

**Towards an ‘Intensional Semantics’, Part 2:  
The Semantics of ‘Believe’ and Consequences for our Theory<sup>1</sup>**

In This Handout:

- We first develop a theory of the *truth-conditions* of sentences containing “believes”
- We then develop a semantics for “believes” which captures these truth conditions, and makes use of the formalized ‘intensions’ developed in Part 1
- We discuss various issues surrounding this analysis and the concomitant changes to our semantic theory.

(1) **What We Have Thus Far**

- An informal hypothesis that the meaning of the verb “believes” takes as argument the *intension* of its complement clause.
- A formalized theory of what *intensions* are (stated in the vocabulary of set-theory and lambda-calculus), and how to (compositionally) compute the intension of a complex phrase from the ‘meanings’ of its component parts.

(2) **What We Want to Do Now**

Develop a lexical entry for the verb “believes” which accomplishes the following:

- (a) Takes as argument the (formalized) *intension* of its sentential complement.
- (b) Captures the intuitive, logical content of the verb “believes” in a perspicuous way.

***How do we construct a hypothesis regarding the meaning of a lexical item L (like “believes”)?***

- We first develop a theory of the *truth-conditions* of sentences containing L.
- We then write a lexical entry for L which will – in combination with the other lexical entries we already have – derive the observed truth conditions of the complex sentences containing it.

***So... what are the truth conditions of sentences containing the verb “believes”?...***

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<sup>1</sup> These notes are based upon material in Heim & Kratzer (1998; Chapter 12) and von Stechow (2007; Chapter 2).

## 1. The Truth Conditions of Sentences Containing “Believes”

### (3) Core Observation Underlying Our Approach

A person’s beliefs seem to *determine* a set of *possible worlds*: those possible worlds which are *compatible* with the person’s beliefs.

#### a. Illustration:

Let’s suppose for argument’s sake, that I believe only one thing: the Earth is flat.

Let’s suppose we’re playing a game where you (somehow) submit to me for consideration various possible worlds from  $W$ , and my task is to say whether or not I think that that possible world could be  $w_0$  (the actual world).

- (i) If you were to submit to me a world where the Earth is *round*, I would say “No; according to my beliefs, this could not be  $w_0$ ”
- (ii) If you were to submit to me a world where the Earth is *flat*, I would say “Yes; according to my beliefs, this could be  $w_0$ ”.
- (iii) Since I only believe a finite number of things (namely, that the Earth is flat), there will be *many* worlds that I say ‘yes’ to.
  - Suppose we have two worlds  $w'$  and  $w''$ :
  - In  $w'$ , the Earth is flat, and there are three million tree frogs.
  - In  $w''$ , the Earth is flat, and there are two million tree frogs.
  - Since I don’t have an opinion about how many tree frogs there are, only about whether the Earth is flat, I would accept both worlds as possibly being  $w_0$ .

Now let’s suppose we gather up all those worlds that I said ‘yes’ to. This set of worlds is *per force* the set of worlds compatible with my beliefs.

- Everything I *believe* is true in those possible worlds.
- For things I have *no opinion about*, in some possible worlds, those things are true, and in others, those things are false.

#### b. Main Point of this Thought Exercise:

For any entity  $x$ ,  $x$ ’s *beliefs* determine a set of possible worlds:

- the set of possible worlds *compatible* with  $x$ ’s beliefs
- those worlds which, as far as  $x$  can tell, *could* be the actual world.

(4) **The ‘Abductive Leap’**

Let’s build a theory of the truth conditions of “believes”-sentences based upon the informal observations in (3).

a. Step 1: We Take ‘The Existence of Beliefs’ as a Primitive

We will take as *primitive* the notion that an entity  $x$  has *beliefs*.

That is, for the purposes of our *semantic* theory, we assume that entities have *beliefs*, but we don’t in any way explain what this ‘having beliefs’ property is, or attempt to *derive* an entity’s beliefs from some other, more basic property of it.

**That is, we crucially *don’t* say that “ $x$ ’s beliefs are the propositions  $x$  believes.”**

b. Step 2: We Identify  $X$ ’s Beliefs as a Set of Possible Worlds

Recall how (intuitively) an entity’s beliefs *determine* a set of possible worlds?

For the purposes of our semantic theory/formalism, let us simply *identify* an entity’s beliefs with that set of possible worlds.

So, we will have a function –  $[\lambda x. \text{Beliefs}(x)]$  – from *entities* to *sets of possible worlds*, which takes an entity and yields that set of possible worlds that we might identify as the entity’s beliefs.

(i) *Illustration* (following the scenario in (3a)):

$$\text{Beliefs}(\text{Seth}) \subseteq \{ w : \text{the Earth is flat in } w \}$$

c. Step 3: We Build in the ‘World-Dependence’ of Beliefs

Note that what beliefs an entity has depends upon the possible world we are looking at.

- In  $w_0$ , my beliefs include the proposition that “semantics is great!”
- In some other possible worlds, though, I might not like semantics, and so my beliefs would not include that proposition.

Thus, the function from entities to beliefs should also contain a parameter for worlds. That is, it should be  $[\lambda w. [\lambda x \text{ Beliefs}(x,w)]]$

(i) *Illustration*

$$\begin{array}{lcl} \text{Beliefs}(\text{Seth}, w_0) & \subset & \{ w : \text{semantics is great in } w \} \\ \text{Beliefs}(\text{Seth}, w') & \not\subset & \{ w : \text{semantics is great in } w \} \end{array}$$

With these ingredient concepts, we can now provide a characterization of the truth-conditions of sentences containing “believes”...

(5) **Our Hypothesis Regarding the Truth Conditions of “Believes” Sentences**

a. Hypothesis:

A sentence of the form “X believes that S” is T at a world  $w$  iff:  
*“S” is true in all the worlds that are compatible with X’s beliefs in  $w$ .*

b. Illustration (in More Formal Language):

$[[ \text{Hannity believes that Obama smokes} ]]^w = T$  *iff*

For all  $w' \in \text{Beliefs}(\text{Hannity}, w)$ :  $[[\text{Obama smokes}]]^{w'} = T$  *iff*

For all  $w' \in \text{Beliefs}(\text{Hannity}, w)$ : Obama smokes in  $w'$

**Preliminary Goal Complete:**

- We have a theory of the truth conditions of “believes”-sentences which captures the intuitive content of such sentences.
- *Now we just need to develop a lexical entry for “believes” which is able to derive these (hypothesized) truth-conditions...*

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2. **The Lexical Entry for “Believes”**

(6) **Initial Observation**

If we assume that the sentence “Hannity believes Obama smokes” has the truth-conditions in (6a), then it’s clear that the extension of the VP “believes Obama smokes” must be the  $\langle \text{et} \rangle$  function in (6b).

a.  $[[ \text{Hannity believes that Obama smokes} ]]^w = T$  *iff*  
For all  $w' \in \text{Beliefs}(\text{Hannity}, w)$ : Obama smokes in  $w'$

b.  $[[ \text{believes Obama smokes} ]]^w =$   
 $[ \lambda x. \text{For all } w' \in \text{Beliefs}(x, w): \text{Obama smokes in } w' ]$

**Thus, the meaning of “believes” must be some function which, when applied to the *intension* of its sentential complement, yields the function in (6b)!!**

...Here's something that seems to work!  
(Recall, 'propositions' are  $\langle st \rangle$  functions, and so are the intensions of sentences.)

(7) **Lexical Entry for "Believes"**

$$[[ \text{believes} ]]^w = \lambda p_{\langle st \rangle} [ \lambda x. \text{For all } w' \in \text{Beliefs}(x, w): p(w') = T ]$$

*The function which takes a proposition  $p$  and yields*

*The  $\langle et \rangle$  function which takes an entity and yields*

*$T$  iff For all  $w' \in \text{Beliefs}(x, w): p(w') = T$*

*In all the worlds consistent with  $x$ 's beliefs,  $p$  is  $T$ .*

Let's see if the rule in (7) will work to derive the truth-conditions in (6a)!

(8) **Derivation of the Truth-Conditions in (6a)**

a.  $[[ \text{Hannity believes that Obama smokes} ]]^w = T$  *iff* (by FA)

b.  $[[ \text{believes that Obama smokes} ]]^w ([[ \text{Hannity} ]]^w) = T$  *iff* ....

**We're stuck!**

We can't continue the 'proof' in (8) past the line in (8b)!

- According to our lexical entry in (7),  $[[\text{believes}]]$  must take a *proposition* as argument.
- **As of yet, our semantic system *still* doesn't ever yield propositions (intensions) as the values of "[[ ]]"**.

*This problem is easily fixed... consider the rule in (9) below!*

(9) **Intentional Function Application (IFA)**

If  $X$  is a structure consisting of two daughters –  $Y$  and  $Z$  – and if  $[[Y]]$  is a function whose domain contains  $[[Z]]_e$ , then  $[[X]] = [[Y]]([[Z]]_e)$  [*i.e.*, the extension of  $X$  is equal to the extension of  $Y$  taking as argument the *intension* of  $Z$ ].

With the addition of the rule of IFA, our proof in (8) can continue...

(10) Derivation of the Truth-Conditions in (6a)

- a.  $[[ \text{Hannity believes that Obama smokes} ]]^w = \mathbf{T}$  *iff* (by FA)
- b.  $[[ \text{believes that Obama smokes} ]]^w ([[ \text{Hannity} ]]^w) = \mathbf{T}$  *iff* (by IFA)
- c.  $[ [ [ \text{believes} ] ]^w ([ [ \text{that Obama smokes} ] ]_c) ([ [ \text{Hannity} ] ]^w) = \mathbf{T}$  *iff* (by Lex.)
- d.  $[ [ [ \text{believes} ] ]^w ([ [ \text{that Obama smokes} ] ]_c) (\text{Hannity}) = \mathbf{T}$  *iff* (by ‘Notation’)
- e.  $[ [ [ \text{believes} ] ]^w (\lambda w'. [ [ \text{that Obama smokes} ] ]^{w'}) (\text{Hannity}) = \mathbf{T}$  *iff* (by FA)
- f.  $[ [ [ \text{believes} ] ]^w (\lambda w'. [ [ \text{smokes} ] ]^{w'} ([ [ \text{Obama} ] ]^{w'})) (\text{Hannity}) = \mathbf{T}$  *iff* (by Lex.)
- g.  $[ [ [ \text{believes} ] ]^w (\lambda w'. [ [ \text{smokes} ] ]^{w'} (\text{Obama})) (\text{Hannity}) = \mathbf{T}$  *iff* (by Lex.)
- h.  $[ [ [ \text{believes} ] ]^w (\lambda w'. [ \lambda x. x \text{ smokes in } w'] (\text{Obama})) (\text{Hannity}) = \mathbf{T}$  *iff* (by LC.)
- i.  $[ [ [ \text{believes} ] ]^w (\lambda w'. \text{Obama smokes in } w') (\text{Hannity}) = \mathbf{T}$  *iff* (by Lex.)
- j.  $[ \lambda p_{\langle st \rangle} [ \lambda x. \text{For all } w'' \in \text{Beliefs}(x, w): p(w'') = \mathbf{T} ]$   
 $(\lambda w'. \text{Obama smokes in } w') (\text{Hannity}) = \mathbf{T}$  *iff* (by LC)
- k.  $[ \lambda x. \text{For all } w'' \in \text{Beliefs}(x, w):$   
 $[ \lambda w'. \text{Obama smokes in } w'] (w'') = \mathbf{T} ] (\text{Hannity}) = \mathbf{T}$  *iff* (by LC)
- i. For all  $w'' \in \text{Beliefs}(\text{Hannity}, w):$   
 $[ \lambda w'. \text{Obama smokes in } w'] (w'') = \mathbf{T}$  *iff* (by LC)
- m. **For all  $w'' \in \text{Beliefs}(\text{Hannity}, w): \text{Obama smokes in } w''$**

**Success!**

Our lexical entry for the verb “believes” in (7) accomplishes the following.

- It can derive (accurate) truth-conditional statements for sentences containing “believes”.
- According to our lexical entry, the extension of “believes” is a function that takes as argument the *intension* of its sentential complement.

**Thus, our semantics no longer makes the (epically false) prediction that if an entity believes one true sentence, they believe *all* true sentences.**

(11) **The Empirical Adequacy of Our Semantics in More Detail.**

Let's see in some finer detail *how* our semantics avoids the 'epically false' prediction:

- Given our lexical entry for "believes", our semantics predicts that:

[[ Hannity believes that Obama smokes ]]<sup>w</sup> = T  
**For all w' ∈ Beliefs(Hannity,w): Obama smokes in w'**

[[ Hannity believes that Obama is a natural-born citizen ]]<sup>w</sup> = T iff  
**For all w' ∈ Beliefs(Hannity,w): Obama is a nat.-born citizen in w'**

- However, consider that there are worlds *w* such that:

Obama smokes in *w*, but Obama is *not* a natural born citizen in *w*.

Obama *doesn't* smoke in *w*, but Obama *is* a natural born citizen in *w*.

- It follows that:

The worlds *w* such that Obama smokes in *w* are not all such that Obama is natural-born citizen in *w*.

The worlds *w* such that Obama is a natural-born citizen in *w* are not all such that Obama smokes in *w*.

- Consequently:

If it's the case that:

**For all w' ∈ Beliefs(Hannity,w): Obama smokes in w'**

It doesn't necessarily follow that:

**For all w' ∈ Beliefs(Hannity,w): Obama is a nat.-born citizen in w'**

*And vice versa.*

- And therefore:

If it's the case that:

"Hannity believes that Obama smokes" is T

It doesn't necessarily follow that:

"Hannity believes that Obama is a natural born citizen" is T.

*And vice versa.*

- So, in conclusion, our semantics accurately predicts that neither of the following sentences entails the other:

"Hannity believes that Obama smokes"

"Hannity believes that Obama is a natural born citizen".

### 3. Some Further Discussion

#### 3.1 The Changes to Our Semantic System, and a More Radical Alternative

Recall that the following combination of assumptions proved fatal for our (purely) extensional semantics:

##### (12) ‘Purely’ Extensional Semantics

- a. The interpretation function “[ ]” is a function from natural language expressions to their extensions (in the actual world).
- b. The extension of a complex phrase is (always) derived by computing the *extensions* (and *only* the extensions) of its component parts.

Interestingly, our augmented ‘intensional’ system doesn’t diverge *completely* from these two assumptions.

##### (13) The ‘Mixed’ System Developed Above

- a. The interpretation function “[ ]<sup>w</sup>” is a function from natural language expressions to their extensions (in the world *w*).
- b. The extension of a complex phrase (at a world *w*) is derived by computing *either* the extension *or* the intension of its component parts (*cf.* our rules ‘FA’ and ‘IFA’)

Thus, in the system developed above, our interpretation function still delivers *extensions*.

Moreover, a special rule (IFA) must apply in order for computation to ever yield the *intension* of a structure (otherwise, it will always compute only the *extension* of a structure).

***But, things could have been much different!...  
In fact, it’s possible to spell out a system that has the properties in (14).***

##### (14) ‘Purely’ Intensional Semantics

- a. The interpretation function “[ ]” is a function from natural language expressions to their *intensions*.
- b. The intension of a complex phrase is (always) derived by computing the *intensions* (and *only* the intensions) of its component parts.

Such a system is sketched out explicitly below...

(15) **A Purely ‘Intensional’ Fragment of English**

a. Lexical Entries

- (i)  $[[ \text{Obama} ]]$  =  $\lambda w. \text{Obama}$
- (ii)  $[[ \text{Hannity} ]]$  =  $\lambda w. \text{Hannity}$
- (iii)  $[[ \text{smoke} ]]$  =  $\lambda w. [ \lambda x_{\langle se \rangle} . x(w) \text{ smokes in } w ]$
- (iv)  $[[ \text{believes} ]]$  =  $\lambda w . [ \lambda p [ \lambda x_{\langle se \rangle} . \text{For all } w' \in \text{Beliefs}(x(w), w): p(w') = T ] ]$

b. Augmented Function Application (AFA)

If X is a structure consisting of two daughters – Y and Z – and if  $[[Y]]$  is a function of type  $\langle s \langle \sigma, \tau \rangle \rangle$  and  $[[Z]]$  is of type  $\sigma$ , then:

$$[[ X ]] = \lambda w. [[Y]](w)([[Z]])$$

As shown below, such a system will correctly derive the intension of the sentence “Obama smokes”.

(16) **Derivation in the Purely Intensional System**

- a.  $[[ \text{Obama smokes} ]]$  = (by AFA)
- b.  $\lambda w. [[ \text{smokes} ]](w)([[ \text{Obama} ]])$  = (by Lex.)
- c.  $\lambda w. [ \lambda w' [ \lambda x. x(w') \text{ smokes in } w' ] ](w)([[ \text{Obama} ]])$  = (by LC)
- d.  $\lambda w. [ \lambda x. x(w) \text{ smokes in } w ] ([[ \text{Obama} ]])$  = (by Lex.)
- e.  $\lambda w. [ \lambda x. x(w) \text{ smokes in } w ] ([ \lambda w'. \text{Obama} ])$  = (by LC)
- f.  $\lambda w. [ \lambda w'. \text{Obama} ](w) \text{ smokes in } w$  = (by LC)
- g.  $\lambda w. \text{Obama smokes in } w$

Furthermore, as shown below, the system above (particularly the rule in (15b)) is sufficient to derive the intension of the sentence “Hannity believes Obama smokes”...

(17) Derivation in the Purely Intensional System

- a.  $[[ \text{Hannity believes Obama smokes} ]]$  = (by AFA)
- b.  $\lambda w. [[\text{believes Obama smokes}]](w)([[\text{Hannity}]])$  = (by AFA)
- c.  $\lambda w. [ \lambda w' . [[\text{believes}]](w')([[\text{Obama smokes}]])(w)([[\text{Hannity}]])$  = (by (16))
- d.  $\lambda w. [ \lambda w' . [[\text{believes}]](w')( [ \lambda w'' . \text{Obama smokes in } w'' ] )(w)([[\text{Hannity}]])$   
= (by Lex.)
- e.  $\lambda w. [ \lambda w' . [ \lambda w''' [ \lambda p [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w'''), w''') : p(w'''' ) = T ] ] ] (w')$   
 $( [ \lambda w'' . \text{Obama smokes in } w'' ] )(w)([[\text{Hannity}]])$  = (by LC)
- f.  $\lambda w. [ \lambda w' . [ \lambda p [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w'), w') : p(w'''' ) = T ] ]$   
 $( [ \lambda w'' . \text{Obama smokes in } w'' ] ] )(w)([[\text{Hannity}]])$  = (by LC)
- g.  $\lambda w. [ \lambda w' . [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w'), w') :$   
 $[ \lambda w'' . \text{Obama smokes in } w'' ] (w'''' ) = T ] ] (w)([[\text{Hannity}]])$  = (by LC)
- h.  $\lambda w. [ \lambda w' . [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w'), w') :$   
 $\text{Obama smokes in } w'''' ] ] (w)([[\text{Hannity}]])$  = (by LC)
- i.  $\lambda w. [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w), w) : \text{Obama smokes in } w'''' ] ([[ \text{Hannity} ]])$   
= (by Lex.)
- j.  $\lambda w. [ \lambda x_{\langle se \rangle} . \text{For all } w'''' \in \text{Beliefs}(x(w), w) : \text{Obama smokes in } w'''' ] ([[ \lambda w' . \text{Hannity} ]])$   
= (by LC)
- k.  $\lambda w. \text{For all } w'''' \in \text{Beliefs}([ \lambda w' . \text{Hannity} ])(w, w) : \text{Obama smokes in } w''''$   
= (by LC)
- j.  $\lambda w. \text{For all } w'''' \in \text{Beliefs}([ \text{Hannity} ], w) : \text{Obama smokes in } w''''$   
= (by Variable Substitution)
- l.  **$\lambda w \text{ For all } w' \in \text{Beliefs}([ \text{Hannity} ], w) : \text{Obama smokes in } w'$**

**Observations:**

Our purely intensional system in (15) is able to compute the intension of the complex sentence “Hannity believes Obama smokes” by using *only* the compositional rule in (15b).

Our ‘mixed system’ would require the use of *both* regular ‘FA’ *and* the special rule of ‘IFA’.

*...so, in a certain sense, the purely intensional system in (15) may be ‘simpler’ or ‘more elegant’ than our mixed system!*

(18) **Using the Purely Intensional System to Derive Truth Conditions**

a. Question:  
Can the purely intensional semantics in (15) yield a theory of truth conditions?

b. Answer:  
Of course! If the function “[[ ]]” delivers the *intension* of a phrase, we simply use that function to derive statements like the following:

$$(i) \quad [[S]](w_0) = T \quad \text{iff} \quad X$$

For example, given the basic result in (16), it’s clear that our system derives:

$$(ii) \quad \begin{array}{l} [[\text{Obama smokes}]](w_0) = T \\ [\lambda w. \text{Obama smokes in } w](w_0) = T \\ \text{Obama smokes in } w_0 \end{array} \quad \begin{array}{l} \text{iff} \\ \text{iff} \end{array}$$

Thus, a purely *intensional* semantics is also able to derive (accurate) truth-conditional statements regarding the sentences of English.

...so, is there any reason **not** to adopt such a ‘purely intensional semantics?’....

**3.2 Some Evidence that Intensions are *Still* Not Enough**

(19) **Some Bad News**

Despite the successes of our intensional treatment of “believes”, it nevertheless faces certain serious empirical challenges....

*Even for two sentences S1 and S2 sharing the same intension, it is possible for “X believes S1” to be true while “X believes S2” is false.*

(20) **Illustrative Example**

a. Two Sentences Sharing the Same Intension

- (i)  $2 + 2 = 4$  (true in *all* possible worlds)
- (ii)  $14589 - 658 = 13931$  (true in *all* possible worlds)

b. Two Sentences With Different Truth Values

- (i) My daughter believes that  $2 + 2 = 4$  (True)
- (ii) My daughter believes that  $14589 - 658 = 13931$  (False)

(21) **Another Illustrative Example**

The problem in (20) doesn't just hold for sentences that are necessarily true/false. It also applies to *any* two sentences that are logically equivalent.

a. Two Sentences Sharing the Same Intension (Due to Logical Equivalence)

- (i) Muno is orange.
- (ii) Everything that is not orange has a property that Muno lacks.

b. Two Sentences With Different Truth Values

- (i) My daughter believes that Muno is orange. (True)
- (ii) My daughter believes that everything that is not orange has a property that Muno lacks. (False?)

(22) **One Conclusion (Not Necessarily Correct)**

The verb "believe" is *not* a relation between an entity and an *intension*.

*So what kind of a relation does the verb "believe" describe?...*

(23) **One Line of Thought ('Structured Intentions/Meanings')**

- a. Looking to the examples above, we notice that two different *formulas/sentences* can have the same intension.
- b. Intuitively, though, we obtain that intension in two separate ways for each of these sentences, *by combining different constituent intensions in different orders*.
- c. Let's suppose, then, that the object of belief is (in some sense) a kind of representation of the way we *obtain/compute* the intension. For purposes of discussion, let's call this kind of an object a 'structured intension (SI)':
  - (i)  $SI(\text{"Muno is orange"}) = \langle [\lambda w. x \text{ is orange in } w], [\lambda w. \text{Muno}] \rangle$   
*The intension of 'orange' applied to the intension of 'Muno'*
  - (ii)  $SI(\text{"Everything that is not orange has a property Muno lacks"}) = \langle [\lambda w. \lambda P. \lambda Q. \text{for all } x, \text{ if } P(x) \dots\dots] \rangle$   
*The intension of 'everything' applied to....*
- d. Consequently, two sentences with the same intension might nevertheless have two different 'structured intensions'.
- e. So, if we assume that "believe" is a relation between entities and *structured intensions*, we would accurately capture the possibility of (20b) and (21b).

This ‘structured intensions’ approach is (to my knowledge) the oldest and best-worked-out solution to the problems raised by (20) and (21) [it is particularly well-developed in the work of Max Cresswell...]

...Nevertheless, there are some imaginable alternatives...

(23) **Some Alternatives**

a. Impossible Worlds (Limited Solution to Problem (20))

Suppose we allow the existence of worlds where  $14589 - 658 \neq 13931$

After all, the fact that I don’t know the answer to ‘ $14589 - 658$ ’ off the top of my head (or get it wrong) means that I believe that  $w_0$  could be a *mathematically impossible* world where ‘ $14589 - 658$ ’ is some *other* number.

If we allow such worlds, then it’s no longer obvious that the two equations in (20a) have the same intension!

b. Ambiguity of ‘Believe’ (Limited Solution to Problem (21))

There is definitely a way of understanding (21bii) where it is *true*.

Under the true reading of (21bii), the verb “believes” receives the purely ‘logical’ reading our intensional semantics provides.

There is, though, also a way of understanding (21bii) where it is *false*.

Under the false reading of (21bii), the verb “believes” takes on a more ‘behavioral’ or ‘practical’ meaning, where it means something more like “would be disposed to assent to”.

Under this latter reading, “believes” is more like a relation between entities and *particular expressions of a given language*.

Though our semantics doesn’t capture this latter reading (indeed, it was an analysis we had initially *ruled out*), our intensional semantics *does* rightly capture one possible interpretation of the verb “believes”.