Downward Causation

Minds, Bodies and Matter

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Anticipated Downward Causation and the Arch Structure of Texts

OLE TOGEBY

In this article I will show that linguistic wholes such as an utterance, a speech or a text are determined not only by downward causation from the whole to its parts, as well as by upward causation from the parts to the whole, but also by anticipated downward causation from later events to earlier events. But first I will analyze the meaning of the words *whole* and *parts* in the domains of physical reality, visual perception of space, and linguistic interpretation of time.

Wholes in physical space-time are not the same as perceived mental wholes, so-called gestalts. And gestalts are not the same as temporal units or interpreted wholes in time. The criteria for wholeness are different for physical entities, mental gestalts and temporal wholes. What ties the parts of a temporal whole together are not the same forces as those that tie together the parts of a physical entity or a mental gestalt.

Physical entities

In the physical world we believe that there are things or entities, and that they are composed of parts, e.g., a cloud is composed of small drops of water floating in the air, a lake of molecules of water, a stone of molecules of some mineral. A chair is composed of the parts: legs, seat, and back, and a dog has head, body, legs, and tail as its parts. The properties of the whole are a function of the properties of the parts of which it is composed and the way they are configurated or organized. H_2O is fluid water when the molecules move freely inside the boundaries of the surface, and ice when the molecules are fixed in a crystal grid. That is what is called upward causation or compositionality.

In physical space-time the criteria for calling a collection of parts one entity are the following (mentioned with the weakest first): contact in space, common permutability, unchangeableness, inseparability, stable spatial relations and configura-

tion, and simultaneity. Elements not present at the same time will not be parts of one entity. The criterion of simultaneity is a necessary condition for wholeness.

In the physical world we also find emergent properties explained as downward causation on the organization of the parts from the boundary conditions. A cloud has form and color and can drift in the wind under the boundary conditions of temperature and pressure, a lake is liquid when temperatures are above zero, but can turn into a solid form when it is freezing. A chair can serve as a device for sitting upon, and a dog can run and wag its tail because it is a living creature born of another living creature.

The same collection of water molecules can emerge as different types of wholes (a lake or a huge piece of ice) controlled by the external variables (temperature and pressure). That is what is called bifurcation controlled by external variables in catastrophe theory. The molecules will not change, but the configuration of the molecules will change into a crystal grid when water suddenly stiffens into ice, and their organization in a crystal grid will break up when ice melts into water. The laws describing the relations between the boundary condition and internal organization of a physical system are reversible. Water can turn into ice, and ice into water.

Phenomenological gestalts

In the phenological world we don't talk of wholes as 'entities', but as 'phenomena' or 'gestalts'. When we perceive a phenomenon, we believe that the perceptual stimuli originate from an entity in the world. Most times we are right, otherwise we would not have survived as a species through the ages, but the thing and the phenomenon are not the same. In cases of sensory illusions we see something which is not there. We see a river as one phenomenon, but from a physical point of view a river is not one entity. 'You can walk into the same river and you cannot walk into the same river' (Heraclitus quoted from Næss 1996).

A perceived whole is often called a gestalt, i.e. a configuration or pattern of perceived elements so unified as a whole that its properties cannot be derived from a simple summation of its parts. The standard example is the drawing of two faces. Each of them consists of a circle, three straight lines and a curve. But as wholes they are seen as drawings of a smiling face and an angry face:

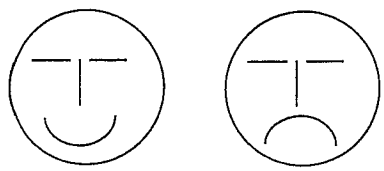

Fig. 1. The impression of the whole gestalt influences the way the parts are interpreted; the eyes look different in the two faces although they are identical.

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We see the eyes of the smiling face as different from the eyes of the angry face, although they are physically identical. The impression of the whole gestalt influences the way you interpret the parts. In this case it can be explained by the principle of compositionality: the properties of the perceived whole are a function of the properties of the perceived parts and the way they are combined.

All phenomena are grasped as a figure on a background. The figure is perceived as one unit having a form that can be recognized and remembered, while the background is material and has texture but no form. From Gestalt psychology we know that the forces which tie many elements together to be perceived as an organized whole are the following (with the weakest first): similarity, proximity, the property of being a closed geometrical figure, continuity (the good curve) and simultaneity. Again, simultaneity is a necessary condition for wholeness. These gestalt laws can be seen from the following example:

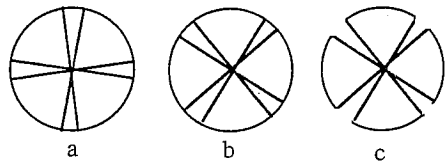

Fig. 2. Gestalt laws of a) similarity, b) proximity and c) closed figures.

Figure (a) is seen as a cruciform (+) in a circle because of the similarity; (b) is seen as an x in a circle because of the law of proximity, in spite of its similarity to a wide cruciform, and (c) is seen as a wide cruciform in accordance with the law of closed figures, in spite of the fact that the law of proximity would give an x in a circle.

A figure is always seen as having aspectual shape; we will always see a figure as something, as belonging to a category. One of the most famous examples is the Wittgensteinian duck-rabbit (Wittgenstein 1953):

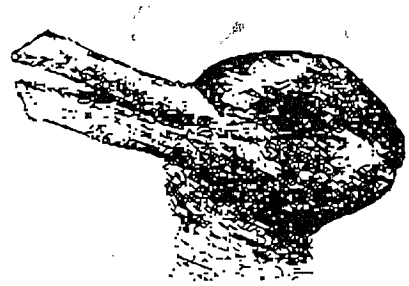

Fig. 3. Seeming as. All figures are seen as having an aspectual shape. This figure is seen as either a duck or a rabbit.

We can see it as a duck or we can see it as a rabbit, but we cannot see it as both at the same time, and we cannot see it as neither of them. If we see the duck, we see it as composed of a head with one eye and two pieces of an open beak. If we see the rabbit, we see a head with one eye, a snout and two long ears.

All phenomena have aspectual forms, and if something has two or more aspectual forms, it is not the thing let alone its parts that determine the aspect under which the thing will be perceived. The decisive factors are the viewer's acquaintance with the category, and the relevance of the categorized thing in relation to the interests, wishes and desires of the viewer. And if the boundary conditions change, the gestalt will change too; we can change the interpretation at will, if we are able to see both of them.

The psychological gestalt examples are parallel to the examples of physical entities. The gestalt and the aspectual shape can be understood as emergent properties under the boundary conditions of the knowledge and interests of the person doing the viewing. The duck-rabbit is an example of reversible bifurcation controlled by external variables.

Sentences

The units to be investigated in this article are sentences and texts. Sentences are collections of morphemes and words which constitute a proposition, and texts are collections of sentences serving to communicate thoughts from a speaker to a listener in a real situation. (Sometimes a text consists of only one sentence which is uttered by the speaker to the listener in a given situation, but that is a marginal case, and I will make a distinction between the propositional content of a sentence and the social act of uttering a sentence. A one-sentence text could be called *an utterance* or *a speech act*.) In this section I will deal with the sentence, and in the next with the utterance.

In traditional linguistics the meaning of a whole is explained by the principle of compositionality (Partee 1984):

- According to the *principle of compositionality,* the meaning of a linguistic unit (e.g., a sentence) is a function of the meaning of its parts (e.g., the words and morphemes) and the meaning of the way they are combined.

In the Danish sentence *Eva elskede Adam* the word *Eva* has the meaning 'Eva', the word *elskede* has the meaning 'loved', and the word *Adam* has the meaning 'Adam'.

The rules for combining morphemes and words in Danish could be stated as follows: a sentence consists of a noun phrase (NP) as subject and a (finite) verb phrase (VP) which operates upon the NP to make a sentence. Another NP, the ob-

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ject NP, operates on the preceding transitive verb (Vtr) to make a VP. So the structure of the sentence is illustrated by a tree diagram:

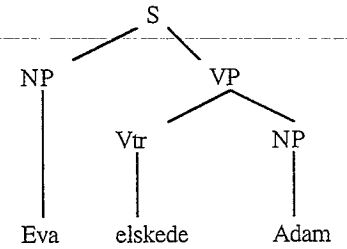

Fig. 4. Tree diagram showing the grammatical structure of the Danish sentence: *Eva elskede Adam.*

The meaning of the whole sentence *Eva elskede Adam* is a function of the meaning of the single words and the meaning of the way they are combined (*Eva* as subject, *elskede* as finite verb, and *Adam* as object), viz: 'Eve loved Adam'.

The meaning of the sentence *Can you pass the salt?* is, because of the word order finite verb + subject, analyzed as a question with *you* as the subject and *the salt* as the object; the verb phrase consists of a finite modal verb *can,* and an infinite main verb *pass*; and it has the meaning 'is the addressee able to hand over the saltshaker?'.

Most existing grammars are attempts to explain the meaning of sentences solely by upward causation according to the principle of compositionality; so are Chomsky's generative grammar, government and binding theory, categorial grammars, Montague grammar and so on.

Nevertheless, it can easily be seen that the explanation of upward causality is not sufficient to explain properties of a linguistic unit such as the sentence. Most morphemes and words, and most grammatical constructions are ambiguous, and this implies that most sentences have two or more readings according to the linguistic rules. The Danish sentence *Eva elskede Adam* can in fact, according to the Danish rules of word order, be analyzed in a different way than shown above, viz.

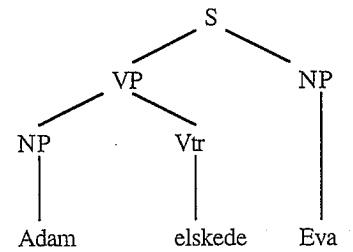

Fig. 5. Tree diagram showing another grammatical structure of the Danish sentence: *Eva elskede Adam.*

With this grammatical structure it means 'it was Eve Adam loved'. The two readings of the sentence can be found in different contexts. The first reading is found in the following context:

Eva vidste godt at Gud havde skabt både Adam og slangen. Men Eva elskede Adam, og hun frygtede slangen ... (Eve knew that God had created both Adam and the serpent. But Eve loved Adam and she feared the serpent)

And the second reading in the following context:

Før syndefaldet havde det første menneske kun rene stærke følelser i forhold til andre: Eva elskede Adam, Gud frygtede han og slangen foragtede han. (Before the Fall, the first Man had only pure and intense emotions towards others; it was Eve that Adam loved, God he feared, and the serpent he scorned).

The linguistic context is the determining factor, in one context the sentence will have one structure and one meaning, and in another context another structure and another meaning. The sentence has different functions in the first context (where it is first part of an opposition of two parallel feelings that Eve had in relation to Adam and the serpent) and in the second context (where it is the first part of a contraposition of parallel relations which Adam had to Eve, God and the serpent).

Consequently, the principle of compositionality cannot stand alone; we have to add the principle of functionality.

- According to *the principle of functionality,* the meaning of a linguistic unit depends on its function as a relevant part of the (linguistic) context in which it is uttered.

Utterances

Sentences can only have propositional meaning if they are uttered in some situation from a speaker to an listener. Referring devices such as noun phrases have no reference if they are not uttered in a sentence together with a predicate. And the reference does not depend on the noun phrase alone, but also on the situation in which is uttered. In isolation morphemes make no sense, they only have a number of potential senses.

In the sentence *Can you pass the salt?* (Searle 1979) the word *you* is highly ambiguous; it denotes the addressee in the speech situation and will change from one situation to another; this is a well-known fact about the so-called deictic words. But other words are ambiguous too. The words *the salt* can refer to 'the saltcellar, if the sentence is uttered at the dining table; if it is uttered in Isfahan by a man looking towards the great salt desert Dasht-E Kavir in Iran, *the salt* will probably refer to this desert. The word *pass* has many potential meanings: 'go through', 'deliver', 'go by', 'occur', 'spend', 'surpass', 'satisfy (finish)', and

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And if the sentence is uttered at the dining table, it is probably not understood as a question because the listeners know that the speaker knows that every one of them in fact are able to deliver the saltshaker. As a consequence, uttering this sentence with the word order of a question counts as a polite request: 'Please hand me the saltcellar!'. On the other hand, if the sentence is uttered in Isphahan, and the listener is the driver of an old jeep heading towards the great salt desert, the sentence will have the meaning: 'Are you able to go through the salt desert?'

The principle of functionality has to be reformulated. The meaning of a sentence not only depends on the linguistic context, but also on the whole situation in which it is uttered; who are the persons present, what are the immediate salient features of the situation, what do the participants know, and what do they know that the other part knows?

- According to *the principle of functionality,* the meaning of a linguistic unit depends on its function as a relevant part of the context and situation in which it is uttered.

This principle of functionality is a type of downward causality, we find emergent properties, the propositional content, emerging from the organization of the parts determined by the boundary conditions, i.e. the situation in which it is uttered. Two readings of the same sentence, *Can you pass the salt,* are what is called a bifurcation controlled by external variables. The laws describing the relations between boundary condition and the internal organization of a linguistic sentence are reversible. If we change the context or the situation, the meaning of the sentence will change.

In traditional grammar the criteria for the wholeness of a sentence are often described as similar to the criteria for the wholeness of physical entities and mental gestalts. The parts are contiguous or continuous (there are no pauses in a sentence), they are moved around in transformations, have common permutability, and are inseparable. But since the only relation between the parts of speech is succession (concatenation or chaining), the fact that one part follows the other, the description is not consistent. There is in fact no common permutability or inseparability because the parts are not simultaneous, and no transformations take place in real time.

But the grammatical rules can be formulated in a different way than in ordinary grammars; the grammar then describes the actions performed by the language users when they communicate. It is a joint rule for all people speaking the same language that something (A) counts as something (B) in a context (C). A standard example of this type of rule is the social construction of money: a piece of paper

imprinted with some pictures, letters and numbers counts as the equivalent of one hundred kroner in the state of Denmark.

In the Danish and English languages, the most basic grammatical rule is that the utterance of a definite noun phrase counts as a subject-referring device in the context of a predicate, and a finite intransitive verb counts as a predicate in the context of a subject-referring device. The next rule could be: the utterance of a definite noun phrase counts as a predicate in the left hand side context of a transitive verb.

Along with traditional grammars, rules of this type will explain in detail how the utterance of morphemes of different types in special combinations functions as a tool for communicating meanings from one mind to the other. The vocabulary and the grammatical rules are conventionalized and are known and accepted by all users of the language.

The forces that tie together the parts of speech are in fact these grammatical rules and the principle of cooperation. The speaker would not utter the word *Adam* to the listener if it did not count as an object in the context of the transitive verb *elskede*, and *elskede* would not be pronounced if it did not count as a predicate in the context of the subject *Eva*.

The listeners are able to interpret *Adam* as an object because they keep a memory of the earlier pronunciation of the words *Eva elskede* as a context of the actual word *Adam*. The memory makes all three words present simultaneously in the mind of the listener although they are not pronounced simultaneously. By means of their memory of the immediate past, the so-called short-term memory, language users are able to grasp the meaning of a chain of words as if some of them were a figure on a ground consisting of the rest of the words simultaneously present. The short-term memory has only a limited capacity, namely the magical number seven plus or minus 2 (Miller 1956). It is not possible to remember the pronunciation of 50 words (with no sense). But most sentences have a length of not more than 7 constituents, so they can normally be kept in the short-term memory from the first pronounced word until the pronunciation of the last word.

The grammatical relations tying the parts together are not the same as the gestalt laws (similarity, proximity, closed figure, continuity and simultaneity). The grammatical relations are subordination (forward dependency of occurrence, backward dependency of occurrence), nexus (mutual dependency), and coordination (joint occurrence).

Temporal events and acts

The units dealt with in text theory are not at all like physical entities or phenomenological gestalts and not exactly like sentences, but rather they are units

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(wholes) of time. Examples of temporal units are the battle of Austerlitz, the American presidential election, a football match, the speech by the Danish Queen on New Years Eve, the fairy tale *The Tinder Box* by Hans Christian Andersen, and the sentence I uttered 20 years ago in Isfahan to a driver of an old jeep: *Can you pass the salt?* In general, temporal units are social events, actions or acts.

Every temporal unit consists of temporal parts (Clark 1996), i.e. shorter temporal units: the battle consists of preparations, attacks, movements, retirements and defeats, a football match of the kickoff, first half, second half, goals, free kicks, and the time-out whistle; a speech or a text of the introductory sentences, the middle sentences and the final sentences.

The criteria for wholeness in time are totally different from the criteria for wholeness in physical space-time and in phenomenological space. Especially the necessary condition of simultaneity of the parts forming the whole is untenable for wholes in time. The parts need not be contiguous or continuous (there is a pause in a football match or in a speech), they have no common permutability, and they are not inseparable. The question now arises: when none of the forces which tie the parts of physical entities and mental gestalts together are tenable for temporal wholes, what kind of forces tie the parts of temporal wholes together? In the case of the sentence we have seen that it is possible for the human mind to keep up to seven successive items in its short-term memory, and at the end of the sentence treat them as if they were simultaneous. But football matches, speeches, and texts (novels, reports) can last for hours, and that is too much for the capacity of the short-term memory.

Temporal units are events, and long or molecular events (episodes) are sequences of smaller, transitory or atomic events. An atomic event is a 'piece of time' which is interpreted in a similar way by two or more persons present. An atomic event is the difference that makes a difference. It is a figure on the background of time acknowledged as such by its salience compared to what precedes it and what succeeds it. This means that an atomic event involves a change from one state to another at the beginning of the event, and a change from the new state back to the previous state at the end of the event.

The referee's kickoff whistle is such an atomic event, the kick of the ball at a free kick is another, but the movement of the leg making the kick is not. A morpheme in a sentence is an atomic event, but a phoneme is not.

The difference between a kick and the movement of the leg, between a morpheme and a phoneme is as follows: the kick and the morpheme are differences that make a difference, they count as something in the social interaction with common interests and goals, a movement of the leg and a phoneme do not count as anything in the social interaction, they make no difference. Kicks and morphemes are atomic events that can proceed or follow other events, movements of the leg and phonemes are not. An event can only count as something if it is

known and recognized by the participants pursuing a common goal in the interaction.

It is my claim — and a rather strong one — that units in time, i.e. temporal wholes that consist of successions of atomic events, are social phenomena with joint goals and beginnings and ends salient to all participants. Physical entities are not mental, they are wholes independent of any perception or knowledge of them. Mental gestalt phenomena must be recognized as relevant categories, and consequently they presuppose memory, knowledge, wishes and desires, but they do not presuppose ongoing social interaction. Events in time are successions of atomic events, and they presuppose ongoing social recognition.

We can now address the crucial question again: assuming that none of the forces which tie the parts of physical entities and mental gestalts together hold for temporal wholes, then what kind of forces tie the parts of temporal wholes together?

Time is an endless flow, there are no breaks, no marks or milestones indicating the different parts. The digitalization of time is made by the mutually recognized atomic events indicating boundaries. The only force which ties a certain number of atomic social acts together to form one molecular event is the joint recognition of a common social goal for all the successive acts inside the boundaries of the whole in one-dimensional time. The boundaries of a temporal whole are marked by one salient atomic event signaling the beginning of the molecular event and one salient atomic event signaling the end of the molecular event.

The temporal unit of the day has sunrise and sunset as its boundary events, and is constituted by all the joint institutional acts and actions performed by the members of a society with the common goal of creating and maintaining the society.

In a football match the kickoff whistle and the time-out whistle are the acts indicating boundary. Only if all the players acknowledge them as indicating boundaries and behave accordingly, will the match exist as a game with the constitutive goal of winning.

Texts

Texts are temporal wholes, consisting of smaller temporal units, namely sentences. In describing the properties (interpretation) of texts we will face the problem of the hermeneutic circle: We cannot interpret the meaning of the whole before having interpreted each of its parts, and we cannot interpret the parts before having understood the meaning of the whole.

As the principle of linguistic meaning, the hermeneutic circle can be formulated as a function of both the compositionality and the functionality of its parts: the meaning of a linguistic unit depends both on the meaning of its parts and the mea-

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ning of the way they are combined, and on its function as a relevant (obvious, fit and meaningful) part of the whole current situation in which it is uttered. This means that the same sentence has different meanings in different contexts. It also means that a sentence in the middle of a text has to be understood before the conclusion in the end of the text is pronounced, although the conclusion is the necessary context for understanding the function of the middle sentence.

As an example I will use the fairy tale by Hans Christian Andersen: *The Tinder Box*. Below is the first part of the story.

1. THE TINDER BOX
2. There came a soldier marching down the high road — one, two! one, two! He had his knapsack on his back and his sword at his side as he returned home from the wars. On the road he met a witch, an ugly old witch, a witch whose lower lip dangled right down to her chest.
1. 'Good evening, soldier,' she said. 'What a fine sword you've got there, and what a big knapsack. Aren't you every inch a soldier! And now you shall have money, as much as you please.'
2. 'That's very kind, you old witch,' said the soldier.
3. 'See that big tree.' The witch pointed to one near by them. 'It's hollow to the roots. Climb to the top of the trunk and you'll find a hole through which you can let yourself down deep under the tree. I'll tie a rope around your waist, so that when you call me I can pull you up again.'
4. 'What should I do deep down under that tree?' the soldier wanted to know.
5. 'Fetch money,' the witch said. 'Listen. When you touch bottom you'll find yourself in a great hall. It is very bright there, because more than a hundred lamps are burning. By their light you will see three doors. Each door has a key in it, so you can open them all.
6. 'If you walk into the first room, you'll see a large chest in the middle of the floor. **On it sits a dog**, and his eyes are as big as saucers. But don't worry about that. I'll give you my blue checked apron to spread out on the floor. Snatch up that dog and set him on my apron. Then you can open the chest and take out as many pieces of money as you please. They are all copper.
7. 'But if silver suits you better, then go into the next room. There sits a dog and his eyes are as big as mill wheels. But don't you worry about that. Set the dog on my apron while you line your pockets with silver.
8. 'Maybe you'd rather have gold. You can, you know. You can have all the gold you can carry if you go into the third room. The only hitch is that there on the money-chest sits a dog, and each of his eyes is as big as the Round Tower of Copenhagen. That's the sort of dog he is. But never you mind how fierce he looks. Just set him on my apron and he'll do you no harm as you help yourself from the chest to all the gold you want.'
9. 'That suits me,' said the soldier. 'But what do you get out of all this, you old witch? I suppose that you want your share.'

10. 'No indeed,' said the witch. 'I don't want a penny of it. All I ask is for you to fetch me an old tinder box that my grandmother forgot the last time she was down there.'

To illustrate my point about the relations between parts and wholes in texts, I will now describe the function of the sentence in the text *On it sits a dog*, which is uttered by the witch to the soldier, starting with *See that big tree* (paragraph 3), ending with *to all the gold you want* (paragraph 8).

In order to demonstrate that the internal pragmatic structure of a sentence is determined by the function of the sentence in relation to the text in which is a part, I will introduce some new pragmatic concepts of informational elements in the utterance: basis, designators, predicators and message. a) The first constituent of the sentence is called 'the basis' and is indicated by square brackets: [basis]. b) The referring devices (noun phrases), are called designators, indicated by curled brackets: {designator}. c) Pieces of new information (verbs, adjectives, prepositions, indefinite noun phrases) in the proposition are called predicators, with no special notation: *predicators*. d) The predicate of the utterance that is most relevant to the listener is called the message, indicated by bold type: **message**.

The pragmatic structure of the sentence *On it sits a dog* is the following:

[**On** {it}] **sits** {a dog}

The rules regulating the pragmatic elements of the utterance are the following (Grice 1975, Sperber and Wilson 1986, Togeby 1993):

1. The speaker defines in the basis of the sentence the mental space of the propositional content in relation to the mental background of the listener: *[On it] sits a dog*.
2. The speaker designates with the help of noun phrases and adverbials topics accessible to the listener in a formulation which is sufficient to distinguish the references and necessary to recognize them: *On {it} sits {a dog}*; the phrases are not: *the large chest* or *a bulldog* although the references are the same.
3. The speaker informs the listeners about the true relations and properties of the topics in the mental space by the predicators of the sentence, using the strongest relevant formulation: *On*, *sits* and *a dog*; the wordings are not: *on the middle of it* or *sits and snarls*. Among the pieces of information in a sentence, the one most relevant to the listener counts as the message: ***[On {it}] sits a {dog}***.
4. A sentence uttered as part of a longer text is not necessarily relevant in itself to the listener but aims by its message at a later relevant message (the conclusion) in the text; the aim is illustrated by the question answered by the

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later relevant message: ***[On {it}] sits*** *a {dog}*AIM: and what is the consequence of that? (...) *Snatch up that dog and set him on my apron.*[1]

5. When the message has to be formulated as strongly as necessary to tell the whole truth, it is an implicature of the utterance that a stronger formulation would not be true: ***[On {it}] sits*** *{a dog}*IMPLICATURE: it just sits there, it does not snarl or bite.

The function of a sentence in a text

The message of the sentence is taken to be *sits on* (which is one predicate) and not *a dog*, although both constituents are predicators in the utterance of the sentence. The reason for that is that *sits on* is more relevant to the listener than *a dog*. If *a dog* had been the message, the aim of the utterance would have been the answer to the question: AIM: and what about the dog?. This question is in fact answered in the subsequent sentence: *and his eyes are as big as saucers* with the message ***are as big as saucers***AIM: and what is the consequence of their size?. And that implicit question is not answered by the witch in her speech or in any other sentence of the fairy tale. To believe that *a dog* should be the message of the utterance would lead to a dead end.

If we take *sits on* to be the message with the aim: AIM: and what are the consequences of the fact that a dog sits on it?, the implicit question is answered by the sentence: *Snatch up that dog and set him on my apron,* with the message ***Snatch up and set***AIM: and what then?. And that implicit question is answered in the subsequent sentence: *Then you can open the chest and take out as many pieces of money as you please.*

This last sentence is the conclusion of the whole speech by the witch. The piece of information *take out as many pieces of money as you please* is the common goal for the communicative collaboration of the witch and the soldier. It is relevant in relation to the interests of the soldier to know how to get money.

In other words, if we take *a dog* to be the message, it leads to a dead end, if we take *sits on* to be the message of the utterance, it is a proper part of a temporal whole; it serves as a means to reach the goal of the whole collaboration, that is to inform the soldier how to get money, which is the meaning of the sentence that concludes the speech. And this is the reason for choosing *sits on* and not *a dog* as the message of the sentence.

This choice is an example parallel to the interpretation of the straight lines as being smiling or angry eyes in the smiling and angry faces respectively. The inter-

1 For every type of predicator there will be one type of question to be answered: state predicators elicit the question: AIM: *What's the consequence of that?* accomplishment predicators elicit the question: AIM: *and what then?*, and new topic predicators elicit the question: AIM: *and what about that topic?* There are more types of predicators and more types of implicit questions, but I will not go into details about that here.

pretation of the whole affects the interpretation of the parts also called downward causation or bifurcation controlled by external variables. But there is a difference. In the case of the gestalt interpretation of the smiling face, all the parts are present at the same time, and the viewer can choose either the whole face or eye as the figure and the rest as the background. If the viewer selects one of the pairs of eyes as the figure they appear to be smiling in the context of the smiling face and angry in the context of the angry face. But in the case of the witch's speech the soldier has to choose an interpretation of the sentence *On it sits a dog* without any access to the context from which it should have its interpretation. The decisive clue to how the sentence should be considered is uttered by the witch several sentences after the sentence in question.

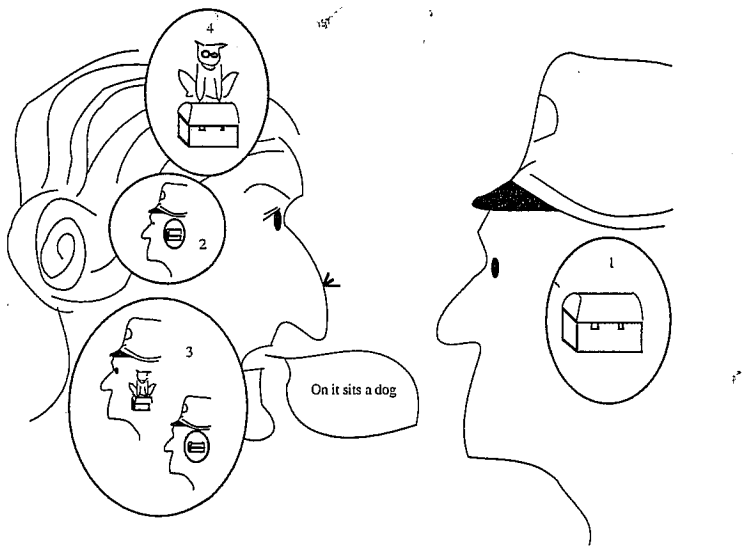

Fig. 6. The five conditions for the functionality of the utterance are illustrated by four balloons of thought. 1: the narrated mental space is accessible to the listener from the current situation. 1-2: the topics are accessible. 2 and 4: the predicate is new and informative. 3: the message is relevant (if he gets the information, he will be smiling, if not he will be sad). 4: the information is the whole truth about the topics.

The soldier probably makes the right interpretation (with *sits on* as the message) because he knows that they have a joint goal for their interaction, namely that she should inform him of how to get the money. And he has probably guessed that the money is in the chest. In this case it is obvious that if there is a dog sitting on the chest, it is relevant for the soldier to know, because then he has to remove it in order to get the money. In other words, he has anticipated the conclusion because he trusts the witch, he believes that the message of the current sentence aims at a later conclusion, and that the conclusion of her speech will be relevant in relation

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to his interests, which are to get money. We can call this downward causation, but also anticipated downward causation, determination from a later speech event (the conclusion) to an earlier speech event (the utterance and interpretation of *on it sits a dog).*

The whole case is illustrated by Fig. 6.

Anticipated downward causation

The interpretation of a text can be compared to an arch, which although constructed of many blocks allows many of them to hang in the air with no support underneath. An arch spans a wall opening by means of separate units (e.g., bricks or blocks) assembled into an upward curve that maintains stability through the mutual pressure of the load of the separate pieces. The vertical pressure from the weight of the load is converted into horizontal pressures by the wedge-shaped blocks and received by the piers flanking the opening.

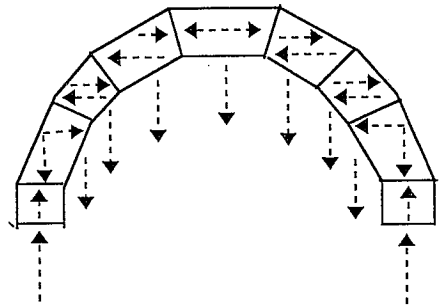

Fig. 7. The vertical pressure from the weight of the load is converted into horizontal pressure by the wedge-shaped blocks. Stability is maintained through the mutual pressure of the load of the separate pieces.

While an arch is being built, the wedge-shaped blocks will fall down until the keystone (the block at the top) is placed; consequently the blocks have to be supported by a scaffold, and when the keystone is placed, the scaffold can be removed. So the blocks support the keystone by forward causation, and the keystone stabilizes the blocks by downward causation.

The same is true every time a person communicates his or her thoughts by means of many sentences in a text. A sentence in the middle of a text is a precondition for the understanding of the subsequent conclusion, but on the other hand the middle sentence cannot be properly understood when its function in relation to the conclusion is not properly understood. The interpretation of the middle sentence hangs in the air until the conclusion is uttered.

What resembles the scaffold in 'in real time' communication is the fact that the listener trusts the relevance of a middle sentence, although this relevance is not apparent when it is heard. When hearing a middle sentence the listeners look forward to hearing the conclusion, at which time they will look back to the actual sentence and find the full interpretation.

In this way we can say that language users have 'a memory of the future'. Because communication is social cooperation with a joint goal, they can anticipate the meaning of the whole before it is uttered or understood and let it determine the interpretation of the earlier sentences.

This means that every sentence is governed by two principles of collaboration: The designators in the basis must not have a stronger formulation than necessary for recognition, and the predicates of the message must not have a weaker formulation than sufficient for relevance.

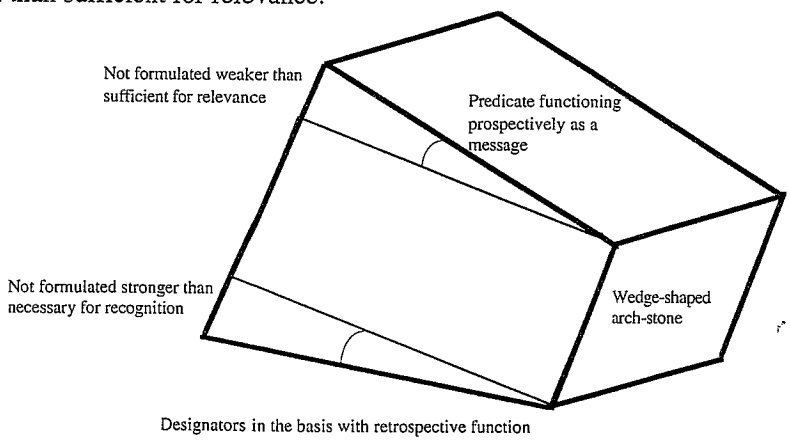

Fig. 8. The right angle between the two edges of the arch stone resembles the rules that the designators in the basis must not be formulated stronger than necessary for recognition, and the message weaker than sufficient for relevance.

The two principles regulating the strength of formulation of designators and predicators in relation to recognition and relevance govern the production and interpretation of every sentence in a text. The principles are like the angles on the wedge-shaped arch stones, which in a way enables all the stones in an arch to aim at the keystone. If the angles are not right, the arch will collapse, and if the strength of the base designator and the message predicator is not right, the text will collapse as a unit over time. All the sentences of a text aim at the same conclusion, the communication of which is the common goal of the joint action of the speaker and the listener.

This type of determination is of another type than both upward causation from the parts to the whole and downward causation from the whole to the parts; it is

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determination from a later goal to an earlier means, and I will propose to call this anticipated downward causation. The forces tying the parts of a temporal whole together are the participants' (speaker and listener) memory of the past and anticipation of the future in a communicative collaboration.

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