SEVEN RELATIONS FOR REPRESENTING CONCEPTUAL COHERENCE OF EVENTS

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ABSTRACT

This paper develops a model for representing one aspect of coherence. It is claimed that a part of the connectedness of events is directly build into the conceptual network underlying the lexicon, and consequently a system for representing intrinsic relationships between event and state concepts can also serve to represent an aspect of coherence in text. Seven inter-event relations are developed, each definition is refined by a sample question that the relation can be used to answer. Three of the relations are taxonomic, and four signify causal-temporal relaionships. The relation scheme is applied to a sample paragraph of text from a folktale, and the resulting representation is used to explain the connections between several pairs of events.

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Consider the following sentence:

> A peasant was digging in his garden one day, when his spade unexpectedly hit a hard object.

How can we represent the coherence of the 'digging' and 'hitting' events depicted in the text? Better yet, why should we? To answer the second question we must discuss some of the issues involved in a computational understanding of text. In answering the first question we will develop a set of inter-event relations, and show how they can be used to achieve certain representational goals.

Text is at best a partial representation of the information which the author intends to convey to his reader. A major portion of the meaningfulness of the text is produced by the reader when he embeds the text in his base of knowledge about the world and language. If we think of the text as a series of clues, then we can describe the reader as something of a detective. Each new clue must be maximally connected to previous clues. If the reader fails to understand a clue adequately, subsequent clues become more difficult, and consequently the reader is less likely to accomplish a full understanding of the text.

Suppose we take each of the clauses in the above example as a clue. How can we connect the two clues? We need to be able to connect the phrases 'a peasant' and 'his spade'; understanding

both that the peasant possesses the spade and that the spade is the instrument of his digging. We need to be able to detect that both events occurred in the same time period (one day) and the same location (in his garden). We need to observe the 'when' and the progressive tense of the verb 'to dig' in order to fix the events along a time line. Lastly we need to deduce a relation between 'digging' and 'hitting'.

We know that the reader performs this last piece of detective work, because we can ask him to explain the connection between the two events and he will explain in some such terms as, " Well, when I am digging I bend over the ground, and lifting my spade I swing my arms back. Then I swing my weight forward, and shove the spade into the ground to break up the earth. If there's a hard object in the ground my spade could hit it."

To say that a machine understands is to say it produces a certain representation with desirable properties. The types of connections that a machine can represent will be limited by the basic constructs of some representation language. Just as we can test a human reader's understanding by asking him questions, we can test the adequacy of a machine's understanding by the kinds of questions that the representation the machine produces can be used to answer. Thus the development of a representation system for representing text is guided by its intended use; both the understandings it will be used to represent and the kinds of

questions it can be used to answer constrain the notation.

This paper will develop a notation for representing one aspect of the coherence of events in text. Our position is that part of the connectedness of events is directly built into the conceptual network underlying the lexicon. When I read text I detect coherence wherever I recognize a tandem of event or state concepts which are intrinsically associated in the language. For example, if the author says "John had the book. He gave it to Mary." I should recognize the intrinsic relationship between concepts like 'giving' and 'having', because to 'give' something I must 'have' the thing I give. Our theory is that we can represent some of the coherence of events in text by producing a trace of paths between event concepts in the conceptual network. Our goal in this paper is to develop and demonstrate a set of relations for representing intrinsic relationships between event and state concepts, and consequently, an aspect of coherence in text.

The type of question we're interested in using our representation to answer is: " What is the connection between the events x and y?" For example, in the case of the peasant digging in his garden, our question would be: " What is the connection between the peasant digging and his spade hitting a hard object. " Our answers will be directly derived from the arcs which describe the path from the event concept x to the event concept

y.

I will briefly mention three relevant lines of research. First, Quillian's work [5] on semantic memory represents the prototype of this kind of system. Also relevant is Reiger's [6] work on inferencing and Schank's [7, 9] and Schank & Abelson's [8] subsequent development of a set of relations for constructing causal chains between events. Finally, Miller [2] and Miller & Johnson-Laird's [3] taxonomy of verbal concepts organized in terms of semantic fields provided a useful backround to the development of the paper.

The form of this paper will be to present a paradigm for describing conceptual relationships between events and then use it to generate a set of inter-event relations. As each relation is presented we will discuss the questions that it can answer effectively. Finally we will demonstrate the adequacy of our representation on a paragraph of paraphrased text from a folktale, 'A Tale of the Pig'. [4]

1. Paradigm

Imagine a reel of film. This is an unusual reel of film because instead of containing just images and sounds, it conveys information across the several senses. Viewers of this film would not only see and hear it, but they would participate in it. Maybe each frame consists of information transparencies layered

one on top of the other. One transparency might contain sight information, a second sound, a third tactile sensation, another, empathy, etc. Melded together they create a total effect which tends to merge the viewer with the protagonist of the film.

Suppose we viewed this film and attempted to describe it. At best we would be able to convey only part of our experience. One strategy would be to describe only the salient changes between frames of the film. Each description would convey the information contained in some, but not all, of the transparencies contained in a sequence of frames. We might assign the description 'John walked to school', to a sequence of frames where we had experienced that John was walking to school, scratching his itching beard, worried about his car, and thinking about the date he had on Friday.

Using the reel of film as a metaphor, how can we represent the conceptual relationships between the events and states underlying our descriptions? Our first step is to convert each description into some kind of uniform notation. Case notation provides a convenient way of describing semantic relations between events and their attendant roles. The head of each representational unit designates an event or state. Associated with the head is a set of roles, marked by names like: agent, instrument, object, location, source, destination, and affected entity (abbreviated agt, instr, obj, loc, source, dest, and ae.). For,

John rode his bicycle to the market.

the case representation is:

(ride agt John instr bicycle dest market)

After converting a description to case notation, we need a set of inter-event relations to represent the connection between the new description and previous descriptions. The next section of this paper developes a set of inter-event relations in the terms of our metaphor of sequences of frames existing on a multi-dimensional reel of film. We will refer to the person describing the film as the speaker, and the person constructing a representation as the hearer. Furthermore we will assume that the hearer, himself, has viewed a great number of films of this type.

2. Relations

The general format of this section will be to describe the inter-event relations in terms of our metaphor, cite an example, give a more formal definition of the relation, and then demonstrate the type of questions that the relation can be used to answer. The substitution of event and state terms for the x's and y's in the formal definitions will provide an initial determination of the conceptual relationship between two terms. The questions will help us refine our understanding of each conceptual relation. In all we'll end up with seven relations:

class/subclass, sequence/subsequence, coordination, antecedent, consequent, enablement, and sequel. The first three relations are taxonomic, collecting into a single unit of representation a description of an event or state and its more detailed specification. The later four relations explicate the causal-temporal relationships between event concepts.

2.1. Class/Subclass

If the speaker describes two sequences of frames and one is a more exact description of the other, the hearer should construct a class/subclass (sc) relationship between the two descriptions. For example,

> The elevator finally moved, descending rapidly.
>
> (move obj elevator
> sc (descend obj elevator mod rapidly))

Everytime the hearer has 'viewed' a sequence of frames which he describes as 'descending', he could have described the same sequence as 'moving'; thus 'descending' is a subclass of 'moving'. But obviously not every experience of 'moving' is a 'descending'. Formally we can state the conditions for establishing a class/subclass relationship as follows:

> A subclass of x is y if, i) any sequence of frames which can be described as y can be described as x, and ii) not all sequences of frames which can be described as as x can be described as y.

We can use the subclass relation to answer 'how' questions.

How did the elevator move?
By descending.

Additional examples of the class/subclass relation are:

1. John walked slowly, hobbling on his sore foot.
2. John put the china on the table, setting each piece carefully in place.
3. John hit the ball, striking at it viciously.
4. John took the cash, snatching it from the dealer's hands.
5. The eagle flew away, soaring into the sky.

2.2. Sequence/Subsequence

If the speaker describes two sequences of frames and one sequence is a subset of the other, then the hearer should classify the relationship between the two descriptions as sequence/subsequence (subseq). For example,

He dug deeper, breaking the earth with his spade.

```
(dig agt he dir deeper
     subseq (break ae earth instru (spade possby him)))
```

Everytime the hearer has 'observed' sequences of frames where the concept' digging' has applied, s/he has also observed a sequence where the concept 'breaking' (e.g. breaking earth) has applied, and there are no instances of observing a 'digging' without a 'breaking'; consequently, 'digging' and 'breaking' have a sequence/subsequence relationship.

Our conditions for establishing a sequence/subsequence relationship are:

> A subsequence of x is y if, i) sequences which can be described as x always contain sequences which can be described as y, and ii) there are no instances where x is a subsequence of y.

The second condition distinguishes sequence/subsequence from the class/subclass relation. In effect, the second condition guarantees that y is only a part of the sequence x, and cannot refer to all of x.

The sequence/subsequence arc can be interpreted to mean that the goal of the subsequence is the sequence; thus it can be used to answer questions about goals.

> Why did he break the earth?
> Because he was digging.

Additional examples of the sequence/subsequence relation are:

1. John was travelling to N.Y. His plane departed at 4 a.m.
2. John visited N.Y. He travelled by train.
3. John cleaned his laundry. He washed his clothes in a machine.
4. John farms an acre of land. He'll be planting in the spring.
5. He dug deeper, removing dirt by the spadeful.
6. They exchanged gifts. He gave her a new hat.
7. Patco negotiated with the government. They argued

that they should be compensated for stressful working conditions.

2.9. Coordination

If a speaker describes a sequence of frames twice and one description implies the other description as a component, the hearer should classify the relationship between the two descriptions as coordination (coord). For example,

John carried the book.
He held it in his hands.

(carry agt John obj book
coord (hold agt John obj book instr hands))

Every sequence which conveys a sense of 'carrying' in part also conveys a sense of 'holding', and there are 'holding' events that are not part of a 'carrying', and no 'carrying' event can completely be described by 'holding'; thus 'holding' is a coordination of 'carrying'. A formal statement of this relation is:

> A coordinate of x is y if, i) every sequence which can be described as x can in part be described as y, and ii) not every sequence which can be described as y is embedded in a sequence which can be described as x, and iii) there are no instances where a sequence which can be described by x can be completely described by y.

If we say y is a subsequence of x then y describes a subset of the frames that x describes, if we say that y is a coordinate of x then y describes a part of each of the frames in the sequence that we are describing by x (i.e. i'travelling is made up os the successive events 'depart', 'move' and 'arrive', but 'carrying is

a continuous coordination of 'holding' and 'travelling'.). Note, the third condition insures that y is not in a subclass relation to x.

The coordinate relation tells us that a sequence of frames is simultaneously depicting two different events, and one of them is in the decomposition of the other. The coordinate relation can be used to answer 'while' questions about simultaneity.

While John carried the book did he hold it?
Yes.

Additional examples of coordination are:

1. The wren moved slowly down the road, the fox followed.
2. He carried the box of books. He travelled slowly to the car.
3. She rode the horse along the path. She sat high in the saddle.
4. Mary glared at John, showing him her feelings.
5. Mary glared at John, staring at him fiercely.
6. John brought the dessert. He travelled by car.
7. He chopped the wood, holding the axe in one hand.

2.4. Antecedent

If the speaker describes two sequences of frames and one sequence is a condition for the other sequence to occur, the hearer should classify the relationship between the two descriptions as antecedent (ante). For example,

John had some food.
He ate it.

(eat agt John obj food
ante (have agt John obj food))

Everytime the hearer has observed a sequence of 'eating' something it has been preceded by a sequence of frames which gave the hearer an impression of 'having' that thing; thus a pre-condition of 'eating' is 'having food'. Our formal statement for establishing an antecedent relationship is:

> An antecedent of x is y if, i) every sequence which can be described as x is preceded by a sequence which can be described by y, and ii) y is a condition for x to occur.

The antecedent relation can be used to answer questions about the necessary conditions of an event.

Could John have eaten without having some food?
No.

Other examples of the antecedent relation are:

1. John lost his axe, but then he recovered it.
2. Mary had the book, but she gave it to John.
3. John's car moved forward and hit Mary's car.
4. The trumpet sounded and he heard it.

2.5. Consequent

If the speaker describes two sequences of frames and one sequence of frames always occurs after the other sequence, then the hearer should mark the relationship between the first and second sequence of frames as consequent (consq). Take the following example,

John gave Mary a red kite.
Mary had a red kite.

```
(give agt John rec Mary obj kite
      consq (have possby Mary obj kite))
```

Everytime the hearer has 'observed' a sequence of 'giving', subsequent sequences of frames have created the impression that the recipient now 'possesses' the gift; thus a consequent of 'giving' is 'having'. Formally we say that:

> A consequent of x is y if, i) every sequence that can be described as x is always followed by a sequence which can be described as y, and ii) y logically follows from x.

Consequent arcs tell us that y was caused by x; thus we can use them to answer question about causes.

Why did John give Mary the red kite?
So she could have it.

Listed below are several examples. The above question works for examples (1) thru (4) and (6). For (5) the question and resulting answer seems to be incorrect, probably because John didn't intend to drop the axe. In such a case we can substitute

the question and answer: " Why did the axe fall into the lake? Because it was dropped."

1. John threw the baseball. It moved across the diamond to the third basemen.
2. They seized the fort, and held it for 3 months.
3. He grabbed the gun and held it in his right hand.
4. Mary has some wild flowers. She gathered them in the park.
5. John dropped the axe and it fell into the lake.
6. John persuaded Mary. She agreed to buy a ticket for the fundraiser.

2.6. Enable

If the speaker describes two sequences of frames and one sequence usually enables the other, the hearer should classify the relationship between the two descriptions as enablement (enab). For example,

John sharpened the knife.
He carved the meat.

(carve agt John obj meat instr knife
enab (sharpen agt John instr knife))

Sequences which can be described as 'carving' are sometimes preceded by sequences which enable the 'carving' and can be described as 'sharpening'. Formally we can say,

> A enablement of x is y if, i) a sequence which we can describe as x is sometimes preceded by a sequence which can be described as y, and ii) y makes it possible for x to occur.

Note, y is an antecedent of x if y is a necessary condition for x to occur; y is an enablement of x if y makes it possible for x to occur by removing a disablement of x.

The enablement relation can be used to answer questions about events which make it possible for other events to occur.

What enabled John to carve the meat?
Sharpening the knife.

Additional examples of enablement are:

1. John released the bird. It travelled northwards.
2. John was admitted to the university. He'll enter in the fall.
3. He uncovered the painting so John could see it.
4. After bargaining for an hour, Jack traded the cow for the magic beans.

2.7. Sequel

If the speaker describes two sequences of frames and one sequence of frames can result in the second sequence, the hearer should classify the relationship between the two descriptions as sequel (seq). If one sequence always follows the other the relationship is classified as consequent. An example of a sequel relatonship is:

John was hungry.
He ate.

```
(hungry stateof John
        seq (eat agt John))
```

Sequences of 'hunger' are typically followed by sequences of 'eating', thus 'eating' is a sequel of 'hunger'. Formally we say,

> A sequel of x is y if, i) sequences of frames that can be described as x are usually followed by sequences of frames which can be described as y, and ii) either x has y as a possible outcome or x motivates y.

The sequel relation can be used to answer questions about outcomes.

> What happened when John was hungry?
> He ate.

Additional examples of sequel are:

1. John was thirsty. He drank a glass of water.
2. He searched for the clue and found it.
3. After negotiating for a month, they agreed to terms.
4. He was amused and he laughed.
5. Mary and John argued for an hour. Eventually John agreed with Mary.
6. The cup hit the floor, breaking into pieces.
7. John asked a question and Mary answered it.

2.0. Inferencing

To connect a pair of events it will frequently be necessary to infer that an intermediate event or state has occurred. In the terms of our metaphor of the detective, missing information must be inferred to explain the relationship between a pair of clues. In the terms of our metaphor of the reel of film, if the speaker fails to describe a sequence of film, the hearer must be prepared to infer it as an intermediate sequence between two sequences which s/he is trying to relate.

After we connect a pair of events we can use the conceptual path between the two events as a basis for describing their relationship. Each arc along the path can be simply described, for example the sequence/subsequence relationship between the two events

John travelled to N.Y.
He arrive at 5.

can be describe as "a part of travelling is arriving." Or similarily the sequel relationship between the two sentences,

John searched for the clue.
He found it.

can be described as "a sequel of searching is finding."

Since the next section of the paper will provide ample opportunity to see inferencing at work, we will cite only a few

examples here. Attached to each example will be an answer to our guiding question, "What is the connection between the two events x and y?"

2.0.1. John bought some food. He ate it.

A consequent of 'buying food' is 'having food'. An antecedent of 'eating food' is 'having food'. To represent the connections between 'buying food' and 'eating food' we must infer the intermediate state that John 'had food'. We can represent this connection as follows[1]:

```
(eat agt John obj food
     ante (have agt John obj food
                consq* (buy agt John obj food)))
```

If someone asked what the connection between 'having food' and 'buying food' the answer would be, "In order to eat food one must have food, a consequent of 'buying food' is 'having food'."

2.0.2. John chased the ball. It hit the wall.

A coordinate of 'chasing' is that the object being chased must be 'moving'. An antecedent of 'hitting' is 'moving'. To connect 'chasing' and 'hitting' we must infer a 'moving'. We can represent the connection as follows:

```
(chase agt John obj ball
       coord (move obj ball
                   ante* (hit obj ball ae wall)))
```

---

[1] Consq* is the inverse of consq.

We can describe the relationship in english as, " If John chases the ball it must be moving. In order for the ball to hit the wall the ball must be moving."

2.0.3. John grasped the bucket in his hands. He carried it to the well.

A consequent of 'grasping' the bucket is that you 'hold' it. A coordinate of 'carrying' the bucket is that you 'hold' it. We can represent the connection as follows,

```
(carry agt John obj bucket
       coord (hold agt John obj bucket
                   conseq* (grasp agt John obj bucket
                                  instr hands)))
```

We can can describe the relationship: " If John carries the bucket he must be holding it. A consequent of John grasping the bucket is that he will hold it."

2.0.4. John moved slowly, hobbling on his sore foot.

A subclass of 'moving' is 'walking'. A suclass of 'walking' is 'hobbling'. We can represent the relationship as follows,

```
(move agt John
      sc (walk agt John
               sc (hobble agt John instr (sore foot))))
```

We can describe the relationship: " One way moving is walking. A kind of walking is hobbling."

3. Example

We have devised a paradigm from which we generated a set of relations. We refined our understanding of each relation by citing examples, and testing them against the questions we could use the relation to answer. Finally we allowed ourselves to infer intermediate relations to increase the scope of our representation. In this section we will examine our relation scheme by applying it to a sample of text from the folktale, "The Tale of the Pig".

> The pig trotted towards the stream, carrying a bundle of clothes. The animal expertly soaked and scoured the laundry. The pig hung the clothes in the sun to dry. The pig gathered her laundry and trotted home.

3.1. Analysis

3.1.1. "The pig trotted towards the stream, carrying a bundle of clothes."

There are two events described in this sentence, 'trotting' and 'carrying'. Individually we can represent them as follows:

(trot agt pig dir stream)

(carry obj (bundle of clothes))

An analysis of samples of text shows that: 'Carrying' has two coordinates, 'holding' and 'travelling'. 'Travelling' has three subsequences 'departing', 'moving', and 'arriving'. A subclass of 'moving' is 'trotting'.

```
(carry agt pig obj (bundle of clothes)
       coord (travel agt pig twd stream
                     subseq (move agt pig twd stream
                                  sc (trot agt pig
                                           twd stream))))
```

3.1.2. "The animal expertly soaked and scoured the laundry."

The sentence describes two events:

```
(soak agt pig obj laundry)

(scour agt pig obj laundry)
```

'Soaking' and 'scouring' are both subsequences of a 'washing' event:

```
(wash agt pig obj laundry
      subseq1 (soak agt pig obj laundry)
      subseq2 (scour agt pig obj laundry))
```

3.1.3. "The pig hung the clothes in the sun to dry."

Here the author explicitly states that the consequent of 'hanging clothes in the sun' is to dry them:

```
(dry obj clothes
     consq* (hang obj clothes agt pig loc sun))
```

'Washing' and 'drying' are two subsequences of a 'cleaning' event,

```
(clean agt pig obj clothes
       subseq1 (wash agt pig obj laundry
                     subseq1 (soak agt pig obj laundry)
                     subseq2 (scour agt pig obj laundry))
       subseq2 (dry obj clothes
                    consq* (hang obj clothes
                                 agt pig
                                 loc sun)))
```

An antecedent of cleaning clothes is that the clothes are at the location where they will be cleaned. A subclass of 'moving' is 'carrying'. A consequent of 'move' is that at the termination of the 'move' the object being moved is at a new location.

```
(clean agt pig obj clothes
    ante (loc obj clothes place stream)
            consq* (move agt pig obj clothes
                      sc (carry agt pig obj (bundle of clothes)
                           coord (travel agt pig twd stream
                                    subseq (move agt pig
                                              twd stream
                                              sc (trot agt pig
                                                   twd stream))))
       subseq1 (wash agt pig obj laundry
                     subseq1 (soak agt pig obj laundry)
                     subseq2 (scour agt pig obj laundry))
       subseq2 (dry obj clothes
                    consq* (hang obj clothes
                                 agt pig
                                 loc sun)))
```

3.4.4. "The pig gathered her laundry and trotted home."

Two events are described in this sentence:

```
(gather agt pig obj (laundry possby her))

(trot agt pig  dest home)
```

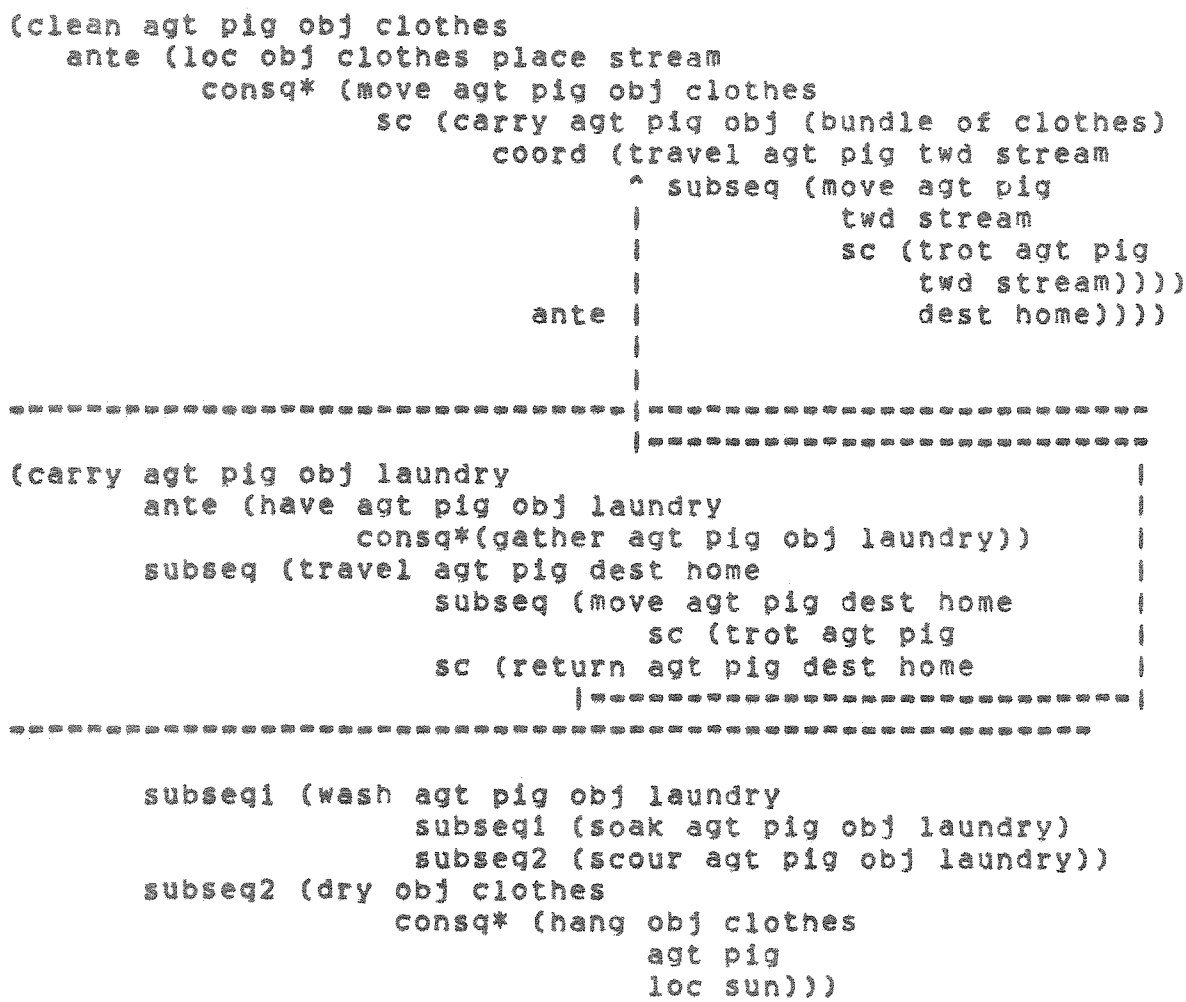
A consequent of 'gathering the laundry' is 'having the laundry'. An antecedent of 'carrying laundry' is 'having laundry'. A coordinate of 'carrying' is 'travelling'. A subsequence of 'travelling' is 'moving'. A subclass of 'moving' is 'trotting'.

```
(carry agt pig obj laundry
       ante (have agt pig obj laundry
                  consq*(gather agt pig obj laundry))
       subseq (travel agt pig dest home
                      subseq (move agt pig dest home
                                   sc (trot agt pig
                                            dest home))))
```

There is finally a 'returning' event that is occurring. 'Returning' has the antecedent that a traveler has previously left the location to which s/he is returning. A subclass of 'travelling' is 'returning'.

```
(travel agt pig dest home
        subseq (move agt pig dest home
                     sc trot agt pig dest home)
        sc (return agt pig dest home
                   ante (travel agt pig twd stream
                                subseq (move agt pig twd stream
                                             sc (trot agt pig
                                                      twd stream)))))
```

If we pull together all the various subgraphs we have constructed, we will end up with the following graph:



3.2. Discussion

There are several remarkable things about this final structure. First, we have produced a graph and not a tree. If we think of the causal relationships between event and state concepts as being represented in a semantic network, then we can think of the procedure that we have been roughly following as a process which uncovers, or reveals, the relevent portion of the underlying

conceptual network. Each description uncovers a new path, consequently one would be surprised to discover that a set of descriptions produced by a speaker would always trace out a tree in the conceptual network of events and states.

Secondly, since moving the laundry to the stream is connected via an antecedent arc to cleaning the laundry, why isn't moving the laundry home connected to cleaning via a consequent or sequel arc. Moving the laundry to the stream is connected, because it would be impossible to clean something unless it was at the location where you planned to clean it. Carrying the laundry home is not a consequent of cleaning it, since in no way does cleaning laundry cause one to carry the laundry home. Nor is it a sequel since cleaning laundry neither motivates it nor suggests it as a likely outcome. In the former case moving the laundry to the stream produces a state which is a condition for the cleaning event to occur, in the latter case cleaning laundry only suggests that the laundry might be carried home.

Lastly, explanations of the connections between events can be derived from the structure we have produced. For example, we can explain the connection between the pig gathering her laundry and the pig trotting home. Our explanation would be along the lines of, "A consequent of the pig gathering the laundry is she has it. In order to carry the laundry the pig must have it. To carry laundry the pig must travel, to travel the pig must move, a kind

of moving is trotting." The interesting arcs are the consequent/antecedent pair which connects the 'gathering' to the 'carrying' via the 'having'.

We can also explain the relationship between the pig soaking and scouring the laundry: " Part of washing laundry is soaking it. Another part of washing laundry is scouring it. "

We can explain the relationship between soaking laundry and drying it; " Part of cleaning laundry is washing it. Part of washing is soaking. Another part of cleaning laundry is drying it."

Finally, we can describe the relationship between the pig trotting to the stream and then later trotting home: " In order to return home the pig must travel away from her home." The interesting arcs are the antecedent arc which connects the 'returning' to the 'travelling' to the stream event, and the class/subclass arc which connects 'travelling' home and 'returning'.

4. Conclusions

We have argued that text is at best a partial representation of the information an author intends to convey to his reader. To make text meaningful a reader must actively interpret it within the bounds of his knowledge. We can always test the depth of a

reader's understanding by asking questions.

When a machine produces a representation, we can test it's adequacy by the types of questions that the representation can answer. The development of a notation for representing text should be guided both by the level of understanding it will be used to represent and by the kinds of question it can be used to answer.

This paper has produced a set of relations for representing intrinsic relationships between event and state concepts, and consequently for encoding aspects of coherence in text. In all, there are seven relations: three that act to collect together an event and its parts into a more exact specification, and four that causally and temporally relate events. We exemplified our relation scheme in a sample paragraph of text, and produced a graph which represents the conceptual coherence of the events that were described. In our discussion we used the resulting representation to explain the connections between several pairs of events.

The next phase of research has already begun. Parts of ten folktales have been analysed and used as a basis for 'growing' [1] a conceptual network of causally related events and states. An interpreter has been constructed which uses the conceptual network as a basis for building graphs which explicate the

conceptual coherence of events and states described in text. The interpreter has been successfully applied to several samples of text, including a more complicated version of the paragraph of text about the pig and her laundry.

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