

# CHAPTER ONE

## BEGINNINGS OF INTENSIONAL SEMANTICS

*We introduce the idea of extension vs. intension and its main use: taking us from the actual here and now to past, future, possible, counterfactual situations. We develop a compositional framework for intensional semantics.*

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### 1.1 Displacement

Hockett [8, 9] in a famous article (and a follow-up) presented a list of DESIGN FEATURES OF HUMAN LANGUAGE. This list continues to play a role in current discussions of animal communication. One of the design features is DISPLACEMENT. Human language is not restricted to discourse about the *actual here and now*.

How does natural language untie us from the actual here and now? One degree of freedom is given by the ability to name entities and refer to them even if they are not where we are when we speak:

- (1) Thomas is in Hamburg.

HOCKETT, Charles F.: 1960. "The origin of speech." *Scientific American*, 203: 89–96

Plenty of web references at <http://www.google.com/search?q=hockett+design+features+displacement>.

This kind of displacement is not something we will explore here. We'll take it for granted.

Consider a sentence with no names of absent entities in it:

- (2) It is snowing (in Cambridge).

On its own, (2) makes a claim about what is happening right now here in Cambridge. But there are devices at our disposal that can be added to (2), resulting in claims about snow in displaced situations. Displacement can occur in the TEMPORAL dimension and/or in what might be called the MODAL\* dimension. Here's an example of temporal displacement:

- (3) At noon yesterday, it was snowing in Cambridge.

This sentence makes a claim not about snow now but about snow at noon yesterday, a different time from now.

Here's an example of modal displacement:

- (4) If the storm system hadn't been deflected by the jet stream, it would have been snowing in Cambridge.

This sentence makes a claim not about snow in the actual world but about snow in the world as it would have been if the storm system hadn't been deflected by the jet stream, a world distinct from the actual one (where the system did not hit us), a merely POSSIBLE WORLD.

Natural language abounds in modal constructions. (4) is a so-called COUNTERFACTUAL CONDITIONAL. Here are some other examples:

- (5) MODAL AUXILIARIES  
It may be snowing in Cambridge.
- (6) MODAL ADVERBS  
Possibly, it will snow in Cambridge tomorrow.
- (7) PROPOSITIONAL ATTITUDES  
Jens believes that it is snowing in Cambridge.
- (8) HABITUALS  
Jane smokes.
- (9) GENERICS  
Bears like honey.

The plan for this course is as follows. In Part 1, we explore modality and associated topics. In Part 2, we explore temporal matters.

In this chapter, we will put in place the basic framework of intensional semantics. To do this, we will start with one rather special example of modal displacement:

\*The terms MODAL and MODALITY descend from the Latin *modus*, "way", and are ancient terms pertaining to the way a proposition holds, necessarily, contingently, etc. More on the history of modal studies in a later draft.

See Kratzer [10, 11] for more examples of modal constructions.

(10) In the world of Sherlock Holmes, a detective lives at 221B Baker Street.

(10) doesn't claim that a detective lives at 221B Baker Street in the actual world (presumably a false claim), but that in the world as it is described in the Sherlock Holmes stories of Sir Arthur Conan Doyle, a detective lives at 221B Baker Street (a true claim, of course). We choose this example rather than one of the more run-of-the-mill displacement constructions because we want to focus on conceptual and technical matters before we do serious empirical work.

Check out <http://221bakerstreet.org/>.

The questions we want to answer are: How does natural language achieve this feat of modal displacement? How do we manage to make claims about other possible worlds? And why would we want to? Our task in the rest of this chapter is to put in place a framework for intensional semantics with which we can explore modal displacement.

## 1.2 An Intensional Semantics in 10 Easy Steps

### 1.2.1 Laying the Foundations

STEP 1: POSSIBLE WORLDS. Our first step is to introduce possible worlds. This is not the place to discuss the metaphysics of possible worlds in any depth. Instead, we will just start working with them and see what they can do for us. Basically, a possible world is a way that things might have been. In the actual world, there are two coffee mugs on my desk, but there could have been more or less. So, there is a possible world – albeit a rather bizarre one – where there are 17 coffee mugs on my desk. We join Heim & Kratzer in adducing this quote from David Lewis [15:1f.]:

The world we live in is a very inclusive thing. Every stick and every stone you have ever seen is part of it. And so are you and I. And so are the planet Earth, the solar system, the entire Milky Way, the remote galaxies we see through telescopes, and (if there are such things) all the bits of empty space between the stars and galaxies. There is nothing so far away from us as not to be part of our world. Anything at any distance at all is to be included. Likewise the world is inclusive in time. No long-gone ancient Romans, no long-gone pterodactyls, no long-gone primordial clouds of plasma are too far in the past, nor are the dead dark stars too far in the future, to be part of the same world. . . .

The way things are, at its most inclusive, means the way the entire world is. But things might have been different, in ever so many ways. This book of mine might have been finished on schedule. Or, had I not been such a commonsensical chap, I might be defending not only a plurality of possible worlds, but also a plurality of

impossible worlds, whereof you speak truly by contradicting yourself. Or I might not have existed at all – neither myself, nor any counterparts of me. Or there might never have been any people. Or the physical constants might have had somewhat different values, incompatible with the emergence of life. Or there might have been altogether different laws of nature; and instead of electrons and quarks, there might have been alien particles, without charge or mass or spin but with alien physical properties that nothing in this world shares. There are ever so many ways that a world might be: and one of these many ways is the way that this world is.

Previously, our “metaphysical inventory” included a domain of entities and a set of two truth-values and increasingly complex functions between entities, truth-values, and functions thereof. Now, we will add possible worlds to the inventory. Let’s assume we are given a set  $W$ , the set of all possible worlds, which is a vast space since there are so many ways that things might have been different from the way they are. Each world has as among its parts entities like you and me and these coffee mugs. Some of them may not exist in other possible worlds. So, strictly speaking each possible world has its own, possibly distinctive, domain of entities. What we will use in our system, however, will be the grand union of all these world-specific domains of entities. We will use  $D$  to stand for the set of all possible individuals.

Among the many possible worlds that there are – according to Lewis, there is a veritable plenitude of them – is the world as it is described in the Sherlock Holmes stories by Sir Arthur Conan Doyle. In that world, there is a famous detective Sherlock Holmes, who lives at 221B Baker Street in London and has a trusted sidekick named Dr. Watson. Our sentence *In the world of Sherlock Holmes, a detective lives at 221B Baker Street* displaces the claim that a famous detective lives at 221B Baker Street from the actual world to the world as described in the Sherlock Holmes stories. In other words, the following holds:<sup>1</sup>

- (II) The sentence *In the world of Sherlock Holmes, a detective lives at 221B Baker Street* is true in a world  $w$  iff the sentence *a detective lives at 221B Baker Street* is true in the world as it is described in the Sherlock Holmes stories.

What this suggests is that we need to make space in our system for having devices that control in what world a claim is evaluated. This is what we will do now.

STEP 2: THE EVALUATION WORLD PARAMETER. Recall from  $H\acute{e}K$  that we were working with a semantic interpretation function that was relativized to an assign-

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<sup>1</sup> We will see in Section 1.3.2 that this is not quite right. It’ll do for now.

ment function  $g$ , which was needed to take care of pronouns, traces, variables, etc. From now, on we will relativize the semantic values in our system to possible worlds as well. What this means is that from now on our interpretation function will have two superscripts: a world  $w$  and an assignment  $g$ :  $\llbracket \cdot \rrbracket^{w,g}$ .

So, a sentence like the one embedded in (10) will have its truth-conditions described as follows:

- (I2)  $\llbracket \text{a famous detective lives at 221B Baker Street} \rrbracket^{w,g} = 1$   
iff a famous detective lives at 221B Baker Street in world  $w$ .

It is customary to refer to the world for which we are calculating the extension of a given expression as the EVALUATION WORLD. In the absence of any shifting devices, we would normally evaluate a sentence in the actual world. But then there are shifting devices such as our *in the world of Sherlock Holmes*. We will soon see how they work. But first some more pedestrian steps: adding lexical entries and composition principles that are formulated relative to a possible world. This will allow us to derive the truth-conditions as stated in (I2) in a compositional manner.

STEP 3: LEXICAL ENTRIES. Among our lexical items, we can distinguish between items which have a world-dependent semantic value and those that are world-independent. Predicates are typically world-dependent. Here are some sample entries.

- (I3) For any  $w \in W$  and any assignment function  $g$ :
- a.  $\llbracket \text{famous} \rrbracket^{w,g} = \lambda x \in D. x \text{ is famous in } w.$
  - b.  $\llbracket \text{detective} \rrbracket^{w,g} = \lambda x \in D. x \text{ is a detective in } w.$
  - c.  $\llbracket \text{lives-at} \rrbracket^{w,g} = \lambda x \in D. \lambda y \in D. y \text{ lives-at } x \text{ in } w.$

The set of detectives will obviously differ from world to world, and so will the set of famous individuals and the set of pairs where the first element lives at the second element.

Other items have semantic values which do not differ from world to world. The most important such items are certain “logical” expressions, such as truth-functional connectives and determiners:

- (I4)
- a.  $\llbracket \text{and} \rrbracket^{w,g} = \lambda u \in D_t. \lambda v \in D_t. u = v = 1.$
  - b.  $\llbracket \text{the} \rrbracket^{w,g} = \lambda f \in D_{\langle e,t \rangle} : \exists ! x. f(x) = 1. \text{ the } y \text{ such that } f(y) = 1.$
  - c.  $\llbracket \text{every} \rrbracket^{w,g} = \lambda f \in D_{\langle e,t \rangle}. \lambda g \in D_{\langle e,t \rangle}. \forall x \in D : f(x) = 1 \rightarrow g(x) = 1.$
  - d.  $\llbracket \text{a/some} \rrbracket^{w,g} = \lambda f \in D_{\langle e,t \rangle}. \lambda g \in D_{\langle e,t \rangle}. \exists x \in D : f(x) = 1 \ \& \ g(x) = 1.$

Note that there is no occurrence of  $w$  on the right-hand side of the entries in (I4). That's the tell-tale sign of the world-independence of the semantics of these items.

We will also assume that proper names have world-independent semantic values, that is, they refer to the same individual in any possible world.

- (I5) a.  $\llbracket \text{Noam Chomsky} \rrbracket^{w,g} = \text{Noam Chomsky}.$   
 b.  $\llbracket \text{Sherlock Holmes} \rrbracket^{w,g} = \text{Sherlock Holmes}.$   
 c.  $\llbracket \text{221B Baker Street} \rrbracket^{w,g} = \text{221B Baker Street}.$

STEP 4: COMPOSITION PRINCIPLES. The old rules of Functional Application, Predicate Modification, and  $\lambda$ -Abstraction can be retained almost intact. We just need to modify and add world-superscripts to the interpretation function. For example:

- (I6) FUNCTIONAL APPLICATION (FA)  
 If  $\alpha$  is a branching node and  $\{\beta, \gamma\}$  the set of its daughters, then, for any world  $w$  and assignment  $g$ : if  $\llbracket \beta \rrbracket^{w,g}$  is a function whose domain contains  $\llbracket \gamma \rrbracket^{w,g}$ , then  $\llbracket \alpha \rrbracket^{w,g} = \llbracket \beta \rrbracket^{w,g}(\llbracket \gamma \rrbracket^{w,g})$ .

The rule simply passes the world parameter down.

STEP 5: TRUTH. Lastly, we will want to connect our semantic system to the notion of the TRUTH OF AN UTTERANCE. This is done by the following principle:

- (I7) TRUTH OF AN UTTERANCE  
 An utterance of a sentence  $\phi$  in a possible world  $w$  is true iff  $\llbracket \phi \rrbracket^{w,\emptyset} = 1$ .<sup>2</sup>

EXERCISE 1.1: Compute under what conditions an utterance in possible world  $w_7$  (which may or may not be the one we are all living in) of the sentence *a famous detective lives at 221B Baker Street* is true. [Since this is the first exercise of the semester, please do this in excruciating detail, not skipping any steps.]  $\square$

### 1.2.2 Intensional Operators

So far we have merely redecorated our old system inherited from last semester. We have introduced possible worlds into our inventory, our lexical entries and our old composition principles. But with the tools we have now, all we can do so far is to keep track of the world in which we evaluate the semantic value of an expression, complex or lexical. We will get real mileage once we introduce INTENSIONAL OPERATORS which are capable of shifting the world parameter. We

<sup>2</sup> Recall from Heim & Kratzer that the empty assignment function  $\emptyset$  is one that is undefined for any variable index. So, this notion of truth of an utterance presupposes that there are no free variables in  $\phi$  to be taken care of. The alternative is to make reference to an assignment function salient in the context of the utterance.

introduced a number of devices for modal displacement. As advertised, for now, we will just focus on a very particular one: the expression *in the world of Sherlock Holmes*. We will assume, as seems reasonable, that this expression is a sentence-modifier both syntactically and semantically.

STEP 6: A SYNCATEGOREMATIC ENTRY. We begin with a heuristic step. We want to derive something like the following truth-conditions for our sentence:

- (18)  $\llbracket$ in the world of Sherlock Holmes,  
a famous detective lives at 221B Baker Street $\rrbracket^{w,g} = 1$   
iff the world  $w'$  as it is described in the Sherlock Holmes stories is such  
that there exists a famous detective in  $w'$  who lives at 221B Baker Street  
in  $w'$ .

We would get this if in general we have this rule for *in the world of Sherlock Holmes*:

- (19) For any sentence  $\phi$ , any world  $w$ , and any assignment  $g$ :  
 $\llbracket$ in the world of Sherlock Holmes  $\phi$  $\rrbracket^{w,g} = 1$   
iff the world  $w'$  as it is described in the Sherlock Holmes stories is such  
that  $\llbracket \phi \rrbracket^{w',g} = 1$ .

This is a so-called SYNCATEGOREMATIC entry. What this means is that in (19) we do not compute the meaning for *in the world of Sherlock Holmes*,  $\phi$  from the combination of the meanings of its parts, since *in the world of Sherlock Holmes* is not given a separate meaning, but in effect triggers a special composition principle. This format is very common in modal logic systems which usually give a semantics for two modal operators (the necessity operator  $\Box$  and the possibility operator  $\Diamond$ ). When one only has a few closed class expressions to deal with that may shift the world parameter, employing syncategorematic entries is a reasonable strategy. But we are facing a multitude of displacement devices. So, we will need to make our system more modular.

So, we want to give *in the world of Sherlock Holmes* its own meaning and combine that meaning with that of its sister by a general composition principle. The Fregean slogan we adopted says that all composition is function application (modulo the need for  $\lambda$ -abstraction and the possible need for predicate modification). So, what we will want to do is to make (18) be the result of functional application. But we can immediately see that it cannot be the result of our usual rule of functional application, since that would feed to *in the world of Sherlock Holmes* the semantic value of *a famous detective lives in 221B Baker Street* in  $w$ , which would be a particular truth-value, 1 if a famous detective lives at 221B Baker Street in  $w$  and 0 if there doesn't. And whatever the semantics of *in the world of Sherlock Holmes* is, it is certainly *not* a truth-functional operator.

The diamond  $\Diamond$  symbol for possibility is due to CI Lewis, first introduced in Lewis & Langford 1932, but he made no use of a symbol for the dual combination  $\neg\Diamond\neg$ . The dual symbol  $\Box$  was later devised by F. B. Fitch and first appeared in print in 1946 in a paper of R. Barcan. See footnote 425 of Hughes and Cresswell 1968. Another notation one finds is L for necessity and M for possibility, the latter from the German *möglich* 'possible'.

So, we need to feed something else to *in the world of Sherlock Holmes*. At the same time, we want the operator to be able to shift the evaluation world of its argument. Can we do this?

STEP 7: INTENSIONS. Guess what? We already have what we need. Our system actually provides us with two kinds of meanings. For any expression  $\alpha$ , we have  $\llbracket \alpha \rrbracket^{w,g}$ , the semantic value of  $\alpha$  in  $w$ , also known as the EXTENSION of  $\alpha$  in  $w$ . But we can also calculate  $\lambda w. \llbracket \alpha \rrbracket^{w,g}$ , the function that assigns to any world  $w$  the extension of  $\alpha$  in that world. This is usually called the INTENSION of  $\alpha$ . We will sometimes use an abbreviatory notation<sup>3</sup> for the intension of  $\alpha$ :

$$(20) \quad \llbracket \alpha \rrbracket_{\mathfrak{t}}^g := \lambda w. \llbracket \alpha \rrbracket^{w,g}.$$

It should be immediately obvious that since the definition of intension abstracts over the evaluation world, intensions are not world-dependent.<sup>4,5</sup>

Before we say more about intensions, here's a sketch of how they are going to help us solve our puzzle. We will feed the intension of the embedded sentence to the shifting operator. The crucial part is that the intension can be applied to any world and give the truth-value of the sentence in that world. The operator will use that intension and apply it to the world it wants the evaluation to happen in. Voilà.

Note that strictly speaking, it now makes no sense anymore to speak of “*the* semantic value” of an expression  $\alpha$ . What we have is a semantic system that allows us to calculate extensions (for a given possible world  $w$ ) as well as intensions for all (interpretable) expressions. We will see that when  $\alpha$  occurs in a particular bigger tree, it will always be determinate which of the two “semantic values” of  $\alpha$  is the one that enters into the compositional semantics. So, that one – whichever one it is, the extension or the intension of  $\alpha$  – might then be called “*the* semantic value of  $\alpha$  in the tree  $\beta$ ”.

It should be noted that the terminology of EXTENSION vs. INTENSION is time-honored but that the possible worlds interpretation thereof is more recent. The technical notion we are using is certainly less rich a notion of meaning than tradition assumed.

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<sup>3</sup> The notation with the subscripted cent-sign comes from Montague Grammar. See e.g. Dowty et al. [5:147].

<sup>4</sup> Since intensions are by definition not dependent on the choice of a particular world, it makes no sense to put a world-superscript on the intension-brackets. So don't ever write “ $\llbracket \dots \rrbracket_{\mathfrak{t}}^{w,g}$ ”; we'll treat that as undefined nonsense.

<sup>5</sup> The definition here is simplified, in that it glosses over the fact that some expressions, in particular those that contain PRESUPPOSITION TRIGGERS, may fail to have an extension in certain worlds. In such a case, the intension has no extension to map such a world to. Therefore, the intension will have to be a partial function. So, the official, more “pedantic”, definition will have to be as follows:  $\llbracket \alpha \rrbracket_{\mathfrak{t}}^g := \lambda w : \alpha \in \text{dom}(\llbracket \cdot \rrbracket^{w,g}). \llbracket \alpha \rrbracket^{w,g}$ .

STEP 8: SEMANTIC TYPES. If we want to be able to feed the intensions to lexical items like *in the world of Sherlock Holmes*, we need to have the appropriate types in our system.

Recall that  $W$  is the set of all possible worlds. And recall that  $D$  is the set of all POSSIBLE INDIVIDUALS and thus contains all individuals existing in the actual world *plus* all individuals existing in any of the merely possible worlds.

We now expand the set of semantic types, to add intensions. Intensions are functions from possible worlds to all kinds of extensions. So, basically we want to add for any kind of extension we have in our system, a corresponding kind of intension, a function from possible worlds to that kind of extension. We do this as follows:

(21) SEMANTIC DOMAINS

- a.  $D_e = D$ , the set of all possible individuals
- b.  $D_t = \{0, 1\}$ , the set of truth-values
- c. If  $a$  and  $b$  are semantic types, then  $D_{\langle a, b \rangle}$  is the set of all functions from  $D_a$  to  $D_b$ .
- d. If  $a$  is a type, then  $D_{\langle s, a \rangle}$  is the set of all functions from  $W$  to  $D_a$ .

The functions of the schematics type  $\langle s, \dots \rangle$  are intensions. Note a curious feature of this set-up: there is no type  $s$  and no associated domain. This corresponds to the assumption that there are no expressions of English that take as their extension a possible world, that is, there are no pronouns or names referring to possible worlds. We will actually question this assumption in a later chapter. For now, we will stay with this more conventional set-up.

Here are some examples of intensions:

- The intensions of sentences are of type  $\langle s, t \rangle$ , functions from possible worlds to truth values. These are usually called PROPOSITIONS. Note that if the function is total, then we can see the sentence as picking out a set of possible worlds, those in which the sentence is true. More often than not, however, propositions will be partial functions from worlds to truth-values, which fail to map certain possible worlds into either truth-value. This will be the case when the sentence contains a presupposition trigger, such as *the*. The famous sentence *The King of France is bald* has an intension that is undefined for any world where there fails to be a unique King of France.
- The intensions of one-place predicates are of type  $\langle s, \langle e, t \rangle \rangle$ , functions from worlds to set of individuals. These are usually called PROPERTIES.
- The intensions of expressions of type  $e$  are of type  $\langle s, e \rangle$ , functions from worlds to individuals. These are usually called INDIVIDUAL CONCEPTS.

STEP 9: A LEXICAL ENTRY FOR A SHIFTER. We are ready to formulate the semantic entry for *in the world of Sherlock Holmes*:<sup>6</sup>

- (22)  $\llbracket \text{in the world of Sherlock Holmes} \rrbracket^{w,g} =$   
 $\lambda p_{\langle s,t \rangle}. \text{ the world } w' \text{ as it is described in the Sherlock Holmes stories}$   
 $\text{is such that } p(w') = \mathbf{1}.$

Now, *in the world of Sherlock Holmes* expects as its argument a function of type  $\langle s, t \rangle$ , a proposition. It yields the truth-value  $\mathbf{1}$  iff the proposition is true in the world as it is described in the Sherlock Holmes stories.

All that's left to do now is to provide *in the world of Sherlock Holmes* with a proposition as its argument. This is the job of a new composition principle.

STEP 10: INTENSIONAL FUNCTIONAL APPLICATION. We add the new rule of Intensional Functional Application.

- (23) INTENSIONAL FUNCTIONAL APPLICATION (IFA)  
 If  $\alpha$  is a branching node and  $\{\beta, \gamma\}$  the set of its daughters, then, for any world  $w$  and assignment  $g$ : if  $\llbracket \beta \rrbracket^{w,g}$  is a function whose domain contains  $\llbracket \gamma \rrbracket_{\mathcal{C}}^g$ , then  $\llbracket \alpha \rrbracket^{w,g} = \llbracket \beta \rrbracket^{w,g}(\llbracket \gamma \rrbracket_{\mathcal{C}}^g)$ .

This is the crucial move. It makes space for expressions that want to take the intension of their sister as their argument and do stuff to it. Now, everything is in place. Given (22), the semantic argument of *in the world of Sherlock Holmes* will not be a truth-value but a proposition. And thus, *in the world of Sherlock Holmes* will be able to check the truth-value of its complement in various possible worlds. To see in practice that we have all we need, please do the following exercise.

EXERCISE 1.2: Calculate the conditions under which an utterance in a given possible world  $w_7$  of the sentence *in the world of the Sherlock Holmes stories, a famous detective lives at 221B Baker Street* is true.  $\square$

## 1.3 Comments and Complications

### 1.3.1 Intensions All the Way?

We have seen that to adequately deal with expressions like *in the world of Sherlock Holmes*, we need an intensional semantics, one that gives us access to the extensions of expressions across the multitude of possible worlds. At the same time, we have kept the semantics for items like *and*, *every*, and *a* unchanged and extensional. This is not the only way one can set up an intensional semantics. The following exercise demonstrates this.

<sup>6</sup> This is not yet the final semantics, see Section 1.3 for complications.

EXERCISE 1.3: Consider the following “intensional” meaning for *and*:

$$(24) \quad \llbracket \text{and} \rrbracket^{w,g} = \lambda p_{\langle s,t \rangle} . \lambda q_{\langle s,t \rangle} . p(w) = q(w) = \mathbf{1}.$$

With this semantics, *and* would operate on the intensions of the two conjoined sentences. In any possible world  $w$ , the complex sentence will be true iff the component propositions are both true of that world.

Compute the truth-conditions of the sentence *In the world of Sherlock Holmes, Holmes is quick and Watson is slow* both with the extensional meaning for *and* given earlier and the intensional meaning given here. Is there any difference in the results?  $\square$ .

There are then at least two ways one could develop an intensional system.

- (i) We could “generalize to the worst case” and make the semantics deliver intensions as *the* semantic value of an expression. Such systems are common in the literature, see Cresswell [4], Lewis [12].
- (ii) We could maintain much of the extensional semantics we have developed so far and extend it conservatively so as to account for non-extensional contexts.

We have chosen to pursue (ii) over (i), because it allows us to keep the semantics of extensional expressions simpler. The philosophy we follow is that we will only move to the intensional sub-machinery when triggered by an expression that creates a non-extensional context. As the exercise just showed, this is more a matter of taste than a deep scientific decision.

For a course in semantics that goes intensional from the beginning but otherwise is very much in the same neighborhood as ours, see Arnim von Stechow’s lecture notes on semantics at <http://vivaldi.sfs.nphil.uni-tuebingen.de/~arnim10/Lehre/index.html> – in German.

### 1.3.2 Why Talk about Other Worlds?

Why would natural language bother having such elaborate mechanisms to talk about other possible worlds? While having devices for spatial and temporal displacement (talking about Hamburg or what happened yesterday) seems eminently reasonable, talking about worlds other than the actual world seems only suitable for poets and the like. So, why?

The solution to this puzzle lies in a fact that our current semantics of the shifter *in the world of Sherlock Holmes* does not yet accurately capture: modal sentences have empirical content, they make CONTINGENT claims, claims that are true or false depending on the circumstances in the actual world.

Our example sentence *In the world of Sherlock Holmes, a famous detective lives at 221 Baker Street* is true in this world but it could easily have been false. There is no reason why Sir Arthur Conan Doyle could not have decided to locate Holmes’ abode on Abbey Road.

To see that our semantics does not yet capture this fact, notice that in the semantics we gave for *in the world of Sherlock Holmes*:

- (25)  $\llbracket \text{in the world of Sherlock Holmes} \rrbracket^{w,g} =$   
 $\lambda p_{\langle s,t \rangle}. \text{the world } w' \text{ as it is described in the Sherlock Holmes stories}$   
 $\text{is such that } p(w') = 1.$

there is no occurrence of  $w$  on the right hand side. This means that the truth-conditions for sentences with this shifter are world-independent. In other words, they are predicted to make non-contingent claims that are either true whatever or false whatever. This needs to be fixed.

The fix is obvious: what matters to the truth of our sentence is the content of the Sherlock Holmes stories as they are in the evaluation world. So, we need the following semantics for our shifter:

- (26)  $\llbracket \text{in the world of Sherlock Holmes} \rrbracket^{w,g} =$   
 $\lambda p_{\langle s,t \rangle}. \text{the world } w' \text{ as it is described in the Sherlock Holmes stories}$   
 $\text{in } w \text{ is such that } p(w') = 1.$

We see now that sentences with this shifter do make a claim about the evaluation world: namely, that the Sherlock Holmes stories as they are in the evaluation world describe a world in which such-and-such is true. So, what is happening is that although it appears at first as if modal statements concern other possible worlds and thus couldn't really be very informative, they actually only talk about certain possible worlds, those that stand in some relation to what is going on at the ground level in the actual world. As a crude analogy, consider:

- (27) My grandmother is sick.

At one level this is a claim about my grandmother. But it is also a claim about me: namely that I have a grandmother who is sick. Thus it is with modal statements. They talk about possible worlds that stand in a certain relation to the actual world and thus they make claims about the actual world, albeit slightly indirectly.

### 1.3.3 The Worlds of Sherlock Holmes

So far, we have played along with colloquial usage in talking of *the* world of Sherlock Holmes. But it is important to realize that this is sloppy talk. Lewis [13] writes:

[I]t will not do to follow ordinary language to the extent of supposing that we can somehow single out a single one of the worlds [as the one described by the stories]. Is the world of Sherlock Holmes a world where Holmes has an even or an odd number of hairs on his head at the moment when he first meets Watson? What is Inspector Lestrade's blood type? It is absurd to suppose that these questions about the world of Sherlock Holmes have answers. The best expla-

nation of that is that the worlds of Sherlock Holmes are plural, and the questions have different answers at different ones.

The usual move at this point is to talk about the set of worlds “COMPATIBLE WITH the (content of) Sherlock Holmes stories in  $w$ ”. We imagine that we ask of each possible world whether what is going on in it is compatible with the stories as they were written in our world. Worlds where Holmes lives on Abbey Road are not compatible. Some worlds where he lives at 221B Baker Street are compatible (again not all, because in some such worlds he is not a famous detective but an obscure violinist). Among the worlds compatible with the stories are ones where he has an even number of hairs on his head at the moment when he first meets Watson and there are others where he has an odd number of hairs at that moment.

What the operator *in the world of Sherlock Holmes* expresses is that its complement is true throughout the worlds compatible with the stories. In other words, the operator *universally quantifies* over the compatible worlds. Our next iteration of the semantics for the operator is therefore this:

$$(28) \quad \llbracket \text{in the world of Sherlock Holmes} \rrbracket^{w,g} = \\ \lambda p_{\langle s,t \rangle}. \forall w' \text{ compatible with the Sherlock Holmes stories in } w: \\ p(w') = \mathbf{1}.$$

This is where we will leave things. There is more to be said about fiction operators like *in the world of Sherlock Holmes*, but we will just refer to you to the relevant literature. In particular, one might want to make sense of Lewis’ idea that a special treatment is needed for cases where the sentence makes a claim about things that are left open by the fiction (no truth-value, perhaps?). One also needs to figure out how to deal with cases where the fiction is internally inconsistent. In any case, we’re done with this kind of operator.

In the following chapters, we will apply what we have learned here to attitude predicates, modals, and conditionals.

## Supplemental Readings

There is considerable overlap between this chapter and Chapter 12 of Heim & Kratzer’s textbook:

HEIM, Irene & KRATZER, Angelika: 1998. *Semantics in Generative Grammar*. Blackwell.

Here, we approach intensional semantics from a different angle. It would probably be beneficial if you read H & K’s Chapter 12 in addition to this chapter and if you did the exercises in there.

Come to think of it, some other ancillary reading is also recommended. You may want to look at relevant chapters in other textbooks:

DOWTY, David, WALL, Robert, & PETERS, Stanley: 1981. *Introduction to Montague Semantics*. Kluwer. [Chapters 5 & 6].

GAMUT, L. T. F.: 1991. *Logic, Language, and Meaning*. Chicago University Press. [Volume II: Intensional Logic and Logical Grammar].

CHIERCHIA, Gennaro & MCCONNELL-GINET, Sally: 2000. *Meaning and Grammar: An Introduction to Semantics (2<sup>nd</sup> Edition)*. MIT Press. [Chapter 5: Intensionality].

An encyclopedia article by Perry on possible worlds semantics:

PERRY, John R.: 1998. "Semantics, possible worlds." In E. Craig (Editor) *Routledge Encyclopedia of Philosophy*. London: Routledge. URL <http://www.rep.routledge.com/article/U039>. Preprint <http://www-csli.stanford.edu/~john/PHILPAPERS/possfld.pdf>.

An influential philosophical works on the metaphysics and uses of possible worlds:

KRIPKE, Saul: 1980. *Naming and Necessity*. Blackwell.

LEWIS, David: 1986. *On the Plurality of Worlds*. Oxford: Blackwell.

An interesting paper on the origins of the modern possible worlds semantics for modal logic:

COPELAND, B. Jack: 2002. "The Genesis of Possible Worlds Semantics." *Journal of Philosophical Logic*, 31(2): 99–137. doi:10.1023/A:1015273407895.

A personal history of formal semantics:

PARTEE, Barbara H.: 2003. "Reflections of a Formal Semanticist." In *Compositionality in Formal Semantics: Selected Papers*. Blackwell. URL <http://www.blackwellpublishing.com/book.asp?ref=1405109343>.

A must read for students who plan to go on to becoming specialists in semantics, together with a handbook article putting it in perspective:

MONTAGUE, Richard: 1973. "The Proper Treatment of Quantification in Ordinary English." In Jaako Hintikka, Julius Moravcsik, & Patrick Suppes (Editors) *Approaches to Natural Language*, pages 221–242. Reidel. Reprinted in Portner & Partee [20], pp. 17–34.

PARTEE, Barbara H. & HENDRIKS, Herman L.W.: 1997. "Montague Grammar." In Johan van Benthem & Alice ter Meulen (Editors) *Handbook of Logic and Language*, pages 5–91. Amsterdam: Elsevier.

Finally, to learn more about discourse about fiction, read Lewis:

LEWIS, David: 1978. "Truth in Fiction." *American Philosophical Quarterly*, 15: 37–46. Reprinted with postscripts in Lewis [14], pp. 261–280.

A recent reconsideration:

BONOMI, Andrea & ZUCCHI, Sandro: 2003. "A Pragmatic Framework for Truth in Fiction." *Dialectica*, 57(2): 103–120. Preprint <http://filosofia.dipafilo.unimi.it/~zucchi/NuoviFile/Bonomipdf.zip>.

Last year, there was an entry on my blog with comments from readers about indeterminacies in fiction.

Inconsistencies in fictions and elsewhere are discussed in:

VARZI, Achille: 1997. "Inconsistency without Contradiction." *Notre Dame Journal of Formal Logic*, 38(4): 621–638. Preprint [http://www.columbia.edu/~av72/papers/Ndjfl\\_1997.pdf](http://www.columbia.edu/~av72/papers/Ndjfl_1997.pdf).

LEWIS, David: 1982. "Logic for Equivocators." *Noûs*, 16: 431–441. Reprinted in ? : pp. 97–110].