Chapter 3: Ludlow’s Theory

Ludlow (1999) argues for a direct connection between scientific semantics and metaphysics of time. He claims that the role of a semantic theory is to represent the semantic knowledge of an individual speaker, and that inasmuch as the semantic knowledge of that speaker is connected to metaphysical reality (which, for him, is much indeed, as we shall see), the semantic theory must be formulated in a tensed metalanguage.

Ludlow, a presentist, builds his theory around two related concerns: (1) to develop a semantics that accounts for the differences between indexical and non-indexical temporal expressions that the new B-theorists allege are “extra-semantic” differences; and (2) to develop an A-theory metaphysics of time that avoids McTaggart’s paradox.

Before attempting (1) and (2), Ludlow makes several auxiliary arguments which serve to establish the direct relationship between semantics and metaphysics. First, he argues, following Kant, that the answers to some, if not all, metaphysical questions, can be found in answers to questions about the nature of human thought. He then argues that thought is inherently linguistic in nature, so that it is inquiry into the nature of language which will shed light on metaphysical questions. If Ludlow’s arguments are sound, then answers to metaphysical questions like that of the relative ontological priority of the A-series and the B-series in a metaphysical account of time can be found in answers to questions about the structure and meaning of the temporal expressions of natural language.

The Kantian Approach and the “Language of Thought”

Let’s look at the first of Ludlow’s auxiliary arguments, namely, the argument for a Kantian-style connection between thought and metaphysics. I will simply present Ludlow’s account of the connection, setting aside the question whether it is actually compatible with Kant’s philosophy. Ludlow claims that, in general, the nature of reality cannot be discovered without some investigation into the nature of thought:

We can never know things as they are “in themselves,” since the mind is actively involved in organizing our experience. The best we can do is elucidate the categories or structure of reason. For example, according to Kant, time was not itself a property of things in themselves; rather, it was imposed upon our experience by the mind. Of course, from this perspective, it would be futile to begin an investigation into the nature of time apart from a consideration of the nature
of thought or reason. And indeed, after an investigation into the nature of time as a category of human reason had taken place, there would be little left to do in the way of metaphysics, save perhaps to dot the i’s and cross the t’s. (p. 4)

Ludlow’s second auxiliary argument is an attempt to establish the proposal that “thought is inherently linguistic in nature” and “thus...the proper starting place for [metaphysical] investigation should be the language in which we think” (p. 4). But what exactly is the language of thought, and how is it related to the languages we speak?

Following Chomsky (1986), Ludlow makes the following distinction: I-language (or ‘internal’ language) is “an internal computational system that is part of our biological endowment” (p. 19) which we “have co-opted for communication and for other purposes” (p. 17), and an E-language (or ‘external’ language) is one of the social objects we refer to when we talk about English, Spanish, Mandarin, etc. Ludlow argues that since proper boundaries between distinct E-languages and between distinct E-idioms are impossible to establish (he notes that it would be impossible both to determine where, e.g., Spanish begins and Italian ends or to determine where someone’s idiom ends and where meaningless noises—e.g., coughs and sneezes—begin), E-languages cannot be individuated as “natural objects,” and thus all talk of language must be replaced with talk of the internal computational system that explains our linguistic competence (§1.1).

Ludlow then suggests that although the standard view is that language is primarily for communication, given that I-language is a biological endowment like any other, any claims about its purpose are subject to the same controversy that surrounds the “doctrine” of teleological explanation in evolutionary theory. So even if we discover all the details about some function of language, we still can’t know for sure what its other or original purposes are (§1.2). This lays the groundwork for the possibility that one of the functions, maybe the primary function, of language is to serve as the mechanism of thought. Ludlow believes this is the case, but admits that he hasn’t provided “knock-down evidence,” and claims that whether it is the case or not, the rest of his argument will remain essentially unaffected (p. 26)\(^1\).

**Ludlow’s Resolution of McTaggart’s Paradox**

In simultaneous pursuit of goals (1) and (2) above, Ludlow reformulates the apparently contradictory proposition of McTaggart’s paradox as a (natural language) conjunction of natural language utterances. Since, for

\(^1\)This is disputable and will be investigated later.
Ludlow, the structure and meaning of natural language utterances directly reflects the nature of so-called
metaphysical reality, he should be able to find answers about the metaphysical paradox in a semantic analysis
of the sentence:

X is past and X is present and X is future.

Taking X to be some event, e.g. Queen Anne’s death:

Queen Anne’s death is past and Queen Anne’s death is present and Queen Anne’s death is future.

McTaggart noted that this is problematic because the properties past, present, and future are incompatible,
but Queen Anne’s death (like every other event) seems to have them all. Pointing out that Queen Anne’s
death has these properties at different times won’t do, McTaggart’s argument goes, because such a move
presupposes time and launches an infinite regress. But Ludlow claims he can avoid the regress, first, by
denying the existence of past and future times, and second, by rendering all tensed sentences true or false in
virtue of present facts alone, without reference to past or future times—so a claim like "Queen Anne’s death
was present" is a general claim about the present state of the world, verifiable or falsifiable by examination
of the current state of affairs alone. For this reason, according to Ludlow, reformulating the sentence as
follows fails to launch an infinite regress because the newly introduced past tenses refer not to past times
but only to the present state of affairs:

Queen Anne’s death is past and Queen Anne’s death was present and Queen Anne’s death was
future.

According to Ludlow, “Queen Anne’s death is past” will be evaluated by looking to see, e.g., whether Queen
Anne’s body is in a graveyard somewhere, “Queen Anne’s death was present” by looking to see, e.g., whether
there is some general truth about every dead person’s having undergone death, and “Queen Anne’s death
was future” by looking to see, e.g., whether there is some general truth about the finiteness of death events.

While some A-theorists have been satisfied to stop at this point in the analysis (e.g., Prior), Ludlow isn’t
satisfied that this move alone establishes the compatibility of the three states of affairs (what’s the difference
between, for example, “Queen Anne’s death was present” and “Queen Anne’s death was future”?). Something
else appears to be necessary to establish the fact that Queen Anne’s death was present at a different time
than it was future, only without reference to times. To this end, Ludlow develops a syntax according
to which which each natural language utterance is accompanied by an implicit (unpronounced) "temporal adjunct clause," introduced by ‘when,’ which, according to his semantics, serves to nonreferentially describe the circumstances of its truth:

Queen Anne’s death is past [when I am writing this] and Queen Anne’s death was present [when Queen Anne’s heart stopped beating] and Queen Anne’s death was future [when Queen Anne was born].

Crucially, such clauses are general claims about the world (claims like "properties x, y and z are satisfied" and unlike "time t has properties x, y and z") which denote, rather than refer\(^2\). In other words, they are more like definite descriptions—complexes of properties which are uniquely satisfied—than directly referring expressions. According to Ludlow’s semantics, the truth conditions for each of the simply tensed sentences are sufficiently distinct to establish the compatibility of the three conjuncts as a result of the differing contents of the metalanguage when-clauses. Crucially, “‘when’ cannot mean ‘at the same time’; it must be taken as a kind of primitive... [it] must be understood as being more fundamental than the B-series conception of simultaneity” (p. 112).

“Queen Anne’s death is past [when I am writing this]” is true iff Queen Anne’s death is past when I am writing this.

“Queen Anne’s death was present [when Queen Anne’s heart stopped beating]” is true iff Queen Anne’s death was present when Queen Anne’s heart stopped beating.

“Queen Anne’s death was future [when Queen Anne was born]” is true iff Queen Anne’s death was future when Queen Anne was born.

Thus the truth conditions for the whole sentence would be the following according to Ludlow’s theory:

“Queen Anne’s death is past [when I am writing this] and Queen Anne’s death was present [when Queen Anne’s heart stopped beating] and Queen Anne’s death was future [when Queen Anne was born]” is true iff Queen Anne’s death is past when I am writing this and Queen Anne’s death was present when Queen Anne’s heart stopped beating and Queen Anne’s death was future when Queen Anne was born.

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\(^2\)Ludlow emphasizes these two distinctions in establishing the non-referentiality of temporal adjunct clauses (pp. 112-114):

**Singular vs. general propositions.** Singular propositions are propositions about some particular object, e.g., “Bill is tall.” General propositions aren’t about anything in particular, but are rather general claims about the world, e.g., “No one lives forever.” Ludlow’s temporal adjunct clauses are supposed to be general propositions (or proposition-like objects).

**Reference vs. denotation.** In cases of genuine reference, expressions refer directly to individuals: “Fred,” “Jane.” Denoting expressions instead uniquely determine their referents via description: “the the man who walked into the room,” “the king of France.” Denoting expressions may refer to a collection of properties that the some entity uniquely satisfies. Ludlow’s temporal adjunct clauses are supposed to be denoting and not referring expressions.
was born] is true iff Queen Anne’s death is past when I am writing this and Queen Anne’s death was present when Queen Anne’s heart stopped beating and Queen Anne’s death was future when Queen Anne was born.

According to Ludlow then, the differing contents of the hidden temporal adjunct clauses perform the differentiating function that reference to specific times did in the response McTaggart anticipated, but without reference to past or future times. Whether this resolves the contradiction and escapes the paradox, however, depends both on the soundness of his auxiliary arguments and the consistency and plausibility of his syntax and semantics.

A Foundational Fragment

Before getting into the more technical details of Ludlow’s theory, it will help us to be familiar with Ludlow’s particular style of syntactic and semantic axiomatization. Let’s introduce, in that style, the syntax and semantics for a very basic fragment of English to which we can later add, and do an example derivation.

Syntax

\[
S \rightarrow S1 \text{ and } S2 \\
S \rightarrow S1 \text{ or } S2 \\
S \rightarrow \text{ it is not the case that } S1 \\
S \rightarrow \text{ NP VP} \\
\text{ NP } \rightarrow \text{ Dick, Sally} \\
\text{ VP } \rightarrow \text{ leaps, walks}
\]

Semantics

\[
\text{Val}(x, \text{“Dick”})^3 \text{ iff } x = \text{ Dick} \\
\text{Val}(x, \text{“Sally”}) \text{ iff } x = \text{ Sally} \\
\text{Val}(x, \text{“leaps”}) \text{ iff } x \text{ leaps} \\
\text{Val}(x, \text{“walks”}) \text{ iff } x \text{ walks}
\]

\[
\text{Val(True, } [S \text{ NP VP}]) \text{ iff, for some } x, \text{ Val}(x, \text{ NP}) \text{ and Val}(x, \text{ VP})
\]

\[^3\text{Val}(x, y)\text{ means “the semantic value of } y \text{ is } x.”\]
Val($x, [\alpha, \beta])$ iff Val($x, \beta$), where $\alpha$ ranges over categories and $\beta$ ranges over categories and lexical items

Val(True, [$S$ S1 and S2]) iff Val(True, S1) and Val(True, S2)

Val(True, [$S$ S1 or S2]) iff Val(True, S1) or Val(True, S2)

Val(True, [$S$ it is not the case that S1]) iff it is not the case that Val(True, S1)

**Example derivation**

“Dick walks and it is not the case that Sally leaps.”

1. “Dick walks and it is not the case that Sally leaps” is true iff Val(True, [$S$ [NP Dick] [VP walks]] and Val(True, [S2 it is not the case that [NP Sally] [VP leaps]])
2. ... iff for some $x$, Val($x$, [NP Dick]) and Val($x$, [VP walks]) and it is not the case that Val(True, [S2 [NP Sally] [VP leaps]])
3. ... iff for some $x$, Val($x$, “Dick”) and Val($x$, “walks”) and it is not the case that for some $y$, Val($y$, [NP Sally]) and Val($y$, [VP leaps])
4. ... iff for some $x$, $x = $ Dick and $x$ walks and it is not the case that for some $y$, Val($y$, “Sally”) and Val($y$, “leaps”)
5. ... iff Dick walks and it is not the case that for some $y$, $y = $ Sally and $y$ leaps
6. ... iff Dick walks and it is not the case that Sally leaps

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<table>
<thead>
<tr>
<th>(\alpha)</th>
<th>(\beta)</th>
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<tbody>
<tr>
<td>Dick walks</td>
<td>it is not the case that Sally leaps</td>
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<td>(\alpha)</td>
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| \(\beta\)

---

4To do a derivation we technically also need two “production rules” (p 35):
(1)
\[
\cdots \alpha \cdots \\
\alpha \text{ iff } \beta \\
\cdots \beta \cdots 
\]
(2)
\[
\Phi \text{ iff for some } x, x = \alpha \text{ and } \cdots x \\
\Phi \text{ iff } \cdots x
\]
The Syntax and Semantics of Temporal Adjunct Clauses

Ludlow’s proposal involves a significant modification to the structure of the typical sentence: according to his theory, there are no single-clause sentences—every sentence comes either with an explicit or an implicit temporal adjunct clause, introduced by a primitive temporal connective like ‘when’ (he later expands his account to include two more primitive temporal connectives; I will discuss this shortly). Ludlow observes that explicit temporal adjunct clauses are always tensed ("I got home before it started raining") and that their tense is always "coordinated with the tense of the matrix clause" (not "I got home before it will start raining"), and then hypothesizes that implicit temporal adjunct clauses follow precisely the same rules as explicit ones—in other words, Ludlow’s “tense system merely recapitulates the structures made available by the system of explicit temporal conjunctions, and inherits the constraints on that system” (p. 124).

For example, a sentence with an explicit temporal adjunct clauses might be given the following structure:\footnote{Ludlow presents his theory with ternary branching trees, but mentions that it can be converted to a system of exclusive binary branching if necessary:}

![Diagram](image-url)

The same sentence with the temporal adjunct clause instead implicit would be given precisely the same structure, but with the added information that the content of that clause is unpronounced.
The basic semantics for Ludlow’s temporal adjunct clauses is simple, first because tense is preserved by the semantic evaluation function \( \text{Val}(x, y) \), and second because the temporal connective is supposed to be primitive and unanalyzable:

\[
\text{Val}(\text{True, “Queen Anne’s death was future when Queen Anne was born”}) \iff \text{Val}(\text{True, “Queen Anne’s death was future”}) \quad \text{when} \quad \text{Val}(\text{True, “Queen Anne was born”})
\]

\[
\text{Val}(\text{True, “Queen Anne’s death was future”}) \iff \text{“Queen Anne’s death be [tenseless] future” was true}
\]

This unanalyzability is extremely crucial to Ludlow’s proposal. ‘When’ can’t mean anything like ‘at the same time’ or ‘overlapping in a temporal series’ or else Ludlow’s argument would be subject to McTaggart’s objection that this attempted escape from the paradox presupposes time and launches an infinite regress. Ludlow thus essentially treats ‘when’ as having no meaning at all outside of its function.\(^6\)

**E-type Temporal Anaphora**

Also crucial to Ludlow’s proposal is the nonreferentiality of his temporal adjunct clauses. Motivated by, in addition to something unsatisfactory about his first step toward resolving McTaggart’s paradox, what he perceives as a need to account for apparent inadequacies in a simple quantifier account of tense, Ludlow acknowledges the need for some kind of temporal anaphora. Believing this need to be one of the most serious challenges that a presentist semantics faces (temporal anaphora generally requires reference to at least past, if not both past and future, events), he then attempts to apply the paradigm of E-type (nonreferential) anaphora from work on pronouns.

In the E-type approach to pronominal anaphora, a pronoun, rather than referring directly to the referent of the noun with which it is coindexed, is treated as "standing proxy for" a definite description. The E-type approach was developed in response to so-called "donkey sentences," the meanings of which appear impossible to give under a traditional coreference account of pronouns. Take the original donkey sentence, for example:

> Every man who owns a donkey beats it.

\(^6\)It is an open question whether the function of ‘when,’ especially its role in the resolution of McTaggart’s paradox, can even be established without giving it some meaning first. Defining ‘when’ based on its function alone (‘when’ := a primitive connective which, when used to conjoin two clauses, e.g., \( A \text{ when } B \), serves to modify the meaning of the first just sufficiently to temporally distinguish it from the meaning of that same clause were it conjoined with a different clause, e.g., \( A \text{ when } C \)) seems to be begging the question.
Taking "every man" as a universally quantified noun phrase and "a donkey" as an existentially quantified one, we get the following logical form:

$$\forall x \exists y [(x \text{ is a man} \& y \text{ is a donkey} \& x \text{ owns } y) \rightarrow x \text{ beats } y]$$

But the meaning of this is something like 'for every man there is some object y which satisfies the conditional if y is a donkey and x owns y then the man beats y'. If there is an object in the world which is neither a donkey nor owned by the man, then it will satisfy the conditional. This clearly doesn’t capture the intended meaning of the sentence.

The solution proposed by Evans (1977), called the E-type approach, is to treat "a donkey" above not as an existential quantifier but rather as a definite description in disguise. The logical form of the donkey sentence above would on this treatment be something like the following:

$$\forall x [(x \text{ is a man} \& x \text{ owns a donkey}) \rightarrow x \text{ beats the donkey he owns}]$$

From a philosophical perspective, the logical form of the E-type anaphoric pronoun is basically that of a Russellian definite description. In other words, its meaning is not the individual to which it eventually refers, but rather a set of properties which the intended individual uniquely satisfies. Thus "the donkey he owns" refers not to the donkey, but to the set of properties being-a-donkey and being-owned-by-the-man. If a given individual satisfies these properties, then it becomes the referent of the E-type anaphoric pronoun.

Ludlow attempts to adopt this general framework for contexts in which temporal anaphora appears to be necessary. Take an example from Partee (1986), uttered by someone halfway down the turnpike on their way to work:

I didn’t turn off the stove.

On a typical tense-as-existential-quantifier approach where both the tense and the negation are taken as operators that can have scope over one another, the sentence has two interpretations, depending on which one takes wider scope. If the past tense takes scope over the negation, the sentence means something like There is a time in the past at which I did not turn off the stove. This sentence is true in almost all circumstances—no one spends their entire life turning off a stove—but “I didn’t turn off the stove” seems to be informative under only certain circumstances, e.g., while the utterer is halfway down the turnpike driving
to work. If the negation takes scope over the past tense, the sentence means instead something like *It is not the case that at some time in the past I turned off the stove.* But most if not all people who can use this sentence informatively have turned off the stove at least once in their lives. Again, the quantifier approach gives this sentence too general a meaning.

Partee’s solution is to replace the existential quantification over past times with a mechanism for picking out a specific reference time from context or previous discourse (the reference time in this case would be the relevant moment or interval before the utterer left his or her home and started driving to work). Ludlow follows Partee in adopting anaphora as the solution to this problem, but in order to make it consistent with his presentist metaphysics, adds the stipulation that all temporal anaphora must be E-type—that is, general, descriptive, and nonreferential. Ludlow doesn’t offer any details about the logical structure of his temporal adjunct clauses, but assuming the mechanism to be the same as or similar to that of E-type pronominal anaphora, the meaning of a clause like “when Queen Anne was born” appears to be the set of properties that are uniquely satisfied by some aspect of the current state of affairs pertaining specifically to the truth of the tensed matrix clause.

**Before and After and Complex Tenses**

According to Ludlow’s theory, hidden when-clauses account for the meanings of simply tensed sentences like "I didn’t turn off the stove." But what about sentences with so-called complex tenses, like "I had left the house [when it started raining]" or "She will have left [by the time I get there]"? Ludlow discusses Reichenbach’s (1947) proposal at length, and notes that the proposal has been adopted by "legions of linguists in various traditions" (p. 78), but rejects it because it inescapably involves reference to past and future times. Ludlow instead introduces two more "primitive and unanalyzable" temporal connectives: *before* and *after*. In complexly-tensed sentences, he claims, the temporal adjunct clauses are not when-clauses, but before- and after-clauses:

---

7 To account for complex tenses like past perfect and future perfect, the Reichenbach incorporated a context-supplied reference time, R (using Reichenbach’s notation, S = speech time, E = event time). The following formulation is Ludlow’s (§5.1) but captures Reichenbach’s proposal adequately:

Present: Val(True, “Fred is hungry”, S, R, E) iff S=R and E overlaps with S/R and Fred is hungry at E  
Simple past: Val(True, “Fred was hungry”, S, R, E) iff R=E and R/E is before S and Fred is hungry at R/E  
Present perfect: Val(True, “Fred has been hungry”, S, R, E) iff S=R and E is before S/R and Fred is hungry at E  
Future: Val(True, “Fred will be hungry”, S, R, E) iff R=E and R/E is after S and Fred is hungry at R/E  
Past perfect: Val(True, “Fred had been hungry”, S, R, E) iff E is before R and R is before S and Fred is hungry at E  
Future perfect: Val(True, “Fred will have been hungry”, S, R, E) iff E is after R and R is after S and Fred is hungry at E

---
"I had left the house [when it started raining]."

```
S
  _____
 |     |
 S   before   S
  |   |   |
 NP  VP   NP  VP
   |   |   |   |
 I   left the house I   it started raining
```

"She will have left [by the time I get there]."

```
S
  _____
 |     |
 S   before   S
  |   |   |
 NP  VP   NP  VP
   |   |   |   |
 I   will leave I   I   will get there
```

The Full Theory

ILFs & Tense

Ludlow’s next step is to add tense to the existing syntax and semantics. Ludlow proposes that tenses are “semantic predicates” which take untensed proposition-like objects as their arguments:

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8Complex tenses requiring the use of the temporal connective after, like so-called future-in-future or future-in-past, arguably don’t appear grammatically in English, but would look something like the following if they did:

“I was (going to be) leaving town the next day when she called.”

```
S
  _____
 |     |
 S   after   S
  |   |   |
 NP  VP   NP  VP
   |   |   |   |
 I   left town I   she called
```
He proposes that the appropriate proposition-like objects are interpreted logical forms (ILFs), which he developed extensively in Larson & Ludlow (1993) and discussion of which he also attributes to Higginbotham (1986 & 1991), Segal (1989), and Larson & Segal (1995). According to Ludlow, ILFs are syntactic trees with, instead of a syntactic category label at each node, an ordered pair of that syntactic category label and its semantic value. Each node represents the entire sub-tree which it dominates; thus the syntactic category in the ordered pair is the category of that sub-tree, and the semantic value is the semantic value of the entire sub-tree:\(^9\):

\[
\text{<S, True>}
\]

\[
\text{<NP, Jane> } \quad \text{<VP, Jane>}
\]

\[
\text{<"Jane", Jane> } \quad \text{<"arrives", Jane>}
\]

For reasons detailed in Larson & Ludlow (1993) and also in chapter 3 of Ludlow (1999), tensed ILFs are most useful for dealing with problems arising in intensional contexts. But untensed ILFs play a crucial role in Ludlow’s presentist semantics: they serve as the arguments of tense predicates, as follows (where $||S|| =$ the ILF of S):

**New semantics:**

Val($x$, PAST) iff $x$ was true

Val($x$, PRES) iff $x$ is true

Val($x$, FUT) iff $x$ will be true

Val(True, $\left[\text{T}, \text{TP, TNS S} \right]$) iff, for some $x$, Val($x$, TNS) and $x=||S||$

**New syntax:**

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\(^9\) Ludlow argues that the value of a predicate expressed by a verb phrase (“arrives,” “walks,” “leaps”) depends on its sentential context. “Predicates do not refer to their extentions; rather, their senses specify rules of classification which are applied to the referent of the subject expression” (p 46). Thus, in this context, the semantic value of “arrives” is not the set of all arriving things, but rather Jane herself.
TP → TNS TP
TNS → PAST, PRES, FUT
S → TP when/before/after TP

Example derivation:

“Sally leapt [when Dick walked].”

\[
\begin{array}{c}
\text{S} \\
\text{TP} \quad \text{when} \quad \text{TP} \\
\text{TNS} \quad \text{S} \\
| \\
\text{PAST} \quad \text{Sally leap} \\
\| \\
\text{TNS} \quad \text{S} \\
| \\
\text{PAST} \quad \text{Dick walk}
\end{array}
\]

1. Val(True, “Sally leapt [when Dick walked]”) iff Val(True, \([\text{TP} [\text{TNS PAST}] [\text{s Sally leap}]]) when Val(True, \([\text{TP} [\text{TNS PAST}] [\text{s Dick walk}]])

2. ... iff, for some \(x\), Val(\(x\), PAST) and \(x = [\text{Sally leap}] \) when, for some \(y\), Val(\(y\), PAST) and \(y = [\text{Dick walk}] \)

3. ... iff \([\text{Sally leap}] \) was true when \([\text{Dick walk}] \) was true

The Full Theory\(^{10}\)

Syntax

\[
\begin{align*}
\text{S} & \rightarrow \text{S}1 \text{ and } \text{S}2 \\
\text{S} & \rightarrow \text{S}1 \text{ or } \text{S}2 \\
\text{S} & \rightarrow \text{it is not the case that } \text{S}1 \\
\text{S} & \rightarrow \text{TP when/before/after } \text{TP}
\end{align*}
\]

\(^{10}\)I’m leaving out Ludlow’s syntax and semantics for prepositional phrases, temporal adverbs, and aspect because they are only significant inasmuch as they demonstrate that Ludlow’s theory is capable of handling these phenomena. It appears to be, but that’s irrelevant for present purposes.
TP → TNS TP
TP → NP VP
TNS → PAST, PRES, FUT
NP → Dick, Sally
VP → leaps, walks

**Semantics**

Val(x, “Dick”) iff x = Dick
Val(x, “Sally”) iff x = Sally
Val(x, “leaps”) iff x leaps
Val(x, “walks”) iff x walks

Val(True, [S S1 and S2]) iff Val(True, S1) and Val(True, S2)
Val(True, [S S1 or S2]) iff Val(True, S1) or Val(True, S2)
Val(True, [S it is not the case that S1]) iff it is not the case that Val(True, S1)
Val(True, [S TP1 when TP2]) iff Val(True, TP1) when Val(True, TP2)
Val(True, [S TP1 before TP2]) iff Val(True, TP1) before Val(True, TP2)
Val(True, [S TP1 after TP2]) iff Val(True, TP1) after Val(True, TP2)
Val(True, [TP1 TNS TP2]) iff, for some x, Val(x, TNS) and x = ||TP2||
Val(True, [TP NP VP]) iff, for some x, Val(x, NP) and Val(x, VP)
Val(x, [α β]) iff Val(x, β), where α ranges over categories and β ranges over categories and lexical items

**Formal Analysis of McTaggart’s Paradox**

“Queen Anne’s death is past [when I am writing this] and Queen Anne’s death was present [when Queen
Anne’s heart stopped beating] and Queen Anne’s death was future [when Queen Anne was born].”

---

11 This is the rule Ludlow presents in the appendix; elsewhere it is implied to be TP → TNS S. I’m not sure which version is the “right” one.
Conclusion

If Ludlow’s syntax and semantics for temporal expressions are plausible and consistent, he has indeed shown that the sentence from which the contradiction giving rise to McTaggart’s paradox was derived is, in fact, not self-contradictory. If his auxiliary arguments (that there is a direct connection between thought and metaphysical reality and that I-language is the language of thought) are sound, and the sentence is a direct reflection of metaphysical reality, then the demonstration is in fact a resolution of the paradox-generating contradiction. If the rest of Ludlow’s metaphysical position is consistent, the resolution provides an escape from McTaggart’s paradox.
But the escape is contingent upon affirmative answers to at least all of the following questions:

- Is Ludlow’s version of the Kantian connection between thought and reality plausible and consistent?
- Is thought “inherently linguistic in nature”? If so, is I-language the language of thought?
- Are Ludlow’s syntax and semantics for temporal expressions internally consistent and empirically adequate?
- Is presentism consistent?
- Is a semantic theory meant to be a direct representation of the semantic knowledge of an individual speaker?

As we will see, there is some reason to doubt the possibility of affirmative answers to all of these questions. In order to assess the plausibility of Ludlow’s attempt to appeal directly to semantics in his argument for presentism (and all other attempts to directly involve semantics in the dispute over the metaphysics of time), it will be necessary to address some foundational questions about the nature and function of semantic theories in science and philosophy and about the relationship between science and metaphysics in general.