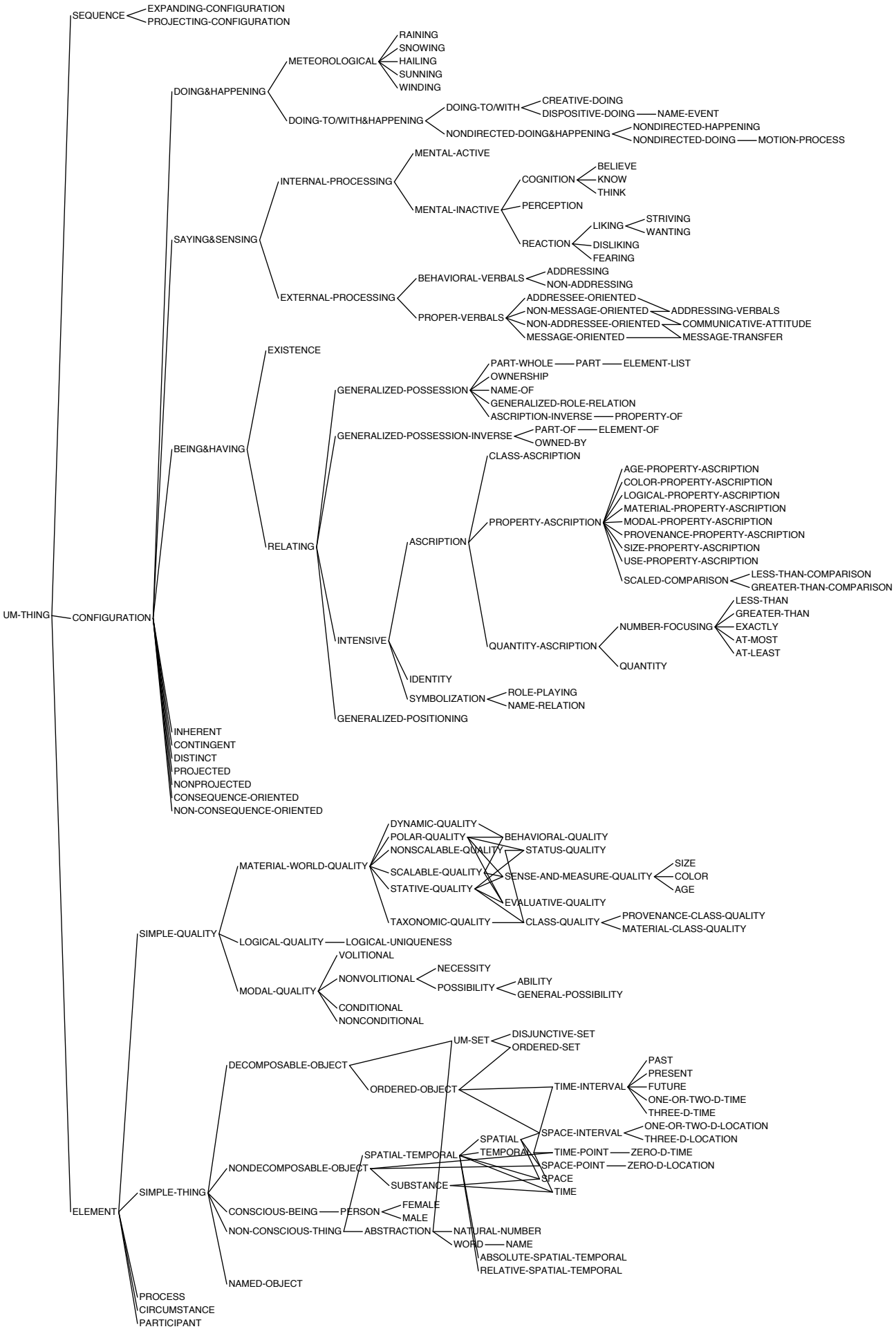
> [...] the semantic theory of [configurations] is a theory of 'goings-on' in the world and it embodies two subtheories – one concerning different domains of experience and one concerning the way in which phenomena can interact. [19]

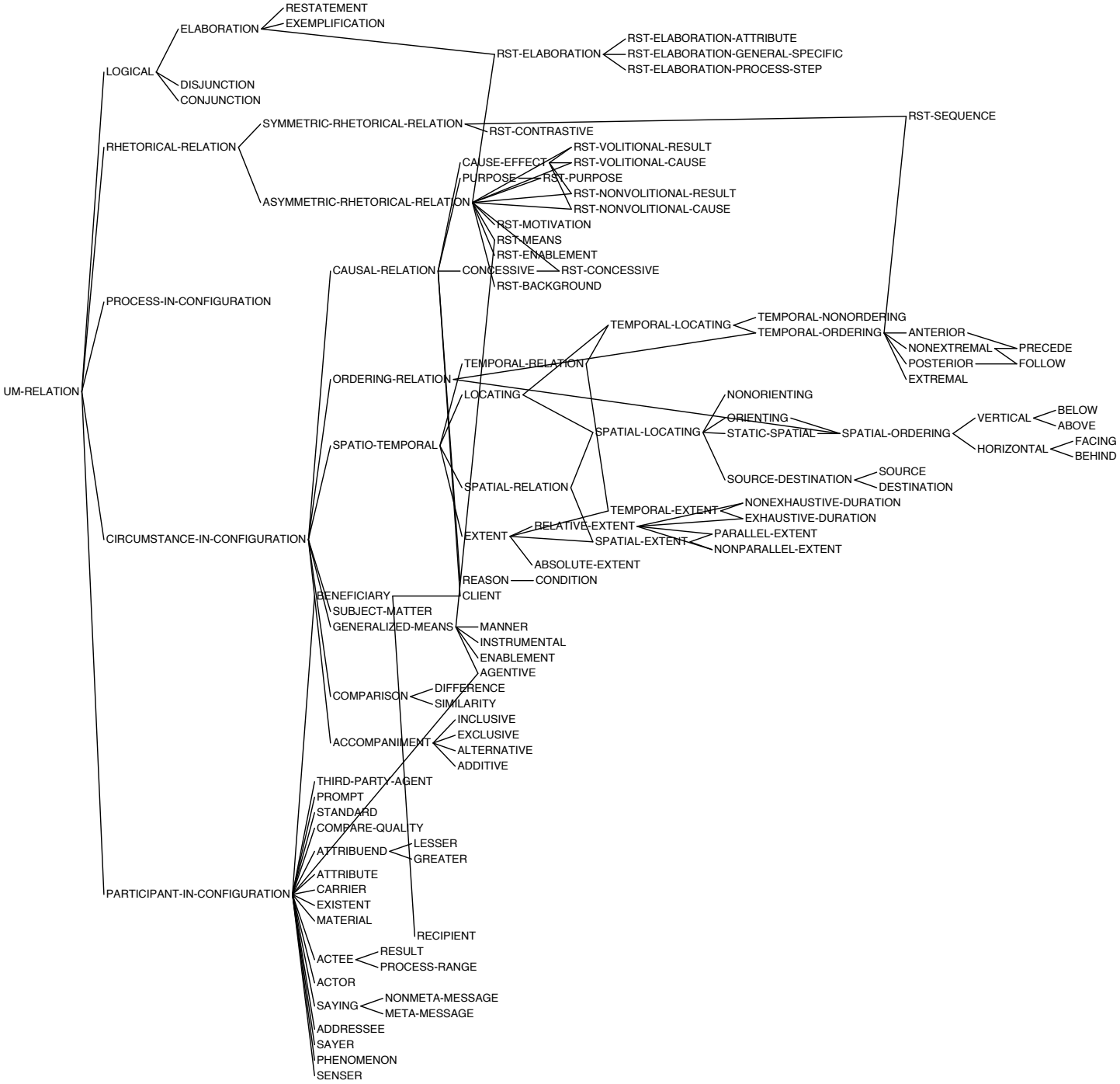
Configurations are typically signalled by a wide range of co-occuring phenomena in the grammar of a natural language. That is,

> The different [configuration] types are not signalled overtly in the grammar; they are covert or cryptotypic categories and emerge only when we consider reactances (see [43] for the notions of cryptotypes and reactances). [19]

2.6.1 A note on the Systemic-functional Perspectives on 'Process'

Since the organization of the Upper Model has been strongly strongly motivated by the informational requirements of the systemic functional models of grammar,


UM-THING
SEQUENCE
EXPANDING-CONFIGURATION
PROJECTING-CONFIGURATION
CONFIGURATION
DOING&HAPPENING
METEOROLOGICAL
RAINING
SNOWING
HAILING
SUNNING
WINDING
DOING-TO/WITH&HAPPENING
DOING-TO/WITH
CREATIVE-DOING
DISPOSITIVE-DOING
NAME-EVENT
NONDIRECTED-DOING&HAPPENING
NONDIRECTED-HAPPENING
NONDIRECTED-DOING
MOTION-PROCESS
SAYING&SENSING
INTERNAL-PROCESSING
MENTAL-ACTIVE
MENTAL-INACTIVE
COGNITION
BELIEVE
KNOW
THINK
PERCEPTION
REACTION
LIKING
STRIVING
WANTING
DISLIKING
FEARING
EXTERNAL-PROCESSING
BEHAVIORAL-VERBALS
ADDRESSING
NON-ADDRESSING
PROPER-VERBALS
ADDRESSEE-ORIENTED
NON-MESSAGE-ORIENTED
ADDRESSING-VERBALS
NON-ADDRESSEE-ORIENTED
COMMUNICATIVE-ATTITUDE
MESSAGE-ORIENTED
MESSAGE-TRANSFER
BEING&HAVING
EXISTENCE
RELATING
GENERALIZED-POSSESSION
PART-WHOLE
PART
ELEMENT-LIST
OWNERSHIP
NAME-OF
GENERALIZED-ROLE-RELATION
ASCRIPTION-INVERSE
PROPERTY-OF
GENERALIZED-POSSESSION-INVERSE
PART-OF
ELEMENT-OF
OWNED-BY
INTENSIVE
ASCRIPTION
CLASS-ASCRIPTION
PROPERTY-ASCRIPTION
AGE-PROPERTY-ASCRIPTION
COLOR-PROPERTY-ASCRIPTION
LOGICAL-PROPERTY-ASCRIPTION
MATERIAL-PROPERTY-ASCRIPTION
MODAL-PROPERTY-ASCRIPTION
PROVENANCE-PROPERTY-ASCRIPTION
SIZE-PROPERTY-ASCRIPTION
USE-PROPERTY-ASCRIPTION
SCALED-COMPARISON
LESS-THAN-COMPARISON
GREATER-THAN-COMPARISON
QUANTITY-ASCRIPTION
NUMBER-FOCUSING
LESS-THAN
GREATER-THAN
EXACTLY
AT-MOST
AT-LEAST
QUANTITY
IDENTITY
SYMBOLIZATION
ROLE-PLAYING
NAME-RELATION
GENERALIZED-POSITIONING
INHERENT
CONTINGENT
DISTINCT
PROJECTED
NONPROJECTED
CONSEQUENCE-ORIENTED
NON-CONSEQUENCE-ORIENTED
ELEMENT
SIMPLE-QUALITY
MATERIAL-WORLD-QUALITY
DYNAMIC-QUALITY
POLAR-QUALITY
BEHAVIORAL-QUALITY
NONSCALABLE-QUALITY
STATUS-QUALITY
SCALABLE-QUALITY
SENSE-AND-MEASURE-QUALITY
SIZE
COLOR
AGE
STATIVE-QUALITY
EVALUATIVE-QUALITY
TAXONOMIC-QUALITY
CLASS-QUALITY
PROVENANCE-CLASS-QUALITY
MATERIAL-CLASS-QUALITY
LOGICAL-QUALITY
LOGICAL-UNIQUENESS
MODAL-QUALITY
VOLITIONAL
NONVOLITIONAL
NECESSITY
POSSIBILITY
ABILITY
GENERAL-POSSIBILITY
CONDITIONAL
NONCONDITIONAL
SIMPLE-THING
DECOMPOSABLE-OBJECT
UM-SET
DISJUNCTIVE-SET
ORDERED-SET
ORDERED-OBJECT
TIME-INTERVAL
PAST
PRESENT
FUTURE
ONE-OR-TWO-D-TIME
THREE-D-TIME
SPACE-INTERVAL
ONE-OR-TWO-D-LOCATION
THREE-D-LOCATION
NONDECOMPOSABLE-OBJECT
SPATIAL-TEMPORAL
SPATIAL
TEMPORAL
TIME-POINT
ZERO-D-TIME
SPACE-POINT
ZERO-D-LOCATION
SUBSTANCE
SPACE
TIME
CONSCIOUS-BEING
PERSON
FEMALE
MALE
NON-CONSCIOUS-THING
ABSTRACTION
NATURAL-NUMBER
WORD
NAME
ABSOLUTE-SPATIAL-TEMPORAL
RELATIVE-SPATIAL-TEMPORAL
NAMED-OBJECT
PROCESS
CIRCUMSTANCE
PARTICIPANT


UM-RELATION
LOGICAL
ELABORATION
RESTATEMENT
EXEMPLIFICATION
DISJUNCTION
CONJUNCTION
RST-ELABORATION
RST-ELABORATION-ATTRIBUTE
RST-ELABORATION-GENERAL-SPECIFIC
RST-ELABORATION-PROCESS-STEP
RHETORICAL-RELATION
SYMMETRIC-RHETORICAL-RELATION
RST-CONTRASTIVE
RST-SEQUENCE
ASYMMETRIC-RHETORICAL-RELATION
CAUSE-EFFECT
RST-VOLITIONAL-RESULT
RST-VOLITIONAL-CAUSE
PURPOSE
RST-PURPOSE
RST-NONVOLITIONAL-RESULT
RST-NONVOLITIONAL-CAUSE
RST-MOTIVATION
RST-MEANS
RST-ENABLEMENT
CAUSAL-RELATION
CONCESSIVE
RST-CONCESSIVE
RST-BACKGROUND
PROCESS-IN-CONFIGURATION
TEMPORAL-LOCATING
TEMPORAL-NONORDERING
TEMPORAL-ORDERING
ANTERIOR
NONEXTREMAL
PRECEDE
POSTERIOR
FOLLOW
EXTREMAL
TEMPORAL-RELATION
ORDERING-RELATION
LOCATING
NONORIENTING
ORIENTING
SPATIAL-LOCATING
STATIC-SPATIAL
SPATIAL-ORDERING
VERTICAL
BELOW
ABOVE
HORIZONTAL
FACING
BEHIND
SPATIO-TEMPORAL
SOURCE-DESTINATION
SOURCE
DESTINATION
SPATIAL-RELATION
TEMPORAL-EXTENT
NONEXHAUSTIVE-DURATION
EXHAUSTIVE-DURATION
RELATIVE-EXTENT
PARALLEL-EXTENT
CIRCUMSTANCE-IN-CONFIGURATION
EXTENT
SPATIAL-EXTENT
NONPARALLEL-EXTENT
ABSOLUTE-EXTENT
REASON
CONDITION
BENEFICIARY
CLIENT
SUBJECT-MATTER
GENERALIZED-MEANS
MANNER
INSTRUMENTAL
ENABLEMENT
AGENTIVE
COMPARISON
DIFFERENCE
SIMILARITY
INCLUSIVE
ACCOMPANIMENT
EXCLUSIVE
ALTERNATIVE
ADDITIVE
THIRD-PARTY-AGENT
PROMPT
STANDARD
COMPARE-QUALITY
ATTRIBUEND
LESSER
GREATER
ATTRIBUTE
CARRIER
EXISTENT
MATERIAL
RECIPIENT
PARTICIPANT-IN-CONFIGURATION
ACTEE
RESULT
PROCESS-RANGE
ACTOR
SAYING
NONMETA-MESSAGE
META-MESSAGE
ADDRESSEE
SAYER
PHENOMENON
SENSER

such as that for English developed by Halliday (e.g., [17]) and now set out in great detail in [34], it can be useful to know something about the grammatical account of 'processes' that the systemic model adopts.

Halliday [17, 101] states that grammatically a process potentially consists of three components:

- the process itself,
- participants in the process,
- circumstances associated with the process.

The process itself is typically realized by a verbal group. Entities classified under **process** can usually be expressed as verbs and are frequently the main verb in a clause; this contrats with entities classified under **configuration** which would be realized by the clause itself.

Participants in a process typically come from the object hierarchy and are realized as nominal groups, although there are, obviously, exceptions — such as processes which relate processes themselves in addition to objects (e.g., causality, or mental processes that describe propositional attitudes, etc.).

Circumstances are usually taken from the circumstance hierarchy and often appear as prepositional phrases. While the participants of a process are considered to be in some sense essential to the performance, or 'actualization', of the process, circumstances provide additional contextualizing information such as temporal and spatial location, manner of performance of the process, purposes, etc. The precise distribution of participants and circumstances depends on the type of process.

From the systemic-functional perspective, process is seen as central with participants linked most tightly to that process (consisting minimally of the 'Medium' participant, see below, and then possibly others in addition as required by the process), and circumstances less tightly. This broad scheme of organization is based on linguistic generalizations across the range of clause types in English. Most current syntactic theories now recognize this kind of separation into essential participants and more circumstantial elements. Terms often used are 'bound' elements, inherent roles [15, p134], theta roles, thematic relations [24, 25], predicate-argument structures [11], etc.

Another dimension of organization drawn specifically from systemic-functional linguistics that will be of use in our descriptions of processes and participants below is that which contrasts the *transitive* model of participancy in processes with the *ergative* model (cf. [17, pp144-149]). A typical transitive interpretation of clause structure is in terms of an *actor* acting upon some *goal* where what is brought into focus is a dimension of *extension*:

> "the Actor is engaged in a process; does the process extend beyond the Actor, to some other entity, or not? So *the lion chases the tourist* relates to *the lion ran*: 'the lion did some running; either the running stopped there (intransitive, *the lion ran*), or else it extended to another participant (transitive, *the lion chased the tourist*)." [17, p145]

Halliday suggests that it is also necessary to provide a complementary analysis in terms of an *ergative* model where the focus is one of *causation* rather than of extension. Here the question is:

> "Some participant is engaged in a process; is the process brought about by that participant, or by some other entity? In this perspective, *the lion chased the tourist* relates not so much to *the lion ran* as to *the tourist ran*: 'the tourist did some running; either the running was instigated by the tourist himself (intransitive *the tourist ran*), or else by some external agency (transitive *the lion chased the tourist*)'." [17, p145]

Pairs such as:

> *The burglar broke the vase / The vase broke*
> *Mary sailed the boat / The boat sailed*
> *The news weakened my resolve / My resolve weakened*

are accordingly said to form ergative/non-ergative pairs rather than the more familiar transitive/intransitive pairs. And, in this perspective, the participant that is common to both members of a pair is functionally labeled as the MEDIUM. This is considered to be the key figure in every process: "the one through which the process is actualized, and without which there would be no process at all."[17, p146]

For the transitive interpretation we find basic configurations of participants such as *actor* and *goal*, whereas from the ergative standpoint we find configurations such as *agent* and *medium*. The participants *actor* and *agent*, and *goal* and *medium* need not correspond and so both dimensions of organization need to be maintained to obtain maximally adequate analyses. In our descriptions of processes and participants below, we will occasionally refer to this interpretation of events; in particular, we will need to refer to the *medium* participant in a process as that participant most centrally concerned or effected.

See Tables 5(18) and 5(20) in [17, p148 and p155] respectively for useful clarifications of the interrelationships of the ergative and transitive views on process participants.

2.6.2 Representational Perspectives

Currently, the Generalized Upper Model is represented primarily in LOOM (although a number of other representations have been experimented with or used). Here, each process is represented as a 'concept'. LOOM concepts may have a variety of 'roles' which take further concepts as their values. These role values may be restricted either in number, by 'number restrictions' placed on roles in the definition of concepts, or in value, by 'value restrictions', which specify which types of concepts are permitted to act as values for a given role (cf. [27]).

Each representation of a process as a concept defines a role for each of its participants. That is, the roles that correspond to the obligatory participants of a process

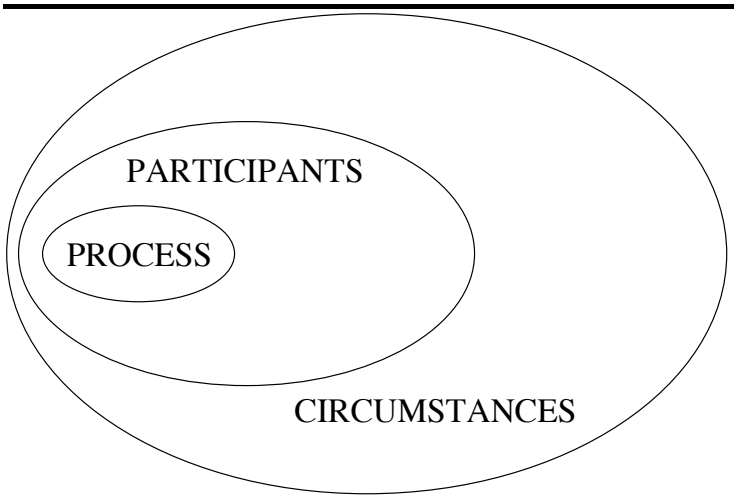


Figure 2.3: Clustering of process, participants, and circumstances

```
(defconcept Material-Process
  :is (:and Process (:at-least 1 Actor)))
```

Figure 2.4: Example LOOM definition of the concept **material-process**

will be constrained (typically by a *number* restriction) to occur on all subclasses of the concept representing the process. An example LOOM definition for the process type **material-process** (described below) is shown in Figure 2.4. Here we see that **material-process** is defined to be a subtype of the concept **process** and all **material-process**es are constrained to possess at least one participant, which is further constrained to be a role of type **actor**. We will see as we discuss more specific classes of processes that there are particular kinds of participant roles associated with different types of processes.

Furthermore, the participant roles may be value restricted to different concepts in the object hierarchy for different processes, e.g., a **mental-process** might require an entity capable of mental processing whereas a **material-process** might not.

The optionality and freedom of occurrence of process circumstances is then represented by defining them as relations of particular types between processes and concepts (typically **object**s) of appropriate kinds. An alternative method would be to include applicable circumstances in the definitions of Configuration themselves. This would necessitate placing an optional role specification (represented by a number restriction of 'at least zero') for all the types of circumstances that might occur with the concept **process**. Instead of this, value restrictions that limit the types of processes to which the circumstance may be attributed are placed directly in the circumstance definition.

```
(defreified-relation Circumstantial
  :is (:and Two-Place-Relation :primitive)
      (:DOMAIN process))
```

Figure 2.5: LOOM definition of **circumstances**

2.6.3 Comparison with previous Upper Model versions

The concepts that in the previous versions were classified as "Objects" or "Qualities" now are considered **element**s (and, more specifically, **simple-object**s and **simple-qualitie**s). The internal organization of these two hierarchies has not been changed (for the moment). Process might be defined as a further kind of elements, but the current version does not give a taxonomy of processes. What in the previous version was represented using a "process", now has to be represented using a **configuration**.

Chapter 3

Configurations

3.1 Being & Having Configurations

One functional component of the NIGEL grammar concerns what is called *relational transitivity*, i.e., the statement, questioning, negation, etc. of relations between entities in contrast to processes of doing or sensing: *"The central meaning of clauses of this type is that something is"* [17, p112].

Halliday's discussion of *processes of being* analyzes this area of English grammar in terms of three primary categories: *intensive, circumstantial,* and *possessive* (See [15] for an alternative analysis). Halliday further divides each of these into two possible modes: *attributive* and *identifying*. These may be summarized as follows:

	(1)	intensive	'x is *a*'
	(2)	circumstantial	'x is at *a*'
+	(3)	possessive	'x has *a*'

each subclassifiable according to:

(i)	attributive	'*a* is an attribute of x'
(ii)	identifying	'*a* is the identity of x'

> One type of figure is in a sense a configurational theory of participants – figures of being&having: the qualities, parts and qualifications of things are construed as relations of being [19].

The principal subtypes of Being & Having Configurations

Being & Having Configurations are currently broken down into two subclasses, corresponding to one and two place relations. No three or more place relations are distinguished by the grammar at present. The current version of the Upper Model includes three subclasses of Relating (**Generalized-Possession, Intensive, Circumstantial**). The subhierarchy and immediate subclasses are shown in the following figure.

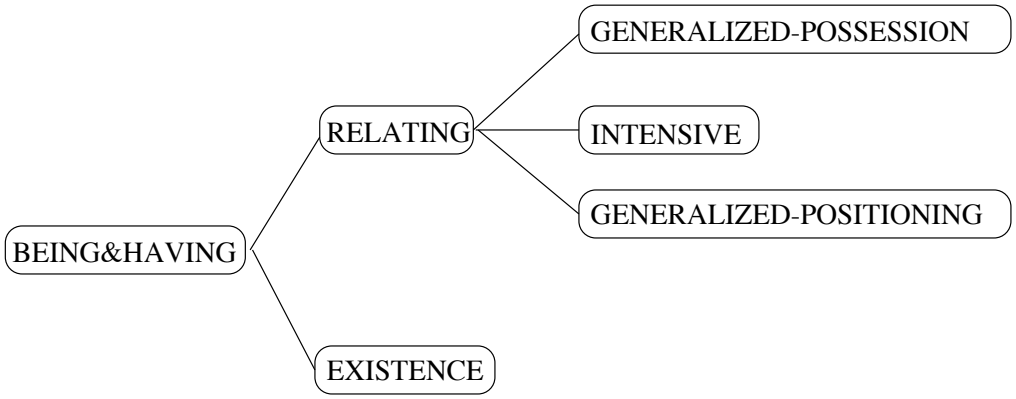


Figure 3.1: Relational Processes

3.1.1 Existence

A one-place relation, found, for example, in

"There is a block".

Obviously, only one participant is allowed for this kind of configuration. It is called Existent (see section 5.0.3.4.1).

Note that the notion of 'state' does not come out as a category of special status in the upper model (following the semantics of English as represented by the Systemic Grammar). Instead, what we may think of as state is spread out over several concepts, e.g. relations, qualities. If considerations of inferencing require the notion of state, it will be necessary to recognize it as a separate category and subordinate that concept to the distinct linguistically-motivated categories as required for the language desired to express that concept.

3.1.2 Relating

This subhierarchy contains all the configurations that can be used to express two-place relations. In general, each two-place relation has two roles, **domain** and **range**.

Two-place relations are often realized linguistically as:

<domain> <relation> <range>

as in the following examples:

"This document *concerns* a concept hierarchy"

"John *is* in his office"

"John *has* an old car"

Differences in representation of Relations Penman UM – Generalized UM

In the version of the Upper Model that we are presenting here we have tryed to clarify the status of the categories that in the original version [6] were generally classified under "two-place-relation". In particular there was a mixture of what in [17] are called "relational processes" and pure "relations" like, for instance, participants (which are really only "slots" in a configuration). [1]

The concept **Relating** corresponds to those entities that in [17] are called "relational processes", which just express a relational configuration of elements. The subclasses provided are: **Generalized-Possession, Intensive, Circumstantial**. There are different ways to express linguistically these configurations, examples are given in the following table:

Generalized-Possession	John has a book	John's book
Intensive	The book is red	The red book
Circumstantial	The book is about Upper Models	The book concerns Upper Models

The immediate subclasses of **relating** are as follows:

3.1.2.1 Generalized-Possession

The most typical expression of **generalized-possession** is as:

<possessor> *has* <possessed>.

Relations in this category can, in general, also be expressed with a possessive form, e.g., 'John's book', 'the key of the door', etc.

Thus, the types of relationship covered by generalized possession, or *generalized marriage* as it is sometimes called, are rather more general than simple possession of objects and include social customs or agreements. Examples of this are kinship, lawyer/client, doctor/patient, boss/employee relationships — expressed as:

<possessor> *has* <relation>

"Henry *has* a brother"

<possessed> *be relation of* <possessor>

"Henry is *the lawyer of* Joan / Joan*'s* lawyer"
"Henry is *the patient of* Joan/ Joan*'s* patient"

The conception of possession is thus quite general, as is intended by the use of the term *generalized* possession. [2]

[1] This was achieved using the undocumented loom macro "defreified-relation", which allowed basically to define a concept and a relation with the same name, thus permitting to have the portion of the concept hierarchy under two-place-relation to actually mirror the relation hierarchy.

[2] [15, p140] remarks on this with respect to his earlier use of the term "associated" for this relation. It should be remembered that possession is here being used in this generalized fashion.

Generalized-possession has five specific subtypes that are currently used by the grammar: **part-whole**, **ownership**, **name-of**, **Generalized-Role-Relation**, **Ascription-Inverse**.

Clearly these do not exhaustively cover the class of generalized possession, but they are those with which the grammar is concerned in its present state of development.

3.1.2.1.1 Part-Whole This is a relation between an entity and its parts. It has two roles: *whole* (the domain) and *part* (the range).

At the most general level, this relation can be expressed as:

<part> *be an element of* <whole>

or

<part> *be a component of* <whole>

or, as inherited from the **generalized-possession** superconcept,

<whole> *has* <part>

Note that how this relation is expressed in the language seems to depend on the type of object that fills the *whole* role.

There are three possible subtypes that we could add for **part-whole**, but which are not currently distinguished within the grammar:

- *consists-of* — which would be expressed as:

  <whole> *consist of* <parts>
  <parts> *make up* <whole>

  This relation requires a special category because the use of the terms "consist of" and "make up" seem to imply that all of the parts of an entity are being mentioned. That is to say, there seems to be a constraint that what fills the part role of a consist-of relation must be *all* of the parts of the whole. For example, one can say:

  An engine is a component of a car
  A car has an engine.

  but it is odd to say:

  An engine makes up a car
  A car consists of an engine

Note that this would be a *conceptual* constraint. This means that the filler of the part role of the consists-of relation should be value-restricted to a concept representing an exhaustive set of constituents.

- *constituency* — a specialization of the part-whole relation in which the whole is value-restricted to be a (cf. Section 4.1.2)

  The justification for this sub-category is that it only makes sense to discuss "parts" of an object when that object has distinguishable parts, i.e., is decomposable into those parts. So,

  An engine is a part of a car

  is acceptable, while

  Gravel is a part of concrete

  seems less so.

- *ingrediency* — this is a relation which expresses the relation between a whole and its parts when the whole is a *mass-object*. For example,

  Gravel is an ingredient of concrete.

  Note that the sub-categories *constituency* and *ingrediency* are mutually exclusive. Note also, that the *consists-of* relation does not discriminate on the type of whole (i.e., decomposable or mass). So, both of the following are acceptable:

  A tree consists of a trunk and branches
  Concrete consists of sand, gravel, cement, and water

3.1.2.1.2 Ownership This is a relation between the owner of an object and the object. It is a specialization of generalized-possession. It has the same roles as generalized-possession, but the possessor role is value-restricted to *active-entity*.

Ownership may be expressed as:

<possessor> *own* <possessed>

or

<possessed> *belong to* <possessor>.

EN : "The government has no money"

DE : "Die Regierung hat kein Geld"

IT : "Il governo non ha soldi"

3.1.2.1.3 Name-of The relation that holds between a name and its bearer.

EN : "The ship is called Knox"

DE : "Das Schiff heisst Knox"

IT : "La nave si chiama Knox"

3.1.2.1.4 Generalized-Role-Relation The generalized perspective on an entity that 'has some relationship' with another. When no more specific information concerning available grammatical realizations is given, subtypes (<role>) of this relationship can be used to generate language of the form: <domain> *has* <range> *as* <role> or <domain>*'s* <role> *is* <range>.

Notice that (contrary to what stated in the original documentation) the 'role' should **not** be defined as a subtype of this concept, but as a separate unit.

This concept can be used to generate sentences like the following:

"John **has** Betty **as** a secretary"

This example can be actually generated by the following SPL:

```
(x / generalized-role-relation
:domain (p1 / person :name John)
:range (p2 / person :name Betty)
:role-playing (r / secretary))
```

Here the 'role' is that of 'secretary' and could be defined as a subtype of person.

Notice that (again contrary to what stated in the original documentation), sentences like:

"John**'s** secretary **is** Betty"

have to be generated using the Identity concept.

3.1.2.1.5 Ascription-Inverse The inverse of the Ascription relation.

3.1.2.2 Intensive

A way of relating two entities as being identical, of one symbolizing the other, or of ascribing a class membership or a quality or property.

The **intensive** relational process subhierarchy of the upper model is intended to provide the necessary semantic support for the set of *intensive* relations in the grammar. It therefore includes the subclasses **identity** and **ascription**, corresponding to the *identifying* and *attributive* modes respectively. In addition, there is also a third subclass, **symbolization**, that is intended to contain relations that hold between entities and other entities that they 'symbolize'.

The classifications beneath the node **intensive** are shown in Figure 3.2 .

The **identity, ascription** and **symbolization** subclasses will now be described in more detail.

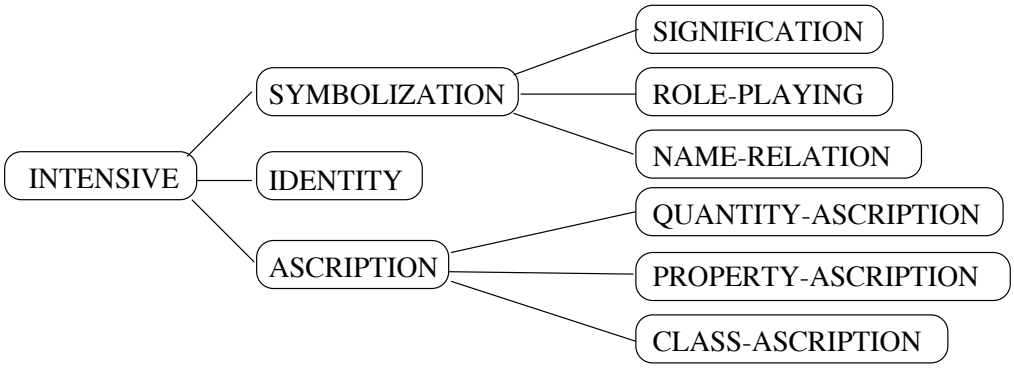


Figure 3.2: Intensive Relations

3.1.2.2.1 Symbolization This category contains relations that hold between entities and other entities they 'symbolize'. All the notions in this category can be expressed by the verb "be". The form of "be" here is different from the existential "be" and the ascriptive "be" because it is reversible, i.e., has a voice distinction. In addition, the verbs used to express concepts in this category are all transitive.

Concepts in this class logically have two roles: *symbol* (the domain) and *symbolized* (the range).

Relations in this category include the following:

3.1.2.2.1.1 Signification The relations concerned with **signification** — as linguistically realized by such verbs as: "represent", "mean", "express", "stand for" and "signify". Note that the verb "be" can be used in place of any of these. For example

Up *represents* happiness.
Up *is* happiness.

Green *means* go.
Green *is* go.

3.1.2.2.1.2 Role-Playing A circumstantial relationship that expresses a restriction of which facet of one of the participants in a process is relevant for the actualization of the process. The participation of a participant which is specified in, and has a definite participant function (such as actor, goal, senser, and phenomenon to the process) is restricted to a particular role, part, or function within the particular participant function being performed. It is frequently realized in English by a prepositional phrase with the preposition "as"; for example: "As a president, he was terrible, although as a golfer he was not too bad."

Examples of verbs in this category are: "act as", "play". This concept can also be realized using the preposition "as", e.g.

As President of the U.S., Reagan vetoed the bill.

Here "as" embodies the notion "playing the role of". Note again that concepts in this category can also be expressed with "be", e.g.

Olivier is Hamlet.
Reagan is President.

3.1.2.2.1.3 Name-Relation The relation that holds between a name's bearer and that name.

For example, the written representation of a lisp function, i.e., the sequence of characters that form the s-expression, *symbolize* the function that that lisp expression performs; thus, in

CAR is a function that returns the first element of a list.

the name CAR is in the **name-relation** to the function that appears to the right of the verb 'to be'. Other examples of this relation's realization are:

Her brother is named Gilbert
Storage locations referenced by access functions are called generalized variables.

3.1.2.2.2 Identity The type of relation between entities that states that they are in some sense identical or overlap. Examples of this type of relation are statements such as 'X is a Y', or 'X is mine'.

Halliday describes **identity** as follows:

> In the identifying mode, the meaning is '*a* serves to define the identity of *x*'. Here *a* and *x* are two distinct entities, one that is to be identified, and another that identifies it.[17]

Examples of sentences which realize this category are the following:

EN : "The teacher is the boss"

DE : "Der Lehrer ist der Chef"

IT : "Il maestro è il capo"

This relationship is in contrast to 'class membership', which does not serve to identify. This is contained under the category (Section 3.1.2.2.3.3below).

Examples of this type of relation are statements such as 'X is a Y', or 'X is mine'. As an example, the following SPL:

```
(y / um-identity
:domain (o / person :name Betty)
:range (s / secretary
:owned-by (c / person :name John))
```

would generate the sentence:

"Betty **is** John's secretary"

Compare with Generalized-Role-Relation.

3.1.2.2.3 Ascription This relation captures the notion of membership in a set. The logical roles of this relation are: *attribute* (the range) and *attribuend* (the domain).

In general, the **attribuend** role of an ascription relation will be filled by an object and the **attribute** role will be a filled by a quality or by an object. Finer restrictions can be made based on the given attribute. This relation is typically expressed by the verb "be".

It is differentiated from **identity** in that it does not claim any exhaustivity for the correspondence that it defines; for example: "Sarah is wise" does not make any claim that Sarah is the only one who is wise, it is therefore not identifying; "Sarah is the wise one" does, however, make such a claim, and is, as such, identifying rather than ascriptive.

As can be seen in Figure 3.2 there are a number of subclasses to this category. We now describe each of them in more detail.

3.1.2.2.3.1 Quantity-Ascription Quantity ascription is the relation of ascribing a quantity to an entity. Two forms of **quantity-ascription** are defined: either a quantity can be provided directly by the subclass **quantity**, or a quantity can be used as the basis for a further specification by the subclass **number-focusing**. This latter supplies the following types of quantity ascriptions: **less-than, greater-than, exactly, at-most,** and **at-least**. Ascriptions of this kind are responsible for nominal phrases such as the following:

exactly two answers
at least three dogs
at most one IBM PC
more than 100 Macs

3.1.2.2.3.2 Property-Ascription Property ascription is a relation describing membership in the set of entities having a particular property. This is expressed by a property that can be used as a set descriptor. For example,

"The students are intelligent"

i.e., they belong to the class of intelligent ones. Note that "intelligent" is a quality. We need many specializations of property ascription corresponding to different types

Subtype of *Property-ascription*	Property
size-property-ascription	**size**
material-property-ascription	**material-class-quality**
color-property-ascription	**color**
age-property-ascription	**age**
modal-property-ascription	**modal-quality**
scaled-comparison	
... less-than-comparison	**quality**
... greater-than-comparison	**quality**

Figure 3.3: Correspondences between property-ascriptions and qualities

of qualities. The qualities themselves are found under the **Quality** subhierarchy, which is described in Section4.2.

Other examples of sentences which express a relation of **Property-Ascription** are the following:

EN : "The girl is sick"

DE : "Das Mädchen ist krank"

IT : "La ragazza è malata"

The current correspondences are given in the following table. This shows the relationship of the current property-ascription subclasses and the appropriate quality concepts that may play the role of attribute. The first set applies to **object**s, the middle one to **process**es, and the last group to **quality**.

3.1.2.2.3.3 Class-Ascription Class ascription is a relation where both *attribuend* (the domain) and *attribute* (the range) are restricted to be filled by an object. It corresponds to the notion of 'super-class', which in many knowledge representation systems is treated as an *is-a-kind-of* relation. It too may be expressed by the verb "be". For example,

EN : "Henry is a teacher."

DE : "Hans ist ein Lehrer."

IT : "Hans è un insegnante."

3.1.2.3 Circumstantial

A Configuration is taken to consist potentially of three components: the process itself, participants in the configuration, and *circumstances* associated with the configura-

tion. Circumstances are often realized as adverbial groups or prepositional phrases. Circumstances expressed as adverbial groups come from the circumstance hierarchy, while those expressed as prepositional phrases are represented as circumstantial relations.

3.1.2.3.1 Generalized-Positioning This configuration is used to represent situations where an object (or a generic phenomena) is located in physical space, time, or in a more abstract space. It has therefore two roles: the **carrier** and the **location**. The latter is typically one of the spatio-temporal relations, but could be a generic circumstance. The kind of relation actually used to specialize the role of location allows the grammar to find the more appropriate way of expressing the configuration.

Consider the following examples:

"John is at the station"

"The meeting is at 3.30"

"The book is about Upper Models"

where *John, The meeting, The book* fill the role of **carrier** and *the station, 3.30, Upper Models* fill the role of **location**. The exact preposition used in the sentences is determined by the **location** which is respectively: static-spatial, temporal nonordering, subject-matter.

3.1.2.3.2 Causal This concept corresponds to a **Causal** configuration, it simply captures the relationship of one thing being the cause of another, the effect.

Logically it has to roles: the **Cause** and the **Effect**.

It can be typically expressed by sentences such as:

"<cause> causes <effect>"

"<effect> because of <cause>"

The cause can be further specified using one of the causal-relations

3.1.2.3.3 Circumstantial-Other This configuration is used to represent circumstantial configurations that are not a kind of **Generalized-Positioning** or **Causal Configuration**.

3.2 Saying & Sensing Configurations

This class groups those configurations of Saying (External Processing) and Sensing (Internal Processing) whose basic property is that they can "project". Projection creates a second order realm either externally (e.g,. saying something) or internally (e.g., thinking something).

3.2.1 Internal-Processing

Internal-Processing contains individual-internal processes of cognition, emotion, decision, or feeling. They typically have two participants: the 5.0.3.3.1 which is mandatory, and also a role for the phenomenon of internal processing, the 5.0.3.3.2 (see section 5.0.3.3) .

The **Senser** is supposed to be endowed with consciousness:

> [...] There are certain goings-on that are restricted only to (human) consciousness – from a nominal point of view, the most nuclear participant is *I, you, we; he, she who* rather than *it, what.* This does not mean that normally non-conscious phenomena cannot be endowed with consciousness; on the contrary, they can be construed as conscious sensers. [31].

The linguistic realization of the **phenomenon** can take the form of:

1. a noun phrase (e.g., *she remembered the old house*)
2. a finite dependent clause (e.g., *she remembered that they had been happy in the old house*)
3. an infinitival clause (e.g., *she remembered him coming down the stairs.*)

Internal-Processing configurations are divided into four main subtypes:

- **Perception**
- **Cognition**
- **Emotion**
- **Intention**

The processes of **Cognition** and **Intention** can create ideas which do not exist prior to the beginning of the process:

> [...] human conscious processing can bring ideas, the 'content' of consciousness, into existence; the higher-order realm of ides is a special property of consciousness. [31].

The processes of **Perception** and **Emotion** can only project facts. To see the difference between ideas and facts compare the following examples taken from [18]:

Mark Anthony thought that Caesar was dead. (idea)
Mark Anthony regretted that Caesar was dead. (fact)

The difference is manifested grammatically as follows: Ideas – in difference to facts –

1. cannot be preceded by the words "the fact",
2. cannot be replaced by a corresponding nominal phrase,
3. but can be quoted:

**Mark Anthony thought the fact that Caesar was dead.*

**Mark Anthony thought Caesar's death.*

Mark Anthony thought, "Caesar is dead".

but

Mark Anthony regretted the fact that Caesar was dead.

Mark Anthony regretted Caesar's death.

**Mark Anthony regretted, "Caesar is dead".*

Both configurations types – Cognition and Intention – can serve as metaphors for modality. Cognition configurations can stand for probabilities (I think : probably, I suppose : perhaps, I know : certainly), and a number of configurations of intention can stand for inclinations and obligations (I want : must, I insist : should).

Cognition and **Intention** differ wrt whether the **Phenomenon** participant is a proposition or a proposal. The terms proposition and proposal are defined in [18] as follows:

> The linguistic system is organized in a way which marks the difference between symbolic reality and non-symbolic reality; social interaction concerns either the exchange of information about the reality (symbolic) or the exchange of goods and services of the real world itself (non-symbolic). Information exchange is encoded grammatically as proposition, the linguistic act which mediates the exchange of goods and services is encoded as proposal.

Propositions are grammatically expressed as finite dependent clauses, proposals as infinitival clauses or finite subjunctive clauses:

She thought that he had left. / She thought he had left. (Cognition)

**She wanted that he had left. / She wanted he had left.*

She wanted him to leave. (Intention)

**She thought him to leave.*

An intended **Phenomenon** is always potential, i.e. it is in future in relation to the process that projects it.

Emotions and **Perception**s cannot create ideas. They are mental processes which arise in response to a pre-existing fact or metathing.

They liked (the fact) that the earth was flat. (Emotion)
They heard (the fact) that the earth was round. (Perception)

Emotions in English are typically bidirectional. They can be realized either as the emotion ranging over the Phenomenon (e.g. I like Mozart's music) or the Phenomenon causing the emotion (e.g. Mozart's music pleases me). Emotion processes can be intensified by means of adverbs of degree such as *much, greatly, deeply.* This option is not open to **Perception**s.

New hierarchy:

3.2.1.1 Perception

An involuntary mental process of perceiving a phenomenon (e.g., "see", "hear", "taste", "smell", "feel", etc.).

3.2.1.2 Cognition

Configurations of cognition involve e.g., "think", "believe", "know", "understand", "realize". Cognition configurations can serve as metaphors for probabilities (I think : probably, I suppose : perhaps, I know : certainly),

Examples:

EN : "Mary thought that she would recover."

DE : "Maria dachte, dass sie wieder gesund werden würde."

IT : "Maria pensava, che si sarebbe presto ristabilita"

3.2.1.2.1 Think The mental process of thinking.

3.2.1.2.2 Know A mental process describing the involuntary state of knowing that something is the case.

3.2.1.2.3 Believe The involuntary mental process of holding a belief.

3.2.1.3 Emotion

A mental process that captures an uncontrolled emotional response to something or some state of affairs in terms of its appeal. Examples would be *fearing* and *disliking* on the negative side, and *liking* on the positive side. **Emotions** in English are typically bidirectional. They can be realized either as the emotion ranging over the Phenomenon (e.g. I like Mozart's music) or the Phenomenon causing the emotion (e.g. Mozart's music pleases me). This pattern is however very typical of English and doesn't apply (or applies only to a limited extent) to other languages.

Examples:

EN : "Mary likes the gift."

DE : "Maria mag das Geschenk."

IT : "Il regalo piace a Maria."

3.2.1.3.1 Liking An involuntary favorable mental/emotional reaction to some entity or state of affairs, or a process that presupposes a favorable reaction, e.g., to want or strive to bring something about.

3.2.1.3.2 Disliking A mental reaction that is negative towards some object or state of affairs.

3.2.1.3.3 Fearing A mental reaction that is negative towards some object or state of affairs and which invokes fear; this is used by the grammar which, in this area, has an approximation to the systemic notion of lexis as grammar; i.e., very fine distinctions are drawn which can be used to guide word choice.

3.2.1.4 Intention

A kind of mental process that captures the notion of actively pursuing a determinate aim. Examples of English verbs that typically express intention are: "want", "wish", "hope", "insist'.

Examples:

EN : "Mary wants to go to Sweden next year."

DE : "Maria will nächstes Jahr nach Schweden gehen."

IT : "Maria wuole andare in Svezia il prossimo anno."

`Note: The current version of the grammar does not handle this concept.`

3.2.1.5 Note: Mental-Active Processes

The distinction Active / Inactive for Mental Processes has been removed.

Follows old description of Mental Activies.

Processes in this class are mental processes which are treated as requiring an expenditure of energy to maintain them or bring them about, as opposed to the more 'state'-like mental processes of the inactive class. Examples of verbs which would fall into this category are: "convince", "please", etc. Mental active processes and mental inactive processes are in the same kind of relationship as directed actions and nondirected actions respectively. For mental active processes the senser role should again be value-restricted to **conscious-being**, however grammatical metaphor often overrules this.

3.2.2 External-Processing

External-Processing configurations apply to processes of "Communication" (verbal processes), like for instance: *"say", "tell", "ask", "order", "command", "report", "request", "promise", "suggest".*

Some example sentences involving verbal-processes are:

The sign says "No Parking."
The newspaper says that Reagan has resigned.
President Reagan said "I will resign."

External-Processing configurations have three participant roles associated with them (See section 5.0.3.2):

- **Sayer**
- **Saying**
- **Addressee**

The principal functional characterizations of a process belonging to this category are that it can 'project' a state of affairs or proposal (as in *"He says [projecting], that he can't come [projected]*) and that it can have a receiver of the message (as in *"He told her [:Receiver] a story"*).

The former differentiates **External-Processing** from actions (**Doing & Happening**) and relations (**Being & Having**), the latter differentiates them from mental processes (**Internal-Processing**) (cf. the nonacceptability, disregarding telepathy, of "He thought her that he would come" and "He thought to her that he would come").

The combination of these defines the prototypical cases of verbal processes and can be used as the primary evidence for verbal process semantic distinctions (cf., for English, [17, §5.5.2: p129, §7.5: pp227-240], [33, §2.2.1.11: pp232-244]).

Another linguistic characteristic of the communicative processes which distinguishes them from, for example, the material processes, is that the *saying* does not behave as does a direct object with material processes even though superficially it appears very similar. In particular, the passive form with *saying* as the subject is odd, rare, or impossible.

Moreover, the nature of the first participant (the **Sayer**) is quite different from that of corresponding participant for Mental Processes (the **Senser**). In fact the set of things being able to act as a **Sayer** is much broader than the set of things capable to act as a **Senser**:

> [...] Unlike mental processes, verbal processes do not require a conscious participant. The Sayer can be anything that puts out a signal, like *the notice* or *my watch*; cf. *the light* in *the light says stop*, *the guidebook* in *the guidebook tells you where everything is*. Such entities could not figure naturally as Senser in a mental process: *my watch thinks it's half past ten* is decidedly incogruos. But *my watch says it's half past ten* calls for no comment at all; a Sayer can just as readily be *it* as *he* or *she*. For this reason verbal processes might more appropriately be called 'symbolic' processes. [17, pp129-130]

Subcategories.

External-Processing Configurations are described in terms of two dimensions: *addressee-orientation* and *message-orientation*. Both addressee orientation and message orientation bring semi-independent realizational constraints with them; addressee-orientation brings constraints on the realization of the addressee; message-orientation on that of the message. Positive orientation along a dimension calls for a more 'direct' realization of the corresponding aspect of the verbal communication, i.e., realization as nominal phrases rather than as prepositional phrases, realization as direct objects rather than indirect objects, obligatoriness rather than optionality, etc. Combining the two dimensions covers most of the observed variation for English, German and Italian. This is summarized in figure 3.4

This configuration corresponds to the old UM concept of "Verbal-Process".

3.2.2.1 Dimensions

3.2.2.1.1 Addressee Orientation An **addressee-oriented verbal process** is a verbal process for which the addressee is an obligatory role — even though it may not be expressed in some cases. An example would be the process "tell."

A **non-addressee-oriented verbal processes** is a verbal process that does not intrinsically require an addressee, e.g., "say". In this case, the addressee (if it occurs) must always be indirect.

For example,

John said to me that he likes his job
John said that he does to the person standing by the window.

Note that this differs from the way the addressee behaves with "told". When the addressee appears directly following the verb, it is direct. E.g.,

John told me the story.

An indirect addressee is used when the addressee appears after the saying, e.g.,

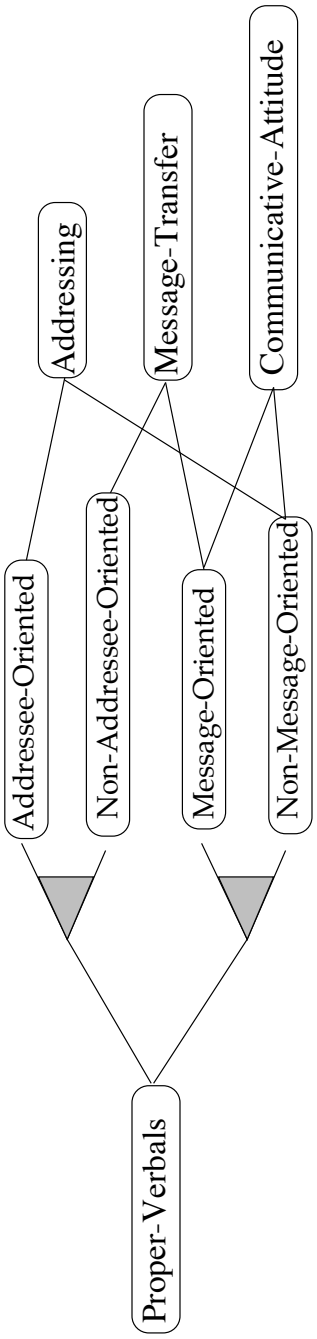


Figure 3.4: Proper Verbals: Subclassification

John told the story to me.

But an indirect addressee following the verb, as in

?John told to me the story.

is marked.

3.2.2.1.2 Message Orientation A **message-oriented verbal process** is a verbal process for which the message is an obligatory role — even though it may not be expressed in some cases. An example would be the process "prove":

"John proved the theorem"

A **non-message-oriented verbal processes** is a verbal process that does not intrinsically require a message, e.g., "inform".

In this case, the message (if it occurs) must always be indirect.

"John informed the driver about the problem"

3.2.2.2 Cross Classification

3.2.2.2.1 Addressing Verbal configurations that are realized by means of a verb which takes the addressee as a direct object (e.g. tell, inform, advise) should be classified as **addressing**. This concept is itself classified as Non-Message-Oriented and Addressee-Oriented.

EN : "I informed him that I was coming"

DE : "Ich habe ihn davon informiert, dass ich kommen würde"

IT : "(Io) L'ho informato che stavo arrivando"

3.2.2.2.2 Message-Transfer Verbal configurations that are realized by means of a verb for which the message (**Saying**) is usually expressed as a direct complement but the **Addressee**) as a indirect complement (e.g. say, demonstrate) should be specified as subtypes of **message-transfer**. This concept is itself classified as Message-Oriented and Non-Addressee-Oriented.

EN : "I demonstrated the theorem" EN : "I demonstrated to him that x"

DE : "Ich habe das Theorem bewiesen" DE : "Ich habe ihn bewiesen, dass x"

IT : "(Io) Ho dimostrato il teorema" IT : "(Io) Ho dimostrato a lui che x"

3.2.2.2.3 Communicative-Attitude Verbal configurations that are realized by means of a verb for which both the addressee and the message cannot be expressed by a direct complement (e.g. complain) should be classified as **communicative-attitude**. This concept is itself classified as Message-Oriented and Non-Addressee-Oriented.

EN : "I complained that x to John"

DE : "Ich habe mich bei John beschwert, dass x"

IT : "(Io) Ho protestato che x con John"

3.2.2.3 A proposal: Behavioral-Verbals

There are some processes which fall in between among the classes of "Material Processes" and "Verbal Processes". These include material actions that represent typically a human behaviour (e.g. "moan", "groan", "gasp", "cough") and which often can be used as if they were verbal processes (e.g. projecting), like in:

He sobbed "I have to go".

On the other side there are some verbs which express a verbal behaviour, but which do not share the typical properties of verbal processes, for instance, they cannot project:

John is talking about the President.

**He speaks that he will come.*

Following [19]) in the version of the Upper Model described in this document we are separating Processes and Configurations. The different kinds of Configurations are strictly determined on grammatical grounds, while the classes of Processes, although originally stemming from those grammatically-based classes, should allow for more leeway with respect to the kind of realization of their inherent participants. This allows us to model in a fairly direct way the kind of grammatical phenomena shown by the examples above.

The former kind of verbs (the "sob" type) would be considered lexical realizations of a **Material-Process** put within a **External-Processessing** Configuration (thus giving them the "projecting" property).

The latter kind of verbs (the "talk" type) would be considered lexical realizations of a **Verbal-Process** put within a **Doing & Happening Configuration** (and more specifically a **Nondirected-Doing**) (thus depriving them of the "projecting" property).

3.3 Doing & Happening Configurations

This configuration corresponds to the concept "Material Processes" of the original Penman UM.

Doing & Happening Configurations include both intentional actions, i.e., actions with a volitional actor such as

"The mouse ran up the clock"

and happenings, such as 'erosion' and 'disintegration', e.g.,

"The wall came tumbling down."

The essential roles of this type of process are **actor** and **actee**.

The actor role of the process is value-restricted to objects excluding things created by mental processing (e.g., facts) and speech (direct or indirect). [3]

A test for determining whether a concept falls into the category of material actions is to look at the least 'marked', or neutral, way of expressing the concept as it is in the process of occurring. Material actions are then typically expressed in the present progressive tense; all other concepts in the process hierarchy use the simple present. Compare the following:

My watch says it is 4:30pm.

with

Henry is going to the market

Thus, for example, in

The house collapses (non-progressive)
The house is collapsing (progressive)

the latter is less marked in that it would be the normal way to refer to a present event of a house collapsing and thus suggests that the process of *collapsing* should be classified as a material process.

Material Processes are broken up into two classes, depending upon whether or not the process + medium combination is considered to be caused by an external agent; these subclasses are: **directed-actions** and **nondirected-actions**.

The subhierarchy of **Doing & Happening** Configurations is shown in Figure 3.5.

[3] To the extent that this is still true, this says something about the way the object hierarchy needs to be organized, i.e., in such a way that we can easily make this restriction.

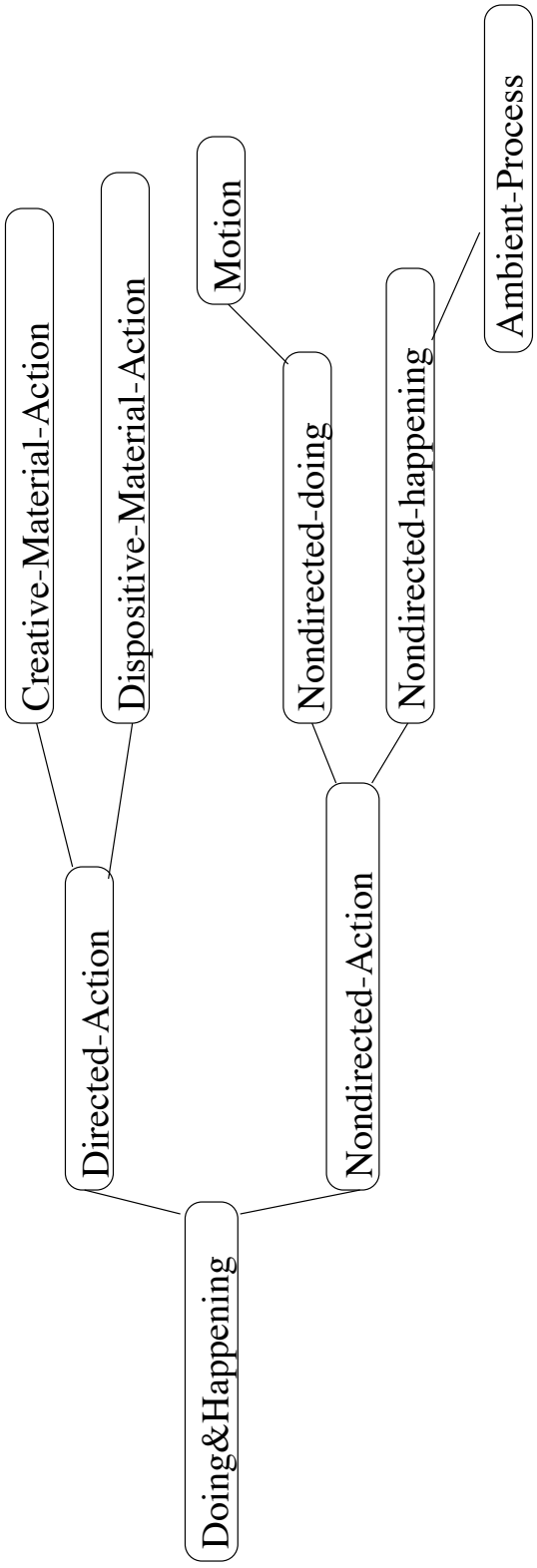


Figure 3.5: Material processes

3.3.1 Directed-Action

Directed-actions necessarily involve an external causer that brings about the action defined by the process and medium combination. The presence of a second partipant requires that they have both an **actor** role and an **actee** role. Thus, they are always transitive. [4] In addition, **directed-actions** can always have a beneficiary of the client type: this is expressed by the prepositional phrase: "for"+<client>.

Directed-actions are further broken up into two subclasses depending upon whether or not the actee existed before the action occurred: **dispositive-material-action** and **creative-material-action**.

The difference among the two classes is grammatically motivated by the fact that **Creative-Material-Action**s are much more likely to have a **Beneficiary** role than **Dispositive-Material-Action**s.

Thus for instance:

"Mary baked a cake *for her child*"

? "Mary ate a cake *for her child*"

3.3.1.1 Dispositive-Material-Action

Dispositive-material-actions affect their actee. This category includes any verbs that describe an action on something that already exists.

Examples:

EN : "Eunice *ate* the cake."

DE : "Eugen *ass* den Kuchen."

IT : "Eugenio *mangiò* la torta."

3.3.1.2 Creative-Material-Action

Creative-material-actions *create* their actee. All actions in this category can be realized using the verbs "create" or "make".

Examples:

EN : "Mary *is baking* a cake."

DE : "Maria *bäckt* einen Kuchen."

IT : "Maria *cuoce* una torta"

[4] Although they may be 'actee-intransitive', in which case the actee is not specified but is inferable. For example, "Henry is eating." In this case, we can infer that Henry eats something in the category of *edible-things*, perhaps even food.

3.3.2 Nondirected-Action

Non-directed-actions are those material actions which require no external causation in addition to the combination of process and (see section 2.6.1).

Thus, a distinguishing feature of a **nondirected-action** is that, in contrast to a **directed-action**, it *cannot* be considered to involve *external agency*.

Such processes are often (though not necessarily) intransitive. In the case where they are transitive, the object is not affected or created by the action: instead it specifies a 'range' of the action. For example, "I play the piano/tennis." This specifies that I am capable of a typical kind of playing. With **nondirected-action**s, therefore, the **actee** role, if present, plays the function of 'range': it serves to further elaborate the process rather than playing the role of a genuine participant. The **actor** role of the process defines the medium.

There are two subclasses of **nondirected-action**s:

- **Nondirected-Doing**;
- **Happening**.

The distinction between these two reflects the presence or absence of an agent which intensionally performs the action. This distinction is made in [41].

The classification of a **nondirected-action** with respect to these subclasses can be checked with the help of the two questions

> What is x doing? (Was macht x?)
> What happens? (Was geschieht mit x?)

Answers to the first question are classified as **nondirected-doing**s ("The mouse ran up the clock."). Answers to the second question are classified as **happening**s ("The wall came tumbling down.").

3.3.2.1 Nondirected-Doing

A material action where the **Actor** is one who intentionally performs the action.

All verbs of movement are examples of **nondirected-doing**s, e.g., "climb", "walk", "fly", "fall", "run". Skills, such as "read (music)", "speak (French)", etc., are included in this category. In addition, the verbs "have" as in "have lunch", "take" as in "take a shower", "do" as in "do a dance", and "make" are in this category, notionally combining with the participant role 5.0.3.1.2.2 to specify what appears as the 'object', or range, of the process. One subclass of nondirected-doings is explicitly represented:

3.3.2.1.1 Motion-Process A type of nondirected action that includes motion on the part of the actor.

EN : "John *is running*"

DE : "John *läuft*"

IT : "John *corre*"

3.3.2.2 Nondirected-Happening

A material action where something is happening. This includes meteorological processes and processes where the **Actor** is not volitionally performing the action. All bitransitive verbs have their ergative version in this class.

Examples: "The glass broke"
"The wall came tumbling down"

EN : "The plant *is dying.*" DE : "Die Pflanze *geht ein.*" IT : "La pianta *sta morendo.*"

One subtype is explicitly represented:

3.3.2.2.1 Ambient-Process A process describing an ambient condition, such as the weather, temperature, etc.

Verbs expressing processes belonging to this class have a distinctive grammatical behaviour, in that they are normally used with a "it" subject In German, as in English, there is an indefinite third person ("es"); Italian doesn't have an indefinite third person, but since normally the subject can be omitted, verbs describing ambient conditions usually do not take it.

EN : "It's raining"

DE : "Es regnet"

IT : "Piove"

This is, however, just one possibility for expressing the corresponding meterological situation. It is of course possible to reformulate the sentences above so that they will have a proper subject. E.g.

"Rain is falling"

Chapter 4

Elements

4.1 Simple-Things

The object subhierarchy contains all the entities that may be regarded as *things* — either abstract or concrete, mental or physical, etc. The subhierarchy is organized at the top level along two dimensions: *decomposability* and *consciousness*.

These dimensions cross-classify some of the subtypes of object, particularly those under **spatial-temporal** objects. For this reason, we will first describe the immediate subtypes of objects classified along these dimensions, and then describe the spatial-temporal object subhierarchy separately. The **object** subhierarchy as a whole is set out in Figure 4.1.

Notice that in previous versions of the Upper Model this concept was called simply **Object**.

4.1.1 Objects: consciousness

One subclass of **object**s is made according to their consciousness. In general, a **conscious-being** is taken to be an active entity that is capable of producing information and that may be ascribed 'consciousness'. Usually it is a **person**, which can either be **male** or **female**.

- **Person** A type of conscious being pronominalizeable by "she", "he", etc. rather than by "it".
- **Male** An object that is to be considered male, for, e.g., pronominalization purposes.
- **Female** An object that is to be considered female, for, e.g., pronominalization purposes.

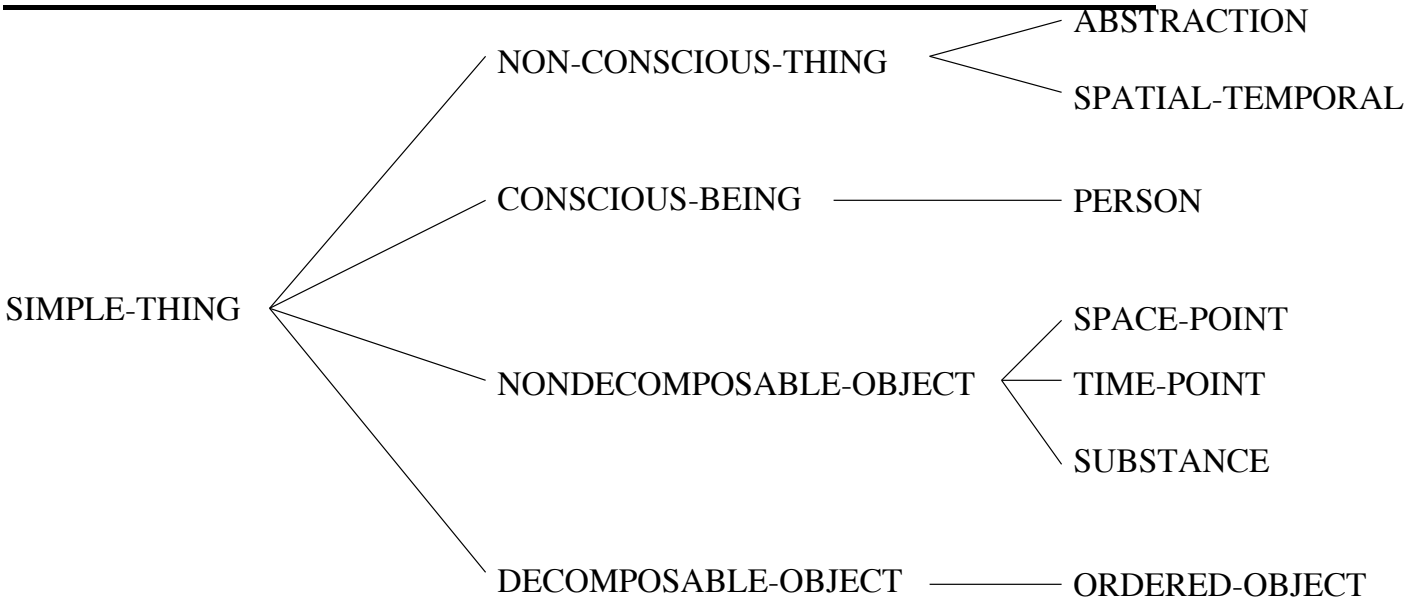


Figure 4.1: Objects

Non-conscious-things are either **abstractions**, i.e, something that exists in metaphorical or qualitative space rather than in physical space — such as 'truth', or **spatio-temporal** objects. These latter are described in Section 4.1.3below.

Two kinds of **abstractions** are provided: **word**s and **number**s. **Word**s include **name**s such as might be used by the naming relation.

4.1.2 Objects: decomposability

Another subclass of **object**s is made according to their decomposability: objects are either **decomposable-objects** or **non-decomposable-objects**.

A **decomposable-object** is an object that is viewed as a collection of parts that may be taken apart; these parts are often given explicit recognition of their own. At present all the decomposable objects dealt with in the upper model are **ordered-object**s also, indicating that their parts have an intrinsic ordering to them.

The **non-decomposable-objects** are objects that are being regarded as not possessing significant parts, or which are not to be considered decomposable for present purposes. The given specializations are **substance**, **space-point** and **time-point**. The latter two are also classifed within the spatial-temporal subhierarchy described in the following subsection.

4.1.2.0.2 Ordered-Object A type of decomposable object whose parts have an intrinsic ordering of their own; for example, the elements of a list, the carriages of a train, etc.

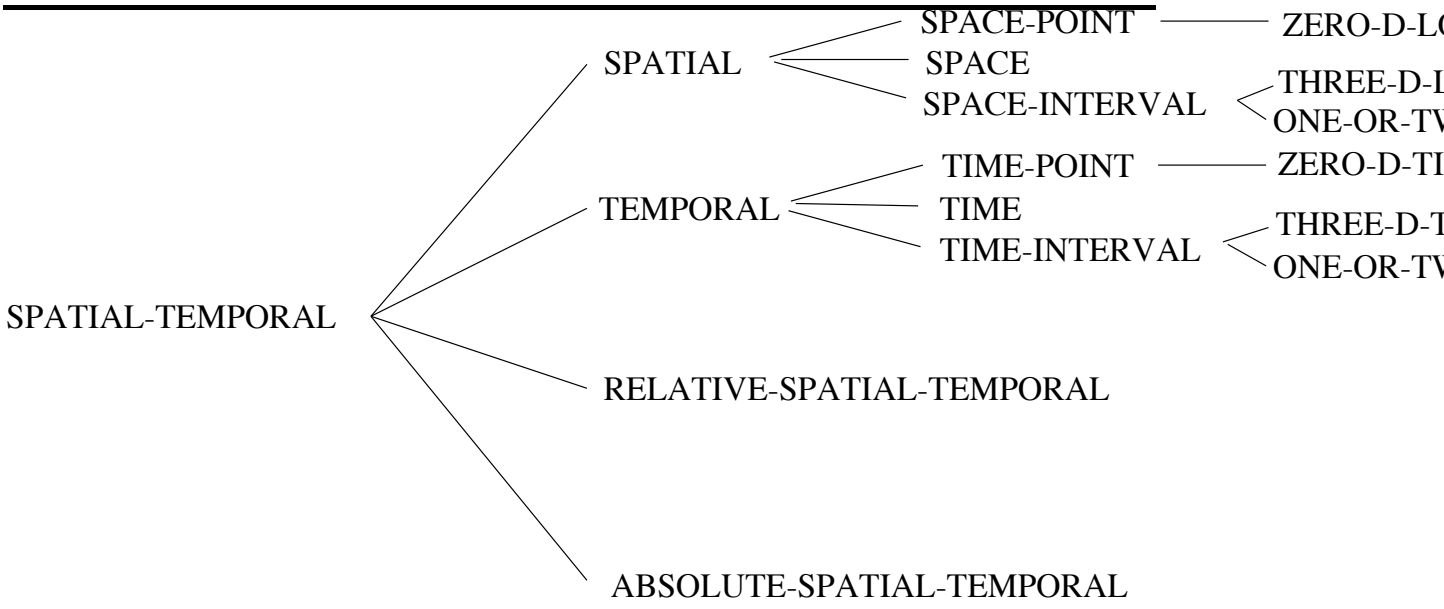


Figure 4.2: Spatial-temporal objects

4.1.2.0.3 Substance E.g., water, grass, flour, butter. The bounded region for substances is not in the domain of physical space, since they are in principle indefinitely expandable in space. Rather, their bounded region is in the domain of some quality spectrum (taste, color, texture, solidity, etc.).

4.1.3 Spatial-temporal objects

Spatial-temporal is the category under which all time and space objects lie. These objects are divided into four subtypes: **spatial**, **temporal**, **relative-spatial-temporal**, and **absolute-spatial-temporal**. Their interrelationships are shown in Figure 4.2.

4.1.3.1 Spatial objects

Spatial provides a class for the general concept of spatial object, including all points, paths, volumes, undivided wholes, etc.

In particular, it currently contains:

- **Space points**, which are *non-decomposable*, zero dimensional points in space; a single explicit subtype is defined here: **zero-d-location**. Zero dimensional points are usually referred to using prepositions such as "at".
- **Space**, which is the combination of **spatial** and **substance**. This is used as an undifferentiated spatial concept that might support, for example, selection of the interrogative form "where". Space as an undecomposable mass.

- **Space-interval**, which is a one, two, or three dimensional set of space points. It is also an **ordered-object**. Two subtypes are differentiated by the grammar: **three-d-location**, i.e., a volume, and **one-or-two-d-location**, i.e., a line or plane. This can condition selection of spatial prepositions such as "on" in contrast to "in".

4.1.3.2 Temporal objects

Temporal provides a class for the general concept of temporal object, including all points, paths, volumes, undivided wholes, etc.

In particular, it currently contains:

- **Time points**, which are **non-decomposable**, zero dimensional points in time; a single explicit subtype is defined here: **zero-d-time**. Zero dimensional points are usually referred to using prepositions such as "at".

  Time as a general undecomposable substance. It is the combination of **temporal** and **substance**. This is used as an undifferentiated spatial concept that might support, for example, selection of the interrogative form "when".

- **Time-interval**, which is a one, two, or three dimensional set of time points. It is also an **ordered-object**. Two subtypes are differentiated by the grammar: **three-d-time** and **one-or-two-d-time**. A **three-d-time** is a portion of time that is being viewed as of sufficiently large scale to need expression as if it were a volume within which thing occured (e.g., "in 1966"), rather than a plane on which things occured (e.g., "on that day"). A **one-or-two-d-time** is a temporal object that is a time interval or smaller scale succession of time intervals, e.g., a day (in opposition to a year). This is clearly a matter of the perspective that is being drawn in particular cases.

4.1.3.3 Absolute/Relative spatial-temporals

A relationship of spatial-temporal locating may locate with respect to a space or time that can be classified as either absolute or relative. Absolute here refers to a posited property of temporal and spatial relationships concerning how they are treated by the grammar of English. Absolute spatio-temporal relationships are taken to be unchanging with respect to the observer. A relative relationship is one that moves with the observer. As an example, the notion of 'today', 'tomorrow', etc. do not stand still and allow the observer to pass them by, they move with the observer; this is in contrast to the notion of a 'Monday', which can come and pass the observer by. Relative locatings are often performed using an adverbial phrase, while absolute locatings use a prepositional phrase. Examples of this distinction, which is still a working hypothesis which will probably need revision as more data on temporal expressions are admitted and treated by the grammar, are as follows:

absolute:	*I will come on Tuesday* *The ship is at 15 N 34 W*
relative:	*I will come tomorrow* *I will come Tuesdays* *I am turning left*

Again, the issue of the perspective that is being taken on the location is clearly here quite decisive for the acceptability of the various forms.

4.2 Simple Qualities

Qualities are properties of objects and processes. They participate in property ascription relations. Roughly speaking, qualities include anything that can be expressed as an English adjective or adverb. The present upper model divides qualities into two subtypes:

- **modal-qualities** which are qualities of being able to do something, wanting to do something, having to do something, etc.
- **material-world-qualities**, which can be thought of as those qualities which are evident when the referent is looked at, weighed, measured, etc. Examples include: "heavy", "blue", "German", "readable", "efficient", "maintainable". The bearers of these qualities are **things**.

Note that in previous versions of the Upper Model this concept was called simply **Quality**.

4.2.1 Modal qualities

Modal qualities are qualities of being able to do something, wanting to do something, having to do something, etc.

The **modal-qualities** are shown in Figure 4.3.

They are classified along two dimensions: **conditionality** and **volition**. They may be described thus:

- Modal qualities that are not conditional are expressed with modalities such as: "will", "must", "can", etc.; those that are conditional are expressed by "would", "might", "could", etc.

  `In Italian and German Modal qualities which are conditional are expressed normally by means of a morphological modification of the main verb of the sentence. In German there is a form called ‘‘Konjunctiv II’’, while in Italian there is a specific form called ‘‘condizionale’’ (conditional).`

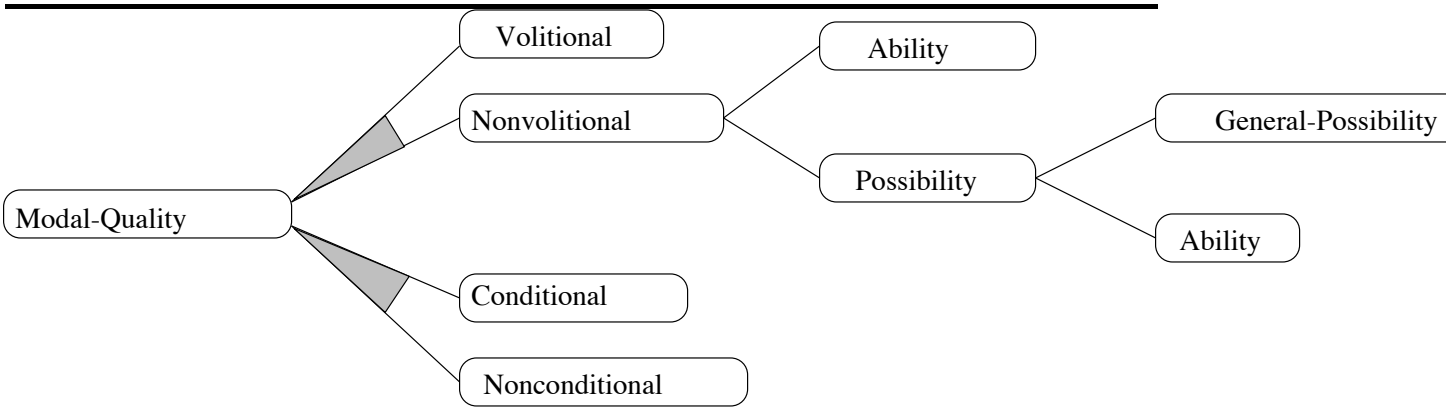


Figure 4.3: Modal qualities

necessity		*must, mustn't, might*
possibility	general-possibility	*may*
	ability	*can, can't, could*

Figure 4.4: Realizations of nonvolitional modals

`So for instace the english sentence ‘‘I would go (if ..)’’ is expressed in Italian as`

`‘‘(Io) andrei (se...).’’`

`In this example ‘‘andrei’’ is the 1st singular present conditional form of the verb ‘‘andare’’ (to go). Notice that in Italian the pronominal subject can be omitted almost always.`

- Modal qualities are classified in terms of the actor's active decision or volition in the performance of a process: a nonvolitional process is one where the actor did not take, or is not expressed as taking, direct responsibility for the process; a volitional process is one where the actor did take responsibility. Volitional processes are often expressed with: "will", "won't", "would", ...; nonvolitional with: "may", "can", "must", "might" ...

The nonvolitional class breaks down further according to **possibility** and **necessity**; and **possibility** further to **general-possibility** and **ability**. The realizational consequences (for English) of these classes are set out in Figure 4.4.

4.2.1.0.1 Conditional A type of modal quality. Modal qualities that are not conditional are expressed with modalities such as: "will", "must", "can", etc.; those that are conditional are expressed by "would", "might", "could", etc.

4.2.1.0.2 Nonconditional A type of modal quality. Modal qualities that are not conditional are expressed with modalities such as: "will", "must", "can", etc.; those that are conditional are expressed by "would", "might", "could", etc.

4.2.1.0.3 Volitional A modal quality concerned with the actor's active decision or volition in the performance of a process; a volitional process is one where the actor takes, or is expressed as taking, direct responsibility for the process.

4.2.1.0.4 Nonvolitional A modal quality concerned with the actor's active decision or volition in the performance of a process; a nonvolitional process is one where the actor did not take, or is not expressed as taking, direct responsibility for the process.

4.2.1.0.5 Possibility A general modal quality that has subtypes general possibility (typically expressed by "may") and ability (typically expressed by "can").

4.2.1.0.6 Necessity An example of a modal quality.

4.2.1.0.7 General Possibility A general possibility relationship is a modal modification of a process that indicates that the process may occur; it is typically realized using the modal "may".

4.2.1.0.8 Ability A modal qualification of the process, with respect to the ability to perform that process; typically realized by 'can'.

4.2.2 Material-world-qualities

Material-qualities can be thought of as those qualities which are evident when the referent is looked at, weighed, measured, etc. Examples include: "heavy", "blue", "German", "readable", "efficient", "maintainable". The bearers of these qualities are (typically) **things**.

The material-qualities are classified according to three dimensions: *gradability* (scalable/nonscalable), *type of contrast* (polar/taxonomic), and *dynamicness* (stative/dynamic).

First we discuss these properties, then present a table which shows how these properties are distributed among the sub-categories. The entire subhierarchy is shown in Figure 4.5.

The properties are:

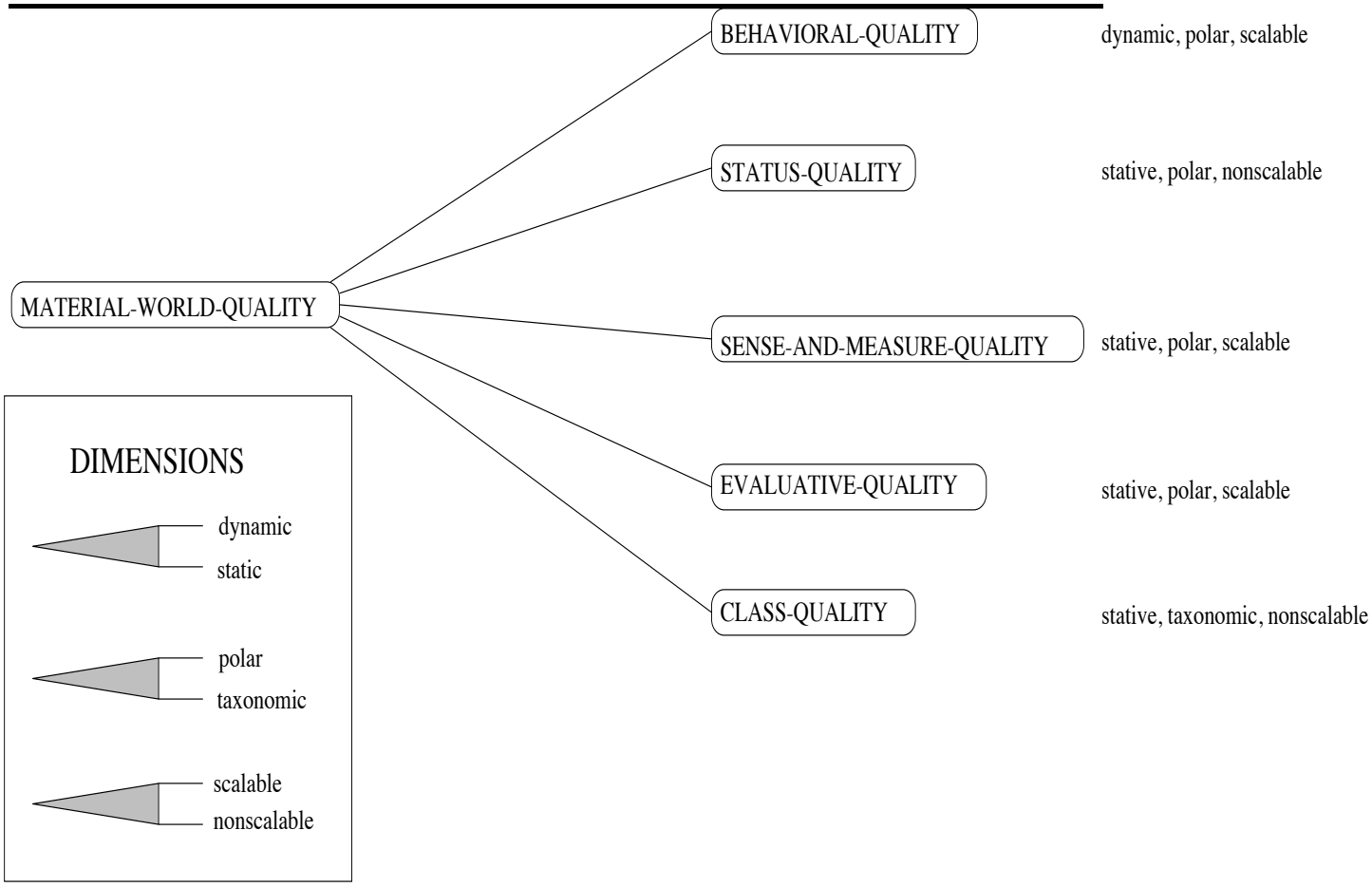


Figure 4.5: Material world qualities

	class	status	evaluative	sense	behavioral
scalable	no	no	yes	yes	yes
type of contrast	taxonomic	polar	polar	polar (except color)	polar
dynamicness	stative	stative	stative	stative	dynamic

Figure 4.6: Properties of Material Qualities

1. *scalability*: A quality is *scalable* if an object may possess it to varying degrees (the set of possible values form a continuum). For example, 'heavy' is a scalable quality. We can describe objects as being 'very heavy', or 'more' or 'less' heavy than other objects. A *non-scalable* quality is either possessed by an object or it is not. 'Dead',"empty" are non-scalable qualities.

2. *type of contrast*: the space of values may be divided in many ways

   - *polar*: A quality is *polar* if it has a corresponding quality describing its opposite or the absence of this quality entirely. A polar quality is not part of a larger taxonomy. E.g., 'heavy'/'light', 'dead'/'alive'.
   - *taxonomic*: All qualities which are not polar are *taxonomic*, i.e., the possible values can be listed. For example, the quality of being mammal is part of some taxonomy.

3. *dynamicness*: a quality can be stative or dynamic. A quality is *dynamic* if the entity possessing this quality must exert some effort in order to maintain the quality. *Stative* qualities hold regardless of any particular process. Dynamic qualities can be expressed using the present progressive tense, i.e., they can take the form:

   X *is being* <quality>

   For example, "John is being clever/skillful/creative/enthusiastic." Stative qualities cannot. "*John is being dead/German/tall." These can take the simple present only.

The table of Figure 4.6 shows how these properties are distributed among the 5 subclasses of **material-world-quality**s currently defined in the upper model.

Further examples of qualities that are candidates for a more distinctive inclusion in the upper model are the 'states': "happy", "angry", "sad", "amused", "afraid". Constructions involving qualities in this class can also specify a fact as the cause of the mental state. For example,

Henry was sad that he missed the performance.
Henry was angry because the train was late.

Two further classifications of qualities of this kind are in terms of whether they are *senser-oriented* or *phenomenon-oriented*, although some qualities fall into both phenomenon- and senser-oriented categories. In this case they are expressed differently depending on their classification. Compare:

I am *amazed* that the earth is flat. (senser-oriented)
That the earth is flat is *amazing* to me. (phenomenon-oriented)

Otherwise, the two classes have differing realizational possibilities; for example:

That the USA has 1,000 nuclear weapons is	*frightening.*
	/likely.
**That the USA has 1,000 nuclear weapons is*	*blue.*
	/happy.

The subclasses which are present in the upper model are the following.

4.2.2.0.9 Status-quality Ascribes a quality to an object, independent of the observer. For example, a specialization of this category could be the quality *life-status* which would be further broken down into the classes *dead* and *alive*.

EN : "full/empty, dead/alive"

DE : "voll/leer, tot/lebendig"

IT : "pieno/vuoto, morto/vivo"

4.2.2.0.10 Class-quality This category should contain numerous taxonomies. For the present it contains only the taxonomy **material-class-quality** that describes the quality of being made of a particular material (e.g., wood, metal, etc.) and **provenance-class-quality** that constrains according to place, institution, social group, or other social category of origin.

- *Provenance-class-quality* provides information that constrains reference by place, institution, social group or other social category of origin.

  EN : "John is English"

  DE : "Renate ist Deutsch"

  IT : "Fabio è Italiano"

- *Material-class-quality* describes the quality of being made of a particular material, e.g., wood, metal, etc.

  EN : "A *wooden* table"

  IT : "Un tavolo *ligneo*"

4.2.2.0.11 Sense-and-measure-quality Qualities that are sensed or measured by conscious beings.

For example, this category would include qualities of age (young, old), of weight (light, heavy), price (expensive, cheap), etc. For the present, the defined subcategories are:

- size
- color
- age

These are all motivated by differential treatments in the grammar of nominal groups.

4.2.2.0.12 Evaluative-quality Qualities which belong to this class are determined by some value system of some conscious being. Such a value system may be moral, aesthetic, or utilitarian. Moral qualities include 'honest', 'polite', 'generous'. 'Beautiful', 'neat' are examples of aesthetic qualities. 'Readable', 'easy', and 'thorough' are some task-oriented qualities.

DE : "Ehrlich, höflich, freigebig"

IT : "Onesto, Educato, Generoso"

4.2.2.0.13 Behavioral-quality Behavioral qualities are qualities which characterize the behavior of a conscious being. In English they can usually take the form:

X is being <quality>

Some English examples are: *"clever", "skillful", "creative", "enthusiastic".*

Equivalent Italian examples are: *"abile", "intelligente", "creativo", "entusiasta".*

Chapter 5

Relations

5.0.3 Participants

Again as described above (Section 2.6.1), a process/state/event is said to 'contain' some number of entities that critically *participate* in the actualization of that process/state/event. The style of these entities' particular participation in the process is identified in terms of given role names. The full list of participant relations currently required to support the distinctions drawn by the grammar is graphed in Figure **??**. We will now describe each of these briefly in turn.

5.0.3.1 Participants in Material Configurations

5.0.3.1.1 Actor A transitivity function in a material clause; the participant always inherent in the clause according to the transitive model of transitivity (cf. Section 2.6.1).

The term Actor is distinguished from the term Agent: while the former is confined to material clauses in the transitive model, the latter is a generalized transitivity function – the 'causer' – in the ergative model. The process in which the **actor** participates may or may not extend to affect another participant, the Goal. For instance,

(Actor:) *Henry* (Process:) *dives*;

(Actor:) *Henry* (Process:) *kicked* (Goal:) *the ugly duckling.*

5.0.3.1.2 Actee **Actee** is a process participant describing the entity upon which a process is 'done', 'carried out', etc. The **actee** role is divided into two subtypes: **result** and **process-range**.

These subtypes are not at present explicitly referred to by the inquiry implementations used in PENMAN since they are predictable from the process-type. For example, the **actee** of a **directed-action** (which is a type of **material-process**; see Section **??**) can only be of the **result** type; similarly, the **actee** of a **nondirected-action** can only be of the **process-range** type. This will be clarified in the section on the **material-process** subhierarchy below.

This participant is termed in [17] and in [13] as **Goal**.

5.0.3.1.2.1 Result The **result** relation holds between a process and its result. For example, the relation between "build" and "a house", or the relationship between a function and its value.

Identifies the participant that is in the role of being affected, acted upon, or brought into being by the actualization of the process.

5.0.3.1.2.2 Process-Range The **process-range** relation is a participant role where the participant is not affected or altered by the actualization of the process, but instead serves more to define the nature of the process: it specifies the domain of application of the actualization of the process.

Like other participants it is realized grammatically by a nominal group, but it does not participate in the process in an operational sort of way. [19]

Compare for instance the two following sentences (from [13, p232]):

"They transfused the blood" "They did the transfusion"

While in the former *"the blood"* is clearly a participant conceptually separated from the verb, in the latter *"the transfusion"* seems to be very closely tied to the verb, in fact, in *"doing the transfusion"* only one action takes place.

Examples in this category are:

Fred plays the piano.

Fred took *a bath*

Fred climbs *mountains*

Fred climbed *the mountain*

If a range element of this kind is picked up in the discourse, it's picked up as a class, not as individuated representatives:

E.g.

"He plays tennis".

"It's a wonderful game".

But not: He had a difficult game

Also compare:

"Fred plays the piano" (Piano as a class of instrument)

"Fred polish the piano" (Piano as an individual item)

Finally, passive forms with Range becoming Subject are very unlikely:

? "Tennis is played by him" ? "A bath is taken by him"

5.0.3.2 Participants in Verbal Configurations

5.0.3.2.1 Sayer **Sayer**: source of the communicative process.

- mandatory,
- this should be restricted to be an 'information-source', e.g.: speakers (**conscious-beings**), documents, watches, signs, traffic lights. However, the problem of grammatical metaphor surfaces here also to defeat the actual statement of value-restrictions. That is, whereas in certain situations one might want to use language which makes inanimate objects like documents and watches seem like sources of information, in others one would like to preserve their inanimacy. This flexibility of expression is currently beyond the realizational capabilities of the released upper model and the current NIGEL Grammar for English, although it is an area of active research.

Notice that in the case of (see section 3.2.2.3) the **Sayer** coincide with the **Actor**.

5.0.3.2.2 Saying **Saying**: the information being communicated by the communicative process.

- mandatory,
- in principle restricted to be a 'direct-quotation' (e.g., "I will resign.") or a 'report', i.e., some kind of linguistic product (e.g., "that he will resign").

5.0.3.2.2.1 Note: Meta-Message / Nonmeta-message The Merged Upper Model [20] accomodates two subconcepts of **Saying**: **Meta-Message** and **Nonmeta-message**.

Examples of sentences involving this participant are the following:

- Meta-Message

  "The President told *a story*"

- Nonmeta-message

  "The exhibition visitor thanked the policeman *for helping him*"

The proper status of these two participants is however still under consideration, and therefore they have been left out of the current implementation of the Upper Model.

5.0.3.2.3 Addressee **Addressee**: receiver of the communicative process, e.g., "Henry told *me* that dinner would be ready at 6:00pm."

- optional,
- in principle value-restricted to **conscious-being**

This participant is termed in [17] and in [13] as **Receiver**.

5.0.3.2.4 Prompt It is an optional participant in Saying Configurations (see External-Processing).

The following examples from [41] illustrate its function in a sentence:

The doctor answered *the question.*

The pupil responded *to the question* that he was sick.

5.0.3.3 Participants in Mental Configurations

5.0.3.3.1 Senser The entity that undergoes the experience in a mental process. Referents of qualities in this category ought to be restricted to be conscious-beings. Examples include: "happy", "angry", "sad", "amused", "afraid". Constructions involving qualities in this class can specify a fact as the cause of the mental state. For example, "Henry was sad that he missed the performance"; "Henry was angry because the train was late". Note that such constructions are not possible with phenomenon-oriented-qualities. Some qualities fall into both categories, but are expressed differently depending on their classification. Compare: "I am *amazed* that the earth is flat." (senser-oriented) "That the earth is flat is *amazing* to me." (phenomenon-oriented).

5.0.3.3.2 Phenomenon The object of perception in a mental process of perceiving.

5.0.3.4 Participants in Relational Configurations

5.0.3.4.1 Existent It is the only participant allowed in an Existential Configuration (see pag.3.1.1).

5.0.3.4.2 Carrier

5.0.3.4.3 Attribute

5.0.3.4.4 Attribuend The participant in a scaled comparison whose possession of a quality is being compared.

5.0.3.4.4.1 Lesser A direction of comparison in a scaled comparison: here the quality with respect to which comparison proceeds holds less rather than more.

5.0.3.4.4.2 Greater A direction of comparison in a scaled comparison: here, the quality with respect to which comparison proceeds holds more rather than less.

5.0.3.4.5 Compare-Quality The slot in a scaled comparison that contains that quality with respect to which an object (the attribuend) is being compared.

5.0.3.4.6 Standard The standard against which comparison is drawn in a scaled comparison.

5.0.3.4.7 Third-Party-Agent This is the third participant which occurs in some Being & Having Configurations regarding to Fawcett's and Steiner's perspective (see [14]). In this perspective, configurations which have a "Being" or "Having" as their result are still considered to be Being & Havings. The third-party-agent is the agent who brings the configuration into existence.

Examples of Being & Having configurations with third-party-agent are illustrated by the following sentences:

The dog caused the man an injury.

The teacher called the pupil hard-working.

The son accompanied his father to the city.

Notice that in Halliday's approach these configurations are classified as Doing & Happenings.

5.0.3.5 Generalized Participants

In the Upper Model there are a few participant roles which are not restricted to a particular type of configuration but might generalize to various configuration types.

At the present stage of development the generalized participants are the following.

5.0.3.5.1 Agentive **Agentive** captures the notion of causal responsibility and volition for a process' performance. Can be both a participant and a circumstance (generalized-means).

It is a participant from the ergative perspective on process as described in section2.6.1above.

EN : "The father was accompanied *by his Son* to the city"

DE : "Der Vater ist *von seinem Sohn* in die Stadt begleitet worden"

IT : "Il padre venne accompagnato *dal figlio* in città"

5.0.3.5.2 Beneficiary **Beneficiary** is a transitivity function in the clause, according to the generalized ergative transitivity model: the participant benefitting from the actualization of the combination of Process + Medium (as explained in Section 2.6.1). In a **material process**, it is the Recipient ("My aunt gave *the farmer* a duckpress") or the Client ("Pour *me* out a cold Dos Equis beer") and in a **verbal** one, it is the addressee ("Joe told *us* all about Eve"). It also occurs in a few **relational process** types ("I owe *you* an apology") and **mental process**es ("I envy *you* your luck"; "I don't begrudge *you* your happiness").

EN : "My aunt gave *the farmer* a duck"

DE : "Meine Tante gab *dem Farmer* eine Ente"

IT : "Mia zia diede un'oca *al contadino*"

5.0.3.5.2.1 Client **Client** captures the relationship between a process and a person for whom the process was undertaken or carried out. It is typically realized in English by the preposition *for* and is also a subtype of **participant**.

The role of beneficiary where something is done for another person.

EN : "Pour *me* out a cold beer"

DE : "Schenk *mir* ein küles Bier ein"

IT : "Dam*mi* una birra fredda"

5.0.3.5.2.2 Recipient The beneficiary participant role of a material process.

5.0.4 Circumstances

A Configuration is taken to consist potentially of three components: the process itself, participants in the Configuration, and *circumstances* associated with the Configuration. Circumstances are often realized as adverbial groups or prepositional phrases. Circumstances expressed as adverbial groups come from the circumstance hierarchy, while those expressed as prepositional phrases are represented as circumstantial relations.

This is the relationship of being a circumstance of a Configuration — as described above (Section **??**), they are represented as relations between a Configuration and an object. Circumstances are often realized as adverbial groups or prepositional phrases. The subtypes of circumstantial relations are shown in Figure 5.0.4 and we now describe each of them in turn.

If a phenomenon is sematicized and grammaticalized either as a participant or as a circumstance , its greater involvement as a participant is brought out in some way, typically as a higher degree of affectedness – as is shown by familiar examples such as

"shoot the pianist"

"shoot at the pianist"

The Pianist is more likely to escape unscathed in the latter case than in the former [19].

5.0.4.1 Accompaniment

Accompaniment is a relation that holds between objects which participate jointly in some process. Accompaniment may be expressed as:

<independent-argument> + "be with" + <dependent-argument>;

or by a prepositional phrase beginning with the preposition *with* as in:

"with" + <dependent-argument>.

Note that it is not necessary for both of the participants to be aware of the participation. Thus both of the following sentences are examples of this relation:

John went for a walk with Mary.
John went for a walk with his umbrella.

The relation also allows for variation in both a positive and negative direction; For example, "without" is also a type of accompaniment, albeit negative, as is "instead of", which is an accompaniment of alternative. These possibilities are captured in the subtypes of **accompaniment** as follows:

inclusive	*with*
exclusive	*without*
alternative	*instead of*
additive	*as well as*

5.0.4.1.1 Inclusive A subtype of accompaniment that picks out the positive nature of accompaniment; an exclusive accompaniment indicates that accompaniment occured in addition to some other entity that accompanies.

EN : "John went for a walk *with Mary*"

DE : "John ging *mit Mary* spazieren"

IT : "John andò a passeggiare *con Mary*"

5.0.4.1.2 Exclusive A subtype of accompaniment that picks out the negative nature of accompaniment; an exclusive accompaniment indicates that accompaniment occured at the expense of, or without some entity that did not accompany.

EN : "John went for a walk *without Mary*"

DE : "John ging *ohne Mary* spazieren"

IT : "John andò a passeggiare *senza Mary*"

5.0.4.1.3 Alternative One type of accompaniment that may holds between objects which participate jointly in some process. This form of accompaniment states that the accompaniment is positive but replacing; i.e., that some object participated in a process or state as an alternative to some other. In English it may be expressed as a prepositional phrase beginning with the preposition "instead", as in: <independent-argument> ... *instead* <dependent-argument>. Note that it is not necessary for both of the participants to be aware of the participation. Thus both of the following sentences contain examples of this relation: "John went for a walk with Joan instead of Mary." "John went for a walk with his blue shoes instead of his white ones."

5.0.4.1.4 Additive One type of accompaniment that may holds between objects which participate jointly in some process. This form of accompaniment states that the accompaniment is positive and actual; it may be expressed by a prepositional phrase beginning with the preposition ''as well as' as in: <independent-argument> ... *as well as* <dependent-argument>.

The following sentences contain examples of this relation:

EN : "John went for a walk with Mary as well as Joan."

5.0.4.2 Comparison

Comparison encompasses relations which indicate how similar or dissimilar two entities are. At present there are two specializations: **similarity** and **difference**; equality could be a further specialization of similarity. Verbs articulated by this category include: "resemble", "differ from", "be similar to", "be different than", "be like", "match", "fit", etc.

In English, a grammatical characteristic of entities in this category is that they are symmetric, i.e., subject and object can be interchanged without passivization.[1] Note however, that the passive form is still possible. For example,

Henry resembles Joan
Joan resembles Henry
Joan is resembled by Henry

[1]Some relations are symmetric while others are not. *Symmetric* and *non-symmetric* could well be high-level concepts from which this kind of knowledge would be inherited. In addition, at present there is no direct link between this concept and the class **identity** under **intensive**s; arguably there should be.

2

5.0.4.2.1 Difference A sub-type of the comparison relationship that picks out negative comparison.

EN : "Henry differs from John"

DE : "Heinrich unterscheidet sich von Johann"

5.0.4.2.2 Similarity A sub-type of the comparison relationship that picks out positive comparison.

EN : "Henry resembles John"

DE : "Heinrich ähnelt Hans"

IT : "Enrico somiglia a Giovanni"

5.0.4.3 Generalized-Means

Generalized-means is a generalized notion that refers to the abstract concept of the means for actualizing some process. The subtypes of **generalized-means** are: **enablement, instrumental, manner,** and **agentive**.

5.0.4.3.1 Manner **Manner** is a circumstantial role of a process that describes the manner in which the process' actualization is achieved. Commonly realized by adverbs in English, although there are other possibilities, for example, within the current grammar, it is realized through patterns of the form: <verb> + "by", "like", or "as if" + <nonfinite clause>:

"John hit the nail *by* holding the hammer"

"Henry came into the room *like* lightning"

"Joan leapt up *as if* stung"

5.0.4.3.2 Instrumental **Instrumental** captures the notion of the instrument that is used in order to perform a process. It is typically expressed as: <verb> + "with" where <verb> cannot be "be"; german and italian express Instrument in a similar way, with the prepositions "mit" and respectively "con":

EN : "John hit the nail *with* a hammer"

DE : "John schlug den Nagel *mit einem Hammer*"

IT : "John colpì il chiodo *con* il martello"

[2]Notice that the reversibility pattern above mentioned appears to be typical of English, in German and Italian it is difficult to find similar verb pairs.

5.0.4.3.3 Enablement **Enablement** refers to a possible enabling relationship between the actualization of some process or state of affairs and an entity, state of affairs, or other process. It is typically realized in English by <verb> + "by" + <noun phrase>, as in, e.g.:

EN : "Henry solved the problem *by hard work*"

DE : "Heinrich löste das Problem *durch harte Arbeit*"

IT : "Enrico risolse il problem *lavorando intensamente*"

5.0.4.3.4 Agentive It is also a participant, see section 5.0.3.5.1.

5.0.4.4 Spatio-Temporal

The spatio-temporal subhierarchy is organized along a number of dimensions which combine to form specific categories of relationship between entities and locations in space or time. Most of the subclasses are responsible for the appearance of specific prepositions within prepositional phrases generated by the grammar to express the spatio-temporal relationships the subclasses identify. There are also often consequences for other parts of the clause which is realizing the configuration: most commonly, for temporal spatio-temporals, constraints on tense selection and temporal adjuncts. For this reason, it is always important to consider the clausal context of the grammatical realization: it is rarely sufficient to consider the prepositional phrase alone (and virtually never only the preposition!). This is particulary the case in some of the German examples.

Further specializations of **spatio-temporal** include relations concerned with time, space, directions, and extents.

The two top level distinctions are between:

- **locating** and **extent**

  In English, the **extent**-dimension is responsible for the selection of prepositional phrases involving prepositions such as *for*, *along*, *across*, *during*, etc.; as in the prepositional phrases:

  for three days
  for five miles
  across the bridge
  along the road
  during the debate

  The concept here, therefore, is one of a segment of space or time throughout which some process or state obtains, as opposed to a simple **locating** which picks out spatio-temporal points of location.

- **temporal-relation** and **spatial-relation** This distinction doesn't need an explanation.

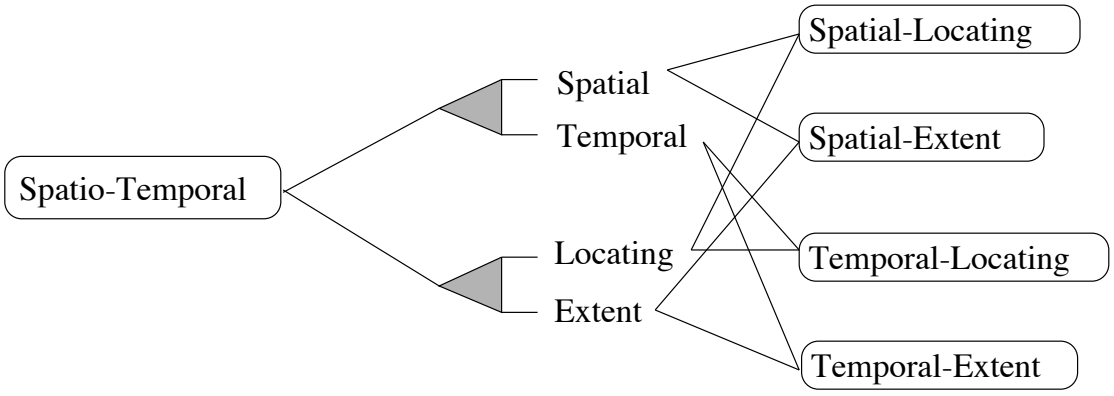


Figure 5.1: Spatio-temporal Relations

The top level distinctions combine to give rise to a range of subcategories that are distinguished by the grammar and described below. For example, **Temporal-relation** and **extent** combine to give the subcategory **temporal-extent**; **spatial-relation** and **extent** combine to give the subcategory **spatial-extent**. **Locating** combines with each of **spatial-relation** and **temporal-relation** to give the subcategories **temporal-locating** and **spatial-locating** respectively.

The full spatio-temporal relation subhierarchy is shown in Figure 5.1.

5.0.4.4.1 Temporal extent **Temporal-extent** further decomposes into **non-exhaustive-duration** and **exhaustive-duration**. This distinction provides the motivation for selecting between the prepositions *in* and *during* in their corresponding prepositional phrases.

The relationship of a process or object to a path or interval in time.

5.0.4.4.2 Temporal-locating **Temporal-Locating** locates a process or state with respect to a time in either an **ordered** or **unordered** fashion.

The **ordered-locating** defines a nonsimultaneous ordering between the configuration/process/state and a time, again organized along two dimensions:

- **anterior/posterior** : expressing whether the relationship expressed is one of preceding or following in time;
- **extremal/nonextremal** : expressing the perspective that is taken on the relationship between the process/state and time with respect to whether there is an orientation to the end or beginning points of some interval or not.

This latter dimension reflects the organization of possible meanings for prepositional phrases of time as represented in the current NIGEL grammar for English. A prepositional phrase involving a preposition such as *since*, for example, is analyzed as

	anterior	posterior
nonextremal	anterior-nonextremal **precede** *(before)*	posterior-nonextremal **follow** *(after)*
extremal	anterior-extremal *(until)*	posterior-extremal *(since)*

Figure 5.2: Combinations of *extremal/nonextremal* and *posterior/anterior*

enforcing an orientation to the *beginning* of the period identified within the prepositional phrase; the semantics of the relation expressed between the clause and the prepositional phrase is therefore **extremal** in addition to **posterior** and is in contrast to the **nonextremal**, posterior perspective expressed by *after*. We can illustrate the contrast as follows:[3]

There have been many problems since the war
There were many problems after the war
? There were many problems since the war
? There have been many problems after the war

The *since* temporal relationship focuses on the entire interval including the beginning point, it therefore favors the present-in-past tense ("have been") to express the explicit extension in time of the holding of the process/state; the *after* temporal relationship does not necessarily extend to the extreme of the interval, simply expressing that some process/state holds at some point within the interval identified.

The current paradigm formed by combining the classes of **anteriority — posteriority** and **extremal — nonextremal** and their realizations as prepositions by the grammar is set out in Figure 5.2.

In addition, it is possible to have a relation that is classified as being *ordered* but neither *posterior* nor *anterior*; this is realized as the prepositional phrases involving *by*; e.g.:

By 3 o'clock there were many problems
I will be back by 10

Further, in the case of *unordered* temporal locatings, the actual preposition that is selected in a prepositional phrase can depend on the type of temporal 'object' with respect to which the locating is made. The types of possible temporal objects are described in Section 4.1.3.2 under *spatial-temporal objects*; these distinctions motivate selection in the grammar between the prepositions of time *in, at,* and *on*.

[3]Note that with these examples the question of the perspective that is being taken is crucial and there can be no categorial statements of acceptability.

5.0.4.4.3 Spatial-Extent **Spatial-extent** is the relationship of a process or object to a path or interval in space.

It further decomposes into **parallel-extent** and **nonparallel-extent**. This distinction provides the motivation for selecting between grammatical circumstantial constituents realized by prepositional phrases involving the prepositions *along* and *across*.

5.0.4.4.4 Spatial-Locating **Spatial-Locating** is the relationship between an object or process and its location in space.

It has three immediate subcategories for finer classification:

- **Orienting**, which specifies that there is an element of relative directionality included in the relationship between process/state and the space within which that process/state is being located. It is in contrast with **nonorienting**. Examples of this dimension of contrast are given by grammatical circumstantials realized by prepositional phrases involving the prepositions *to, from, off, onto* (**nonorienting**) *vs.* the prepositional phrases involving *towards, in front of, above, below, behind* (**orienting**).

- **Source-destination**, which indicates the direction of directionality included in a process; i.e., either *from* the **source** or *towards* a **destination**;

- **Static-spatial**, which specifies that there is no movement involved and the spatial location is unchanging. For example,

  Joan sat at the table.

  More generally, the NIGEL grammar realizes this category by the prepositional phrases involving *to, from, onto,* and *into* for **motion-process**es, and by *on, in,* and *at* for concepts which are not. As was the case with unordered temporal locatings, some of these selections of prepositional phrases are also dependent on the type of spatial object with respect to which locating is occurring; for the possible types of these see Section 4.1.3.1under **spatial-temporal objects**.

  Static-Spatial also combines with **Orienting** to provide a classification of relative locations along **vertical** and **horizontal** dimensions. These each further divide into two to give the categories: **below** and **above**, **facing** (realized as *in front of*) and **behind**.

5.0.4.5 Ordering-Relation

Ordering-relation is the general relationship that holds between the parts of an ordered object. It is used as an additional classification of both temporal and spatial locating relations, and is described in the **spatio-temporal** subhierarchy description (Section **??**). The temporal ordering subtype is also used for temporal reasoning concerning time intervals and ascertaining tense in English.

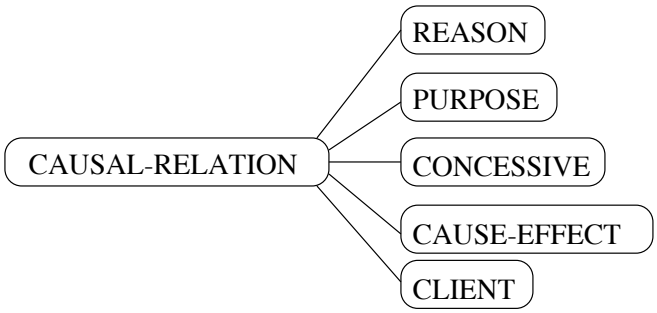


Figure 5.3: Causal Relations

5.0.4.6 Causal-Relation

In this subhierarchy we can find relations that express a generic notion of "cause", as the followings:

- **reason**
- **purpose**
- **concessive**
- **client**

some of these have further sub-classes that are also classified elsewhere in the upper model (see Section 5.0.6). [4]

This is shown in Figure 5.3 .

Note that there may be other useful specializations of causality. For example, we may want to represent logical implication or necessary entailment as a kind of causality to account for expressions such as:

> *You can switch the operands of a multiplication because of the commutativity of the operation.*

and the language of formal logic, e.g.,

> *Because A implies B and A is known to be true, B.*
> *Since A implies B and A is true, B.*
> *A implies B and A is true, therefore B.*

[4] The appropriate positioning and status of 'rhetorical' relationships such as **rst-purpose, rst-concessive**, etc. is still under discussion; at present they are represented as a separate class of concepts. They may, at a later stage, be folded into possible realizations of other concepts, including, for example, the causal relations described in this section, some temporal relations, etc.

Whether a separate concept is required here or not depends finally on whether or not the grammar makes a distinction between these constructions and those of, for example, **reason**. Only if it does make a distinction is a separate category motivated according to the definition of the upper model that we are following in this document.

Notice that also one of the participant roles (the client, section 5.0.3.5.2.1) is a subtype of causal relation.

5.0.4.6.1 Purpose *Purposes* capture the notion of why something was done. They may be motivational as with 'reasons' but look forward rather than back.

Purpose also expresses a volitional effect. However, in this case the cause is considered 'future' with respect to the effect. Expression of this relation uses terms such as: "for" with either a noun or verb, "to"+<verb>, "by"+<verb>-*ing*, and "in order to/that". For example:

John went to the market to buy milk.
The funds are for education.

This relation is useful for any system that needs to represent the causality of behavior; for example, constructions such as:

In order to achieve <goal>, program did <plan>.
<Plan> was executed for the purpose of <goal>.
Program achieves <goal> by applying <plan>.

will be common.

[German grammatical behaviour]

In Italian the notion of purpose is typically realized by means of the prepositions "per" or "a":

John andò al mercato a/per *comprare del latte.*
I fondi sono per *scopi educativi.*

Like in English, there are some complex expressions of purpose, like "allo scopo di" (for the purpose of):

Allo scopo di <goal>, il programma fece <plan>.
<Plan> fu eseguito allo scopo di <goal>.

moreover, it is possible to express purpose by using a gerund without any preposition:

Il programma realizza <goal> applicando <plan>.

5.0.4.6.2 Concessive One type of generalized causation relationship. This relation states that some process occured despite some other event or state of affairs holding. It is typically realized in English by the preposition "despite" therefore.

EN : "*Despite* the bad weather, the football match took place"

In German the conjunction "obwohl" can be used to express this state of affairs, such as in:

DE : "*Obwohl* das Wetter schlecht war, fand das Fussballspiel doch statt."

In Italian there is the equivalent conjunction "nononostante", e.g.

IT : "*Nonostante* il maltempo, la partita ebbe inizio"

5.0.4.6.3 Reason Reason captures the notion of motivation. Here the effect is volitional or intentional. This relation is expressed by terms such as: "since", "because". Examples include:

EN : "Henry went to the store *because* he needed milk" EN : "*Since* it was raining, Henry brought his umbrella."

German uses the terms "weil" or "da".

DE : "Heinrich ging zu den Laden, *weil* er Milch brauchte" DE : "*Da* es regnete, brachte Heinrich seinen Schirm mit"

The equivalent italian terms are "perchè", "Dato che" (given that):

IT : "Henry andò al negozio *perchè* voleva del latte" IT : "*Dato che* pioveva, Henry prese l'ombrello"

5.0.4.6.3.1 Condition

5.0.4.7 Subject-Matter

Subject-matter is a relation typically expressed in English as: *be about*, as in

EN : "This document *is about* the Upper Model"

DE : "Dieses Dokument *bezieht sich auf* das Upper Model"

IT : "Questo documento *riguarda* l'Upper Model"

5.0.5 Logical Relations

Logical relations combine processes or states of affairs into larger, composite processes or states of affairs, either conjunctively (e.g., 'and'), or disjunctively (e.g., 'or'), or by providing more information in an elaboration. These possibilities for expression define the three main subclasses of **logical**: **conjunction**, **disjunction**, and **elaboration** respectively.

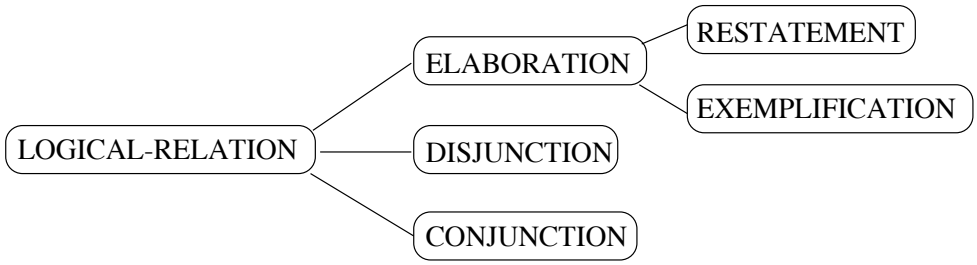


Figure 5.4: Logical Relations

Elaboration further divides into two classes that are used to discriminate between possible inter-clause or inter-nominal group relationships: **restatement**, **exemplification**.

The classes below **logical** are shown in Figure 5.4.

> It is important to interpret these 'logical' relationships in their own terms as part of the semantics of a language, and not to expect them to fit exactly into non-linguistic logical categories – although since the latter were derived from natural language in the first place there will obviously be a close relationship between the two.[17, pp202]

5.0.5.0.1 Elaboration A logical relationship between processes and objects of providing more information concerning those processes or objects; this includes restating and providing examples.

5.0.5.0.1.1 Restatement A type of elaboration that provides further information by restating in different terms.

5.0.5.0.1.2 Exemplification The relation between some thing/process and an example of that thing/process.

5.0.5.0.2 Disjunction A relation of logical disjunctive combination of process or states of affairs; often realized by conjoining with "or".

5.0.5.0.3 Conjunction A relation of logical additive combination of process or states of affairs; often realized by conjoining with "and".

5.0.6 Rhetorical Relations

The original Upper Model [6] includes a hierarchy of "Rhetorical Relations", as derived from "Rhetorical Structure Theory" [30]. This kind of relations are more textual in nature rather than ideational and therefore shouldn't appear in an Upper Model that is meant to capture the "Ideational" categories. In the current implementation of the Generalized Upper Model these relations are still for the present preserved, we don't consider however necessary to provide any additional documentation.

For the overall description of the very different treatment of the area of 'rhetorical relations' that will be brought into the Generalized Upper Model in the future, see [2].

Chapter 6

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