**The Kaplan-Lewis Analysis and its Basic Implementations:**
**Lewis (1979) and Cresswell & von Stechow (1982)**


**1.        Lewis (1979) "Attitudes *De Dicto* and *De Se*"**

It's fair to say that Lewis's (1979) theory of the truth-conditions of *de re*, *de dicto* and *de se*
readings – and the surrounding ontology – is the 'standard view' in the linguistic literature.

* In the linguistic literature, all the 'action' has mainly been in implementing Lewis's basic
  proposals within a compositional semantics.

(1)        **The Importance of Lewis (1979)**

    a.        Coining of the term *de se* as a category of attitude (or reading) distinct from *de
              dicto* and *de re*.

    b.        The notion that the object of 'propositional attitudes' are actually *properties*,
              rather than propositions

    c.        The notion, building on Quine (1969) that properties (*qua* objects of attitudes) can
              be modeled as sets of centered worlds. [Note: Lewis doesn't actually adopt this]

    d.        The notion (building on Kaplan 1968) that *de re* readings invoke a special relation
              of *acquaintance* between the attitude holder and the entity in question.

    e.        The notion that this allows for the following reductions:
              (i)        *De dicto* as a subspecies of *de se*
              (ii)       *De se* as a subspecies of *de re*

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(2)        **Important Caveat**

* Lewis's discussion is focused on the *truth-conditions* of the sentences in question.

* Lewis is agnostic as to how these truth-conditions can be compositionally assigned to
  the English sentences that bear them.

* This sometimes raises complications of understanding for the casual reader:

    o Lewis consistently asserts that the attitudes at play have *properties* as their objects
    o But in the sentences he analyzes, the grammatical object of the propositional
      attitude verb is a fully inflected *sentence*.

* Lewis doesn't formalize his proposals in quite the depth that semanticists may expect.
  (That work is done by later authors, like Cresswell & von Stechow (1982))

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(3)     **Lewis's (1979) Central Goal**
        To argue that the objects of 'propositional attitudes' are *not* propositions (sets of possible worlds), but rather *properties* (sets of **entities** / characteristic functions of such sets).

        (i)     In cases where it suffices to model the objects of attitudes as propositions (*de dicto* belief), we can recast the theory in terms of properties.

        (ii)    There are cases where the objects of attitudes *cannot* be insightfully modeled as propositions (*de se* belief), but where they *can* be modeled in terms of properties.

        <u>Note:</u>  **For Lewis (1979), 'properties' are what semanticists would usually call 'predicates' (sets of entities, type *<e,t>* functions)**

(4)     **Argument for the First Thesis**

        a.      For every proposition *p*, there is a unique property:

$$[ \lambda x : \exists w' \,.\, x \text{ occupies } w' \text{ and } p(w') = T ]$$

                'The property that holds of an individual x *iff* x occupies a world where *p* is true'

        b.      Consequently, we can recast attitudes *de dicto* as attitudes towards properties without loss of information.

                'x believes*de dico* the proposition *p*'     ≈
                'x self-ascribes the property [ $\lambda x : \exists w' \,.\, x$ occupies w' and $p(w') = T$ ]'

        c.      <u>Illustration:</u>
                'Dave believes*de dicto* the proposition [$\lambda w$ : it is raining in w]'      ≈
                'Dave self-ascribes the property [$\lambda x : \exists w$. x occupies w and it is raining in w]' =
                'Dave self-ascribes the property of living in a world where it is raining.

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(5)     **A Note on 'Self-Ascription'**

        Lewis (1979) doesn't offer a technical explanation/definition of the term 'self-ascribes'

        •   We could try to recast this in terms of centered worlds as doxastic alternatives (see Handout 1). *This is what Cresswell & von Stechow (1982) later do…*

            'x believes*de dicto* the proposition *p*'          =

$\forall$<w',y> $\in$ Dox-Alt(x,w): [$\lambda w''$: $\lambda z$: z occupies w'' and it is raining in w'' ](<w',y>) = T     *iff*
$\forall$<w',y> $\in$ Dox-Alt(x,w): y occupies w' and it is raining in w'                                                *iff*
$\forall$<w',y> $\in$ Dox-Alt(x,w): it is raining in w'

## 1.2    The Arguments for the Second Thesis: *De Se* Attitudes

As noted by Lewis, the reformulation of *de dicto* belief in (4) is pretty pointless on its own…
  *What makes it interesting are cases where we **can't** model propositional attitudes in terms of relations to propositions (sets of possible worlds)…*

- Here, Lewis (1979) builds on prior work by Perry (1977) and Casteñeda (1966, 1968) arguing that 'first person attitudes' (*de se* knowledge/belief) are a special category of attitudes, and cannot be 'reduced' to attitudes about external objects/events/entities

- What Lewis (1979) adds to the discussion of these cases is the notion that we can model the first-person (*de se*) belief states as a relation (self-ascription) to a *property*

(6)    **Lingens in the Library**
       This basic scenario has been used by numerous philosophers (Frege, Strawson, Perry, Stalnaker) to illustrate the puzzling nature of 'first person' belief (*de se* belief)

  - Rudolf Lingens has amnesia and is lost in the Stanford library. In this library, there's an extremely detailed (magically detailed) biography of his life, which includes all the moments of his life up to the very present.

    o  This book includes the fact that Rudolf Lingens is presently lost in a library, reading a magically detailed book about himself, while looking towards a window showing a cloudy day, *etc. etc.*

    o  Any true proposition involving Rudolf Lingens is in this biography, which Lingens reads and believes.

  a.    The Key Intuition:
        Lingens can have complete 'propositional' knowledge of Rudolf Lingens without knowing something critically important: "I am Rudolf Lingens"

  b.    The Key Conclusion:
        That self-knowledge, which Rudolf is missing, cannot be modeled as a proposition (since he is assumed to have complete propositional knowledge concerning Rudolf Lingens)

    - Lewis: The statements in the book tell Lingens what possible world he occupies, but not *who he is* in that possible world.

  c.    Lewis's Key Claim:
        **What Lingens is lacking in this scenario is the ability to self-ascribe the property '[λx: x is Rudolf Lingens]'**

    - Thus belief which Lingens is lacking ('I am Rudolf Lingens') is best modeled as the self-ascription of that (non-propositional) property.

(7) **The Two Gods**
Lewis claims we can imagine the following scenario:

- There is a possible world $w_{gods}$ where there are two 'propositionally omniscient' gods. That is, each of these gods knows exactly what possible world they are in ($w_{gods}$)

- One of the gods lives on the tallest mountain and throws down manna. The other god lives on the coldest mountain and throws down lightening bolts.

- Both gods have an 'equally perfect view of every part of their world'. Thus, we imagine that they have the same 'omnipresent' subjective view of the world.

     a.      <u>The Key Intuition:</u>
Such gods might still not know something: *which god they are*. (Note: the third assumption is pretty crucial here).

     b.      <u>The Key Conclusion:</u>
The self-knowledge that the gods lack (i.e., which one they are) cannot be modeled as a proposition, since they know *exactly* which world they are in.

     c.      <u>Lewis's Key Claim:</u>
**What the gods are lacking in this scenario is the ability to self-ascribe the property '[λx: x lives on the tallest (/coldest) mountain]'**
- Thus belief which the gods lack is best modeled as the self-ascription of that (non-propositional) property.

(8) **The Case of Mad Heimson (Perry 1977)**

     a.      <u>The Scenario:</u>
There's a guy Heimson who is delusional, and who believes he is David Hume.

     b.      <u>The Puzzle:</u> If belief is a relation between a believer and a proposition, *what is the proposition that Heimson believes?*
- It can't be the proposition '[λw: Rudolf Heimson is David Hume in w]'
- There is no possible world where that proposition is true, and so it's contradictory ('not a fit object of belief')
- Heimson seems crazy, *not contradictory*.
- Also, there's a sense in which Heimson and Hume believe *the same thing*.

     c.      <u>The Key Conclusion:</u> Heimson's belief cannot be modeled as a proposition.

     d.      <u>Lewis's Key Claim:</u> What Heimson is doing is (incorrectly) self-ascribing the property '[λx: x is David Hume]', *and so we should model the object of his belief as that property.*
- That property can also be object of Hume's belief, since he also (correctly) self-ascribes it!

(9) **Terminology: *De Se* Belief**

Cases where the object of belief is a property, and where the agent's belief consists in the self-ascription of that property.

'x believes*de se* the property *P*'     =     'x self-ascribes the property *P*'

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(10) **Lewis's Key Thesis**    Belief *de dicto* is a subspecies of belief *de se* (see (3)-(4))

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(11) **Question**      Are there are also *de se* varieties of attitudes other than belief?

      **Answer**       Yes! Lewis goes through a number of cases motiving this. They mostly boil down to the following, originally taken from Quine (1969)

(12) **The Puzzle of the Cat's Desire (Quine 1969)**

     a.      <u>The Scenario:</u>  A cat is being chased by a dog, and wants to be on the roof.

     b.      <u>The Puzzle:</u>
          If desire is a relation between an entity and a proposition, *what is the proposition that the cat desires?*

          •    Suppose we say that it's the proposition { w : the cat is on the roof in w }

          •    *But, is this set of possible worlds really all that well-defined?*

          •    Consider a possible world with two cats *perfectly qualitatively identical to the cat in our story*, one on the roof and one being eaten by the dog…

          •    *Is this world in that set of worlds or not?*

     c.      <u>The Key Conclusion:</u>
          To avoid the puzzle in (12b), we should give up an analysis where the objects of *want* are propositions (sets of possible worlds).

     d.      <u>Lewis's Key Claim:</u>
          The attitude of 'wanting'/'desiring' is a relation between an entity and a property.

          'The cat wants to be on the roof'     =
          'The cat desires that the property '[$\lambda$x : x is on the roof]' holds of itself.

(13)    **Wanting to be a Poached Egg**

    a.    The Scenario:
        It seems I can hold the very strange desire to be a poached egg. In such a case, 'Seth wants to be a poached egg' is true.

    b.    The Puzzle:
        If desire is a relation between a believer and a proposition, *what is the proposition that Seth desires?*

- It can't be the proposition '[$\lambda$w: Seth Cable is a poached egg in w]'
- There is no possible world where that proposition is true, and so it's contradictory ('not a fit object for desire')
- But, it again seems that my desire is simply 'crazy', *not contradictory*.

    c.    The Key Conclusion:  My desire in scenario (a) can't be modeled as a proposition.

    d.    Lewis's Key Claim:
        The object of my desire in scenario (a) is the property '[$\lambda$x: x is a poached egg]', which is a totally sensible property (it's just crazy to want that property to hold of yourself).

## 1.3    Lewis's Proposal and Centered Worlds

(14)    **Quine's (1969) Solution to the Puzzle of the Cat's Desire (12)**

    a.    Centered World (Quine 1969):
        A pair consisting of a possible world and a space-time coordinate at that world.

        Lewis's (1979) Revision:
        A pair consisting of a world and an individual in that world.
        (Allows for two individuals to occupy the same space-time coordinate.)

    b.    Quine's Take on the Puzzle in (12):

- Desire is not a relation between an entity and a set of worlds, but rather between an entity and *a set of centered worlds*.

- What the cat desires in (12) is a set of *centered* worlds where the *center* of the world is on the roof in that world.
  - o  A world with two qualitatively identical cats will be in the 'desired worlds' if the center of that world is on the roof in that world.

- (As Lewis notes, Quine later rejects this proposal, but it has gone on to be hugely influential in the semantic literature on attitude descriptions)

(15)    **Lewis's Observation:**
        For every set of centered worlds *S*, there is a unique property:

$$[ \lambda x : \exists w' . \text{ x occupies w' and } \langle x,w' \rangle \in S ]$$
        'The property that holds of an individual x if x is the center of a centered world in S'

    a.    <u>Illustration:</u>
          { $\langle w',y \rangle$ : y is on the roof in w' }     $\approx$
          [ $\lambda x : \exists w''$. x occupies w' and $\langle x,w'' \rangle \in$ { $\langle w',y \rangle$ : y is on the roof in w' } ]  $=$ [1]
          [ $\lambda x$ : x is on the roof ]

    b.    <u>Lewis's Conclusion:</u>
          Thus, Quine's (1969) proposal is equivalent to Lewis's (*modulo* the fact that for
          Quine, these are properties of space-time points, rather than individuals)

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**Note:**  Although people sometimes cite Lewis (1979) for the notion that the object of a *de se*
attitude is a set of centered worlds, it's clear that he isn't really framing his (1979)
proposals in those terms…

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**1.4    Incorporating Belief *De Re***

(16)    **Interim Summary**

   •  Belief *de se* is the self-ascription of a property.
   •  All belief – including belief *de dicto* – is ultimately a case of belief *de se*.

          'x believes$_{de\ dico}$ the proposition *p*'     $\approx$
          'x believes$_{de\ se}$ the property [ $\lambda x : \exists w'$ . x occupies w' and $p(w') = T$ ]'     $\approx$
          'x self-ascribes the property [ $\lambda x : \exists w'$ . x occupies w' and $p(w') = T$ ]'     $=$
          'x self-ascribes the property of living in a world where *p* is true.'

(17)    **Obvious Question:**    What about belief *de re*? How do we incorporate those cases into
                                 this overall picture?

(18)    **Lewis's Tactic:**

        Following Kaplan (1968), belief *de re* involves 'ascribing a property to an entity under
        some description of that entity'.

   •  So, we'll begin by developing a theory of what it means to do *that*.

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[1] This last equivalence holds if, as Lewis (1979) assumes, every entity occupies exactly one possible world.

(19)    **Property Ascription, First Pass (Based on Kaplan 1968)**

‘x ascribes property *P* to entity y under description Z’          *iff*

(i)     y uniquely has property Z
(ii)    x believes*de dicto* the proposition that there is exactly one thing with property Z which also has property *P*.


(20)    **Problem: Property Ascription Built on *De Se* Belief**

a.      Scenario:
        Suppose that in (7), the god that lives on the coldest mountain and throws down lightening bolts believes *de se* "the mountain I live on is the tallest."


b.      The Problem:

        o   We'd want to say that that god is ascribing the property of 'being tallest' to the mountain they live on under a particular description…

        o   But the definition in (19) won't work, because it requires the underlying belief of the agent to be *de dicto*.


(21)    **Property Ascription, Second Pass**

‘x ascribes property *P* to entity y under description Z’          *iff*

(i)     Z is a **relation**, which x bears uniquely to y.

(ii)    x believes*de se* (that is, self-ascribes) the following property:

        $[\lambda x$: there is exactly one thing that x bears Z to, and that thing has property $P]$

        $\approx [ \lambda x : P( \iota y.Z(x,y) )$

Illustration:
In scenario (20a), we can say that lightening-bolt god ascribes 'the tallest mountain' to the mountain he lives on under the description '$[\lambda x$: $\lambda y$: x lives on y]'

(i)     That god bears '$[\lambda x$: $\lambda y$: x lives on y]' uniquely to the mountain he lives on.

(ii)    That god believes *de se* (self-ascribes) the property:
                                '$[\lambda x$: $[\iota y$. x lives on y] is **the tallest mountain** ]'

Note:   If there ever are any cases where we want ‘Z’ to be a unary property *P* rather than a binary relation, we can let Z be the degenerate relation ‘$[\lambda x$: $\lambda y$: *P*(y)]'

(22)    **Application to Quine's Double Vision Case**

In Quine's original double vision case, the conditions in (a) and (b) below hold:

    a.    (i)    Ralph bears '[λx: λy: x saw y wearing a brown hat]' uniquely to Orcutt

          (ii)    Ralph self-ascribes the following property:
                    '[λx: [ιy. x saw y wearing a brown hat] **is a spy**]'

    b.    (i)    Ralph bears '[λx: λy: x saw y on the beach]' uniquely to Orcutt

          (ii)    Ralph self-ascribes the following property:
                    '[λx: [ιy. x saw y on the beach] **is not a spy**]'

Therefore, in that original case, both (c) and (d) hold:

    c.    Ralph ascribes 'being a spy' to Orcutt under the description '[λx: λy: x saw y wearing a brown hat]' (= 'person I saw wearing a brown hat')

    d.    Ralph ascribes 'not being a spy' to Orcutt under the description '[λx: λy: x saw y on the beach]' (= 'person I saw on the beach')

> *With these ingredients, we can build up a theory of what belief 'de re' is…*

(23)    **Analysis of Belief *De Re*, First Pass**

'x believes$_{de\,re}$ of y that it has property *P*'      *iff*

There is a description Z such that x ascribes property *P* to entity y under description Z

(24)    **Problem: 'My Shortest Ancestor'**
This is Lewis's (1979) version of Kaplan's 'Shortest Spy Problem'

- Suppose that I believe$_{de\,se}$ that my shortest ancestor is one of my ancestors.

- Suppose that my shortest ancestor happens to be Archibald T. McGuiness.

- The definition in (21) entails that I ascribe to Archibald the property of being one of my ancestors, under the description 'my shortest ancestor'.

- **However, it feels wrong to say that I believe *de re* of Archibald that he is one of my ancestors.** [2]

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[2] To my ear, it also sounds wrong to say that I ascribe any property to Archibald, but we'll leave that aside.

(25)    **The Lewis (1979) Analysis of *De Re* Belief**

'x believes*de re* of y that it has property *P*'     *iff*

There is a **suitable** description Z such that x ascribes property *P* to y under description Z

(26)    **When is a Relation Suitable?**

     a.      Key Caveat:
          "It will not be possible to say precisely which relations are suitable, since it is often quite vague whether some case should or should not count as an example of belief *de re*. **The vagueness is partly resolved in context, but differently in different contexts.**" (Lewis 1979: 539-540)
- Compare to the later work by Aloni (2005a,b)

     b.      The Kinds of Relations that Are 'Suitable':
          (i)      y is an acquaintance of x
          (ii)     y is a contemporary public figure in the news
          (iii)    y is a famous dead person who figures prominently in history
          (iv)    y is an author whose works x has read
          (v)     x is face-to-face-with y
          (vi)    x is 'tracing' y (e.g., intentionally following y's car)
          (vii)   **x is identical to y**

     c.      The Key Generalization:     Relations in (b) are all 'relations of acquaintance'

- There is an extensive causal dependence of x's attitudes upon y
- That causal dependence is apt for the reliable transmission of information

> Note:   Lewis also claims that Z is 'suitable' when it is the 'essence' of y (i.e., Z is true of y in all possible worlds). However, he also claims that knowledge of 'essences' is extremely rare

(27)    ***De Se* Belief as an Instance of *De Re* Belief**

- As noted in (26), *identity* is always a 'suitable' relation for *de re* belief…

- Therefore, if x = y, then x can always believe (*de re*) of y that P *under the description of identity*…

- But, this means that x self-ascribes the property '[λx: [ιy. x = y] has *P*]'

- But, this just means that x self-ascribes the property *P*

- **But this just means that x believes *de se* that they have property *P***

(28)    **The Consequence**
Whenever one holds a *de se* belief, one also holds a *de re* belief, where the acquaintance relation is identity! ("So belief *de se* falls under belief *de re*" (Lewis 1979: 543))

Belief *de dicto*          ⊂          Belief *de se*          ⊂          Belief *de re*

*But, don't we also analyze belief de re as involving belief de se?...*

(29)    **A Remaining Problem: Identity of *De Re* and *De Se* Beliefs (Perry 1977)**

   a.       The Scenario:
            We can expand the case of 'Mad Heimson' in (8) in the following way:
            • Heimson ends up (somehow) convincing his psychiatrist that he *is* Hume.

   b.       The Puzzle:
            There's a sense in which now Heimson & his psychiatrist *believe the same thing* ("They both believe that Heimson is Hume")

   c.       The Problem:
            In Lewis's (1979) approach, however, the object of Heimson's and his psychiatrist's beliefs are different:

            (i)       *Heimson's Belief:*       '[λx: [ιy. x = y] is Hume]'

            (ii)      *Psychiatrist's Belief:*   '[λx: [ιy. x meets with y on Tuesdays] is Hume]'

(30)    **A Related Problem: *De Se* Communication (Stalnaker 1981)**

   • Suppose I believe "I am awesome". According to Lewis, the object of my belief is '[λx: [ιy. x = y] is awesome]'

   • Suppose that I assert "I am awesome", and you come to believe me. According to Lewis, the object of your belief is '[λx: [ιy. Z(x,y)] is awesome]' (for some other Z)

   • **How, exactly, did that transformation happen?**

            o   What is it to assert a *de se* belief, if that thing is a *property*?

            o   How does my self-assertion of that property end up leading my addressees to self-assert a *logically distinct* property??

## 2.  Cresswell & von Stechow (1982) "*De Re* Belief Generalized"

(31)  **Importance of Cresswell & von Stechow (1982)**

     a.     Compositional semantics for propositional attitude sentences that builds on / implements the key ideas of Lewis (1979)

     b.     An analysis of 'mathematical' belief statements that offers a solution to the problem that all (true) mathematical statements are propositionally equivalent.

Note:   We won't be concerned with (b) here. Interested parties are referred to the article.

Note:
* The compositional semantics is presented in a relatively idiosyncratic notation/system.
* My presentation below doesn't strictly follow theirs, but encapsulates their key ideas, especially as those have come to be characterized by later authors…

*We'll begin by laying out the main ingredients of Cresswell & von Stechow's characterization of the truth-conditions of de re readings…*

(32)  **Doxastic Alternatives as Sets of Centered Worlds**
The 'doxastic alternatives' of x at world w are the centered worlds <w',y> such that:

* The system of x's beliefs doesn't rule out the possibility that he is the individual y and lives in the world w' (Cresswell & von Stechow 1982: 507)

* According to x's beliefs, they could be individual y living in world w'

* y satisfies in w' all the properties that x self-ascribes in w

     Notation:     Dox-Alt(x,w) =     'the doxastic alternatives of x at world w'

(33)  **Metalanguage Locution: 'X believes φ'**
If φ is a property, then we say (in our metalanguage) that 'x believes φ in w' *iff*

$$\forall <w',y> \in \text{Dox-Alt}(x,w) \;.\; \varphi(w')(y) \qquad \approx$$
$$\forall <w',y> \in \text{Dox-Alt}(x,w) \;.\; \varphi(<w',y>)$$

**Note:**  Here, the term 'properties' refers to functions from worlds to sets of entities

(34)  **Application to *De Dicto* Belief**
If *p* is a proposition, then we say (in our metalangauge) that 'x believes *p* in w' *iff*

* x believes [λw : λy: *p*(w) = T] in w                        *iff*
* $\forall <w',y> \in$ Dox-Alt(x,w) . [λw : λy: *p*(w) = T](<w',y>)     *iff*
* $\forall <w',y> \in$ Dox-Alt(x,w) . *p*(w')

(35)    **Interim Summary: The Truth-Conditions We're Aiming Towards**

      a.      *De Se* Belief:
           "Dave believes his pants are on fire" is true in world w     *iff*

           Dave believes [λw'': λx: x's pants are on fire in w''] in w  *iff*

           ∀<w',y> ∈ Dox-Alt(Dave,w) . [λw'': λx: x's pants are on fire in w''](<w',y>)  *iff*

           ∀<w',y> ∈ Dox-Alt(Dave,w) . y's pants are on fire in w'

      b.      *De Dicto* Belief
           "Dave believes it's raining" is true in world w          *iff*

           Dave believes [λw'' : it is raining in w'' ] in w        *iff*

           Dave believes [λw'': λx: it is raining in w''] in w       *iff*

           ∀<w',y> ∈ Dox-Alt(Dave,w) . it is raining in w'

*Following Kaplan (1968) and Lewis (1979), Cresswell & von Stechow (1982) base their theory of 'de re' belief on a notion of 'property ascription'…*

(36)    **Metalanguage Locution: 'X Ascribes φ to Y'**

      If φ is a property, then we say (in our metalanguage) that 'x ascribes φ to y in w' *iff*

      There is a 'suitable' relation R such that:

      a.      x bears R uniquely to y in w

      b.      x believes [ λw': λy: φ(w')(ιz.R(y,z,w')) ] in w
           'x self-ascribes the property of bearing R uniquely to a thing z that has property φ'

      <u>Note:</u>  Given definition (33), it follows that (b) above is equivalent to (c) below:

      c.      ∀<w',y> ∈ Dox-Alt(x,w) . φ(w')(ιz.R(y,z,w'))
           'In all of x's doxastic alternatives <w',y> at w, the thing that y bears R to has property φ'

(37)    **Metalanguage Locution: 'φ is a *de re* belief that x holds of y'**

      If φ is a property, then we say (in our metalanguage) that 'φ is a *de re* belief x holds of y'
      *iff*     x ascribes φ to y in w

(38)     **Illustration: The *De Re* Truth-Conditions We're Aiming Towards**

"Ralph believes (*de re*) that Orcutt is a spy" is true in world w          *iff*

$[\lambda w'': \lambda x: x$ is a spy in w'] is a *de re* belief that Ralph holds of Orcutt in w    *iff*

Ralph ascribes $[\lambda w'': \lambda x: x$ is a spy in w'] to Orcutt in w           *iff*

There is a 'suitable' relation R such that:
a.       Ralph bears R uniquely to Orcutt in w
b.       $\forall <w',y> \in$ Dox-Alt(Ralph,w) . $[\iota z.R(y,z,w')]$ is a spy in w'

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*We've already seen how the truth-conditions in (38) will hold in the double vision case, since R could be something like* '$[\lambda x: \lambda y: \lambda w: x$ saw y wearing a brown hat in w]'

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(39)     **Key Original Contribution: Generalizing to Predicates of Arbitrary Type**

Cresswell & von Stechow note that the definitions in (36)-(37) can be generalized to predicates of any logical type (not just classical, <s<et>> properties).

- Such generalization is crucial for a treatment of 'multiple *res*' sentences…
- It also ends up being crucial for their treatment of mathematical beliefs (ignored here)

a.      Generalized Property Ascription:
        If $\varphi$ is an n-place property, and $<y_1, …, y_n>$ are in the domain of $\varphi$, then we say (in our metalanguage) that 'x ascribes $\varphi$ to $<y_1, …, y_n>$ in w' *iff*

        There are 'suitable' relations $R_1, …, R_n$ such that:

        (i)      For all $i \leq n$ , x bears $R_i$ uniquely to $y_i$ in w

        (ii)     x believes $[\lambda w': \lambda y: \varphi(w')(\iota z.R_1(y,z,w'), …, \iota z.R_n(y,z,w'))]$ in w    $\approx$

              $\forall <w',y> \in$ Dox-Alt(x,w) . $\varphi(w')(\iota z.R_1(y,z,w'), …, \iota z.R_n(y,z,w'))$

              'In all of x's doxastic alternatives $<w',y>$ at w, $\varphi$ holds of the thing that y bears $R_1$ to, … and the thing that y holds $R_n$ to'

b.      Generalized *De Re* Belief:
        If $\varphi$ is an n-place property, and $<y_1, …, y_n>$ are in the domain of $\varphi$, then we say (in our metalanguage) that '$\varphi$ is a *de re* belief that x holds of $y_1, …, y_n$ in w' *iff*
              'x ascribes $\varphi$ to $<y_1, …, y_n>$ in w'

(40)    **Illustration: The Truth-Conditions of *De Re* Sentences with Multiple *Res***

- "Ralph believes (*de re*) that Cicero denounced Cataline" is true in w            *iff*

- [λw'': λx: λy: x denounced y in w''] is a *de re* belief
                        that Ralph holds of Cicero and Cataline in w            *iff*

- Ralph ascribes [λw'': λx: λy: x denounced y in w''] to <Cicero, Cataline> in w    *iff*

- There are 'suitable' relations $R_1$ and $R_2$ such that:

    (i)      Ralph bears $R_1$ uniquely to Cicero in w,
             Ralph bears $R_2$ uniquely to Cataline in w,

    (ii)     $\forall$<w',y> $\in$ Dox-Alt(Ralph,w). ιz.$R_1$(y,z,w') denounced ιz.$R_2$(y,z,w') in w'

             'In all of Ralph's doxastic alternatives <w',y>, the thing that y bears $R_1$ to
             denounced the thing that y bears $R_2$ to'.

(41)    **Important Note**

- Cresswell & von Stechow allow φ in (39a) to be a 0-place property (*i.e.*, a proposition)

- When φ is a 0-place property, they construe definition (39a) to entail the following:

    'x ascribes φ to the empty sequence *s* in w' *iff*

    $\forall$<w',y> $\in$ Dox-Alt(x,w) . φ(w')
    *In all of x's doxastic alternatives <w',y>, the proposition φ holds at w'*

- **This is crucial for their compositional treatment of the *de dicto* / *de re* ambiguity**

**2.1     Cresswell & von Stechow's Compositional Semantics**

*As stated above, I won't be presenting their system in exactly their terms, but in a notation more familiar to the semanticists/philosophers in the audience…*

(42)    **The Lexical Entry for "Believes"**

    [[believes]]$^w$     =        The function BEL$_w$

    | OK… but what is this function? |
    | --- |

(43)     **The Function BEL$_w$**

The function BEL$_w$ takes the following as argument and returns a truth-value:

   a.     An (n+1)-ary sequence consisting of:
          (i)     an n-place predicate φ, followed by
          (ii)    n elements $y_1, \ldots, y_n$ , such that $\langle y_1, \ldots, y_n \rangle$ is in the domain of φ

   b.     An entity x

   $BEL_w(\langle φ, y_1, \ldots, y_n \rangle)(x) = T$          *iff*          'x ascribes φ to $\langle y_1, \ldots, y_n \rangle$ in w'

Note:   BEL$_w$ is defined so that its first argument could be sequences of various semantic types…
        Consequently, BEL$_w$ – and so $[[believes]]^w$ – doesn't have a traditional semantic type…

   *Two 'Spins' on This:*
   (i)     $[[believes]]^w$ is 'type flexible' / 'cross categorical'          (C & vS 1982)
   (ii)    There is a systematic lexical ambiguity in 'believes'              (Cresswell 1982)

(44)     **A Sketch of How the Semantic Computation is Going to Work**

   a.     $[[$ Ralph believes Orcutt is a spy $]]^w$  =          (under its *de re* reading)

   b.     $[[believes]]^w(\langle[\lambda w'': \lambda x: x$ is a spy in w''$], Orcutt\rangle)(Ralph)$  =     (by (42))

   c.     $BEL_w(\langle[\lambda w'': \lambda x: x$ is a spy in w''$], Orcutt\rangle)(Ralph) = T$ *iff*          (by (43))

   d.     Ralph ascribes $[\lambda w'': \lambda x: x$ is a spy in w''$]$ to Orcutt in w    *iff*          (by (38))

   e.     There is a 'suitable' relation R such that:
          Ralph bears R uniquely to Orcutt in w
          $\forall \langle w', y \rangle \in$ Dox-Alt(Ralph,w) . $[\iota z.R(y,z,w')]$ is a spy in w'

(45)     **Crucial Question:**     *But, how do we get from (44a) to (44b)?...*
         *How do we end up constructing these 'sequences' that are the first argument of*
         *"believes"?*

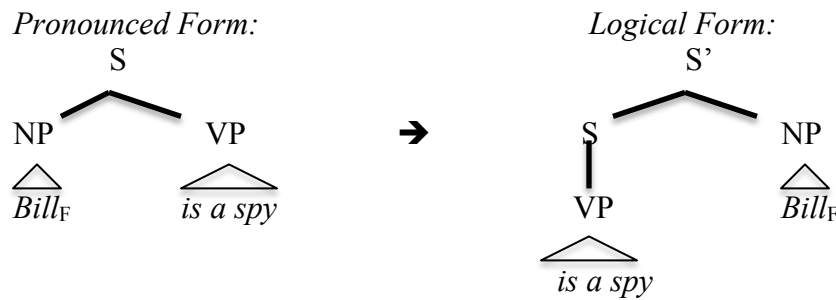         **Disappointing Answer:**          C&vS are somewhat non-committal on this…
                                            They spell out one possible approach, but it's unclear how
                                            seriously they take it…

*Again, the ideas presented below are not <u>exactly</u> what they say, but it's the basic gist…*
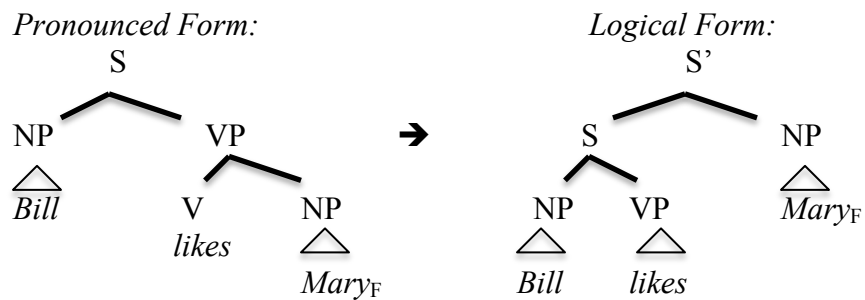
(46)   **The Central Idea, Part 1: Focus Movement**
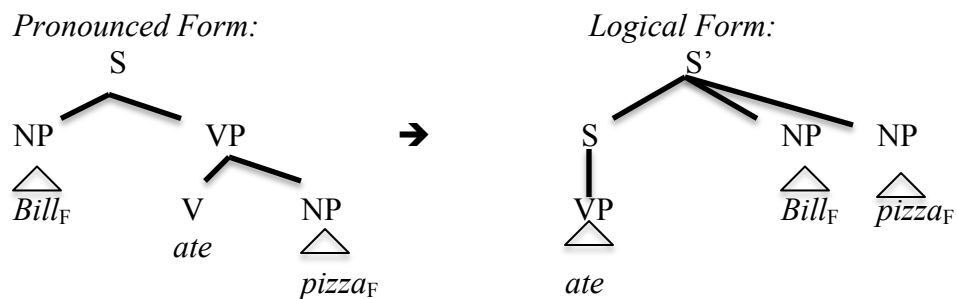There is a syntactic movement operation that adjoins the 'focus' of a sentence to the root.

    a.    <u>Discourse:</u>   (i)    Who is a spy?
                           (ii)   $BILL_F$ is a spy.

*Pronounced Form:*                   *Logical Form:*

```
        S                              S'
       / \                            / \
     NP   VP              ➜         S     NP
      △    △                       / \     △
   Bill_F is a spy                    VP   Bill_F
                                       △
                                    is a spy
```

    b.    <u>Discourse:</u>   (i)    Who does Bill like?
                           (ii)   Bill likes $MARY_F$

*Pronounced Form:*                   *Logical Form:*

```
        S                                 S'
       / \                               /  \
     NP   VP                ➜          S     NP
      △   / \                         / \     △
    Bill V   NP                     NP   VP  Mary_F
       likes  △                      △    △
            Mary_F                  Bill  likes
```

    c.    <u>Discourse:</u>   (i)    Who ate what?
                           (ii)   $BILL_F$ ate $PIZZA_F$

*Pronounced Form:*                   *Logical Form:*

```
        S                                  S'
       / \                               / | \
     NP   VP              ➜          S   NP  NP
      △   / \                        |    △    △
   Bill_F V  NP                      VP Bill_F pizza_F
        ate   △                       △
            pizza_F                   ate
```

(47)   **The Central Idea, Part 2: Special Semantics for "That"**
The complementizer '*that*' converts focus-moved LFs into sequences.

$$[[ \text{ that } [_{S'} \text{ XP YP … ZP } ] ]]^w = \quad < [[XP]]^w , [[YP]]^w, … [[ZP]]^w >$$

(48)    **The Central Idea, Part 3: The Relation Between *De Re* and Focus**

In a *de re* reading of a propositional attitude sentence 'DP V$_{attitude}$ S', the *res*'s of the attitude are the *foci* of the embedded clause S. (Cresswell & von Stechow 1982: 528)

- This is a highly original generalization, one that I don't believe is picked up in subsequent literature… (it seems clearly wrong…)

- Consequently, at the very end of the paper, Cresswell & von Stechow seem to back off from this proposal, and suggest that:
    o While the focus-movement rule in (46) has independent motivation…
    o *De re* belief may be built on a similar such rule, one that is independent of the topic-focus articulation *per se*…

(49)    **Putting All the Ingredients Together: Single *De Re***

a.    <u>Sentence:</u>    Ralph believes that Orcutt is a spy.

b.    <u>LF Structure:</u>  [ Ralph [ believes [ that [ [is a spy] [Orcutt] ] … ]

c.    <u>Semantic Calculation:</u>        $[[(49b)]]^w$    =

(i)    $[[believes]]^w([[ \text{ that } [[ \text{ is a spy } ] [Orcutt]] ]]^w)$(Ralph)        =    (by (47)) [3]

(ii)    $[[believes]]^w(<[\lambda w'': \lambda x: x \text{ is a spy in } w''], Orcutt>)$(Ralph)   =   (by (42))

(iii)    Ralph ascribes $[\lambda w'': \lambda x: x \text{ is a spy in } w'']$ to Orcutt in w   *iff*

(iv)    There is a 'suitable' relation R such that:
       Ralph bears R uniquely to Orcutt in w
       $\forall <w',y> \in$ Dox-Alt(Ralph,w) . $[\iota z.R(y,z,w')]$ is a spy in w'

---

<u>Note:</u>
- Given the 'generalized' approach to *de re* in (39) and (43), the *res* of a *de re* attitude could itself be a high-typed function…
    o This underlies Cresswell & von Stechow's approach to mathematical belief

- It also follows that the *res* of a *de re* attitude can be a *sequence* of multiple individuals…
    o This underlies their approach to *de re* readings with multiple *res's*

---

[3] There's a bit of a fudge here in my semantic calculation, in that we have the *intension* of '*is a spy*' in (ii), but the rule in (47) would only get us the *extension*. This isn't really a problem for the Cresswell & von Stechow (1982) system, which is 'fully intensionalized', and only ever directly computes intensions. Rather, it's simply an effect of my trying to shoe-horn their proposals into a semantic system closer to the one from Handout 1.

(50)   **Putting All the Ingredients Together: Multiple *De Re***

  a.     <u>Sentence:</u>       Ralph believes that Cicero denounced Cataline

  b.     <u>LF Structure:</u>  [ Ralph [ believes [ that [ [denounced] [Cicero] [Cataline]]…]

  c.     <u>Semantic Calculation:</u>        $[[(50b)]]^w$      =

  (i)      $[[believes]]^w([[ \text{ that } [[denounced][Cicero][Cataline]] ]]^w)(Ralph)$   =

  (ii)     $BEL_w(<[\lambda w'': \lambda x: \lambda y: x \text{ denounced } y \text{ in } w''], Cicero, Cataline>)(Ralph) = T$ *iff*

  (iii)    Ralph ascribes $[\lambda w'': \lambda x: \lambda y: x \text{ denounced } y \text{ in } w'']$ to $<Cicero, Cataline>$ in w *iff*

  (iv)     There are 'suitable' relations $R_1$ and $R_2$ such that:
            Ralph bears $R_1$ uniquely to Cicero in w,
            Ralph bears $R_2$ uniquely to Cataline in w,
            $\forall <w',y> \in Dox\text{-}Alt(Ralph,w)$ .
                    $\iota z.R_1(y,z,w')$ denounced $\iota z.R_2(y,z,w')$ in w'

(51)   **Putting All The Ingredients Together: *De Dicto***

  a.     <u>Sentence:</u>       Ralph believes that it is raining.

  b.     <u>LF Structure:</u>  [ Ralph [ believes [ that [ it is raining ] … ]

  c.     <u>Semantic Calculation:</u>        $[[(51b)]]^w$      =

       (i)      $[[believes]]^w([[ \text{ that } [it is raining] ]]^w)(Ralph)$   =

       (ii)     $BEL_w(<[\lambda w'': it is raining in w'']>)(Ralph) = T$ *iff*

       (iii)    Ralph ascribes $[\lambda w'': it is raining in w'']$ to the empty sequence *s* in w' *iff*

       (iv)     $\forall <w',y> \in Dox\text{-}Alt(Ralph,w)$ . $[\lambda w'': it is raining in w''](w') = T$ *iff*

       (v)      $\forall <w',y> \in Dox\text{-}Alt(Ralph,w)$ . it is raining in w'

---

(52)   **Question:**     What about the apparent *de se* reading of a sentence like (a), where it is
                         true in a scenario validating the *de se* truth conditions in (b)?

  a.     Ralph thinks he is awesome

  b.     $\forall <w',y> \in Dox\text{-}Alt(Ralph,w)$ . y is awesome in w'

---

(53)  ***De Se* As a Case of *De Re***

Following Lewis (1979), Cresswell & von Stechow (1982) propose that (52a) gets assigned the *de re* truth-conditions in (a) below.

a.  There is a 'suitable' relation R such that:
 Ralph bears R uniquely to **Ralph** in w
 $\forall<w',y> \in$ Dox-Alt(Ralph,w) . [ιz.R(y,z,w')] is awesome in w'

In scenarios validating the *de se* truth-conditions in (52b), the truth-conditions above also hold true. *After all, the identity relation is always a suitable relation.*

- Again, if 'R' is witnessed by '=', then the truth-conditions in (52b) will also hold.

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**3.  Another Compositional Implementation of the Kaplan-Lewis Analysis of *De Re***

(54)  **A Major Criticism of the Cresswell & von Stechow (1982) System**

- The 'generalized' approach to *de re* in (39) and (43) requires the internal argument of $[[believes]]^w$ to be a sequence of a property and its arguments.

 o  Consequently, we need a *sui generis* semantic rule (47) to construct such sequences…

- Relatedly, we can't assign the verb "believes" to a specific semantic type

- In both cases, the system ends up deviating from the ideal of 'type-driven interpretation'

*For this reason, when semanticists need a 'quick-and-dirty' compositional implementation of the Kaplan-Lewis theory of de re, they tend to employ a system like the following…*
- *Percus & Sauerland (2003) attribute these ideas to 90's-era class notes of Irene Heim's*

(55)  **A Lexical Ambiguity in *Believes***
 The verb '*believes*' is ambiguous, and can receive the following two readings:

a.  $[[believes_{dicto}]]^w$  =  $[\lambda p_{<st>} : \lambda x : \forall<w',y> \in$ Dox-Alt(x,w). p(w') = T ]

b.  $[[believes_{re}]]^w$  =

 $[\lambda y : \lambda P_{<s<et>>} : \lambda x :$ There is a 'suitable' relation R such that R(x,y,w) &
  $\forall<w',y> \in$ Dox-Alt(x,w) . P(w')([ιz.R(y,z,w')]) ]

*Notice that according to (55), "believes" has two readings, and under each it can be assigned a specific semantic type…*

(56)    **The Magical Syntactic Step of *Res*-Movement**

There is a syntactic operation, called *res*-movement, which can move an NP from a subordinate clause to position sister to a propositional attitude verb.

a.      <u>Sentence:</u>        Ralph believes Orcutt is a spy.

b.      <u>Pronounced Form:</u>      [ Ralph [ believes*re* [s Orcutt is a spy ] ] ]

c.      <u>Logical Form:</u>



*Res-movement*
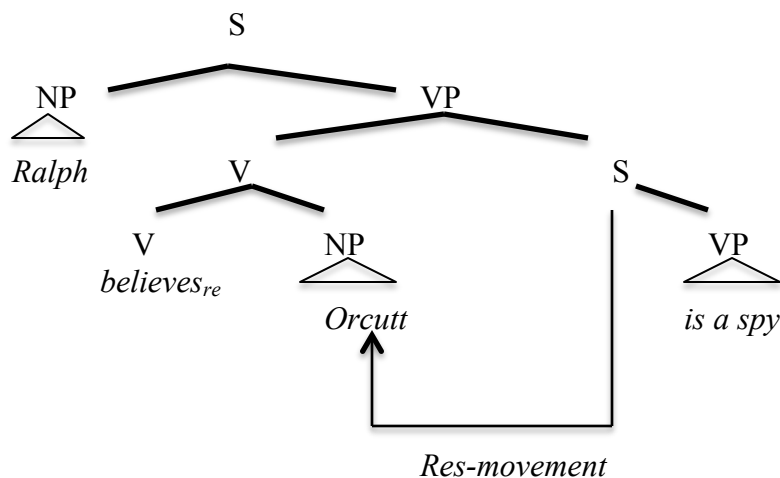
(57)    **Putting the Pieces Together**
With the ingredients in (55)-(56), we can derive the desired Kaplan-Lewis truth-conditions for the *de re* reading of 'Ralph believes Orcutt is a spy'.

a.      $[[(56c)]]^w$       =                                        (by FA, IFA)

b.      $[[believes_{re}]]^w([[Orcutt]]^w)([\lambda w': [[is\ a\ spy]]^{w'}])([[Ralph]]^w)$   =    (by Lexicon)

c.      $[\lambda y : \lambda P_{<s<et>>} : \lambda x :$  There is a 'suitable' relation R such that R(x,y,w) &
          $\forall <w',y> \in$ Dox-Alt(x,w) . P(w')([\iota z.R(y,z,w')]) ]
                    (Orcutt)($[\lambda w': \lambda s : s$ is a spy in w'])(Ralph)   =    (by LC)

d.      There is a 'suitable' relation R such that R(Ralph,Orcutt,w) &
          $\forall <w',y> \in$ Dox-Alt(Ralph,w) . $[\iota z.R(y,z,w')]$ is a spy in w'

*The derivation above uses no special, sui generis semantic rules, only FA…*

(58)     **Obvious Problems With This 'Quick-and-Dirty' System (Yalcin 2015)**

   a.     The syntactic operation of *res*-movement is entirely ad hoc. It also violates well-known general constraints on movement.

   b.     The ambiguity in (55) is not sufficient. We'd need another lexical entry for sentences with multiple *res*'s.

   c.     We'd have to replicate the (infinite) ambiguity in (55) for every propositional attitude verb.
          (Note: this is also a potential criticism of the Cresswell & von Stechow system)

---

*Is there a way to implement the Kaplan-Lewis theory of de re attitudes, but also maintain a purely type-driven semantic system **without** having to posit res-movement or systematic ambiguities in propositional attitude verbs???*

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… Enter Percus and Sauerland (2003)…