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Roles and Anchors of Semantic Situations*)

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Abstract

Although neither theoretical nor computational linguists did provide sufficiently careful insight into the problem of semantic roles, recently some progress is being achieved in robotics (study of the simulation of human interaction), and mostly in multi-agent systems. Taking advantage of this motivation and applying it to the study of languages, I distinguish between various abstract ontological levels. Instead of using such concepts as *agentive*, *objective*, *experiencer*, etc., on the highest (generic) ontological level, I postulate generalised agents which are defined by the following ontological features, among others: (1) features of **control** (autonomy): *goal* and *feedback*, (2) features of **emotion** (character): *desire* and *intention*, (3) **epistemic** features (reason): *belief* and *cognition*, (4) **communication** features (language faculty): *verbal* and *visual*.

In accordance with such ontological concepts, natural and artificial entities are obviously suited to fulfil the semantic roles of *agents* and *figures* respectively in the widest sense of these terms. I further propose to distinguish between three classes of generic ontological roles, namely ACTIVE, MEDIAN or PASSIVE. Here are examples of generic roles: (1) *active role* (Initiator, Causer, Enabler, Benefactor, Executor, Stimulant, Source, Instigator etc.), (2) *passive role* (Terminator, Affect, Enabled, Beneficient, Executed, Experiencer, Goal, etc.) and (3) *median role* (Mediator, Instrument, Benefit, Motor, Means etc.). Figures can play quasi-active (Q-active) roles.

1. Human Communication as a Composite Partial Function

From a philosophical point of view (phenomenology), it is interesting to observe that while signs and situations belong to the universe of *noumena* (they are immanent), representations belong to the realm of *phenomena* (they are transcendental). For this reason, *infons* can be seen as elements of semantic knowledge (declarative *know-what*) as derived (in disorder) from linguistic interactions (communications) of man. However, once they are arranged in a sequential order and completed by sets of complementary infons they are enriched by ontological knowledge (procedural *know-how*). It should be

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emphasized that this idea is similar to our earlier proposal[1] to organize declarative semantic attributes and their values into Feature Structures according to their ontological grounding. It is therefore hypothesized that ontology lies at the basis of any natural language semantics. What is semantic proper for a given natural language is the selection and declarative organisation of ontological situations, their participants and anchors (locations in time and space).

Language is a ***partial function*** from infons to expressions or vice versa (i.e.: only a part of what the speaker means can be put into words, on the one hand, and the hearer must complete every concept he picks up during the communication process, on the other hand). Thus, the theory of semantic situations that is sketched hereafter seeks to clarify the fundamental composability (partial compositionality) of invertible functions which can be played by signs and their combinations in order to enable their users to convey meanings about the entities of the World. Using the notion of composability we shall attempt to explain the well-known and now largely accepted fact that linguistic expressions convey only partially the information that the speaker has in mind. In this connection, We shall use the couple of notions *encoding/decoding* in connection with the communication of meaning both as it is conveyed in a linguistic message (expression) uttered by a speaker and as it means something to the hearer (a signified content).

As an immediate consequence of the above claim, it was necessary to revise the current linguistic theory of ***predication***. Indeed, it is no longer possible to maintain that predication takes place when the content of a sentence is “complete”. Instead, our theory postulates the neat separation of the *truth conditions* (which are characteristic of information or situation with its roles or, more traditionally, argument structure relations) from the *communicative* ***new/given statuses*** of expressions. Thus, it appears necessary to make the following distinction between two language levels: *informative* (relational in logical sense) *level* and *meta-informative* (constitutive in syntactic sense) *level*. Indeed, in the MIC (Meta-Informative Centering) theory, Predication is defined as uttering about a State of Affairs (SOA) with either ***new*** or ***given*** **statuses**. It becomes therefore clear that what is communication proper concerns the *meta-informative status* of truth-conditional (relational) *information* (cf. in this volume Wlodarczyk A. & H.: *The Pragmatic Validation of Utterances* and 2006a, 2006b).

2. Language and Ontology

Since F. de Saussure, natural languages are supposed to be "*systems* in which everything is interconnected" (*systèmes où tout se tient*). In modern philosophy ontologies are no longer concerned with elementary entities which exist in isolation. Consequently, entities are no more single beings/objects but consist of interrelated elements and are considered today to be *structures*. In the case of living beings viewed as *structured objects,* they are said to be able to occur in various environments to which they adapt and with which they interact. Such living beings are known as agents and their

[1] Cf. the framework of the running research project CASK (Computer-aided Acquisition of Semantic Knowledge), Centre for Theoretical and Applied Linguistics (CELTA), Université Paris Sorbonne.

interaction with the universe as well as between themselves is called their *behaviour* (cf. Ingarden, R. - 1981). Entities viewed as structures of elements which develop their *behaviour* in *environments* are also agents. They can be described in terms of the **theory of general systems**.

Finally, general systems can be formally defined using the following tuple of concepts:

S = (*Wld, Rel, Env, Bhv*)

where:

Wld- Set of objects
Rel – Relations between the objects
Env - Environments
Bhv - Behaviours

The behaviour of more than one entities may include interaction with common goals. Such interaction is known as cooperation and necessarily yields communication. Humans are endowed with a particularly efficient communication device: language. In the years 1980, a Polish mathematician J. Pogonowski proposed a hierarchical reconstruction of structural linguistic theory in which language is seen as a *general system* whose *sorts* are all its levels, *objects* - all its (concrete and abstract) units and *signature* - all its syntagmatic, paradigmatic and inter-level relations. Because natural languages are *general systems* themselves they also exhibit properties of those systems. Consequently, they must be studied in connection with the ontologies of their bearers (users). As we shall see later, in the present theory the universe *(Wld)* contains objects (i.e.: *animate* and *inanimate* entities) which are related *(Rel)* through their behaviour *(Bhv)* to *situation roles* within *situation frames* or environments *(Env)*.

Currently Artificial Intelligence (AI) specialists agree that intelligent processing of information requires utilisation of ontological knowledge; i.e.: such knowledge which may be organized in structured and intelligent databases. Indeed, ontologies are necessary for designing any information system which is supposed to interact with humans. According to another tenet of the AI specialists, regardless of the overall architectures of information systems, such systems often should contain more than one ontology. In order to cope with such complex cases, at least two kinds of ontologies are postulated: (1) **upper ontologies** on the highest levels of abstraction, and (2) **domain ontologies** on the lowest (concrete) levels.

2.1. Semantic Theory of Natural Language from the Ontological Perspective

Due to the basic partiality of natural languages, we claim that semantic descriptions are motivated by ontologies. If semantics has to deal with *meanings expressed in a given natural language,* then there cannot be such thing as "universal semantics" precisely because *natural language*s differ from each other. Nevertheless, it seems possible to postulate the feasibility of a useful universal formal *generic* (or upper) ontology and of as many as necessary *domain* ontologies. As a matter of fact, natural languages are themselves parts of ontologies and represent their various *realisations*. Ontologies which are associated with natural languages are comparable to the ***generic*** and ***domain ontologies*** of other information systems. I claim that the **cognitive description** of the semantic structure of a given natural language must integrate both generic and domainspecific (in this case language-specific) ontological knowledge.

UPPER (or GENERIC) ONTOLOGY
1. Entity
    1.1. Agent - Animate entity
        1.1.1. Human
        1.1.2. Non Human
    1.2. Figure - Inanimate entity
        1.2.1. Material
        1.2.2. Immaterial
2. Situation (fragment of the World)
    2.1. Situation Frames
        2.1.1. State (space without time)
        2.1.2. Action (space with time flow)
            2.1.2.1. Event (space with time flow but without progression)
            2.1.2.2. Process (space with time flow and progression and/or granularity)
    2.2. Situation Roles
        2.2.1. Active role (Entities: Initiator, Benefactor, Speaker ...)
        2.2.2. Median role (Entities: Mediator, Means, Tool, OSA (the One Spoken About) ...)
        2.2.3. Passive role (Entities: Terminator, Beneficient, Hearer ...)
        2.3. Situation Anchors
        2.3.1. Start etc. (for spatial anchors), Beginning etc. (for temporal anchors)
        2.3.2. Path etc. (for spatial anchors), Course etc. (for temporal anchors)
        2.3.3. Arrival etc. (for spatial anchors), End etc. (for temporal anchors)

Frame 1: Upper (or generic) ontology (for language semantics)

In the frame #1 we sketch out a few upper-ontological distinctions in a classical classification-like manner. However, ontological classifications are seldom tree-like classifications. For example, there are serious difficulties connected with the distinction Animate Agent/Inanimate Figure and Natural/Artificial entities.

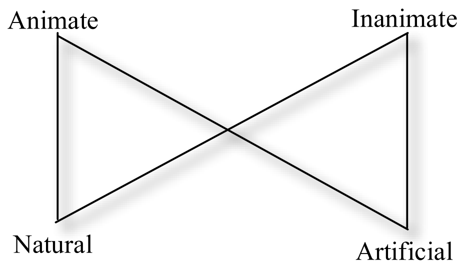

Fig. 1: An Example of heterarchical (inheritance) relations in ontologies

Both natural and artificial entities may be either animate or inanimate. Thus, the set A of animate entities intersects with the set X of natural entities and the set Y of artificial entities respectively. Inanimate entities thus correspond to the difference between natural and artificial entities $X\text{-}A = \{x \mid x \in X \text{ and not } x \in A\}$ as regards *inanimate natural entities* and to the difference between artificial and animate entities $Y\text{-}A = \{x \mid x \in Y \text{ and not } x \in A\}$ as concerns *inanimate artificial entities*. Inanimate entities are those which belong either to X or Y but not to A. Such a definition breaks away from the traditional logical classification but may be dealt with in multiple inheritance systems or in any system able to process membership approximation.

2.2. Entities : Agents and Figures

I propose to borrow the generalised notion of *agent* from Artificial Intelligence and will call Agent any animate participant of a situation, whereas I will call Figure any inanimate participant. Both agents and figures may be explicit or implicit. Thus all situation animate protagonists are agents but linguists generally call them "agents", "patients" (or "contra-agents"), "experiencers", "beneficients", etc. Agents interact in particular situations and it is precisely this interaction (interdependency) that determines their abstract quality of agents in the generic sense.

Animate entities (Agents) are either *human* (+Hum) or *non human* (-Hum) and Inanimate entities (Figures) are material (+Mat) or immaterial (-Mat). It happens, however, that situation participants are transformed *from Figures to Agents* (agentivation, traditionally known as "personification") or *from Agents to Figures* (figuration, traditionally known as "depersonification").

Characteristic Features / AGENTS	Control (autonomy)		Emotive (character)		Epistemic (reason)		Communication (language)	
	Feedback	Purpose	Desire	Intention	Belief	Cognition	Verbal	Visual
Human	+	+	+	+	+	+	+	+
Non human	+	+	-/+	-	-	-	-	-

Table 2: The most characteristic features of semantic agents

Table 2 enumerates some characteristic features of agents on the highest level of abstraction. Agents of a situation are defined by several semantic features: (1) control features (autonomy): *goal* and *feedback*; (2) emotive features (character): *desire* and *intention*, (3) epistemic features (reason): *belief* and *cognition*), (4) communication features (language faculty): *verbal* and *visual*.

3. Relations, Roles and Anchors

It was probably the theory of Case Grammar[2] (Fillmore, Ch. - 1968, 1971) which was most influential and very frequently referred to in linguistics. In particular, it

[2] "*Case grammar has not become a mainstream part of generative grammar, perhaps because the phenomena it deals with do not yield to the kind of neat formal analysis that the paradigm demands. There has been a tendency to push the issues off by arguing that they are 'semantic' rather than to deal with them in the syntax. However, case grammar has been widely discussed and has influenced the design of many computer systems for natural language.*" (Winograd, T., 1983, p. 311)

introduced concepts such as *agentive*, *objective*, *experiencer*, etc., in order to explain meanings of the morphological paradigm of cases (nominative, accusative, dative etc.). Indeed, Case Grammar can be considered as the first attempt at elucidating universal semantic roles (known also as *thematic roles* or *argument structures*). Quite recently, Case Grammar reappeared with substantial modifications in the Berkeley Net Frame (BNF) project, thus becoming the foundational approach in research in the field of semantic networks. However, the most interesting issues in this domain may be found in Sowa J. (1999) who proposed his theory of semantic roles following some original ideas of Somers H. (1987) and Dick J. P. (1991).

As we have seen, from the ontological point of view, everything (Things, Entities), elements of the world, abstractions (including the constituents of linguistic expressions to which attributes can be assigned) can be seen as *structures*. Thus, attributes assigned to objects appear to be relations over those objects. However, in the case when objects (things) happen to be relations between other objects, it is necessary to distinguish between two kinds of attributes: attributes which designate component parts of relations known as *arguments* in logic (*figures* in mathematics) and attributes which represent the *literals* in logic (*grounds* in mathematics) of the above mentioned relations.

In order to explain the linear ordering of basic utterances we propose to model the semantic situation as having three constitutive components[3]: frames, roles and (spatio-temporal) anchors. This model describes information contained in linguistic messages usually referred to as utterances. It suffices that static semantic situations be represented as spatio-temporally located frames (“spaces”, fragments of universe) but the representation of dynamic situations must include also the way situations internally develop in space and time. Moreover, roles determine the “places” (in the frames) that can be occupied by the entities (called participants when fulfilling some situation roles). We formalize this as a projection from mental roles of semantic situations into a set of entities which thereby become their (also mentally represented) participants. However, it is necessary to distinguish between ***explicit participants*** — that have to be recognized by the hearer at the stage of *signification*, i.e. *signified* participants — and ***implicit participants*** — that, in order to be understood, have to be added by the hearer at the stage of *interiorisation* or even deeper at the stage of *categorisation*. This hypothesis is essential for the present theory of semantic situations which, as it takes into account the partiality of meaning of linguistic expressions, entails the need to use, for their formal representation, stratified structures (namely hypergraph structures) instead of simple tree structures. Thus, the *semantic partiality hypothesis* may be seen as an alternate theory to that of surface/deep structures because it makes it possible to elucidate incomplete contents, on the one hand, and to take into account their basically heterogeneous character (conveyed by linear language expressions), on the other hand.

3.1. Role Component

The basic structure of a dictionary being roughly speaking *classification of usages* (i.e.: typified uses in their contexts), the usages being named *semions*, semantic situations

[3] Note that in the proposal recently put forward by Pusteyovsky J. [1995] the term "structure" is used instead of "component".

are valid with respect to mental situations. The semantic part of semions can be represented symbolically using sets of infons[4]. Infons are triples <*i, a, t*> where *i* = infon's name (attribute or relation), *a* = list of arguments and *t* = truth value[5] (*true* and *false*). In this approach, we add a third truth value, namely the instantly *indeterminate* value (or *anonymous* value) in order to distinguish between the speaker's and the hearer's communication acts. When modelling the speaker's activity, the truth value will be most frequently "true" unless he states it otherwise. In the understanding process of the hearer, that value will be "indeterminate" unless expressed overtly as "true" or "false" by the speaker. **Elementary infons** are unary infons. Sets of elementary infons with the same relation names are called **compound infons**. Thus, the names of compound infons are *generalisations* of the names of component infons, i.e.: each relation name of a compound infon being considered as the general name of a given semantic situation. In linguistic expressions, they correspond roughly to verbs.

Here is an example of a compound infon which represents the utterance: *"Brutus killed Caesar."*

```
S1 |= < kill, (killer : Brutus, killee : Caesar), true >
```

The above compound infon can be developed as two elementary infons provided that both of them hold in the same mental situation S_1.

```
S1 |= < kill, (killer : Brutus), true >
S1 |= < kill, (killee : Caesar), true >
```

Now, if we want to represent more information which is associated with the main information contained in the above utterance, we may wish to add some other infons which hold in S_1.

```
S1 |=  < kill, killer : Brutus, killee : Caesar, true >
S1 |=  < at, loc.time : Antiquity, loc.place : Rome, true >
```

The mental entity 'Caesar' could be represented by infons such as :

```
Caesar |= < name, (family : Caesar, given : Julius), true >
Caesar |= < position, (rank : consul, city : Rome), true >
Caesar |= < kill, (killer : Brutus, killee : Caesar), true >
Caesar |= < at, (loc.time : Antiquity, loc.place : Rome), true >
Caesar |=  . . .
```

We call Roles the binary relations which correspond to elementary infons. Roles are component relations within the *frames* of more general situations. Roles either equal or are included in situations (Roles ⊆ Situations), i.e.: roles are either relations or proper subsets of relations. Every semantic situation is therefore composed of *infons* which are partially determined by attributes from both (1) *upper ontologies* and (2) *domain ontologies*. Situation participants of upper ontologies are seen logically as *semantic arguments* and were represented in the theory of situation semantics (Barwise, J. and Perry, J. - 1983) as functions from *roles* to *entities* named "anchors". Note that the term *anchor* will be used here in quite a different way.

In this semantic theory roles are defined as pairs of *participation* functions as

[4] Cf. Devlin, K. (1991).

[5] Note that the presence of truth value makes the only difference between infons and predicates in classical logic.

follows:

- a **type participation** function from roles types to the high level ontological entities (TP: Role type --> Entity type)

- an **instance participation** function from the role instances to the individual entities (IP: Role instance --> Entity instance)

The instant roles inherit the properties from their types (abstractions: hypernyms, super-classes). But, due to the partiality principle mentioned above, when generating or compiling a particular (concrete) role, language users either may be unconscious of many inheritable abstractions or abstractions of entities may be taken into consideration whenever their instances are indeterminate.

The **Role Component** of semantic situations may contain from one to three elements from the set of three kinds of roles whose generic names are: ***active, passive*** *and* ***median***. This theoretical shift[6] has important consequences regarding the very nature of roles which are defined here qualitatively rather than substantially or relationally (as relations between terms). We must not forget that logical arguments are first of all terms. However, such terms are not order-free. If we want to make the sequential order of terms free, it is necessary to split each of them into two parts: the role and its filler (often referred to as participant). We will repeat this shift as regards our second component of semantic situations, which is Anchor Component.

There are two kinds of participant types: Agents (animate entities) and Figures (inanimate entities).

Roles / *Participants*	ACTIVE	MEDIAN	PASSIVE
Agent (animate)	Initiator	Mediator	Terminator
Figure (inanimate)	Source	Means	Goal

Table 3 : Roles of Semantic Actions

Roles enumerated in the table 3 represent the most usual ones. Here are some agents or figures: (1) in *active roles* (Initiator, Causer, Enabler, Benefactor, Executor, Stimulant, Source, Instigator etc.), (2) in *passive roles* (Terminator, Causee, Enabled, Beneficient, Executed, Experiencer, Goal, etc.) and (3) in *median role*s, (Mediator, Instrument, Benefice, Motor, Means, Matter etc.). While active and passive roles are considered here as ***primitive*** roles, *median* roles are definable by introducing two embedded *associated situations* (a-situations) in which (a) the participants of median roles fulfil passive roles in the first of the associated situations and (b) they fulfil active roles in the second associated situation. I distinguish therefore *role associations* (see the above discussion about infons) as explicitly expressed by linguistic utterances from *situation associations* which are implicitly “responsible” for the creation of median roles (but note, however, that associations of semantic situations are also often marked in languages; i.e.: have explicit morphological markers, for example prefixing or suffixing

[6] Note however the rather exceptional idea of Tesnière, L. (1959) who theorized about roles using the abstract name “actant” (acting entity) and enumerated three of them: *first actant*, *second actant* and *third actant*.

verbs or using compound verbs). Let us also add that there may be more than one median roles in the same utterance, nevertheless this is rather rare. In general, linguistic information contains no more than maximum 3-4 roles and 3-4 anchors. This point is crucial for the present theory of *associative semantics*.

In general, active roles are filled by agents and passives roles by figures, but this is not a rule. Initiator and Terminator are entities fulfilling Active and Passive Roles respectively. Agents typically fit the dynamic situations (Actions) whereas figures fit static situations (States). When it is not so, *shallow* level i.e.: partially specified semantic level is probably needed. When the Subject of a default (active or passive) diathesis sentence does not correspond to the default (active or passive in that order) semantic role of a given situation, the ***shallow*** level[7] of meaning must be introduced. In the cases of agentivation or figuration (see above), the shallow role names will be prefixed by the capital letter Q-… (as in quasi-). For example, "Q-initiator" "Q-source" will be said to designate the figure in an active role (which normally fit to agents) and "Q-source" will be said to designate the agent in an active role (which normally fit to figures). Research concerning the similarity of Proper Roles with Quasi-roles would probably require detailed exploration of a number of ***analogies*** in the ontological domain.

Hereafter is an example of transformation of the information contained in *"The key opened the door"* using participation role *types* only.

Shallow level semantics:

< open, (quasi-active-role: 'key', terminator :'door'), true >

Standard level semantics:

< open, (initiator: x , means : 'key', terminator : 'door'), true >

Note that in standard level semantics, it is necessary to recognise that there is an indeterminate initiator x and that the former quasi-initiator has been transformed into a median role (because it is passive with respect to the *initiator* and again *quasi-active* with respect to the terminator).

3.2. Anchor Component

Indeed, it is possible to model the **Anchor Component** of semantic situations in a similar way as their **Role Component**. However, we must be aware of the fact that while the participation functions are projections into the entities, anchoring functions are projections into other situations.

[7] Note, however, that due to the general principle of partiality of linguistic expressions both typified participants and their instances may happen to be *indeterminate*.

Anchors / Localisation	INITIAL	INTERMEDIARY	TERMINAL
Space	Start	Path (Itinerary)	Arrival
Time	Beginning	Course	End

Table 4 : Anchors of Semantic Situations

It is namely because both Components of semantic situations (both Roles and Anchors) can be defined as pairs consisting of (a) the Role and (b) the Participant, on the one hand, and those of (a) the Anchor and (b) the Location, on the other hand, that in the past some linguists have had the intuition of the localistic view[8] of the semantic structure of linguistic expressions.

4. Associative Semantics : Examples of Analysis

In this theory, hypergraphs are thought of as the most adequate representation device for describing associative meaning of information (as expressed by linguistic utterances). Because set-theoretical formalisms generally used in theories with hypergraph representations are rather cumbersome, I provisionally introduce the following (not fully formal) representation in which I will abandon to use quite explicitly the above described Type/Instance participation functions. The *body* of the *associative* situation (A-Situation) semantics being recursive, in order to show the flavour of this analysis I defined the following simple semantic representation language inspired by the CDL[9]:

SITUATION	:= [Sit : HEAD + BODY + FOOT]
HEAD	:= {relation + variable(s)}
BODY	:= {participant(s)} + {role(s)} *or* SITUATION
FOOT	:= {(neutral) role < {relation}}
FOOT	:= {active role < {relation} > passive role}

While HEAD contains *shallow level valence* FOOT corresponds to the *standard level valence*. BODY may contain another situations which are thus ***associated*** with the main (linguistically marked) situation. The above formalism enables the analysis of the semantic situation (meaning) of the utterance #1 as follows:

#1. Brutus killed Caesar.

```
[SIT0: ‘kill’
  HEAD kill x y
  BODY
   {kill relation property=asymetric effect=death:
     {x Brutus participant=agent: }
     {y Caesar  participant=agent: }
```

[8] Note that in this approach the analogy goes from Roles to Anchors rather than backwards.

[9] CDL (Concept Description Language) is designed by Yokoi, T. et al. (2005, 2007).

```
      {Role1 x=killer generic=active  type=initiator  }
      {Role2 y=kilee  generic=passive type=terminator }
      {Role1 < kill > Role2}}
   FOOT
    {Brutus < kill > Caesar}]
```

#2. Brutus killed Caesar with a knife.

```
[SIT0: 'kill'
   HEAD kill x y z
   BODY
    {kill relation property=asymetric effect=death:
      {x Brutus participant=agent: }
      {y Caesar  participant=agent: }
      {z knife  participant=figure: }
    {Role1 x=killer generic=active  type=initiator  }
    {Role2 y=kilee  generic=passive type=terminator }
    {Role3 y=weapon generic=median  type=origin }

    [SIT1:
      HEAD use x y
      {use prop=asym purpose=tool :
           {Role1 x=user generic=active type=initiator : }
           {Role2 y=arm generic=passive type=terminator :}
           {Role1  < use > Role2 }}
      FOOT
           {Brutus < SIT1:use > knife}]

    [SIT2:
      HEAD causeDie x y
        {causeDie prop=asym effect=death :
           {Role1 generic=q-active type=origin object=weapon : }
           {Role2 generic=passive type=terminator }
           {knife  < causeDie > Caesar  }}
      FOOT
           {knife  < SIT2:causeDie > Caesar  : }]
 FOOT
{Brutus < SIT1:use > knife*knife < SIT2:causeDie > Caesar}]
```

Note that in the analysis the median role (fulfilled by 'knife') has been split into two primitive roles (passive and q-active) each belonging to another associated situation (`use x y` and `causeDie x y`).

Let us analyse now the difference between #3a and #3b beneath.

#3a. Peter gave a book to Mary.

#3b. Peter gave Mary a book.

Using the distinction between the informative and meta-informative levels (Włodarczyk A. & H. 2006a, 2006b), it is possible to interpret the above utterances as follows. Due to the English syntax word order, "Peter" in both utterances can be easily analyzed as their global Centre of Attention (Subject). It is clear that "a book" in #3a and "Mary" in #3b correspond to the local Centre of Attention (Object). Let us mention in passing that the so-called "Oblique Object" should not be considered as a centre of attention. Obviously, this is the only difference between #3a and #3b. From the point of view of the information conveyed by the utterances, we cannot but recognize one single meaning which can be represented by the following recursive blocks:

```
[SIT0: #3a and #3b
 HEAD  give0 x y z
 BODY
   {Peter participant=agent: }
   {Mary  participant=agent: }
   {book  participant=figure: }

[SIT1: 'give1"
   HEAD give1 x y
   BODY
   {give1 x y
     {Role1 x=giver  generic=active  type=initiator }
     {Role2 y=object generic=passive type=terminator }
     {Role1 < give1 > Role2}
    FOOT
    {Peter < give1 > book}]

  [SIT2: 'reward'
    HEAD  reward'x y:
    BODY
      {Role1 x=agent generic=active  type=benefactor}
      {Role2 y=agent   generic=passive type=beneficient }
      {Role1 < reward > Role2}
  FOOT
    {Peter < reward > Mary}]

 [SIT3: 'make_happy'
    HEAD make_happy x y
    BODY
      {Role1 x=Q-agent generic=active  type=benefactor}
      {Role2 y=agent   generic=passive type=beneficient }
      {Role1 < make_happy > Role2}
  FOOT
    {book < make_happy > Mary}]
FOOT
{Peter < SIT2:give1 > book*book < SIT2:reward     > y = Mary}]
or
{Peter > SIT3:give1 > book*book < SIT3:make_happy > y = Mary}]
```

The noun "book" has been interpreted as fulfilling the median roles defined by two pairs of associative situations "give1" and "reward" (meaning 1) as well as "give1" and "make_happy".

Here are a few other examples of semantic situations containing median roles. It is important to note that the difference between "to give" and "to receive" is meta-informative only, but the difference between "to sell" and "to buy" concerns in addition the informative contents. This becomes obvious if we consider that there might be another median role (fig-value object=money) attached to both the pair "to sell" and "to buy”, but not to “to give” and “to receive”. It is also for the same reason that the standard level meaning of both “to sell” and “to buy” includes associations of their reciprocal situations (i.e.: “to sell” requires the embedded a-situation [SIT1: ‘buy”], on the one hand, and “to buy” requires the embedded a-situation [SIT1: “sell”], on the other hand).

	Active Role	**Median Role**	**Passive Role**
x gives y to z *z receives y from x*	**x** = agt-initiator (giver)	y = fig-mediator (given object)	z = agt-terminator (receiver)
x sells y to z	**x** = agt-initiator (seller)	y = fig-terminator (sold object)	z = agt-mediator (buyer)
x buy y from x	**x** = agt-initiator (buyer)	y = fig-terminator (bought object)	z = agt-mediator (seller)

Table 5 : Examples of Semantic Roles

As we have said, we have called *shallow level* the semantic interpretation of Valence in which, as a rule, one participant cannot fulfil but one single role (note that Fillmore’s semantics is shallow in this sense). If we admit that it is acceptable that one participant fulfil more than one role in the described situation while our meta-linguistic analysis remains still declarative, we will consider such interpretation as *standard level meaning*, leaving room for the procedural extensions giving rise to *deep semantics*.

We now present the analysis of an utterance containing the median role which results from the association of more deeply embedded a-situations.

#4. “Peter bought a car for his daughter.”

```
[SIT0: 'buy'
 HEAD buy  x y z
 BODY
   {Peter    participant=agent: }
   {car      participant=figure: }
   {daughter  participant=agent: }

  [SIT1: ‘acquire’
   HEAD acquire x y
   BODY
   {acquire x y
     {Role1 x=buyer generic=active type=initiator }
     {Role2 y=bought generic=passive type=terminator }
     {Role1 < acquire > Role2}}
    FOOT
    {Peter < acquire > car}]

  [SIT2: ‘offer’
    HEAD offer x y z:
    BODY
      {Role1 x=donor generic=active type=benefactor}
```

```
          {Role2 y=receiver generic=passive type=beneficient }
          {Role1 < offer > Role2}

       [SIT2.1: 'give'
          HEAD give x y
          BODY
           {Role1 x=giver generic=active type=owner }
           {Role2 y=gift generic=Q-active type=ownedObject }
           {Role1 < give > Role2}
          FOOT
           {Peter  < give > car }]

       [SIT2.2: 'reward'
          HEAD {reward x y }
          BODY
           {Role1 x=rewarder generic=Q-active type=initiator }
           {Role2 y=rewarded generic=passsive type=terminator }
          FOOT {car  < reward > daughter }
            {Role1 < reward > Role2}
            {car   < reward > daughter} ]
       FOOT
          {Peter  < offer:give    > car }
          {car   < offer:reward  > daughter} ]
    FOOT
      {Peter  < {buy:acquire} > car }
      {Peter  < {buy:offer:give } > car}
      {car    < {buy:offer:reward } > daughter}]
```

STANDARD LEVEL VALENCE SEMANTICS:

In the above representation, the agent 'Peter' fulfils two active roles as 'buyer' {Peter > buy:offer:give > car } and as 'donor' {car > buy:offer:reward > daughter} while the figure 'car' fulfils the *median* role because in the [SIT1 'buy:acquire'] it fulfils a passive role as 'bought' in {Peter > buy:acquire > car} and it fulfils a Q-active role in {car > {buy:offer:reward } > daughter}.

5. Further research

At the basis of ontological theories there are classifications. Theories and Logic provide formal languages which can determine whether the given ontological classifications are satisfiable with respect to the knowledge as conveyed by well formed expressions of a formal language. It is clear that such kind of classification with a language is in fact a ***meta-classification*** (cf. Kent R., 1998).

However, when the formal language expressions are seen as type descriptors and the uses of natural (human) language expressions are seen as instances, the corresponding classifications are partial with respect to the ontological meta-classifications from which the formal descriptions are derived. In such cases, the ***ontological*** type description formal language is a ***semantic meta-language*** describing the given natural language.

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