Discourse Representation Theory  
(Kadmon chapter 2, specially pp. 25-40)

1. Linguistic motivation for Discourse Representation Theory (DRT).

- There are two main theories that go beyond the semantic-pragmatic analysis of isolated sentences and build a semantic-pragmatic representation for an entire discourse:
  - Discourse Representation Theory (DRT), by Hans Kamp.  
  - File Change Semantics, by Irene Heim.

- The aim of the Kamp-Heim discourse theory is to give a general treatment of:
  - indefinite NPs (differenciating them from quantificalional NPs)
  - definite NPs
  - anaphora possibilities in discourse

### Indefinite Noun Phrases (NPs) are not referential:

- **Names:** purely referential.
  
  - Mary came in.  
  - It is not the case that Mary came in.
  
  a. [m came in]  
  b. [¬(m came in)]

- **Indefinites:** not purely referential.
  
  - A dog1 came in.  
  - It is not the case that a dog came in.
  
  a. [d1 came in]  
  b. [¬(d1 came in)]

**Indefinite NPs also differ from regular quantificalional NPs (QuNP) in at least two respects:**

- Anaphora possibilities:
  
  - Changing quantificalional force: every always translates as ∀, **most** always means "a majority of", etc. But indefinites do not always translate as ∃.

  (7) A whale is a mammal.
  
  a. ∃x [whale(x) ∧ x is a mammal]
  b. ∀x [whale(x) → x is a mammal]

- If a man meets a donkey, he beats it.

  a. b.

**Question 2.1:** Explain intuitively the two readings of (7) and map them to the formulas (a-b).

**Question 2.2:** Explain intuitively the (main) two readings of (7) and write down the corresponding formulas.

2. Main features of the Kamp-Heim approach.

- The semantic value of a sentence is not its traditional truth conditional content (static view), but rather the role it plays in extending a discourse and determining the truth conditions of the extended discourse (dynamic view).

- Indefinites (and definites) are neither quantificalional nor referential. Rather, they translate as open formulas with a variable. This variable is a discourse referent (Karttunen 1976): an entity which, once introduced into the discourse, can serve as the antecedent for anaphora, but which need not correspond with any particular referent in the world.

- A dog came in.
  
  dog(x) ∧ x came in

- There is existential quantification taking scope over the entire discourse. It unselectively binds all the free variables in the discourse.

- [Blah, blah...] A dog came in. [Blah, blah...]
  
  ∃[... dog(x) ∧ x came in ...]

- For QuNPs and adverbs like always / usually, we have unselective restricted quantification.

- Always, if it rains, it pours.
  
  ∀(it rains at time t) [it pours at time t]

- Always, if a man meets a donkey, he gives it a treat.
  
  ∀(man(x), donkey(y), x meets y) [treat(z), x gives z to y]

- Every farmer has a donkey.
  
  ∀(farmer(x)) [donkey(y), x has y]

- Every farmer who has a donkey gives it treats.
  
  ∀(farmer(x), donkey(y), x has y) [treat(z), x gives z to y]

- Anaphora in discourse as simple variable binding.
3. Kamp’s Discourse Representation Theory (DRT)

The information gathered in a discourse is represented by a Discourse Representation Structure (DRS), which is graphically depicted as a box. A new discourse starts a new DRS.

When a new sentence is parsed, the DRS is expanded:

A dog came in.

Note that the listed DRS-conditions may be simple asserted formulas, as in (15), or complex DRS representing denied formulas, temporarily assumed formulas, disjunctive formulas, etc.

3.1. From NatLg to DRSs: Construction rules.

17. Proper name NP:
- introduce the appropriate constant in the universe of the matrix DRS, unless the constant already is there.
- predicate of it the rest of the sentence in the current DRS.

18. Indefinite NP:
- introduce a new variable in the universe of the current DRS.
- predicate of it the descriptive content of the NP in the current DRS.
- predicate of it the rest of the sentence in the current DRS.

19. Definite NP:
- [To be revised]
  - pick an old discourse referent such that...
  - predicate of it the descriptive content of the NP in the current DRS.
  - predicate of it the rest of the sentence in the current DRS.

20. Quantificational NP:
- create in current DRS a DRS-condition of implication type: protasis-DRS ⇒ apodosis-DRS
  - enter a new variable in the universe of the protasis-DRS.
  - predicate of it the descriptive content of the NP in the protasis-DRS
  - predicate of it the rest of the sentence in the apodosis-DRS.

21. Negation:
- create in current DRS a DRS-condition consisting of negation followed by a DRS.

22. Disjunction:
- create in current DRS a DRS-condition consisting of a DRS to be filled by the first disjunct, the disjunction symbol ∨, and a DRS to be filled by the second disjunct.

23. Implication:
- create in current DRS a DRS condition of implication type, with the protasis-DRS to be filled by the if-clause and the apodosis-DRS to be filled by the matrix clause.

24. Examples:
   a. John snores.
   b. A dog walked in.
   c. Every dog barks.
   d. John does not swear.
   e. Anna swims or runs.
   f. Bill does not have a dog.
   g. Kate saw a nurse or a doctor.
   h. Every farmer that has a donkey is happy.
   i. If Mary sees a doctor, Sue will see a nurse.

QUESTION 3: Draw the DRSs for the sentences in (23).
3.2. Interpreting DRSs.

(25) A VALUE ASSIGNMENT (or embedding function) is a function mapping discourse referents of a DRS onto actual objects in the world. It grows as the discourse proceeds.

(26) A DRS is TRUE iff there is a value assignment which verifies all the conditions in it. \( \exists \) quantification over assignments, not over the discourse referents.

(27) NEGATION: A value assignment \( f \) verifies \( \square \) iff it is not the case that there is a value assignment \( f' \) which extends \( f \) and verifies the conditions in DRS \( K \).

(28) DISJUNCTION: A value assignment \( f \) verifies \( \bigvee \) iff at least for one of the disjunct DRSs there is a value assignment \( f' \) which extends \( f \) and verifies the conditions in that DRS.

(29) IMPLICATION: A value assignment \( f \) verifies \( \rightarrow \) iff for every value assignment \( f' \) which extends \( f \) and verifies the conditions in \( K \), there is a variable assignment \( f'' \) which extends \( f' \) and verifies the conditions in \( K \).

(30) A man walked in. The man did not have a hat. Every girl who saw the man was surprised.

QUESTION 4: It is stipulated that indefinites and quantificational NPs introduce a new variable in the corresponding DRS universe. What would happen if we were allowed to pick an old variable instead? Discuss it for the examples below.

(31) A kid came in. A boy smiled.

(32) A pet came in. Every dog barked.

3.3. Anaphora.

Pronouns and definite NPs are both considered anaphoric. In DRT, this means that they pick a discourse referent (i) which is old, i.e. already used in the discourse, and (ii) which is accessible from the local DRS where the anaphor is.

(33) A discourse referent (or variable/constant) \( x \) is accessible from a given DRS \( K \) iff

- \( x \) is in the universe of \( K \) itself, or
- \( x \) is in the universe of any DRS graphically containing \( K \), or
- \( K \) is \( \rightarrow \) or is embedded in-- an apodosis DRS and \( x \) is in the universe of the corresponding protasis DRS,
- \( K \) is \( \rightarrow \) or is embedded in-- a 2nd-disjunct DRS and \( x \) is in the universe of the corresponding 1st disjunct DRS.

QUESTION 5: Consider the complex DRS (16). From the following positions, which discourse referent universes will be accessible? Positions: 1, 3, 4, 6, 8, 11, 12, 14.

(34) Pronominal NP:
- pick an old discourse referent that is accessible from the current DRS \( K \) where the pronoun is to be translated
- predicate of it the pronominal features (gender, number, person) of the NP in current DRS
- predicate of it the rest of the sentence in current DRS

(35) Definite NP:
- pick an old discourse referent that is accessible from the current DRS \( K \) where the NP is to be translated
- predicate of it the descriptive content of the NP in current DRS
- predicate of it the rest of the sentence in current DRS

- Examples

(36) A dog\(_2\) is proud of itself\(_1\).

(37) Every dog\(_2\) is proud of itself\(_1\).

(38) I have a dog\(_2\). It\(_1\) isn’t smart.

(39) I don’t have a dog\(_2\). It\(_1\) is smart.

(40) A dog\(_2\) came in. It\(_1\) was pretty.

(41) Every dog\(_2\) came in. It\(_1\) was pretty.

(42) If Mary meets a donkey\(_2\), she smiles at it\(_1\).

(42) If Mary meets every donkey\(_2\), she smiles at it\(_1\).

QUESTION 6: Draw the DRSs for the following examples, determining whether the intended anaphoric relation is allowed.

(43) If a farmer owns a donkey, he beats it.

(44) Every farmer that owns a donkey beats it.

(45) If a farmer owns a donkey, the donkey kicks him.

- More on definites: Although DRT treats definites as anaphoric, note that they can be used in out-of-the-blue discourses. This is due to the fact that we can accommodated the required information. We’ll see more of this when we study presuppositions.

(46) Pointing at a door and saying: The door is about to open.

- Sets as discourse referents.
  So far, we have only used singular NPs introducing an individual discourse referent \( x \). When we do plural NPs, the NP will introduce a set discourse referent \( X \).