Contributions of a Computational Linguistic Approach to Narrative Analysis

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Background

- The need for machine-processable descriptions of 'semantic multimedia content'
- The potential role of computing in 'digital humanities'
- The limits of automatic visual information processing

Narrative

- Narrative comprises ***story*** and ***discourse***: the same story can be told in different discourses (Chatman 1978). A story is a chain of ***events***, in ***cause-effect*** relationships, organised in ***space*** and ***time***. The agents of cause-effect are ***characters*** with ***goals***, ***beliefs*** and ***emotions*** (Bordwell and Thompson 1997).

- For a definition, comprising eight criteria for assessing a text's degree of narrativity, see (Ryan 2006)

Narrative: a cognitive approach (Herman 2002)

- “the real target of narrative analysis is the process by which interpreters reconstruct the storyworlds encoded in narratives… storyworlds are mental models of who did what to and with whom, when, where, why, and in what fashion in the world to which recipients relocate – or make a deictic shift – as they work to comprehend a narrative” (p. 5)
- Narrative theory will develop through the charting of “constraints on the variable patterning of textual cues with the mental representations that make up storyworlds” (p. 12), and through the itemization and description of the requirements for narrative understanding (p. 21).

Narrative: where to start?

- To date, research in narratology has started with the specification of mental models, discourse models and storyworlds and has then sought to identify their linguistic correlates.
- Recent developments in corpus linguistics make a converse approach possible. By analysing corpora of narrative texts it may be possible to identify linguistic features that characterize these corpora and assume that these are the textual cues that must be mapped to mental representations of storyworlds.

Narrative: a cautionary note

- "More than reconstructed timelines and inventories of existents, storyworlds are mentally and emotionally projected environments in which interpreters are called upon to live out complex blends of cognitive and imaginative response, encompassing sympathy, the drawing of causal inferences, identification, evaluation, suspense, and so on" (Herman 2002, p. 17).

Today's Aim

- To assess the contributions that a formal corpus-based approach can make to narrative analysis...
  - for the automatic extraction of narrative-related information from text; and,
  - for the development of narrative theory

- This talk will take as a case-study the analysis of narrative in film / audio description

Audio Description

Audio Description

- Audio description makes films and television programmes accessible to blind and visually-impaired audiences (known in US as 'described video')
- It is a spoken account of what is depicted on-screen - integrated with dialogue, music and sound effects
- It is becoming increasingly widespread internationally

Audio description is a surrogate for the moving image

Audio Description

00:10:18 A Red Cross convoy drives through an Italian village. Inside one of the lorries Hana leans over the wounded pilot.

00:10:35 A jeep drives up alongside.

00:10:59 Hana passes Jan some banknotes.

00:11:12 Laughing, Jan falls back into her seat as the jeep overtakes the line of lorries.

00:11:18 An explosion on the road ahead.

00:11:24 The jeep has hit a mine.

00:11:27 Hana jumps from the lorry.

00:11:35 Desperately she runs towards the mangled jeep.

00:11:42 Soldiers try to stop her.

00:11:46 She struggles with a soldier who grabs hold of her firmly.

00:12:02 Later, beside the destroyed jeep, two mine detecting devices sweep the road.

Frequent Open-Class Words

Characters and their body parts: *man, head, face, eyes, hand, hands, men, woman, hair, arms, arm, feet, girl, mouth, boy, crowd, shoulder, officer, people, lady, body, police, soldiers, father*

Actions: *looks, turns, takes, walks, goes, stands, steps, smiles, stares, puts, watches, opens, looking, runs, sitting, comes, picks, sees, holds, wearing, smile, nods, standing, leans, glances, gives, holding, watch, beat, grabs, leaves, falls, reaches, watching, drops, closes, lifts, throws, shakes, passes, run, follows, climbs, kiss, pushes, kisses, walk, lies, staring, carrying*

Objects and scenes: *door, room, car, window, table, water, bed, house, floor, gun, boat, street, road, ground, horse, phone, desk, hat, office, book, bag, stairs, chair, seat, sky, fire, jacket, bedroom*

Kinds of Information

- Manual inspection of concordances of unusually frequent words suggests that audio description concentrates on providing information about...
  - characters' appearances
  - characters' focus of attention
  - characters' interpersonal interactions
  - changes of location of characters and objects
  - characters' emotional states

Some Factors Affecting the Language of Audio Description

- It refers to a restricted domain of discourse
- It fulfils a relatively narrow communicative function, i.e. to provide enough information, concisely and objectively, for the audience to follow the story told by a film
- It is produced by trained professionals, and in accordance with guidelines

Audio description is a sublanguage?

Sublanguages: Harris (1988)

- “Reports and discussions in well-structured aspects of the world show limitations on word use that ... constitute constraints on word occurrence.” (p. 37)
- Harris' observations about sublanguages motivate 'local grammars', i.e. grammars that concentrate on word classes and substitution in local contexts, to avoid ‘overgeneralization’ whilst accounting for all possible sentences within a corpus (Gross 1997)

The Science Sublanguage of Immunology: Harris (1988)

- Sublanguage word classes...

  G – words for *antigen* (including synonyms and names of various antigens)

  A – words for *antibody* (including local synonyms)

  B – a class of bodies, body parts and animal names

  J – words used between G and B, inject and immunize

  ...

- Sublanguage sentence types...

  GJB, for *Antigen is injected into a body part* or *an animal*

  AVC, for *Antibody appears in, is produced by a cell*

  ...

Sublanguages: Harris (1988)

- "... when the word combinations of a language are described most efficiently, we obtain a strong correlation between differences in structure and differences in information. This correlation is stronger yet in sublanguages" (p. 40)
- "... we have here an opportunity to reach an objective and independently obtained structuring of the information. This means a purely word-combinatorial investigation" (p. 40)
- "...we can see in the languages of science that their classes of entities and relations are distinguished vis-à-vis each other as comparably to the entities and relations of the science itself" (p. 84)

Audio Description as Sublanguage?

- Can a local grammar of audio description reveal something about the information structures of the storyworlds of films?
  - This question is answered in part by a corpus-based analysis to investigate the kinds of information that audio description provides about a film's story, and the regular ways in which these are expressed (Vassiliou 2006; Salway, Vassiliou and Ahmad 2005)

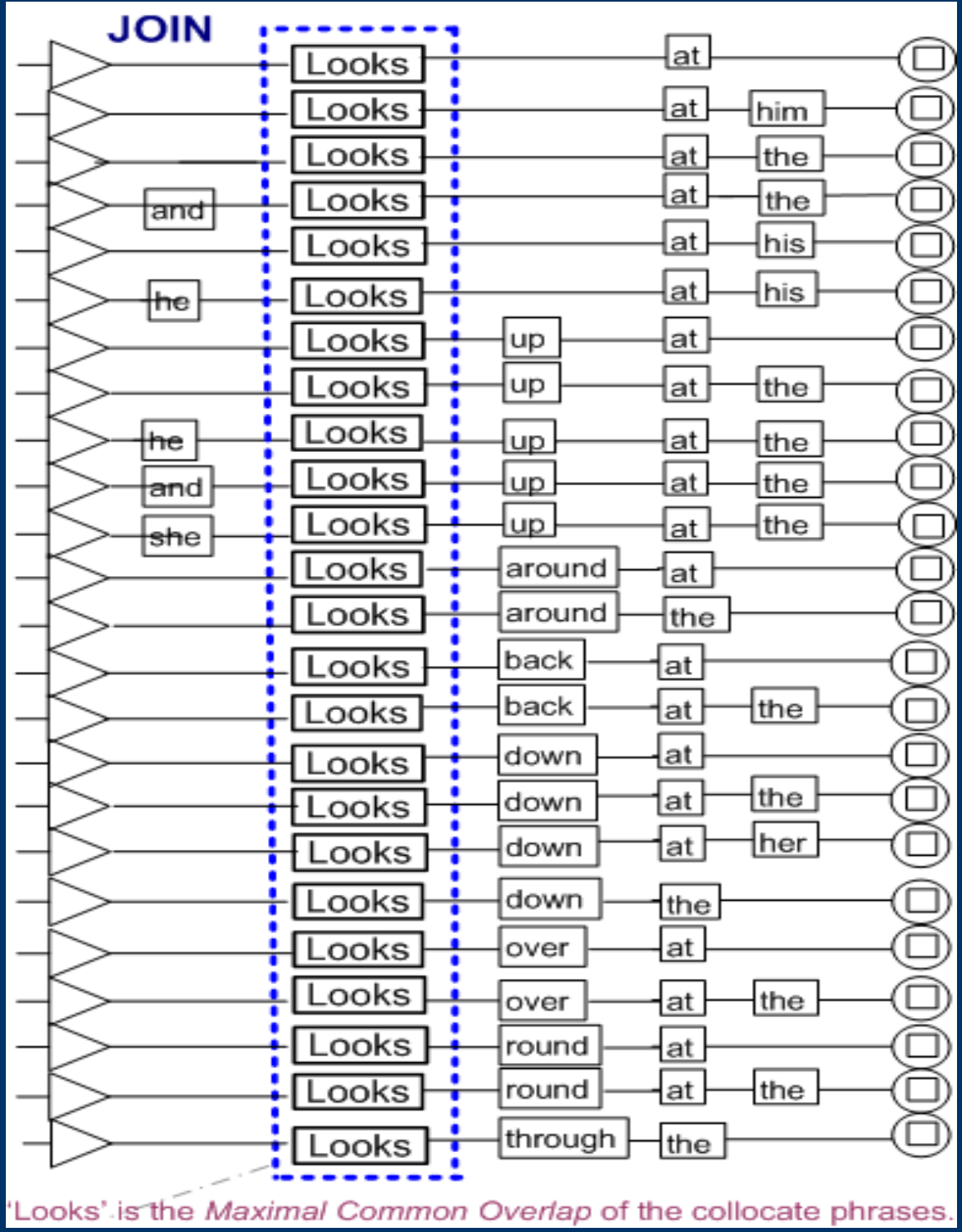
A Word-Combinatorial Analysis of Audio Description

- Vassiliou (2006) adapted and extended an algorithm presented by (Ahmad, Gillam and Cheng 2005), and applied it to analyse a corpus of audio description scripts for 73 films, totalling 714,681 words

1. Identify collocations (statistically significant co-occurrences) of unusually frequent words, then collocations of the collocations, and so on
2. Join and simplify collocations with common word sequences, and expand them with other words that fit in place of the original unusually-frequent word
3. The output can be expressed as a set of Finite State Automata (cf. Gross' local grammars)

Unusually frequent words --> candidate nucleates

looks, door, turns, away, head, towards, eyes, room, takes, around, walks, behind


JOIN
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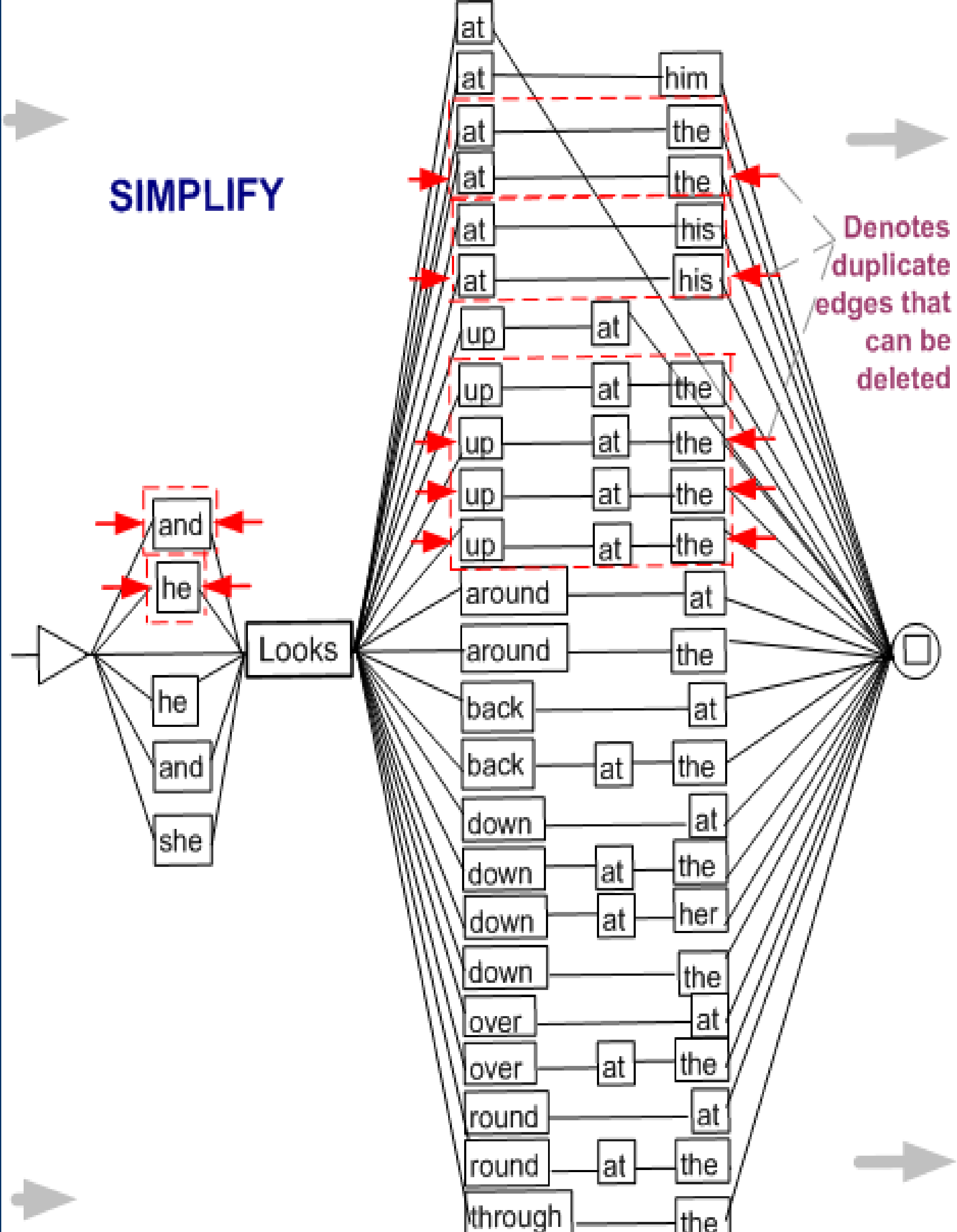
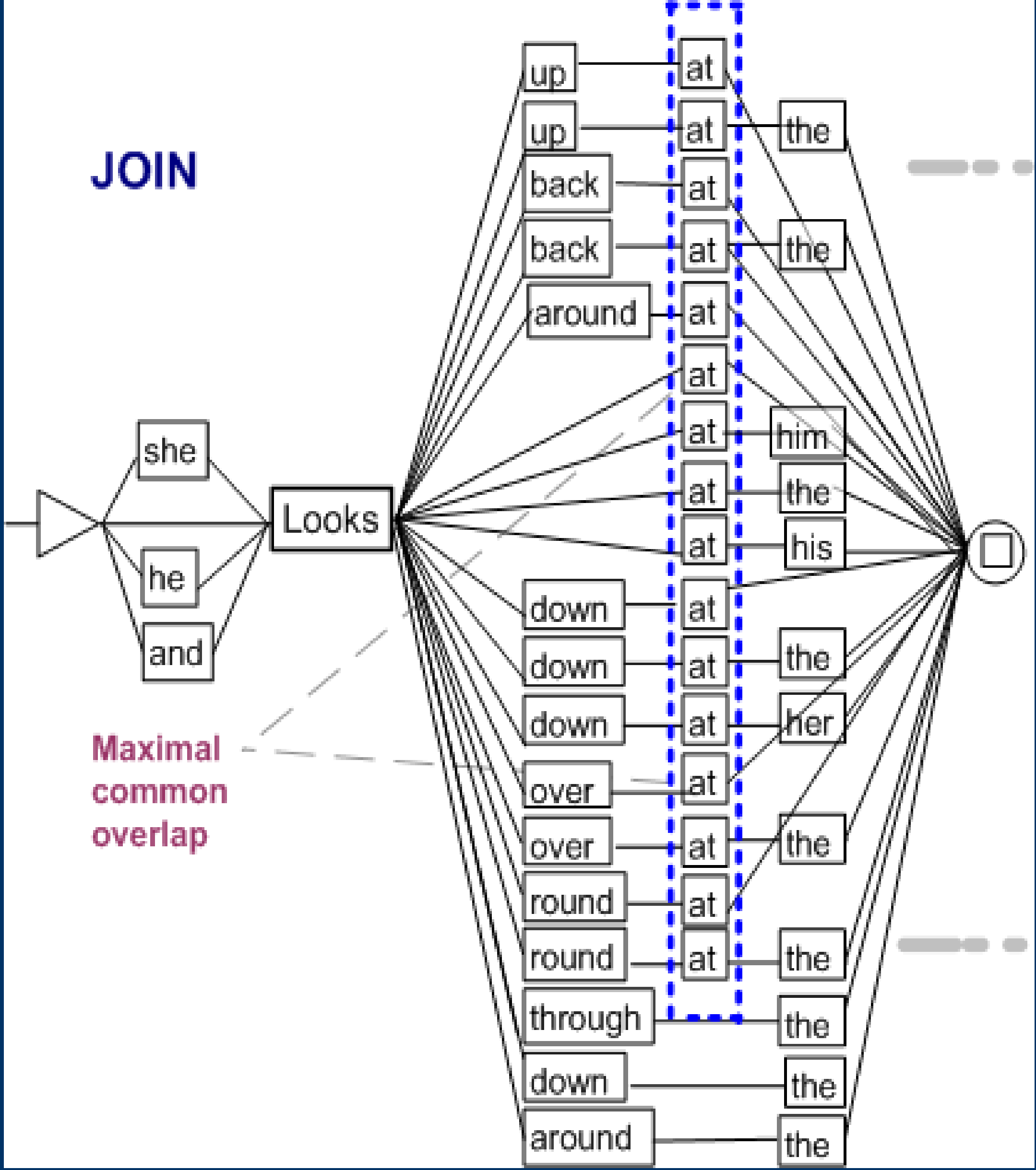
Key
Maximal common overlap.
Edges to be deleted.
Nodes to be deleted.
'Looks' is the Maximal Common Overlap of the collocate phrases.

SIMPLIFY



Key	
(blue dashed box)	Maximal common overlap.
(red dashed box)	Edges to be deleted.
(red arrows)	Nodes to be deleted.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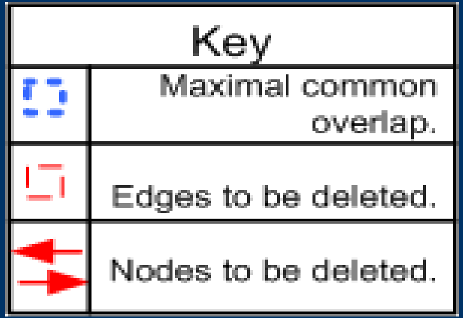
Maximal common overlap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Edges to be deleted.
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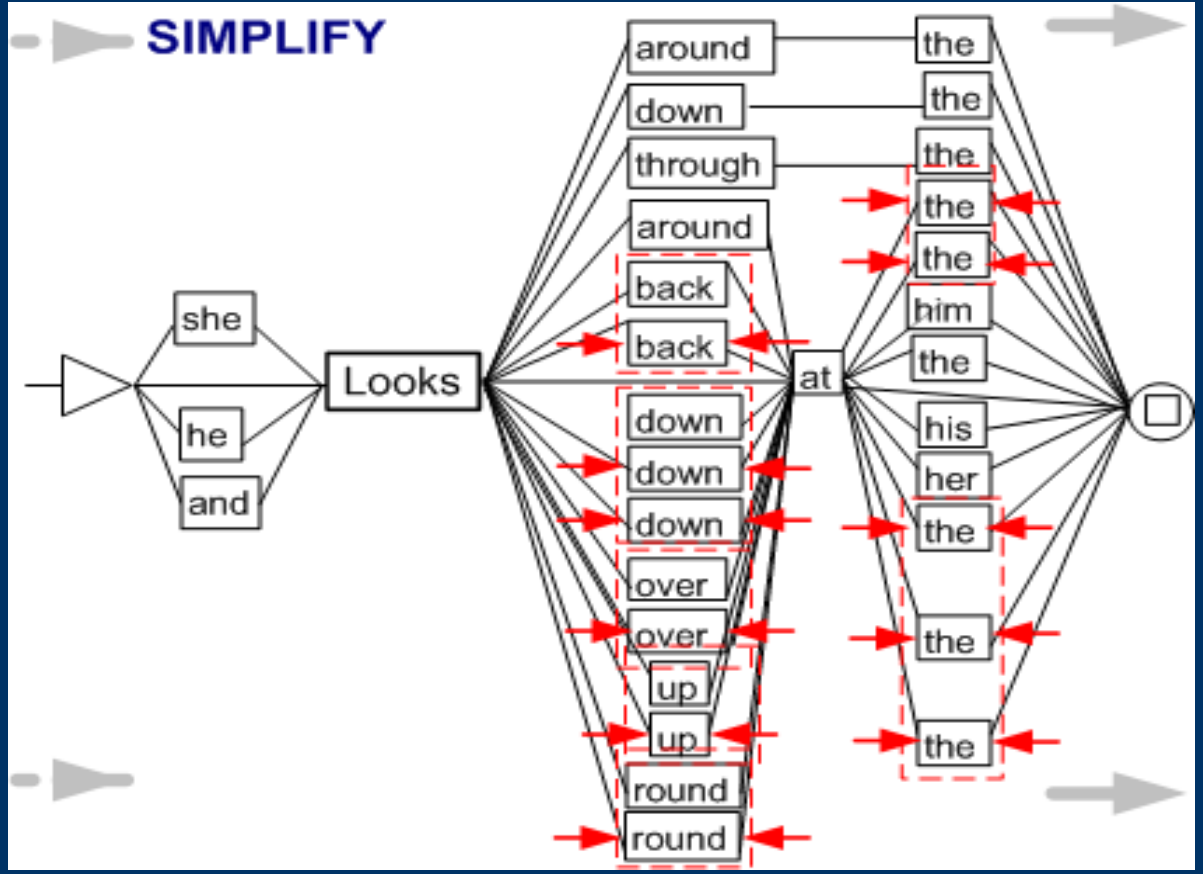

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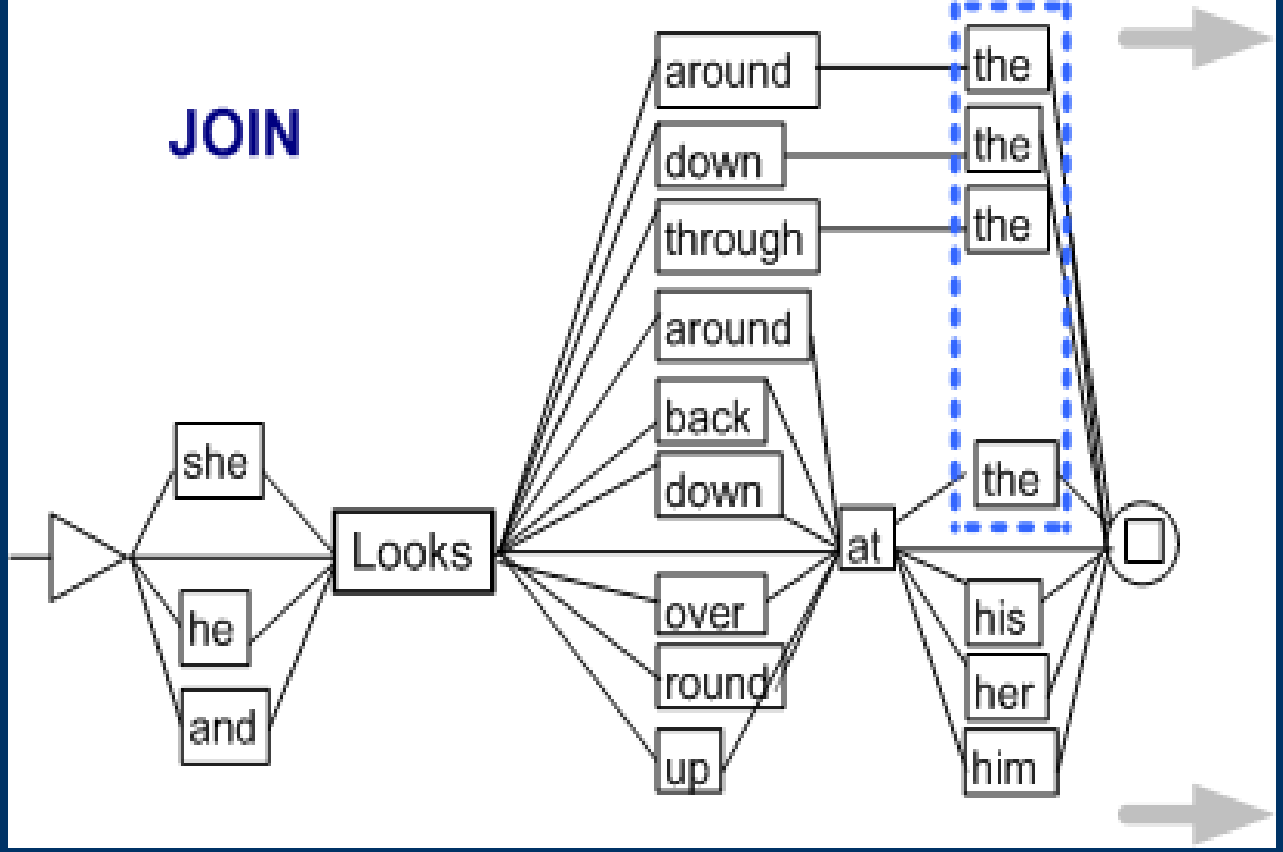
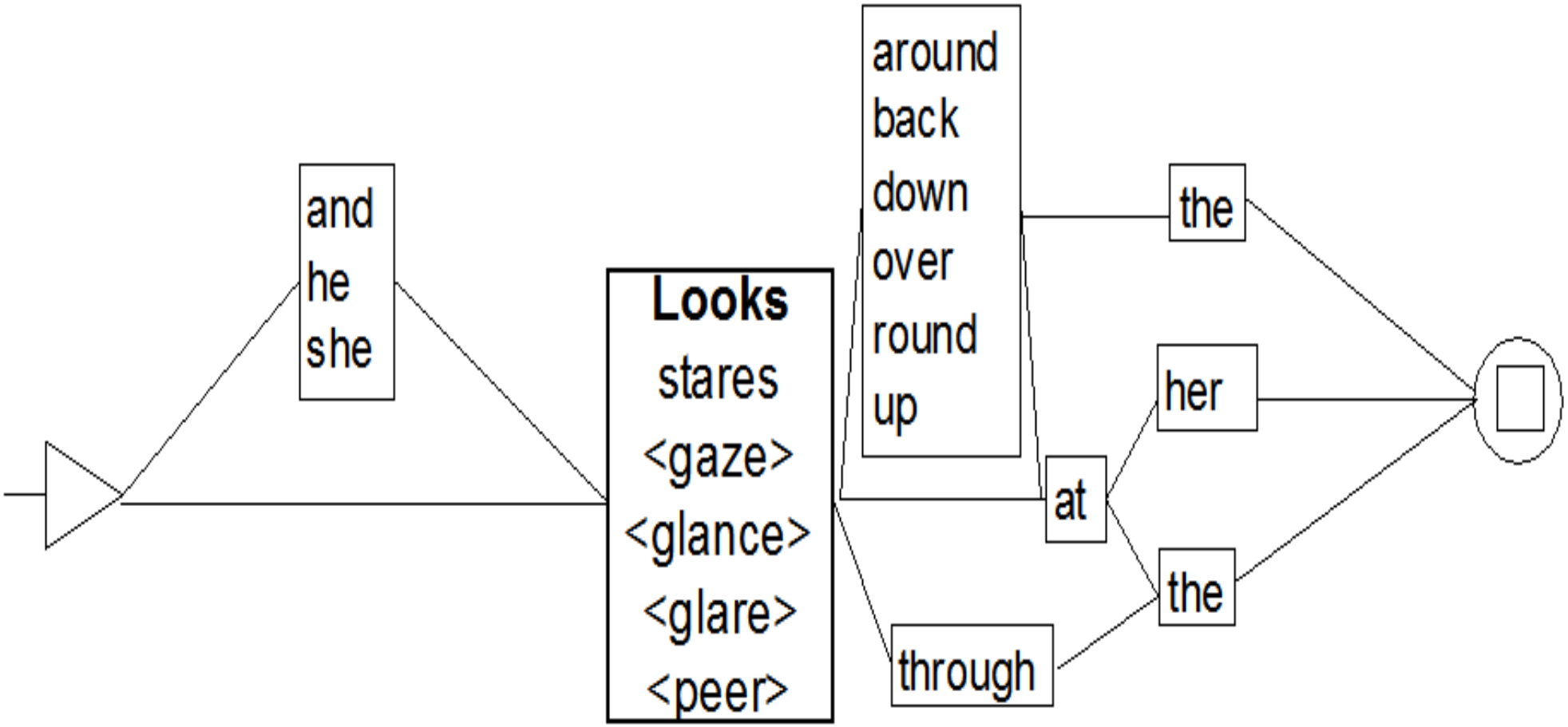
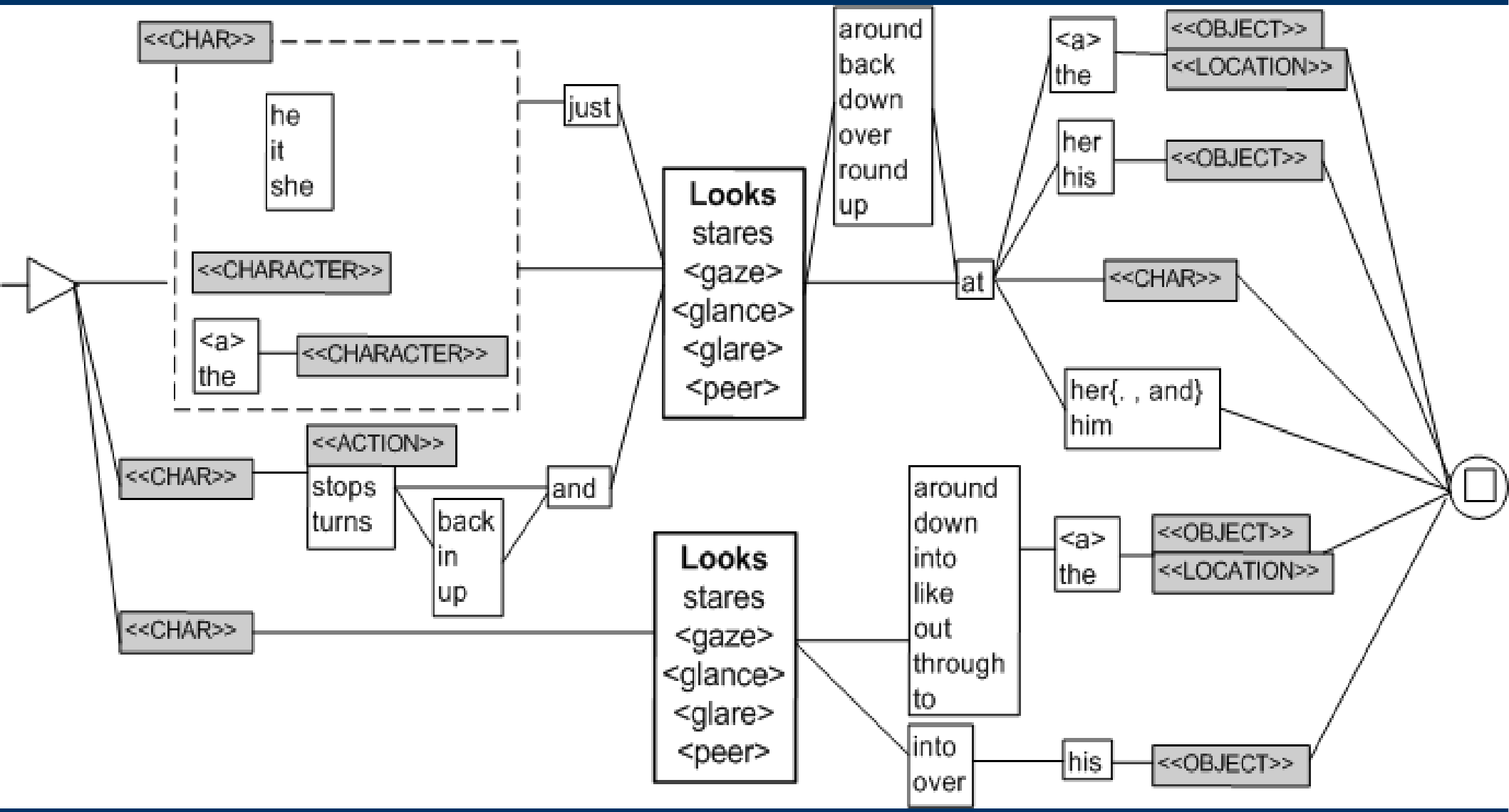


Key	
	Maximal common overlap.
	Edges to be deleted.
	Nodes to be deleted.

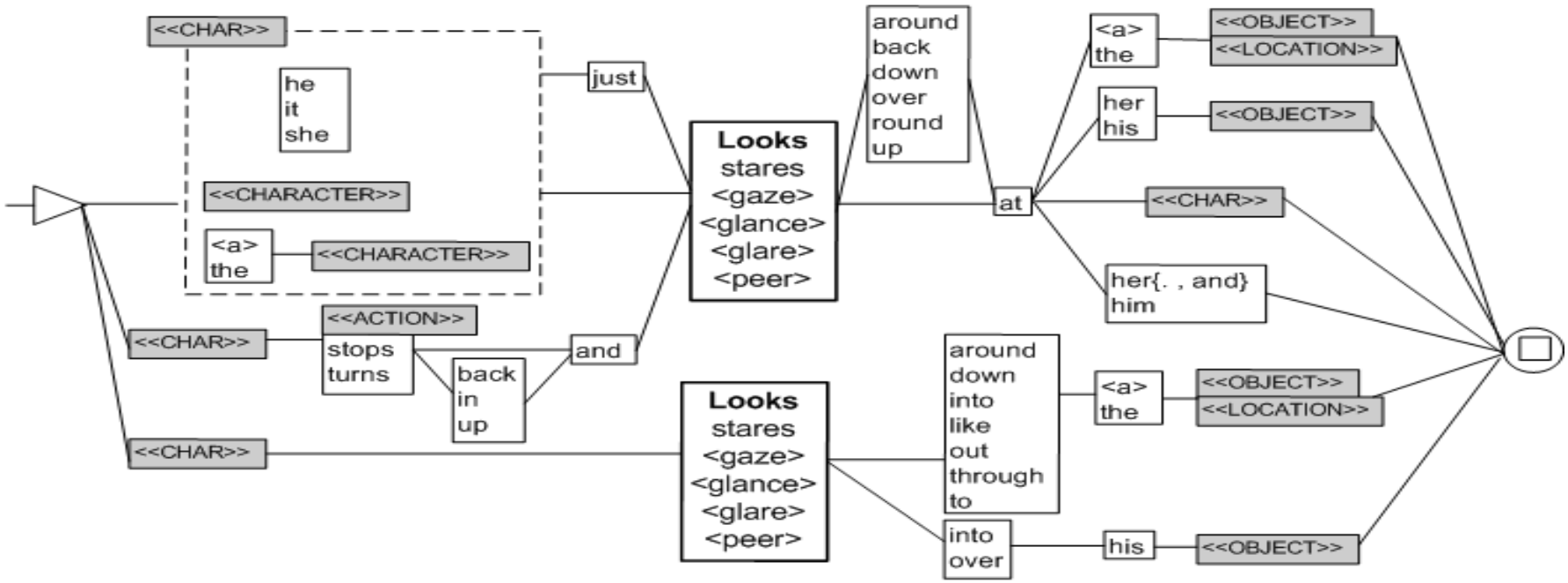
Automatically generated output

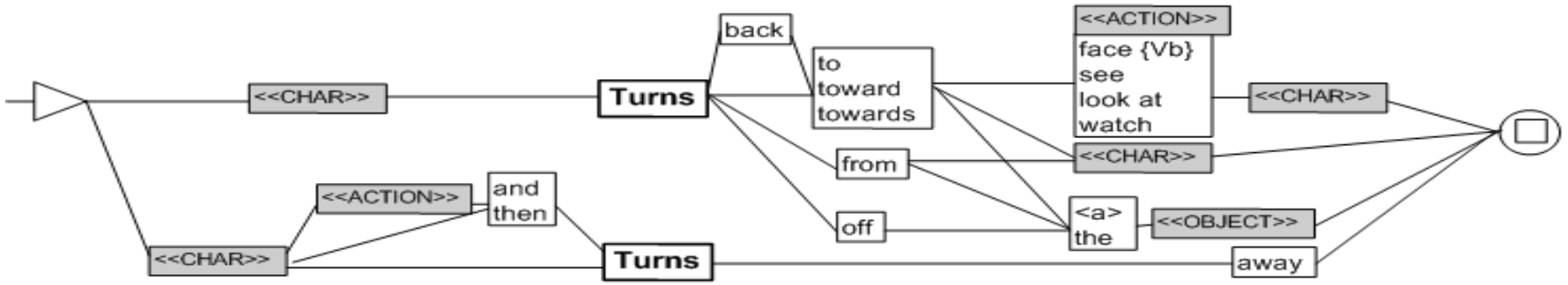


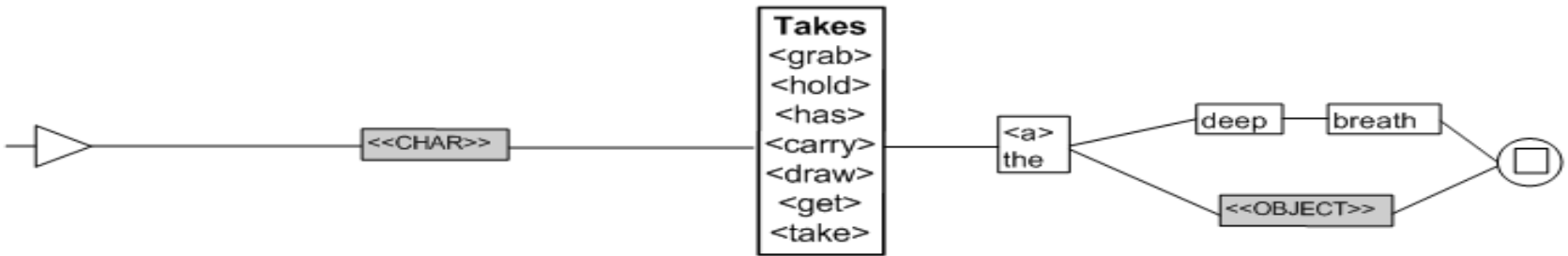
Additional Manual Analysis...



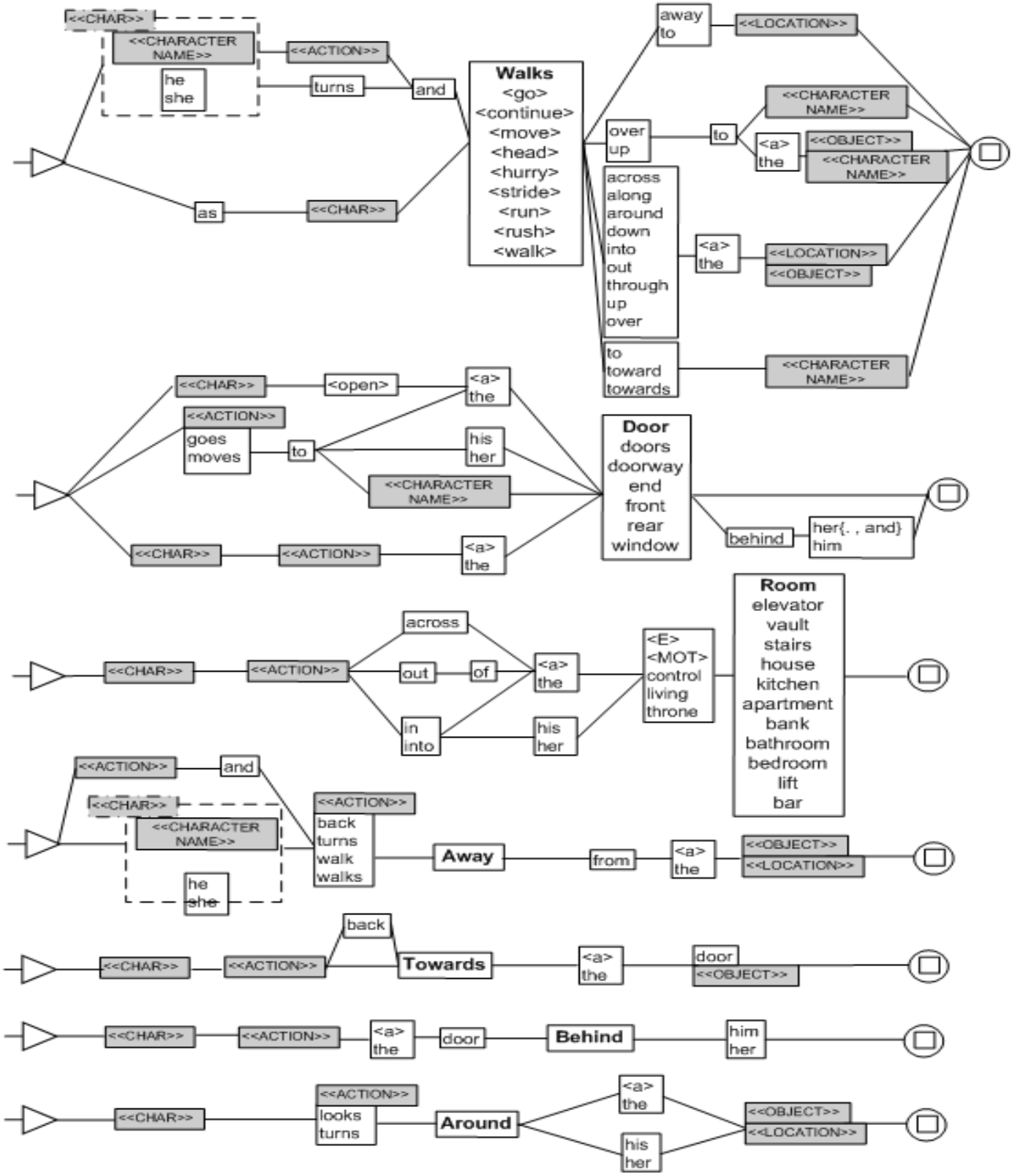
FOCUS OF ATTENTION



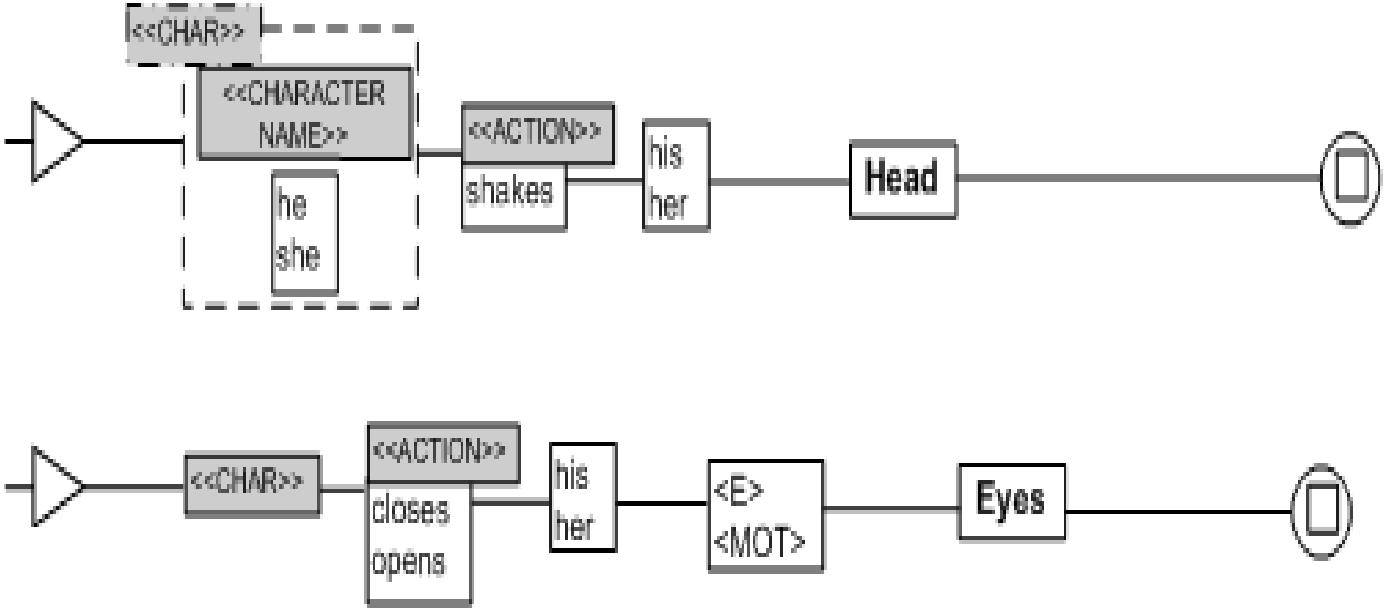


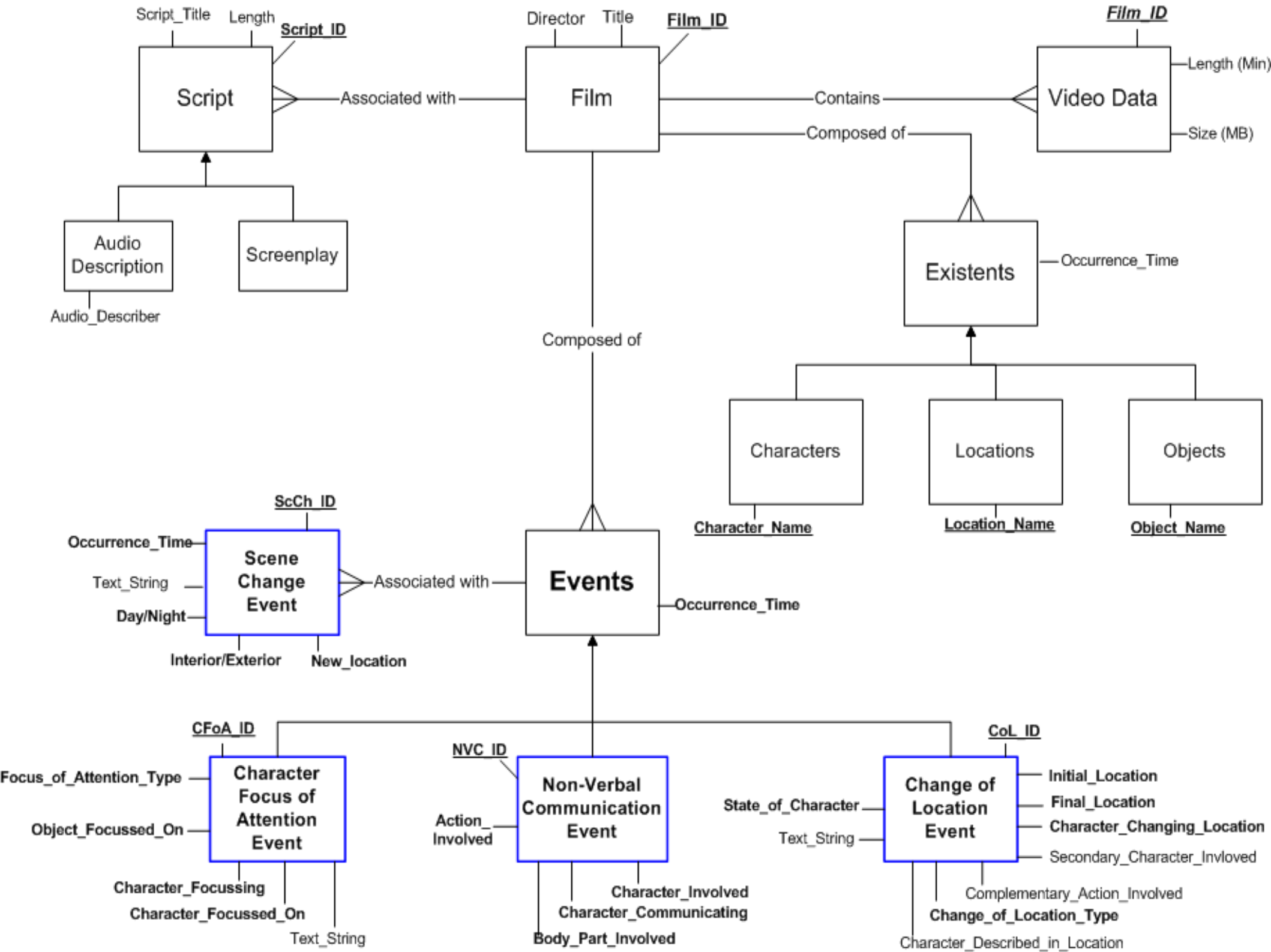


CHANGE OF LOCATION



NON VERBAL COMMUNICATION




Script_Title
Length
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Film_ID
Video Data
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Audio Description
Screenplay
Audio_Describer
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Characters
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Character_Name
Location_Name
Object_Name
ScCh_ID
Occurrence_Time
Text_String
Day/Night
Scene Change Event
Interior/Exterior
New_location
Associated with
Events
Occurrence_Time
CFoA_ID
Focus_of_Attention_Type
Object_Focussed_On
Character Focus of Attention Event
Character_Focussing
Character_Focussed_On
Text_String
NVC_ID
Action_ Involved
Non-Verbal Communication Event
Character_Involved
Character_Communicating
Body_Part_Involved
CoL_ID
State_of_Character
Text_String
Change of Location Event
Initial_Location
Final_Location
Character_Changing_Location
Secondary_Character_Invloved
Complementary_Action_Involved
Change_of_Location_Type
Character_Described_in_Location

An Automatically-extracted Database of Film Events

CFOA ID	Focus Type	Character Focussing	Character Focussed On	Object Focussed On	Occurrence Time	Text String
FOAAD5	ACTIVE	Jim		(their) car	00:15:22:24	00:15:22:24 looking at
FOAAD6	ACTIVE	Carl (He)	Jim		00:23:32:07	00:23:32:07 turns to see
FOAAD7	PASSIVE	Jim		the gun	00:25:11:36	00:25:11:36 takes

ScCh ID	INT\EXT	Location	Time of Day	Line No.	% Film Time	Text String
ScChAD1	Interior	FITTS HOUSE - RICKY'S BEDROOM	Night	2	0.07	INT. FITTS HOUSE - RICKY'S BEDROOM- NIGHT
ScChAD10	Exterior	SALE HOUSE	Day	322	11.25	EXT. SALE HOUSE- DAY

NVC ID	Body Part	Character Communicating	Action Involved	Occurrence Time	Text String
NVCAD9	Head	Madox	shakes	00:25:09:16	00:25:09:16 shakes his head
NVCAD10	Eyes	Caravaggio	closes	00:25:34:20	00:25:34:20 closes his eyes

COL ID	Character State	Character Changing Location	Occurrence Time	Text String
COLAD2	ENTERING	Donkey	00:06:26:17	00:06:26:17 runs into
COLAD3	LEAVING	Donkey	00:10:51:06	00:10:51:06 walks out
COLAD4	WITHIN\ON	Donkey	00:11:55:04	00:11:55:04 walking over to

Discussion

- Vassiliou (2006) showed one way in which a local grammar of audio description can be extracted automatically from a corpus
- The preliminary specification of common film events suggests that the local grammar reflects important aspects of film's narrative structures: this identifies, in an empirical fashion, some of the kinds of information for narrative understanding to happen (in films):
- Ongoing work:
  - Developing novel film retrieval and browsing applications; applying the ADIOS algorithm for grammar induction (Solan et al. 2005)

Discussion

- Will this kind of approach generalise to other narrative text types?
  - It depends on how constrained word co-occurrence is
- Can formal corpus analysis techniques provide the starting point for mapping between the kinds of information present in other kinds of narrative texts to their associated features in storyworlds?
  - It depends on whether constraints are due to the structuring of information in storyworlds
- Can this lead to narrative theory?

References

Ahmad, Khurshid, Gillam, Lee, and Cheng, David (2005) Textual and Quantitative Analysis: Towards a new, e-mediated Social Science. Procs. of the 1st International Conference on e-Social Science, June 2005, Manchester.

Bordwell, David and Thompson, Kristin (1997) *Film Art: An Introduction*, 5th edition. McGraw-Hill.

Chatman, Seymour (1978) *Story and Discourse: Narrative Structure in Fiction and Film*, Cornell University Press.

Gross, M. (1997), The construction of local grammars, in E. Roche and Y. Schabes (eds.), *Finite-State Language Processing*. MIT Press, Cambridge, MA.

Harris, Zellig (1988) *Language and Information*. Columbia University Press.

Herman, David (2002) *Story Logic: problems and possibilities of narrative*, University of Nebraska Press.

Lehnert, W. G. (1981) Plot Units and Narrative Summarization, *Cognitive Science* 4, pp. 293-331.

Salway, Andrew and Graham, Mike (2003) Extracting Information about Emotions in Films. *Procs. 11th ACM Conference on Multimedia 2003*, 4th-6th Nov. 2003, pp. 299-302.

Salway, Andrew Vassiliou, Andrew and Ahmad, Khurshid (2005) What Happens in Films? *Procs ICME 2005: International Conference on Multimedia and Expo* IEEE electronic publication.

Solan, Zach Horn, David Ruppin, Eytan and Edelman, Shimon (2005) Unsupervised Learning of Natural Languages, *Procs. National Academy of Sciences* 102 (33), 11629-11634.

Vassiliou, Andrew (2006) *Analysing Film Content – a text-based approach*. PhD Thesis, Department of Computing, University of Surrey.

Xu, Yan (2005) *Representation of Story Structures for Browsing Digital Video*. PhD Thesis, Department of Computing, University of Surrey.

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