RECAPTURING THE EPISTEMIC DIMENSION OF LOGIC

1. THE TWO DIMENSIONS Historically, the subject matter logic has had both an epistemological, or *epistemic*, and an ontological, or *ontic*, dimension. From the time of Aristotle until the mid-nineteenth century, the focus was primarily epistemic. Logic was concerned with arguments, deductions, and proofs. Following the work of Boole and Frege, logic took an ontic turn. This is perhaps most obvious in the case of Boole, who showed little interest in deductive derivations. Frege, in contrast, did have epistemic concerns. He developed the modern style of deductive system, and regarded his deductions as models of rigor, in which fallacious appeals to intuition would have no place. But Frege was concerned to reason carefully and correctly, not to study reasoning. For Frege, logic is no more a study of knowledge and how we get it than physics is a study of these things.

Perhaps Frege's conception of logic was influenced by his aversion to the psychologism that he saw in Kant's account of mathematics, especially arithmetic. In order to defend the universality of mathematics, or, anyway, arithmetic, and show that its truths would hold in any world whatever, Frege took up the project of showing that arithmetic belongs to a logic whose truths have this character. The project of logic as he understood it was to develop a perspicuous language for describing reality, a language in which grammatical categories reflect ontological ones, and to establish logical laws that have the form of statements about reality.

The ontological dimension of logic is a legitimate object of logical investigation. It was an important advance when logic was reconceived to incorporate ontology. But this advance need not, and should not, lead us to abandon the epistemic dimension of logic. *Illocutionary logic* provides the resources to accommodate both the ontic and the epistemic dimensions of logic, and I want to extol some of the virtues of illocutionary logic.

2. THE LOGIC OF SPEECH ACTS Illocutionary logic as a distinct subject matter was invented, and pioneered, by John Searle and Daniel Vanderveken. However, their understanding of the field is somewhat different from my own, and there is not much overlap between the topics they investigate and the results that I have obtained. I will explain illocutionary logic from my own perspective.

Illocutionary logic is the logic of speech acts, or *language acts*. These are meaningful acts performed with expressions. There are a great variety of language acts. I shall focus on *sentential acts*, which are performed with an entire sentence. Some sentential acts are true or false, and I call these *statements*. This is a special, stipulated use for the word 'statement,' because the word is often used as a near synonym for 'assertion.' On my conception, language acts are the primary bearers of such semantic features as meaning and truth; expressions have syntactic features and can be regarded as syntactic objects.

Some sentential acts are performed with a certain illocutionary force, and constitute *illocutionary acts*. Examples are promises, warnings, assertions, declarations, and requests. Statements themselves can be used to perform a variety of illocutionary acts.

We now understand a logical theory to have three components: (1) a specialized or formal language, (2) a semantic account for this language, and (3) a deductive system for codifying some logically distinguished items in the language. A system of illocutionary logic is obtained from a standard system by making three changes:

(i) Illocutionary-force indicating expressions, *illocutionary operators*, are added to the formal language.

(ii) The semantic account of truth-conditions is supplemented with an account of the *rational commitments* generated by performing illocutionary acts. Asserting this or denying that will commit a person to make further assertions and denials.

(iii) The deductive system is modified to accommodate illocutionary operators.

3. A SIMPLE SYSTEM I will illustrate a simple system of propositional illocutionary logic. The language *L* contains atomic sentences and compound sentences obtained from them by using these connectives: *~, v, &*. (The horseshoe is a defined symbol.) The atomic and compound sentences are *plain sentences of L*. The plain sentences represent natural-language statements.

The illocutionary operators are the following:

⊢ –the sign of assertion	⊣ –the sign of denial
⌞ –the sign of supposing true	¬ –the sign of supposing false

A plain sentence prefixed with an illocutionary operator is a *completed sentence of L*; there are no other completed sentences. Completed sentences represent illocutionary acts.

The language *L* contains two kinds of logical operators. The logical operators in plain sentences are the connectives, which represent things we actually say in making statements. These things we say belong to the statements that we make. But the illocutionary operators don't represent things we say. They represent things we *do* with statements. We may sometimes use expressions to make explicit just what we are doing with a statement, as when we say "suppose." But we generally don't say "I assert" in making an assertion, and we often don't say "suppose" when we are supposing something.

An assertion is understood to be an act of producing and coming to accept a statement as representing what is the case, or an act of producing and reaffirming one's (continued) acceptance of statement. (An assertion in this sense doesn't need an audience, and all such assertions are sincere.) A denial is an act of coming to reject a statement (for being false), or an act reflecting one's rejection of the statement. Supposing a statement *A* to be true or false is not a subjunctive or counterfactual consideration of how things *would be if A were true*. Instead we consider how things *are*, if in addition to what we know or believe, *A* is also true. Once made, a supposition remains in force until it is discharged (canceled) or simply abandoned. An argument which begins with assertions and denials can reach a conclusion which is an assertion or denial. But we cannot correctly begin with at least one supposition, and conclude with an assertion or denial. The conclusion must have the force of a supposition, and will be called a supposition.

The semantic account for the language *L* has two tiers, or levels. The first tier presents the ontology encoded by the language, giving truth conditions of plain sentences and the statements that these represent. An interpreting function assigns truth and falsity to the atomic plain sentences, and determines a *truth-value valuation* of all the plain sentences.

The second tier of the semantic account is epistemic, and deals with *rational commitment*. This is a commitment to perform or not perform some act, or to continue in some state or condition like that of accepting a statement. Commitments generated by performing acts of assertion, denial, or supposition are conditional rather than absolute. A person who accepts a statement will be committed to accept (or to reaffirm her continued acceptance of) some further statement, but only if the matter comes up and she chooses to think about it, and only so long as she continues to accept the first statement.

The second semantic level depends on the first, for the language user must understand the truth conditions of the statements she asserts, denies, or supposes. Since a commitment to perform or not perform an act is always *someone's* commitment, we develop the commitment semantics for an idealized person, the *designated subject*. We consider the designated subject at some particular moment. There are certain statements which she has thought about and accepted, which she remembers and continues to accept. There are similar statements that she has considered and rejected. These *explicit* beliefs and disbeliefs commit her to accept further statements and to reject further statements. We use '+' for the value of assertions and denials that she is committed, at that moment, to perform.

A *commitment valuation* assigns this value to some of the assertions and denials in *L*. A commitment valuation *V* is *based on* an interpreting function *f* if, and only if (from now on: iff) (i) If $V(\vdash A) = +$, then $f(A) = \mathrm{T}$, and (ii) If $V(\dashv A) = +$, then $f(A) = \mathrm{F}$. A commitment valuation is *coherent* iff it is based on an interpreting function.

A coherent commitment valuation V_0 can be understood to register the designated subject's explicit beliefs and disbeliefs at a given time. The *commitment valuation determined by* V_0 is the function *V* such that (i) $V(\vdash A) = +$ iff *A* is true for every interpreting function on which V_0 is based, and (ii) $V(\dashv A) = +$ iff *A* is false for every interpreting function on which V_0 is based. *V* indicates the assertions and denials which the designated subject is committed to perform by her explicit beliefs and disbeliefs. An *acceptable* commitment valuation is one determined by a coherent commitment valuation. Acceptable valuations have these matrices (the letter '*b*' stands for *blank*–for those positions in which no value is assigned):

⊢*A*	⊢*B*	⊣*A*	⊣*B*	⊢*~A*	⊣*~A*	⊢*[A & B]*	⊣*[A & B]*	⊢*[A v B]*	⊣*[A v B]*
+	+	*b*	*b*	*b*	+	+	*b*	+	*b*
+	*b*	*b*	*b*	*b*	+	*b*	*b*	+	*b*
+	*b*	*b*	+	*b*	+	*b*	+	+	*b*
b	+	*b*	*b*	*b*	*b*	*b*	*b*	+	*b*
b	*b*	*b*	*b*	*b*	*b*	*b*	+,*b*	+,*b*	*b*
b	*b*	*b*	+	*b*	*b*	*b*	+	*b*	*b*
b	+	+	*b*	+	*b*	*b*	+	+	*b*
b	*b*	+	*b*	+	*b*	*b*	+	*b*	*b*
b	*b*	+	+	+	*b*	*b*	+	*b*	+

The first row shows the commitments of accepting/asserting both *A, B*, the second shows the commitments of accepting *A* and neither accepting nor rejecting *B*. Etc. In some cases, the values (or non-values) of assertions and denials of simple sentences are not sufficient to determine the values of assertions and denials of compound sentences. For example, if ⊣*A* and ⊣*B* have no value, and *A, B* are irrelevant to one another, then '⊣*[A & B]*' should have no value. But if ⊣*A,* ⊣*~A* have no value, the completed sentence '⊣*[A & ~A]*' will have value +.

4. SEMANTIC CONCEPTS The language *L* and the two tiers of the semantic account for *L* provide the conceptual resources to understand, explain, and explore many logic-related phenomena. For example, it is common to attempt to distinguish inductive from deductive arguments by considerations relating to truth and probability. But these are first-tier concepts. To properly distinguish deductive from inductive arguments, we must employ second-tier concepts. What characterizes deductive arguments, or correct deductive arguments, is that they are based on rational commitment. In contrast, performing the premiss acts of an inductively satisfactory argument won't commit the arguer to performing the conclusion act, the premiss acts only *authorize* him, to a greater or lesser degree, to perform the conclusion act.

The truth conditions of a statement determine what the world must be like for the statement to be true. In standard logic, many concepts are defined in terms of truth conditions. For example, a set *X* of plain sentences of *L (truth-conditionally) implies* a plain sentence *A* iff there is no interpreting function of *L* for which every sentence in *X* has value T, while *A* has value F.

An illocutionary counterpart of implication links completed sentences of *L* and the illocutionary acts that these represent. Instead of speaking of *illocutionary implying*, I prefer to speak of *logical requiring*. In order to define this concept, some preliminary definitions are required.

Let V_0 be a coherent commitment valuation of *L*, let *V* be the commitment valuation determined by V_0, and let *A* be a completed sentence of *L* that is either an assertion or denial. Then V_0 *satisfies A* iff *V(A)* = +.

Suppositions are not assigned values by commitment valuations. But supposing certain statements will commit a person to supposing others. In supposing a statement either true or false, we consider truth values to determine what further statements we are committed to suppose.

Let *f* be an interpreting function of *L*, and let *A, B* be plain sentences of *L*. Then (i) *f satisfies ⌞A* iff *f(A)* = T, and (ii) *f satisfies ¬B* iff *f(B)* = F.

Let *f* be an interpreting function of *L* and *V* be a commitment valuation of *L* based on *f*. Then < *f, V* > is a *coherent pair for L*.

Let < *f, V* > be a coherent pair (for *L*), and let *A* be a completed sentence of *L*. Then < *f, V* > *satisfies A* iff either (i) *A* is an assertion or denial and *V* satisfies *A*, or (ii) *A* is a supposition and *f* satisfies *A*.

Let *X* be a set of completed sentences of *L* and let *A* be a completed sentence of *L*. Then *X logically requires A* iff (i) *A* is an assertion or denial and there is no coherent commitment valuation which satisfies the assertions and denials in *X* but does not satisfy *B*, or (ii) *B* is a supposition and there is no coherent pair for *L* which satisfies every sentence in *X*, but fails to satisfy *A*. If a set *X* of completed sentences logically requires a further completed sentence, then anyone performing the acts represented by the sentences in the set is committed to perform the act represented by the further sentence.

It is necessary to have two clauses in the definitions of illocutionary implication, because if *B* is an assertion or denial, its value is independent of the values assigned to suppositions. For example, consider these completed sentences:

⌞A, ¬A, ⊦B; ⊦[B & A]

There is no coherent pair which satisfies *⌞A, ¬A, ⊦B* and fails to satisfy '*⊦[B & A]*,' because there is no coherent pair which satisfies *⌞A, ¬A, ⊦B*. However, the first three sentences do not logically require '*⊦[B & A]*,' for suppositions make no "demands" on assertions and denials. Incoherent suppositions logically require that we suppose true and suppose false every plain sentence, but they do not require that we assert or deny anything.

5. REASONING The natural deduction system *S* uses tree proofs. Steps in a proof are completed sentences, and the rules take account of both truth conditions and illocutionary force. An initial step in a tree proof is an assertion, a denial, a positive supposition, or a negative supposition. An initial assertion or denial is not a hypothesis of the proof. Instead, an initial assertion or denial should express knowledge or justified (dis)belief of the arguer. Not every asserted sentence is

eligible to be an initial assertion in a proof constructed by a given person. In contrast, any supposition can be an initial supposition. Initial suppositions are hypotheses of the proof.

The rules of inference for conjunction are *elementary:*

& Introduction *& Elimination*

```
⊢/⌞A    ⊢/⌞B          ⊢/⌞[A & B]        ⊢/⌞[A & B]
----------------      -------------     -------------
⊢/⌞[A & B]              ⊢/⌞A               ⊢/⌞B
```

The expression '⊢/⌞' indicates that the illustration holds both for assertions and positive suppositions. For each rule, the conclusion is an assertion only if all premisses are assertions. If at least one premiss is a supposition, then the conclusion must be a supposition.

The following arguments are incorrect:

```
⌞A    ⌞B          ⊢A    ⌞B
------------      ------------
⊢[A & B]          ⊢[A & B]
```

even though they are truth-preserving, for a supposition as premiss will not support a conclusion which is an assertion. These arguments are correct:

```
⊢A    ⊢B          ⊢A    ⌞B          ⌞A    ⌞B
------------      ------------      ------------
⊢[A & B]          ⌞[A & B]          ⌞[A & B]
```

Elementary rules move directly from assertions, denials, or suppositions as premisses to an assertion, denial, or supposition as conclusion. Non-elementary rules include at least one premiss which is a subproof, and cancel, or discharge, a hypothesis of the subproof. The rule ⊃ *Introduction* is a non-elementary rule:

```
     {⌞A}

      ⌞B
  --------------
 ⊢/⌞[A ⊃ B]
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The premiss of this rule is an entire subproof with '⌞*A*' as a hypothesis, and '⌞*B*' as conclusion. Following a use of this rule, the hypothesis '⌞*A*' is canceled. The conclusion is an assertion if the subproof contains only one uncanceled hypothesis, '⌞*A*.' If the subproof contains additional hypotheses, the conclusion is a (positive) supposition.

Given sentences *A, B*, the following is an example of a simple argument in the deductive system *S*:

```
          x
⌞A      ⌞B
------------ &I
⌞[A & B]
----------- &E
    ⌞A
------------ ⊃I, cancel '⌞B'
⌞[B ⊃ A]
```

An '*x*' is placed above canceled hypotheses. This argument shows that the premiss '⌞*A*' logically requires the conclusion '⌞*[B ⊃ A]*.'

Since illocutionary logic is concerned with epistemology, and correct arguments, as well as being concerned with ontology and logical laws, it is important that arguments in the deductive system be perspicuous, and that the difference between direct and indirect arguments be clearly indicated. From the perspective of illocutionary logic, arguments and proofs are not simply instruments for establishing various results; they are also objects to be studied. The tree proofs and the illocutionary operators play an important role in achieving this goal.

6. CONDITIONAL ASSERTIONS A theory, or system, of illocutionary logic has an empirical character. It is intended to represent, to *capture*, our actual practice in using language. It is true that when it comes to reasoning, and arguments, we are concerned with how people *should* reason rather than with how people *in fact* reason. But the practice of using language is *normative* in the sense that there are norms for correct speaking, and for constructing correct arguments. These norms are implicit in the practice, in spite of the fact that people often speak and reason in ways that violate the norms. Systems of illocutionary logic are intended to illuminate and explain our practice in using language, and must be judged on the basis of whether they do fit this practice.

By recognizing that conditional assertions are a distinctive form of illocutionary act, a form intended to establish a commitment from accepting or supposing true the antecedent to accepting or supposing true the consequent, illocutionary logic is able to provide an intuitively satisfactory treatment of conditional assertions. This account is part of a larger account of conditional illocutionary acts of various kinds, like conditional promises, conditional warnings, conditional requests, and many more. Standard accounts of conditionals cannot accommodate these other kinds of conditional acts. I described the illocutionary account of conditional assertions at *Logica 2003,* and a longer account is soon to appear in *Linguistics and Philosophy*.

7. SEMANTIC MODALITIES Distinctive concepts of necessity and possibility are associated with each semantic level of an illocutionary logical theory. A statement is *ontically necessary* if its truth conditions cannot fail to be satisfied. Ontic necessity is *analytic truth*. Whether a

statement is ontically necessary, or analytic, depends on what might be called the “total meaning” of the statement. A statement is *ontically possible* if it is not contradictory. An illocutionary logical version of the modal system *S5* is the appropriate system for exploring analytic truth and logical truth.

Epistemic necessity is relative to a person, or a community, and that person’s or that community’s knowledge at a given time. It is most convenient to develop an illocutionary system of epistemic modal logic from the perspective of the designated subject. A statement is epistemically necessary at a given time if its assertion follows, in the sense of commitment, from the designated subject’s knowledge at that time. And a statement is *epistemically possible* at a time if it is not ruled out by the designated subject’s knowledge at that time.

Illocutionary logic provides the most convenient, and intuitive, framework for developing epistemic modal logic. If we consider a context in which assertions have the force of knowledge claims, it is clear that these inference principles are correct.

□ *Introduction*

$$\frac{\vdash A}{\vdash \Box A}$$

□ *Elimination*

$$\frac{\vdash \Box A}{\vdash A}$$

For positive supposition, we also have a principle □ *Elimination*:

$$\frac{\llcorner \Box A}{\llcorner A}$$

Someone who asserts a statement with the force of a knowledge claim is committed to claiming that the statement follows from what she knows. And if she claims that a statement follows from what she knows, then she is clearly committed to assert that statement itself with the force of a knowledge claim. Similarly, to suppose that statement *A* follows from current knowledge is to suppose that *A* is true. But to suppose that *A* is true is not to suppose that *A* follows from current knowledge. Instead of □ *Introduction*, we need these principles for supposition:

(T)

$$\frac{\vdash/\llcorner \Box A \qquad \vdash/\llcorner \Box [A \supset B]}{\llcorner \Box B}$$

(S4)

$$\frac{\llcorner \Box A}{\llcorner \Box\Box A}$$

I spoke about this at *Logica 2005*, when I talked about the logical difference between knowledge and justified belief. The illocutionary version of epistemic modal logic provides an explanation which dissolves the puzzle in Moore's paradox, and explains what is going on in the surprise execution puzzle or paradox.

8. REFERRING The topic of referring has been important in logic, at least since the work of Frege and Russell, although neither Frege nor Russell used the word 'refer' as a technical term for a type of speech act. However, both men were concerned with our use of language to "get at" things in the world. In "On Sense and Reference," Frege claims that the senses of proper names and definite descriptions provide *modes of access* to their referents, while Russell believed that it is the expressions he called *logically proper names* that directly connect our statements with objects of our acquaintance.

There are various puzzles associated with singular terms and statements made with them. Perhaps the original puzzle is that noted by Frege, who wanted to understand why some identity statements seem trivial, while others are informative; even though all true identity statements simply say that a thing is itself. Another puzzle is to explain how a descriptive singular term can sometimes be used to identify an object which doesn't satisfy the description (as one might use 'the man with a martini' for a person who isn't drinking a martini). Or what is the difference between expressions which provide the direct access to an object which has been characterized as rigid designation, and expressions which designate non-rigidly?

Various theories have been proposed to explain the workings of names, definite descriptions, demonstratives, indexicals, and other singular terms. Some of these theories have been extended to cover common nouns and adjectives. Logical theories of great complexity have been devised to explain a practice that doesn't seem to ordinary language users to be either mysterious or especially complicated.

No entirely successful or satisfactory account has been provided which explains the uses of singular terms. Certainly no logical theory provides much insight. This is partly due to the standard understanding of logic, which fails to adequately accommodate both the ontic and epistemic dimensions of logic. Most singular terms have at least two distinct uses, the *referring* use and the *predicative* use. For some singular terms, the referring use is primary, and there are singular terms which are used only to refer. In a logical theory, the predicative use of singular terms is best understood, and explicated, at the ontic level of logical theory. The referring use of a singular term is epistemic. Each person in referring exploits features which are peculiar to herself. Although different people can assert the same statement, they can't make the same assertion. Jones' assertion commits Jones but not Smith, while Smith's assertion plays a similar role for Smith. And when Jones refers to someone, say Napoleon, he exploits a connection linking him to Napoleon in directing his attention to Napoleon. Smith can also refer to Napoleon, but his connection to Napoleon is different from Jones'.

In a first-order illocutionary theory, the semantic difference between predicative and referring uses of a singular term should be marked syntactically, even though this is not done in English. I mark the distinction by underlining individual constants used to refer, and use plain individual constants to represent their predicative use. A constant can be used predicatively to say that an individual satisfies criteria associated with the constant, or, if the constant is a proper name, that the individual is called by that name. A constant can be used predicatively to talk about whatever individual (uniquely) satisfies the criteria or is called by that name.

A person who performs a referring act uses a singular term to direct her attention to a particular object. In doing this, she exploits a connection (a *mode of access*) that she knows about linking her to that object. This connection might be based on her own experience of the object, or be derivative from the connections of other people who have informed her of the object. There are still other sources of these connections. Since the connections may not be supplied as a matter of language, we can explain how a person might use a singular term like 'the man drinking a martini' to refer to something other than a man drinking a martini.

A system of first-order illocutionary logic includes a domain of modes of access as well as a domain of individuals. An interpreting function for the language assigns individuals to some or all individual constants, while a commitment valuation assigns modes of access to some or all individual constants. The modes of access are construed as functions yielding individuals as values. I haven't the time or the space here to develop the formal details of a suitable logical treatment of our use of singular terms. All that I want to note in this place is that an adequate account of referring expressions and referring acts belongs to the epistemic level of logic, not the ontic level. Once logic is enlarged to accommodate the epistemic, it is a relatively straightforward task to devise a simple and intuitive account that accommodates both referring and non-referring uses of singular terms.

9. SUMMING UP Logic is a very old academic subject, and field of research. But there are many new topics and new areas for logical research. Illocutionary logic, the logic of speech acts or language acts, is one of these. Illocutionary logic accommodates, or incorporates, standard logic, and provides the resources to integrate logic's traditional concern with epistemology into modern logical theory. This more adequate conception of logic provides a perspective which allows us to solve or dissolve certain long-standing problems, and to carry out research which illuminates our linguistic and cognitive practices. I hope I can encourage other students and scholars to investigate this relatively unexplored area of logic.

John T. Kearns
Department of Philosophy and Center for Cognitive Science
University at Buffalo, State University of New York
Buffalo, NY 14260
kearns@buffalo.edu