A Review of Intensions, Propositional Attitudes, and Events

1. Intensions and Propositional Attitudes

The notes below summarize the key material found in:
- Heim & Kratzer (1998): Chapter 12
- http://people.umass.edu/scable/LING610-FA14/Handouts/17.Intro-Intensions.pdf

1.1 Intensional Semantics: The Key Ingredients

(1) **Possible Worlds**

- There is an infinite set W of possible worlds ('alternative realities'), of which the actual world (our reality) is a member.
- The actual world is often designated with 'w_0'

(2) **Extensions and Possible Worlds**

- The truth of a sentence depends upon what possible world it is uttered in.
  - In the actual world, "Barack is the president" is true
  - In other possible world, it might be false
- Therefore, the extension of an expression should be calculated relative to a possible world (and a variable assignment)

a. $[[\text{ XP }]]^{w,g}$ = 'the extension of XP relative to world w and variable assignment g'

(3) **Intensions as Functions**

- The intension of an expression maps a possible world onto the extension of that expression at that world

b. $[\ \lambda w' : [[XP]]^{w',g}\ ]$ = 'the intension of XP'

- If the extension of XP is type τ, then its intension is type $<s,\tau>$

(4) **Terminology for Frequently Encountered Intensional Types**

Term	Type	Intension of
Proposition	<s,t>	Sentence
Property	<s,<e,t>>	NP, VP, AP, …
Individual Concept	<s,e>	Name, Definite DP

1.2 Lexical Semantics of Propositional Attitude Verbs: The Key Ingredients

(5) **Their Semantic Type**

A propositional attitude verb (e.g., 'believes') has an extension of type $<<s,t>,<e,t>>$
- Its first argument is a proposition (the attitude content)
- Its second argument is an entity (the attitude holder)

(6) **The Notion of a 'Doxastic Alternative'**

The *doxastic alternatives* for an entity x at a world w (Dox-Alt(x,w)), are:

- The worlds consistent with the beliefs of x at w
- The worlds where all of x's beliefs at w hold true
- The worlds which x thinks (at w) they might possibly be located in

(7) **Proposed Truth-Conditions for Attitude Sentences with *Believes / Thinks***

$[[$ Dave believes that it is raining $]]^{w,g}$ = T iff
$\forall$w' $\in$ Dox-Alt(Dave,w) . it is raining in w'

> This Statement Seems Accurate:
> After all, if Dave *didn't* believe it was raining, then
> Some worlds consistent with his beliefs are ones where it *doesn't* rain

(8) **A Lexical Semantics for *Believes / Thinks* That Uses These Ingredients**

$[[$ believes / thinks $]]^{w,g}$ = $[\ \lambda p_{<s,t>} : [\ \lambda x_e : \forall w' \in \text{Dox-Alt}(x,w) .\ p(w') = T\ ]\ ]$

(9) **Computing the Truth-Conditions, Option 1: Intensional Function Application**

Intensional Function Application (IFA):
If X is a structure consisting of two daughters – Y and Z – and if $[[Y]]^{w}$ is a function whose domain contains $[\ \lambda w' : [[Z]]^{w'}\ ]$, then $[[X]]^{w} = [[Y]]^{w}(\ [\ \lambda w' : [[Z]]^{w'}\ ]\ )$

- $[[$ [Dave [believes [it is raining]]] $]]^{w,g}$ = (by FA)
- $[[$ [believes [it is raining]] $]]^{w,g}(\ [[\text{Dave}]]^{w,g}\ )$ = (by IFA)
- $[[\text{believes}]]^{w,g}(\ [\lambda w' : [[\text{it is raining}]]^{w',g}\ ]\ )(\ [[\text{Dave}]]^{w,g}\ )$ = (by other rules)
- $[[\text{believes}]]^{w,g}([\lambda w' : \text{it is raining in } w'\ ])(\text{Dave})$ = (by Lex)
- $[\ \lambda p_{<s,t>} : [\ \lambda x_e : \forall w' \in \text{Dox-Alt}(x,w) .\ p(w') = T\ ]\ ]$
  $([\lambda w' : \text{it is raining in } w'\ ])(\text{Dave})$ = (by LC)

- **$\forall$w' $\in$ Dox-Alt(Dave,w) . it is raining in w'**

(10) **Computing the Truth-Conditions, Option 2: Object-Language World-Abstraction**

$[[\ [\ \lambda w\ XP\ ]\ ]]^{w,g} \quad = \quad [\ \lambda w' : [[XP]]^{w'}\ ]$ (where w' is any fresh world variable)

- $[[\ \ [Dave\ [believes\ [\ \lambda w\ [it\ is\ raining]]]]\ \ ]]^{w,g}$ = (by FA)
- $[[\ \ [believes\ [\ \lambda w\ [it\ is\ raining]]]\ \ ]]^{w,g}(\ [[Dave]]^{w,g}\ )$ = (by FA)
- $[[believes]]^{w,g}\ ([[\ [\lambda w[it\ is\ raining]]\ ]]^{w,g})\ (\ [[Dave]]^{w,g}\ )$ = (by rule for 'λw])
- $[[believes]]^{w,g}\ ([\lambda w' : [[it\ is\ raining]]]^{w',g}\ ])([[Dave]]^{w,g}\ )$ = (by other rules)
- $[[believes]]^{w,g}\ ([\lambda w' : \text{it is raining in } w'\ ])(Dave)$ = (by Lex)
- $[\ \lambda p_{<s,t>} : [\ \lambda x_e : \forall w' \in \text{Dox-Alt}(x,w)\ .\ p(w') = T\ ]\ ]$
  $([\lambda w' : \text{it is raining in } w'\ ])(Dave)$ = (by LC)
- $\boldsymbol{\forall w' \in \textbf{Dox-Alt(Dave,w) . it is raining in } w'}$

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2. Event Semantics: The Key Ingredients

The notes below summarize the key material found in:
- http://people.umass.edu/scable/LING610-FA14/Handouts/7.Adverbs&Events.pdf

(11) **Events**
Like entities, events exist *at* possible worlds, but they are not entities.

- The event of Dave dancing ≠ Dave
  The time of the smoking
  The location of the smoking
  The time & location of the smoking
  The world where the smoking happens

- Semantic type for events: ε (epsilon)
  (some folks use 'l')

- Meta-language variable for events: e (don't confuse with type e)

(12) **Events, Entities, Times, Locations**

While events are type-theoretically distinct from entities, times, etc., there is a family of important functions that relate events to entities, times, etc.

a. T(e) = The interval of time that e takes place in
'The temporal trace of e'

b. L(e) = The physical space (location) that e takes place in
'The path of e'

c. Ag(e) = The agent of e (if any)

d. Thm(e) = The theme of e (if any)

(13) **Events and Verbs**
Following Davidson (1967) *et multa alia*, we can model (some) verbs as having an argument place for events in their semantics.

a. $[[\text{ walk }]]^{w,g}$ = $[\ \lambda x_e : [\ \lambda e_\varepsilon : \text{walk(e) \& Ag(e) = x }]\ ]$
'e is an event of walking and its agent is x'

b. $[[\text{ kick }]]^{w,g}$ = $[\ \lambda y_e : [\ \lambda x_e : [\ \lambda e_\varepsilon : \text{kick(e) \& Ag(e) = x \& Thm(e) = y }]\ ]\ ]$
'e is an event of kicking and its agent is x and its theme is y'

(14) **Existentially Closing the Event Argument**

- Once the verb combines with its entity arguments, the resulting structure is type <ε,t>
- Other operators in the sentence can introduce existential quantification over the remaining event argument

a. $[[\ \varnothing_\exists\ ]]^{w,g}$ = $[\ \lambda P_{<\varepsilon,t>} : \exists e\ .\ P(e) = T\ ]$

b. (i) Sentence: Dave walked.

(ii) LF: $[\ \varnothing_\exists$ [Dave walked]]

(iii) Semantic Computation
- $[[\ \varnothing_\exists\ [\text{ Dave walked }]\ ]]^{w,g}$ = (by FA)
- $[[\ \varnothing_\exists\ ]]^{w,g}\ (\ [[\text{Dave walked}]]^{w,g}\ )$ = (by FA, Lex, LC)
- $[[\ \varnothing_\exists\ ]]^{w,g}\ ([\lambda e_\varepsilon : \text{walk(e) \& Ag(e) = Dave }])$ = (by Lex)
- $[\ \lambda P_{<\varepsilon,t>} : \exists e\ .\ P(e) = T\ ]\ ([\lambda e_\varepsilon : \text{walk(e) \& Ag(e) = Dave }])$ = (by LC)
- $\exists$**e . walk(e) & Ag(e) = Dave**
'There exists an event of walking whose agent is Dave'