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Integrated Ambiguity Analysis Model: Detection, Representation and Optimal Meaning Selection[*]

Abstract

The purpose of the paper is three-fold: (i) to review previous analyses of ambiguity and point out their merits and problems, (ii) to devise a formalized system of 'Integrated Ambiguity Analysis Model (IAAM),' which accounts for ambiguity detection, representation and optimal meaning selection, and (iii) to apply the IAAM to examples of English jokes, slogans, and literary works as well as Chinese/Japanese Zen kōan samples in order to show the model's practicality and general applicability. Unlike the previous analyses, the IAAM accounts for intended ambiguities and produces the following three major results. First, the Ambiguity Detection together with the Shared-Knowledge Parameter accounts for the detection procedure of ambiguous expressions. Second, the Integrated Ambiguity Representation provides a unified phonetic/phonological, syntactic, semantic and pragmatic representation of ambiguous expressions. Finally, the Optimal Meaning Detector together with the Shared-Knowledge Parameter establishes a systematic optimal meaning selection procedure and its application to concrete examples in English and Zen kōans, thereby not only contributing towards opening the door to the integrated linguistic analysis of intended ambiguity but also helping enhance a study of the linguistics-literature interface.

1. Introduction

1.1 Scope, object and objectives of the study

Ambiguous expressions can be divided into two types: unintentional and intentional. The first type includes the erroneous, confused, or careless use of language, while the latter includes the deliberate and skillful use of words and expressions in order to attract attention or to persuade the reader/listener. Therefore, the second type of ambiguity reflects the author's/speaker's intention to accomplish a specific purpose or aim as in puns, quibbles, slogans, jokes, poetry, prose, and parables. The object of this study is confined to intended ambiguities in written form.

The purpose of this paper is three-fold: (i) to review previous analyses of ambiguity and point out their merits and problems; (ii) to devise a formalized system of 'Integrated Ambiguity Analysis Model (IAAM),' which accounts for ambiguity detection, representation, and optimal meaning selection; and (iii) to apply the IAAM to examples of English jokes, slogans, and literary works as well as Chinese/Japanese Zen kōan[1] samples in order to show the model's practicality and general applicability.

The critical review of previous ambiguity analyses not only duly evaluates their contribution but also points out theoretical as well as technical problems. The previous analyses which will be discussed in this paper include analyses in the framework of Generative Grammar (see Huang 1995; Radford et al. 1999), Categorial Grammar (see Dowty et al. 1981), Head Driven Phrase Structure Grammar (see Asudeh and Crouch 2001), Functional Grammar (see Bloor and Bloor 1995), and Experience-based Model (see Sturt et al. 2003). It will be shown that although the previous analyses have accounted for the connection between semantics and syntax in ambiguity resolution, all were insufficient in three respects: (i) they were confined to the analysis of out-of-context examples, (ii) they failed to offer a method of ambiguity detection and optimal meaning selection, and (iii) they also failed to provide an integrated system for ambiguity detection, representation, and optimal meaning selection.

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[1] A kōan (公案 in Chinese characters) is "an artificial problem given by a Zen master to a student with the aim of precipitating a genuine religious crisis that involves all the human facilities—intellect, emotion, and will (Hori 2003: 6)." Zen kōans are full of intentional ambiguities. Therefore, some representatives are analyzed in this study.

1.2 What is ambiguity and why does it emerge?

An ambiguous expression can be defined as a word/phrase/sentence which allows two or more interpretations in a given context. An ambiguous word or expression should not be confused with a 'vague' expression, which results when a speaker's/author's intention is not clearly phrased due to the imprecise articulation of thought or feelings.

The inquiry into why ambiguities emerge is not new. Aristotle thought that

> an ambiguity arises because the number of items that form vocabulary of any human language is much smaller than the number of realities that the vocabulary items are supposed to depict to make the human language meaningful and functional. In other words, reality is much more complex than language, its demand is, so to speak, always higher than supply in words that we use to denote it (Pehar 2001: 4).

Therefore, the referential relation between vocabulary items/expressions and objects we see in reality as well as in our mental world is bound to be a one-to-many relation. While Aristotle deserves credit for producing one half of the truth, the other half goes to Pehar (2001: 5), who criticizes Aristotle's assumption: It is a normal and recurring phenomenon we produce by adding new meanings to words, therefore it is not a symptom of representational insufficiency of language but rather ambiguities show a creative aspect of language. It is not surprising therefore that we see ambiguity noticeably in creative literary works such as poetry, novels, and plays. As we shall see in section 4 of this paper, Zen kōans are full of deliberate ambiguous expressions, which were skillfully created to help the students of Zen attain absolute realization or enlightenment.

1.3 Classification of ambiguities

Ambiguities can be classified into three types: syntactic, semantic, and pragmatic as shown in (1). (The classification of ambiguities facilitates the definition of ambiguity detection as explained in section 3.1.)

(1)   Classification of ambiguities

$$\text{Ambiguities} \begin{cases} \text{syntactic} \\ \text{semantic (lexical, scopal)} \\ \text{pragmatic/referential} \end{cases}$$
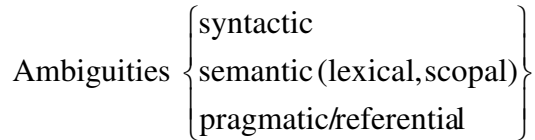
Syntactic ambiguities result when a phrase/clause/sentence allows more than one way of grouping its constituents. The sentence *Frank spotted the man with a telescope* yields at least two distinct interpretations: (i) Frank looked through a telescope and spotted the man, and (ii) The man has a telescope and Frank spotted him (see Radford et al. 1999: 358). The first interpretation is attributable to the labeled bracketing of (2a) whose corresponding tree diagram is (2b), while the second interpretation is attributable to the labeled bracketing of (2c) whose corresponding tree diagram is (2d). Therefore, the two distinct groupings of constituents result in the different meanings.

(2)   *Frank spotted the man with a telescope.*
       a. [VP spotted [DP the man] [PP with a telescope]]
       b.
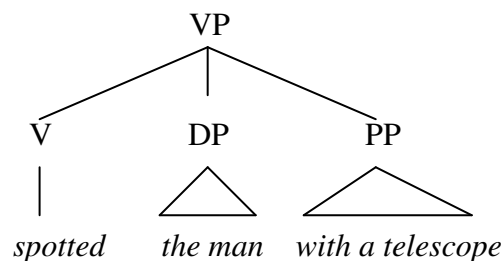
       c. [VP spotted [DP [the man] [PP with a telescope]]]
       d.
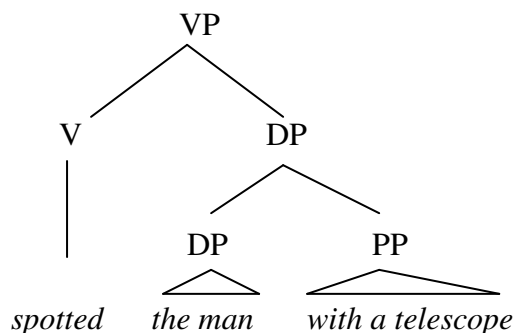
Semantic ambiguities consist of two kinds: lexical and scopal. Lexical ambiguities include homonyms, heteronyms, and homographs.

Homonymous words share the same pronunciation but differ in spelling, while heteronymous words share the same pronunciation and spelling. Consider examples in (3). Here, the first pair of underlined words, *flour* and *flower* are homonyms, whereas the second pair of words *ground* and *ground* are homographs.

(3) "How is bread made?"
     "I know *that*!" Alice cried eagerly.
     "You take some <u>flour</u>—"
     "Where do you pick the <u>flower</u>? The White Queen asked. "In a garden, or in the hedges?"
     "Well, it isn't picked at all," Alice explained; "it's <u>ground</u>—"
     "How many acres of <u>ground</u>?" said the White Queen.
                                        (Lewis Carroll, *Through the Looking-Glass*)

On the other hand, heteronyms are words spelled the same but pronounced differently as in the following example: "*bass* [beɪs], meaning either 'low tone' or '*bass* [bæs], a kind of fish (Fromkin et al. 2003: 584)."

Scopal ambiguities arise due to the different interpretations of quantifier scopes. For example, the sentence in (4) is two-way ambiguous between the wide scope reading of a universal quantifier as in (4a), and the wide scope reading of an existential quantifier as in (4b) (see Larson and Segal 1995: 250). Notice that (4c) exemplifies (4a), while (4d) instantiates (4b).

(4) *Every man admires some woman.*
     a. For every man x, for some woman y, x admires y
     b. For some woman y, for every man x, x admires y

     c. Every–some   d. Some–every
     Chris ⟶ Kate   Chris ⟶ Kate

     Phil ⟶ Jill   Phil ⟶ Jill

     Rolf ⟶ Kumiko   Rolf ⟶ Kumiko

Pragmatic (referential) ambiguities occur when an expression is not specific, and the context where it occurs does not provide details for clarifying the meaning of the expression. Therefore, further information is

necessary in order to resolve a pragmatic ambiguity (see Walton 1996). An example of pragmatic (referential) ambiguity is given below.

(5)   Example (Pehar 2001: 2):

Croesus, an ancient king of Lydia, asked the oracle at Delphi to prophesize the outcome of his attempt at conquering the Persian Empire. The oracle, as clever as always, issued the following prophesy: "If you attacked the Persians, you would destroy a mighty empire."

The underlined phrase '*a mighty empire*' allows at least three interpretations as shown in (6).[2]

(6)   a. *the empire of Persia*
       b. *the empire of Lydia*
       c. *some other empire*

Pehar (2001: 3) claims that

the noun phrase '*a mighty empire*' if taken out of context carries just one sense: (i) a militarily powerful, or (ii) jurisdiction ruled over by a king. However, the phrase under consideration is ambiguous in the following two respects: (i) there are more than one mighty empire under discussion, and (ii) which mighty empire is being referred to?

Pragmatic ambiguities can be cross-sentential or cross textual. Pehar (2001: 4) explains that

this type of ambiguity [i.e. cross-textual] rests not on a separate phrase or on a sentence, but on a larger body of a text comprising many sentences. An example of this type would be a referential/anaphoric expression which is referred to, for

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[2] Another possible interpretation, 'either the empire of Persia or the empire of Lydia' was pointed out to me by a participant in SKY Symposium "Structure and Context" organized by the Linguistic Association of Finland, August 21–22, 2006, Åbo Akademi University (Turku, Finland). Although the above interpretation is logically possible, it is irrelevant at the time of processing the text as a whole. The ambiguous phrase in question '*a mighty empire*' is a proposition thrust before Croesus and the reader, which calls for the choosing of one particular empire among the three alternatives: the Persian Empire, the Lydian Empire, and some other empire. Therefore, the alternative interpretation is eliminated from the optimal meaning selection as we shall see in section 3.3.

example, in sentence A as α; in sentence B, as β; and in sentence C, as γ, etc., where all of the sentences are cohesive and comprise a text.

The above exposition has answered three questions: (i) what is ambiguity?, (ii) why does ambiguity result?, and (iii) how are ambiguities classified? Let us now examine previous ambiguity analyses and consider their strong point and problems.
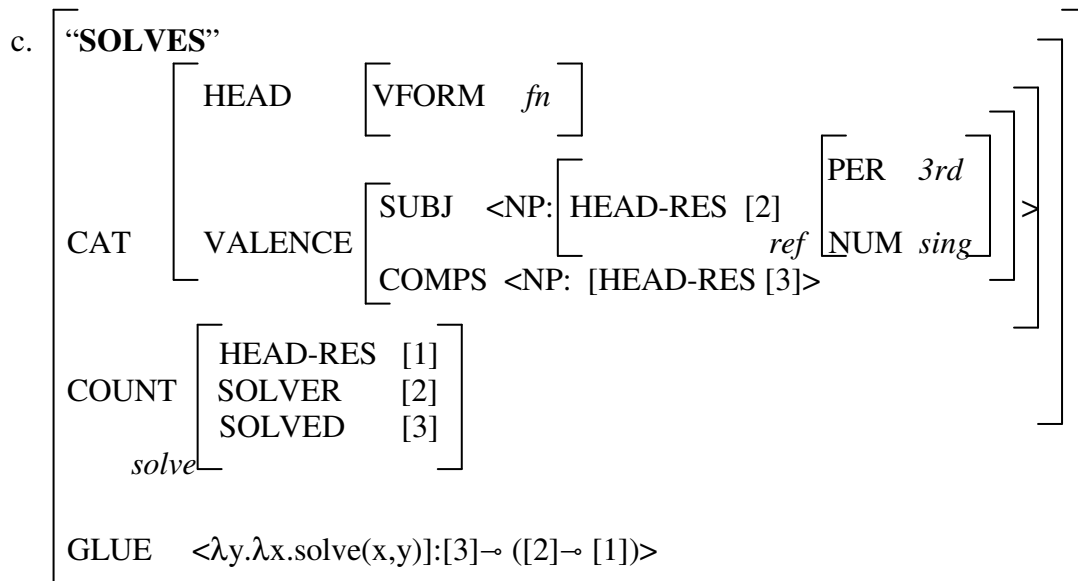
2. Previous analyses

In the early days of Generative Grammar, Chomsky (1965) created two innovative devices. One is the tree-diagram representation, and the other is the corresponding labeled bracketing representation. In terms of these devices, a distinct structural representation can be associated with each of the different interpretations of an ambiguous expression. The PP attachment ambiguity given under (2) in section 1.3 is an example of the tree-diagram representation. As for a representative of the labeled bracketing representation, we consider Huang's (1995) analysis. Within the framework of the Government and Binding, Huang analyzes the scope ambiguity of *Everyone loves someone* in terms of the Quantifier Raising, which Chomsky-adjoins a quantified NP to IP, leaving a trace A'-bound by the adjoined NP, thereby yielding the syntactic structures (7a) and (7b), respectively. The corresponding semantic representations are shown in (7c) and (7d), respectively for heuristic purposes.

(7)   *Everyone loves someone.*
     a. [$_{IP}$ *Everyone*$_i$ [$_{IP}$ *someone*$_j$ [$_{IP}$ t$_i$ *loves* t$_j$]]]
     b. [$_{IP}$ *Someone*$_j$ [$_{IP}$ *everyone*$_i$ [$_{IP}$ t$_i$ *loves* t$_j$]]]
     c. $\forall x \exists y$ [love (x,y)]
     d. $\exists y \forall x$ [love (x,y)]

Asudeh and Grouch's (2001) HPSG analysis of scope ambiguity is quite different from the one discussed above. According to their analysis, the lexical entries at syntax-semantics interface for *every*, *student*, and *solves* are provided as the initial step as illustrated in (8a), (8b), and (8c), respectively.[3]

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[3] See Lasnik and Uriagereka (1988: 7), and Aoun and Li (1993: 25) for analogous analyses.

(8)

a.
$$
\left[
\begin{array}{l}
\text{"EVERY"} \\[4pt]
\text{CAT}\quad\left[\text{HEAD}\ \left[\begin{array}{l}\text{SPEC}\ \ \text{N':}\ \left[\begin{array}{ll}\text{HEAD-RES}\ [3]\ \left[\begin{array}{ll}\text{PERSON}&\textit{3rd}\\ \text{NUMBER}&\textit{sing}\end{array}\right]\\ \qquad\qquad\textit{ref}\\ \text{VAR-RES}\quad[1]\\ \text{RESTR-RES}\ [2]\end{array}\right]\\[6pt]\textit{det}\end{array}\right]\right]\\[10pt]
\text{GLUE}\quad <\lambda P.\lambda Q.\forall x.[P(x)\rightarrow Q(x)]:([1]\multimap[2])\multimap([3]\multimap G)\multimap G)>
\end{array}
\right]
$$

b.
$$
\left[
\begin{array}{l}
\text{"STUDENT"} \\
\text{CAT | HEAD}\quad\textit{noun} \\[6pt]
\text{COUNT}\quad\left[\begin{array}{ll}\text{HEAD-RES}\ \left[\begin{array}{ll}\text{PERSON}&\textit{3r}\\ \text{NUMBER}&\textit{sing}\end{array}\right]\\ \qquad\qquad\textit{ref}\\ \text{VAR-RES}\qquad[1]\\ \text{RESTR-RES}\quad[2]\\ \textit{common}\end{array}\right]\\[10pt]
\text{GLUE}\quad <\lambda x.\text{student}(x)]:[1]\multimap[2]>
\end{array}
\right]
$$

c.
$$
\left[
\begin{array}{l}
\text{"SOLVES"} \\[4pt]
\text{CAT}\quad\left[\begin{array}{l}\text{HEAD}\quad\left[\text{VFORM}\quad\textit{fn}\right]\\[6pt]\text{VALENCE}\ \left[\begin{array}{l}\text{SUBJ}\ \ <\text{NP:}\left[\begin{array}{l}\text{HEAD-RES}\ [2]\\ \qquad\qquad\textit{ref}\ \left[\begin{array}{ll}\text{PER}&\textit{3rd}\\ \text{NUM}&\textit{sing}\end{array}\right]\end{array}\right]>\\ \text{COMPS}\ <\text{NP: [HEAD-RES [3]}>\end{array}\right]\end{array}\right]\\[10pt]
\text{COUNT}\quad\left[\begin{array}{ll}\text{HEAD-RES}&[1]\\ \text{SOLVER}&[2]\\ \text{SOLVED}&[3]\\ \textit{solve}\end{array}\right]\\[10pt]
\text{GLUE}\quad <\lambda y.\lambda x.\text{solve}(x,y)]:[3]\multimap([2]\multimap[1])>
\end{array}
\right]
$$

Granting that the lexical specifications for the words *a* and *problem* are given analogously as in the case of *every* and *student*, the partial lexical entries for the sentence, *Every student solves a problem* is provided as shown in (9).

(9)

$$
\left[
\begin{array}{l}
\textit{CONT | HEAD-RES [1]} \\[4pt]
\qquad \lambda P.\lambda Q.\forall x.[P(x){\to}Q(x)]{:}([4]{\multimap}[5]){\multimap}([2]{\multimap}G){\multimap}G), \\[10pt]
\text{GLUE} \left\langle
\begin{array}{l}
\lambda y.\text{student}(y){:}[4]{\multimap}[5], \\
\lambda y.\lambda x.\text{solve}(x,y){:}[3]{\multimap}([2]{\multimap}[1]) \\
\lambda P.\lambda Q.\exists x.[P(x){\wedge}Q(x)]{:}([6]{\multimap}[7]){\multimap}([3]{\multimap}H){\multimap}H), \\
\lambda z.\text{problem}(z){:}[6]{\multimap}[7]
\end{array}
\right\rangle
\end{array}
\right]
$$
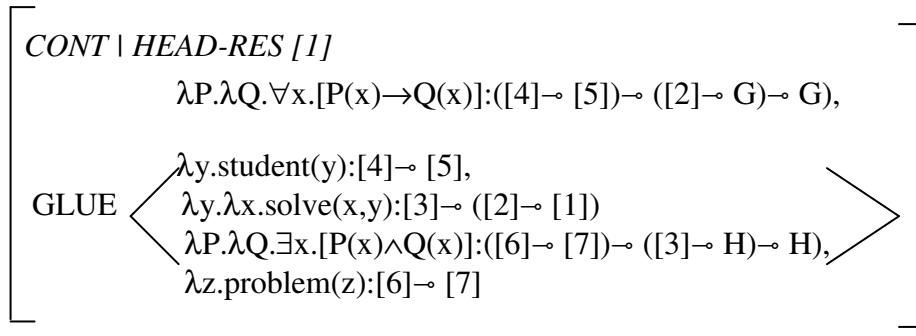
The generalized determiner *every* in (9) contains $([4]{\multimap}[5]){\multimap}([2]{\multimap}G){\multimap}G)$, which corresponds to the standard Montagovian type for generalized determiners, $\langle\langle e,t\rangle,\langle\langle e,t\rangle,t\rangle\rangle$. The determiner *every* consumes the N' semantics, i.e. $([2]{\multimap}G){\multimap}G$ to produce a generalized quantifier semantics as illustrated in the subproof in (10).

(10) $\quad \dfrac{\lambda y.\textit{student}(y){:}[4]{\multimap}[5] \quad \lambda P.\lambda Q.\,\forall x.[P(x){\to}Q(x)]{:}([4]{\multimap}[5]){\multimap}([2]{\multimap}G){\multimap}G)}{\lambda Q.\forall x.[\textit{student}(x){\to}Q(x)]{:}([2]{\multimap}G){\multimap}G} {\multimap}_{\varepsilon}$

Given a similar subproof for *a problem*, the two distinct scope readings for the sentence, *Every student solves a problem* can be derived as shown in (11) and (12), where the former represents the wide scope reading of an existential quantifier, whereas the latter, the wide scope reading of a universal quantifier.
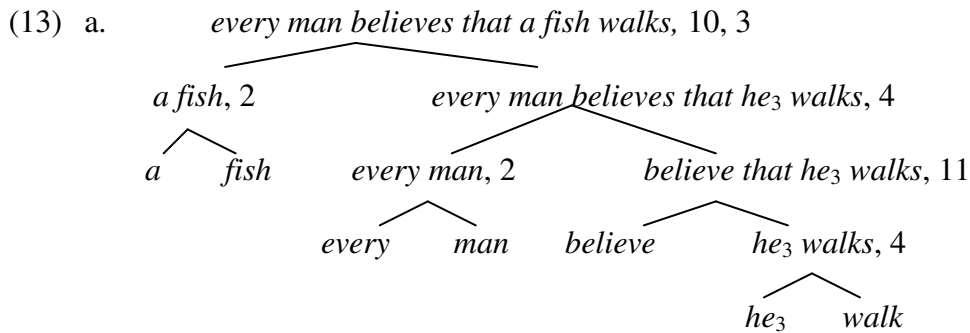
(11)

$$[z:[3]]^1 \; \lambda y.\lambda x.solve(x,y):[3] \multimap ([2] \multimap [1])$$

$$\overline{\hspace{6cm}} \multimap \varepsilon$$

$$\lambda Q.\forall x.[student(y) \to Q(y)]:([2] \multimap G) \multimap G \quad \lambda x.solve(x,z):[2] \multimap [1]$$

$$\overline{\hspace{6cm}} \multimap \varepsilon, G=[1]$$

$$\forall y.[student(y) \to solve(y,z)\;]:[1]$$

$$\overline{\hspace{4cm}} \multimap I,1$$

$$\lambda Q.\exists x.[problem(x) \wedge Q(x)]:([3] \multimap H) \multimap H \quad \lambda z.\forall y.[student(y) \to solve(y,z)]:[3] \multimap [1]$$

$$\overline{\hspace{7cm}} \multimap \varepsilon, H=[1]$$

$$\exists x.[problem(x) \wedge \forall y.[student(y) \to solve(y,x)]]:[1]$$

(12)

$$[z:[2]]^1 \; \lambda x.\lambda y.solve(x,y):[2] \multimap ([3] \multimap [1])$$

$$\overline{\hspace{6cm}} \multimap \varepsilon$$

$$\lambda Q.\exists x.[problem(x) \wedge Q(x)]:([3] \multimap H) \multimap H \quad \lambda y.solve(z,y):[3] \multimap [1]$$

$$\overline{\hspace{6cm}} \multimap \varepsilon, H=[1]$$

$$\exists x.[problem(x) \wedge solve(z,x)]:[1]$$

$$\overline{\hspace{4cm}} \multimap I,1$$

$$\lambda Q.\forall y.[student(y) \to Q(y)]:([2] \multimap G) \multimap G \quad \lambda z.\,\exists x.[problem(x) \wedge solve(z,x)]:[1] \multimap [1]$$

$$\overline{\hspace{7cm}} \multimap \varepsilon, G=[1]$$

$$\forall y.[student(y) \to \exists x.[problem(x) \wedge solve(y,x)]]:[1]$$

Within the framework of Categorial Grammar, Dowty et al. (1981: 208) analyze the two interpretations for the sentence, *Every man believes that a fish walks*: (i) a belief about one particular fish shared by every man, and (ii) beliefs about possibly different fish for each man. The first interpretation is associated with the analysis tree in (13a), whose translation is shown in (13b), whereas the second interpretation is associated with the analysis tree in (14a), whose translation is (14b). Here, the Arabic numerals at the right of the higher nodes denote the numbers of the structural operations, while the items with the same subscripted number are anaphoric. Notice that the two interpretations are accounted for in terms of the two distinct analysis trees.

(13) a.   *every man believes that a fish walks,* 10, 3

        a fish, 2   *every man believes that he$_3$ walks*, 4

   a   *fish*   *every man*, 2   *believe that he$_3$ walks*, 11

              every   *man*   *believe*   *he$_3$ walks*, 4

                                 he$_3$ *walk*

    b. $\exists x[\text{fish'}(x) \wedge \forall y[\text{man'}(y) \rightarrow \text{believe'}(y, \hat{}[\text{walk'}(x)])]]$

(14) a.   *every man believes that a fish walks,* 10, 0

   every man, 2   *he$_0$ believes that a fish walks*, 10, 2

 every *man*   *a fish*, 2   *he$_0$ believes that he$_2$ walks*, 4

            a   *fish*   *he$_0$*   *believes that he$_2$ walks*, 11

                          believe   *he$_2$ walks*, 4

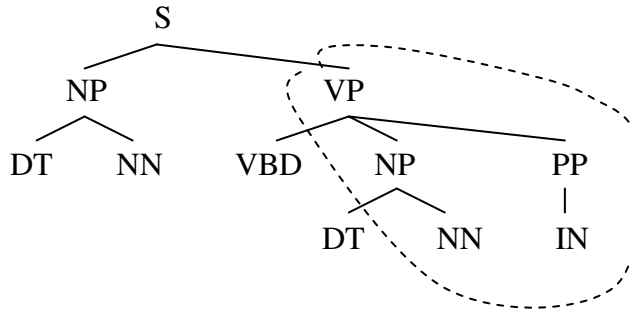   *he$_2$*   *walk*
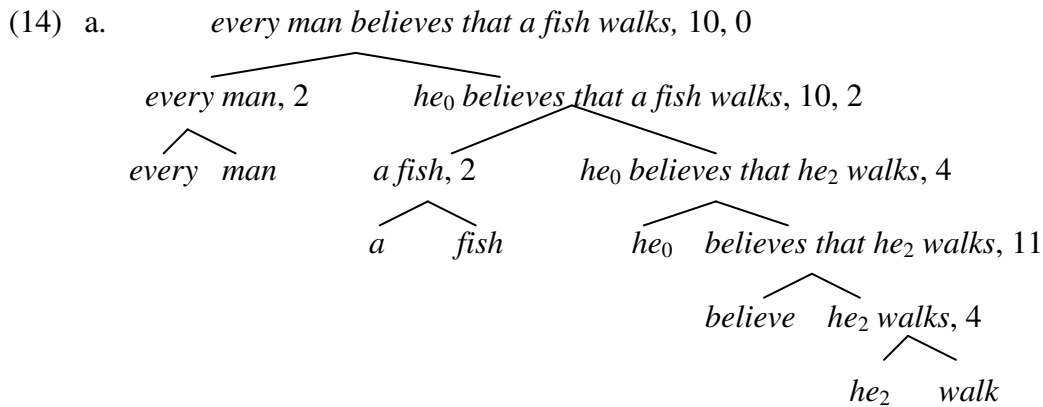
    b. $\forall y[\text{man'}(y) \rightarrow \exists x[\text{fish'}(x) \wedge \text{believe'}(y, \hat{}[\text{walk'}(x)])]]$
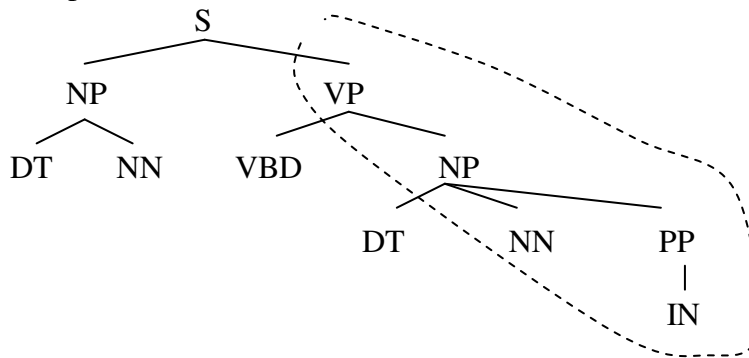
In Sturt et al.'s (2003) Recursive Neural Network analysis under Computational Experience-based Model, a PP attachment ambiguity such as in (15) is assigned two different incremental trees: (15a) and (15b). On the basis of the two incremental trees, they offer a device for determining which interpretation is preferred in terms of frequency. The conventions used here are as follows: NN means singular or mass common noun; VBD denotes past tense verb; and IN signifies preposition. Here, (15a) represents the reading in which the spy has the binoculars, while (15b) represents the reading in which the cop has the binoculars. The dotted loops enclosing the configurations were used to search the frequencies of the two constructions in corpora such as the Penn-treebank database and Wall Street Journal.

(15) *The spy saw the cop with the binoculars.*

a. Verb phrase attachment

```
                        S
           ┌────────────┴────────────┐
          NP                        VP
        ┌──┴──┐          ┌───────────┼───────────┐
       DT    NN        VBD          NP           PP
                                  ┌──┴──┐         │
                                 DT    NN        IN
```

b. Noun phrase attachment

```
                        S
           ┌────────────┴────────────┐
          NP                        VP
        ┌──┴──┐          ┌───────────┴─┐
       DT    NN        VBD            NP
                              ┌────────┼────────┐
                             DT       NN        PP
                                               │
                                              IN
```

According to Sturt et al.'s analysis, the noun phrase attachment reading is ranked above the verb phrase attachment reading therefore preferred as shown in (16). They also claim that the statistical analysis for the replication networks shows that the NP attachment preference is reliable: The mean for NP attachment is .64, whereas it is .26 for VP attachment, where $T(N=20)=24$, $p < .05$.

(16)

Probability estimate		Ranking
NP attachment	.49	1st
VP attachment	.39	2nd

Within the framework of Functional Grammar, Bloor and Bloor (1995: 138) analyze ambiguous noun phrases such as '*a Spanish teacher*' as follows:

> In one interpretation, the word *Spanish* is analyzed as 'Epithet' meaning that a teacher has Spanish nationality; whereas in the other interpretation, the word

Spanish is analyzed as 'Classifier'. In the former case, the characteristic or quality of being Spanish is at issue, while in the latter case what is at issue is a teacher belonging to a subclass of teachers, namely Spanish (language) teachers, as distinct from science teachers, mathematics teachers, and so on.

They claim without elaboration that

when such 'ambiguous' expressions occur in real utterances, there is rarely any confusion about meaning. The context usually provides sufficient information to make it clear what is intended. Furthermore, in spoken English, the distinction between Epithet and Classifier is often reflected by differences in intonation.

All of the above five previous analyses commonly share three shortcomings: (i) their analyses were confined to out-of-context examples; (ii) they failed to provide a method of selecting an optimal interpretation from a set of possible interpretations; and (iii) they failed to offer an integrated model for detection, representation, and optimal meaning selection, which incorporates phonological, morphological, syntactic, semantic, and pragmatic properties into one unified system. Although lacking elaboration, Bloor and Bloor's claim discussed above is worth noting since it acknowledges the importance of taking context into consideration in ambiguity analyses. By conducting a context-oriented analysis, one can expand the horizon of ambiguity analysis. Moreover, a context-oriented ambiguity analysis can go beyond context-independent analyses and enables us to carry out the selection of the optimal meaning from a set of perceived interpretations.

With the above development in mind, the definition of perceived ambiguity is formalized in (17) on the basis of Poesio (1996: 166).

(17)   Definition of perceived ambiguity

An expression E with encoded message in a discourse situation is perceived as ambiguous by a listener/reader (L/R) if the L/R obtains two or more interpretations for E.

In recognizing an ambiguity, a competent speaker produces interpretations conforming to grammatical conditions in a given context/situation. Therefore, Poesio (1996: 177) proposes a constraint shown in (18).

(18)   Anti-Random Hypothesis (Informal)

> Humans do not randomly generate alternative interpretations of ambiguous sentences; only those few interpretations are obtained that (i) are consistent with syntactic and semantic constraints, and (ii) are suggested by the context.

Acknowledging the indispensability of context, the next section advances a unified system of ambiguity analysis in a principled fashion.

3.   Integrated Ambiguity Analysis Model (IAAM)

I have devised a unified system of ambiguity detection, representation, and optimal meaning selection, which is designated as an Integrated Ambiguity Analysis Model (IAAM). The IAAM can be formalized as a quadruple as shown in (19). It will become clear shortly that the IAAM is formulated in a generalized fashion, therefore it can be incorporated into other current models of grammar or those which are under development. [4]
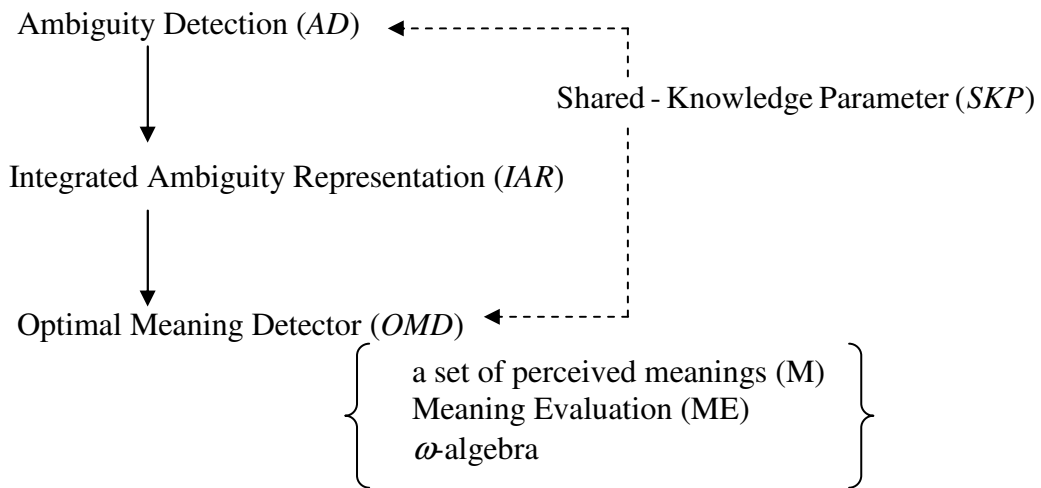
(19)   Integrated Ambiguity Analysis Model (IAAM)

$$IAAM=(SKP, AD, IAR, OMD)$$

The initial component, *SKP*, denotes 'Shared-Knowledge Parameter,' which is prerequisite for the mutual understanding between the author/speaker and reader/listener. The second component, *AD*, signifies 'Ambiguity Detection,' which specifies a method of detecting an ambiguous expression in a given context. The third component, *IAR*, denotes 'Integrated Ambiguity Representation,' which provides a unified method of ambiguity representation: phonetic/phonological description, interpretation, and structural description at syntax-semantics interface. The last component signifies 'Optimal Meaning Detector,' which can be formalized as a triplet, $OMD=(M, ME, \omega\text{-}algebra)$. The *M* designates a set of perceived meanings. The *ME* stands for 'Meaning Evaluation,' which is a set of criteria for judging which meaning is 'optimal' among a set of

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[4] The IAAM is a pioneering study opening roads for researchers who wish to unify phonetics/phonology, morphology, syntax, semantics, and pragmatics into an integrated system of ambiguity analysis. Being more comprehensive, the IAAM can improve on any theory that hinges on syntax-confined or semantics-confined approaches which attempt to analyze an ambiguous expression out-of-the-blue fashion without considering context or situation.

perceived meanings. The third component, *ω-algebra* is a mathematical calculation device for selecting an optimal meaning. The chart given under (20) should help the reader understand how an integrated ambiguity analysis is executed in terms of the IAAM. The downward solid arrow shows a procedure for an integrated ambiguity analysis, while the dotted arrow shows the involvement of the parameter. The three elements of the *OMD* are shown in curly brackets at the bottom.

(20)   IAAM flowchart

Ambiguity Detection (*AD*) ◄ - - - - - - - - - - - - ┐
          │   │
          │   Shared - Knowledge Parameter (*SKP*)
          ▼   │
Integrated Ambiguity Representation (*IAR*)   │
          │   │
          ▼   │
Optimal Meaning Detector (*OMD*) ◄ - - - - - - - - - ┘

$$\left\{ \begin{array}{l} \text{a set of perceived meanings (M)} \\ \text{Meaning Evaluation (ME)} \\ \text{ω-algebra} \end{array} \right\}$$

In the following subsections, we consider in detail each component of the IAAM beginning with a method of detecting ambiguous expressions called Ambiguity Detection.

3.1   Ambiguity Detection

Detecting an ambiguity is an intellectual challenge, which oftentimes requires keen insight and extensive knowledge of the subject matter involved. In this connection, Lecleric's (2004) comment is suggestive. Referring to Wittgenstein's (1967) ambivalent duck-rabbit figure, he states that human perception is fundamentally interpretive since

> our observations are organized by background theories and concepts, experience, language, and in general, our entire past. For example, if someone has never seen a rabbit he/she will never identify the duck-rabbit figure as a rabbit. (Lecleric 2004)

In this respect, shared-knowledge is indispensable not only for the mutual understanding between the speaker/author and the listener/reader in everyday discourse but also in ambiguity analyses. Here, the term 'knowledge' is used to mean ideas, beliefs, concepts and conceptions, as well as visual sensations, auditory sensations, sense of touch, and sense of taste. Acknowledging the significance of shared knowledge, I put forward the following proposition.

(21)   Shared-Knowledge Parameter (SKP):

Let there be
K^a : author's/speaker's knowledge,
i : author's/speaker's intended ambiguity,
e : expression in which i is encoded,
K^r : reader's/listener's knowledge,
r : reader's/listener's interpretation of e, and
$K^a \cap K^r$, where $e \in K^a$ and $e \in K^r$.
If $r = i$ or $r \approx i$, then an 'ambiguity detection' can be arguably carried out.

Bearing the *SKP* in mind, a method of ambiguity detection can be formalized as shown in (22).

(22)   Ambiguity Detection (AD): [5]

Let there be $[_\alpha c_1,c_2,c_3,\ldots,c_m]$, where α is a variable ranging over a sentence, paragraph, and whole text, whereas c is a constituent. As you incrementally process words, look for a possible ambiguous constituent c_i which allows two or more meanings in terms of the following three methods.
   a) Do a syntactic analysis in order to find an alternative grouping of constituents;
   b) Do a semantic analysis in order to find a homonym, heteronym, homograph, or an alternative quantifier scope interpretation; and
   c) Do a pragmatic analysis in order to find an alternative referential interpretation.
Allow a simultaneous amalgam of two or more competing interpretations and continue the analyses until you find no more alternative interpretations.

---

[5] In formalizing the Ambiguity Detection, I have borrowed Norvig's (1988: 2) idea of the methodological procedure in ambiguity interpretation strategy. Norvig's interpretation strategy, however, neither provides a detailed ambiguity detection method nor offers its application to ambiguous expressions taking context into consideration.

Let us now show how the *AD* works taking examples from two types of ambiguities: one-at-a-time ambiguity and simultaneous ambiguity. Consider first a one-at-a-time ambiguity example in (23). Notice that the sentence in question allows two interpretations: (23a) and (23b).

(23) *He chased elephants on horseback.*
      a. *He chased elephants while he was on horseback.*
      b. *He chased elephants which were on horseback.*

In (23a), the prepositional phrase, '*on horseback*' gives rise to a conveyance reading, while in (23b) the prepositional phrase acts as a modifier to the noun, '*elephants*'. The second interpretation stands out if a relevant context is provided as in (24).

(24) *FRIP: When my father was in Africa, he chased elephants on horseback.*
      FRAP: Gee, I didn't know elephants could ride horses.
                            (Rissinger and Yates 1996: 43)

Consider next a simultaneous ambiguity example given under (25).

(25) *We are Flintstones kids, ten million strong and growing.*

Norvig (1988: 4) asserts that

> the coordinate *and growing* can attach to either *are* or *ten million strong*, with the respective interpretations that the individual children are growing, or that the number of children is increasing. Most informants recognize both alternatives, but report an ability to fuse the two into a single image where each individual child in an expanding group is growing. But in (27) [here (25)] we have a special kind of pun, where the point is that both meanings are to be taken simultaneously.
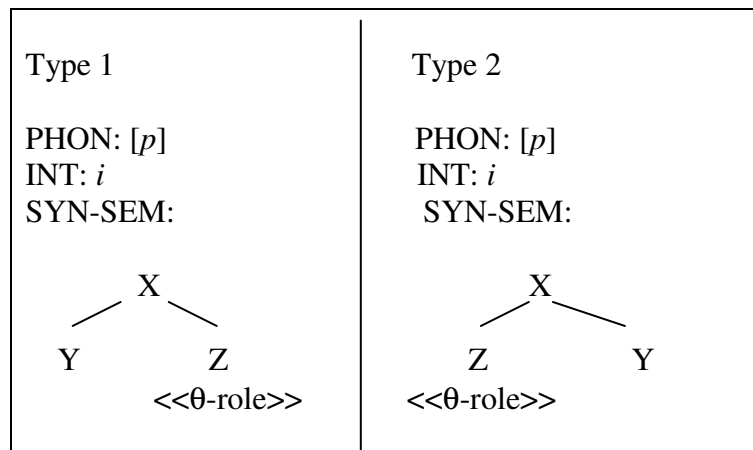
3.2 Integrated Ambiguity Representation

As we have seen in the previous sections, ambiguity analyses involve all of the core components of grammar: phonetics/phonology, morphology, syntax, semantics, and pragmatics. In view of this fact, I have devised the 'Integrated Ambiguity Representation (*IAR*),' which provides fundamental grammatical information: a phonetic/phonological form, interpretation, lexical or syntactic category, syntactic structure, and if relevant a thematic role for a detected ambiguous expression.

(26) Integrated Ambiguity Representation (IAR):

An ambiguous expression **a** detected by means of the *AD* is subject to the following two terms.
i. Each perceived meaning of **a** is assigned a distinct Integrated Ambiguity Representation (*IAR*), which consists of PHON (phonetic/phonological form), INT (interpretation), and SYN-SEM (syntax-semantics unified schema), and
ii. The *IAR* of **a** can be either Type 1 or Type 2 depending on the position of the head and its complement, where [*p*] denotes phonetic/phonological form; *i* denotes **a**'s interpretation by paraphrasing; X, Y, and Z denote syntactic categories. If a thematic role of **a** is relevant, then it is specified in double angle brackets.

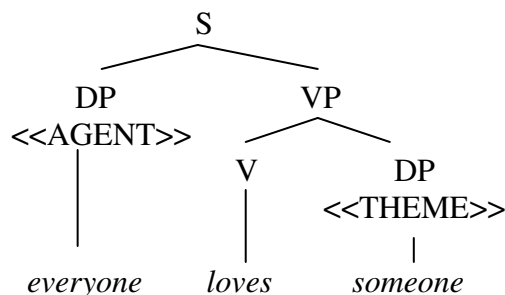| Type 1	Type 2
PHON: [*p*] INT: *i* SYN-SEM:	PHON: [*p*] INT: *i* SYN-SEM:

Given the above exposition, the two interpretations of example (7) are each assigned a distinct Integrated Ambiguity Representation (*IAR*).

(27) Meaning 1

PHON: [ɛvriwʌn lʌvz sʌmwʌn]
INT: ∀x∃y [love (x,y)]
SYN-SEM:

Meaning 2

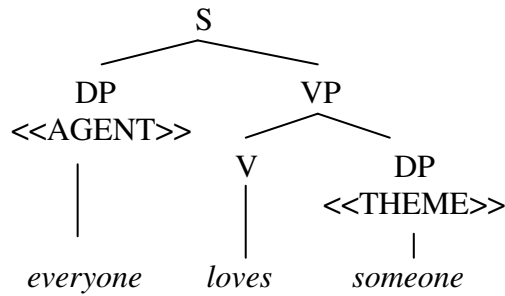PHON: [ɛvriwʌn lʌvz sʌmwʌn]
INT: ∃y∀x [love (x,y)]
SYN-SEM:

```
                          S
                  ┌───────┴───────┐
                 DP               VP
              <<AGENT>>      ┌─────┴─────┐
                  │         V           DP
                  │         │       <<THEME>>
                  │         │           │
               everyone   loves      someone
```

We shall now turn to the issue of selecting an optimal meaning among perceived meanings of an ambiguous expression in the next section.

3.3 Optimal Meaning Detector

The formulation of integrated optimal meaning selection from a set of perceived meanings is justified in three respects. First, it pioneers a method for singling out the best possible interpretation among a set of perceived interpretations. Second, not only does it unify phonetics/phonology, syntax, semantics, pragmatics/discourse analyses, but it also brings together the linguistic analyses and the reader's inference[6] into a single whole in a systematic and principled fashion. Third, due to this linguistics-literature interface, it explores the frontiers of theoretical linguistics thereby providing a new insight into ambiguity analyses.

Of relevance to the above discussion is Relevance Theory (see Sperber and Wilson 1984; Wilson 1994; Wilson and Sperber 2004). As we shall see shortly, one of the basic assumptions of Relevance Theory (RT), 'Principle of relevance' is incorporated with a slight modification into 'Meaning Evaluation' defined in (28). However, other RT stipulations such as 'Relevance to an individual (classificatory),' 'Relevance to an individual (comparative)' and 'Presumption of optimal relevance' are inadequate for

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[6] Following Hobbs (1985), Asher and Lascarides (1995: 72) acknowledge the importance of the reader's inference in correlating the segments of text because a wide variety of linguistic and discourse information is necessary to infer pragmatically the best-suited interpretation of a segment in a text.

the task of selecting an optimal meaning among a set of perceived meanings in jokes, slogans, literary works and Zen kōans due to their allusive, deceptive, and deliberately dubious techniques and styles.[7]

Following the most basic idea of Optimality Theory (see Prince and Smolensky 1993; Archangeli and Langendoen 1997; Kirchner 1998; Roca and Johnson 1999), I have devised a system of optimal meaning selection, by which the best possible meaning is singled out from a set of perceived meanings for an ambiguous expression. As discussed above, Optimal Meaning Detector (*OMD*) is defined as *OMD*=(*M*, *ME*, *ω-algebra*). The *M* is a set of perceived meanings. The *ME* stands for Meaning Evaluation, which consists of four criteria[8] for singling out an optimal meaning from a set of perceived meanings as defined in (28). A detailed explication of each criterion follows the definition of *ME*.

(28) Meaning Evaluation (ME)

Let there be $[_\alpha...\boldsymbol{a}...]$, where α is a variable ranging over a sentence, paragraph, and whole text, while $\boldsymbol{a}$ is an ambiguous constituent which is subject to the following four criteria.
a. Text Criterion (TC): If a meaning, m_i, coheres[9] in $[_\alpha...\boldsymbol{a}...]$, then assign m_i value 1, if not, 0;

---

[7] Clark's (1999: 353) idea of 'layer' bears a direct relevance to the interpretation of jokes, parables, and creative literary works. The layer analysis helps the reader obtain a deeper understanding of how discourse structure affects the meaning of words by explaining the dual or multiple layered domains of action worded in a written text or utterance.

[8] The four criteria are contextually motivated as shown in the following chart.

Contexts	Criteria
Text context	Text Criterion (TC)
Recognition context	Relevance Criterion (RC)
	Inference Criterion (IC)
Production context	Authorial Intent Criterion (AIC)

[9] Here the term 'cohere' means to achieve the consistency and connectedness correlation between constituents in a sentence, or a set of sentences as in a paragraph, or a text as a whole, or an utterance/dialogue/speech in a well-formed fashion phonetically/phonologically, syntactically, semantically and pragmatically. See Asher and Lascarides (1995) for an analysis of how coherence is achieved in the analysis of anaphoric pronoun disambiguation in terms of a systematic and formal theory of lexical processing. The reader is also referred to Jurafsky and Martin's (2000: 694) systematic

b. Relevance Criterion (RC): If m_i is declared optimal by Relevance Condition,[10] then assign m_i value 2, if not, 0;

c. Authorial Intent Criterion (AIC): If m_i is in accord with the author's/speaker's articulated intent, then assign m_i value 3, if not, 0. If the authorial intent is not available, then assign m_i value $\emptyset$; and

d. Inference Criterion (IC): If m_i is declared optimal by the Inference Condition,[11] then assign m_i value 4, if not, 0.

---

account of text coherence by a set of coherence relations on the basis of inference and axioms.

[10] The Relevance Condition of the RC is a pragmatics/discourse oriented rule, which I have formalized in (i) on the basis of Sperber and Wilson's (1984) 'Principle of relevance'.

> (i) Relevance Condition: The optimal meaning is the one which is of immediate relevance to the reader/listener at the time of processing a text/message.

The basic four assumptions of Relevance Theory (Sperber and Wilson 1984), and the Cooperative Principle of Grice (1975) are given below. Of those only the Principle of relevance is directly relevant to the present work. As we shall see in section 4, Zen kōans violate the first and fourth condition of Grice's Cooperative Principle.

> (ii) Principle of relevance: Every act of ostensive communication communicates a presumption of its own optimal relevance.

> (iii) Relevance to an individual (classificatory): An assumption is relevant to an individual at a given time if and only if it is relevant in one or more of the contexts accessible to the individual at that time.

> (iv) Relevance to an individual (comparative):
> Extent condition 1: an assumption is relevant to an individual to the extent that the contextual effects achieved when it is optimally processed are large.
> Extent condition 2: an assumption is relevant to an individual to the extent that the effort required to process it optimally is small.

> (v) Presumption of optimal relevance:
> (a) The ostensive stimulus is relevant enough for it to be worth the addressee's effort to process it.
> (b) The ostensive stimulus is the most relevant one compatible with the communicator's abilities and preferences.

Cooperative Principle of Grice (1975):

> (vi) Quantity: give the right amount of information (not too little, not too much).

> (vii) Quality: try to say only what is true (don't say that for which you lack adequate evidence; don't say what you know to be false).

> (viii) Relevance: make what you say is relevant to the topic at hand.

> (ix) Manner: be clear (avoid ambiguity, excessive wordiness, obscurity, etc.).

[11] The Inference Condition of the IC is formalized as follows: If the reader/listener concludes by deduction or induction that the author's intent is ɩ, then the optimal meaning is the one which expresses ɩ.

The articulated authorial intention of the AIC includes oral or written forms such as recorded statements, aural-visual materials such as video cassettes, CDs, and DVDs.

The third component of Optimal Meaning Detector (*OMD*) is defined in (29).

(29) ω-algebra

>   Let $x=\Sigma\cdot\omega$ be associated with each perceived meaning in an evaluation table called 'Tabla' satisfying terms (i)-(v) specified below. Assume that x, Σ and ω are random variables, where ω is a binary variable that adopts a value of either 1 or 3/2, and $\Sigma=(\sigma+\beta+\gamma+\delta)$ whose lower case Greek letters denote values assigned by the TC, RC, AIC, and IC respectively. If the value of γ is $\varnothing$, then assume $\beta+\varnothing+\delta=\beta+\delta$.
>   i. Find the value of Σ for each perceived meaning;
>   ii. If there is more than one perceived meaning with the highest value in Σ, then assign the value 3/2 to ω of the most 'insightful' meaning, and the rest gets the value 1;
>   iii. Find the value of x for each perceived meaning;
>   iv. If $x=15$, then optimal, otherwise $x\approx15$ is; and
>   v. Check the box next to the optimal meaning.

The evaluation devices of the IAAM and that of Optimality Theory share the same purpose of selecting an optimal candidate among possible ones. In the former case an optimal meaning of an ambiguous expression is chosen among possible meanings, whereas in the latter case an optimal output is singled out among possible outputs produced by the generator. The IAAM's four evaluation criteria are, however, basically different from the evaluation constraints of Optimality Theory. Text criterion (TC) of the IAAM is an essential grammatical requirement ensuring an ambiguous expression to be grammatically coherent within a domain of sentence, or a set of sentences, or a text as a whole, whereas Relevance Criterion (RC) is a prerequisite discourse requirement for mutual understanding between the writer/speaker and the reader/listener. A written or spoken discourse is transmitted by means of a text or utterance which in turn is the basis of an optimal meaning selection, therefore TC comes before RC. This being the case, both TC and RC are generally likely to be satisfied since they are indispensable in a text or an utterance containing intended ambiguity. Consequently, the relative value 1 is assigned for TC and the relative value 2 for RC. On the other hand, Authorial Criterion (AC) and Inference

Criterion (IC) play important roles in singling out an optimal meaning among possible ones. An authorial intent is not usually stated in a text, therefore the reader has to take the burden of finding out the most likely authorial intent by inference. Even if an authorial intent is stated in a text more often than not it is not straightforwardly worded,[12] thus the reader has to determine the most likely authorial intent by inference. For these reasons, the relative value 3 is assigned for AC and the relative value 4 for IC. As suggested above, the values assigned to the four criteria are relative and they are kept in minimum using the elementary Arabic numerals to achieve simplicity in calculation. The spirit of simplicity is also seen in the value assignment of ω-*algebra*. Since each of the four criteria has a fixed value, the ranking of criteria is irrelevant unlike Optimality Theoretic evaluation procedures.

Let us now show how the IAAM accounts for concrete examples. This is done in three steps: (i) ambiguity detection, (ii) ambiguity representation, and (iii) optimal meaning selection. The ambiguous sentence, *He chased elephants on horseback* discussed in section 3.1, which is repeated here as in (30) is now accounted for in terms of the Ambiguity Detection (*AD*) together with the Shared-Knowledge Parameter (*SKP*).
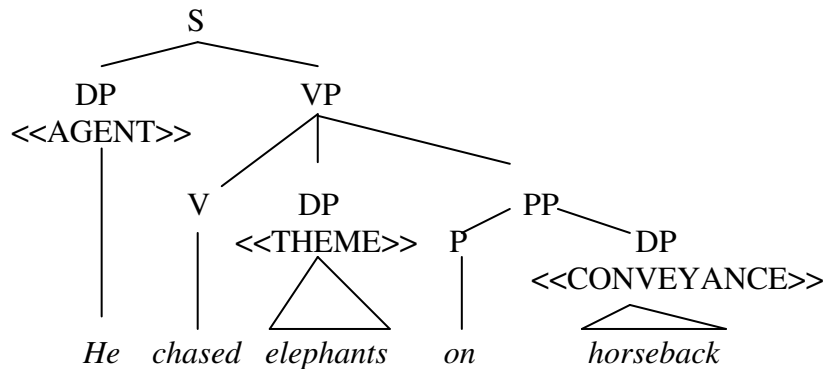
(30) *He chased elephants on horseback.*
      a. *He chased elephants while riding a horse.*
      b. *He chased elephants which were on horseback.*

The interpretations, (30a) and (30b) are each assigned by the Integrated Ambiguity Representation a distinct integrated ambiguity representation as illustrated in (31a) and (31b), respectively.
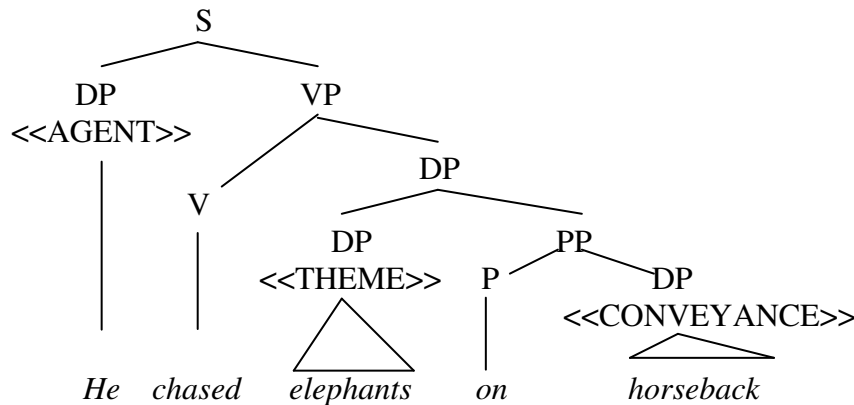
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[12] See Clark (1999: 363).

(31) a. Meaning 1:

PHON: [hi: tʃeɪst elɪfənts ɔn hɔːrsbæk]
INT: He chased elephants while riding a horse.
SYN-SEM:

```
                        S
              ┌─────────┴─────────┐
             DP                  VP
          <<AGENT>>       ┌───────┼───────────┐
             │            V       DP          PP
             │            │    <<THEME>>   P─────┐
             │            │      /\        │      DP
             │            │     /  \       │  <<CONVEYANCE>>
             │            │    /    \      │      /\
            He         chased elephants   on   horseback
```

b. Meaning 2:

PHON: [hi: tʃeɪst elɪfənts ɔn hɔːrsbæk]
INT: He chased elephants which were on horseback.
SYN-SEM:

```
                        S
              ┌─────────┴──────────┐
             DP                   VP
          <<AGENT>>         ┌──────┴──────┐
             │              V            DP
             │              │      ┌──────┴──────┐
             │              │     DP            PP
             │              │  <<THEME>>   P──────┐
             │              │    /\        │      DP
             │              │   /  \       │  <<CONVEYANCE>>
             │              │  /    \      │      /\
            He           chased elephants on   horseback
```

If we take the speech act context into consideration, we see that there could be yet one more additional interpretation: a combination of both Meaning 1 and Meaning 2. This is a natural consequence since the recognition of both Meaning 1 and Meaning 2 leads to the overall appreciation of the joke. This motivates the addition of Meaning 3 as shown in (32).

(32) Meaning 3: Both Meaning 1 and Meaning 2, where the second involves the punchline.

Let us now consider in terms of the Meaning Evaluation the reasoning leading to the selection of the best possible meaning among the three alternatives as pictured in (33).

(33)

Application of Meaning Evaluation (*ME*)

Text Criterion (TC):
    Meaning 1, Meaning 2 and Meaning 3 are consistent with the given context.
Relevance Criterion (RC):
    Since the reader's/listener's immediate concern is to recognize a punchline, Meaning 2 is optimal.
Authorial Intent Criterion (AIC):
    An articulated authorial intent is not available.
Inference Criterion (IC):
    If the intention of joke-writers is to entertain the reader/listener by skillfully arranging words thereby leading to the reader/listener perceive a punchline as well as a non-punchline interpretation, then Meaning 3 is optimal.

By the ω-*algebra* defined in (29), each of the above three meanings is associated with the equation, $x = \Sigma \cdot \omega$. The value of x is calculated by term (iii) of the ω-*algebra* as illustrated in (34). Notice that an articulated authorial intent is not available, therefore the use of the symbol Ø.

(34) $x = \Sigma \cdot \omega$

    Meaning 1: $x = (1+0+Ø+0) \times 1$
        $x = 1$
    Meaning 2: $x = (1+2+Ø+0) \times 1$
        $x = 3$
    Meaning 3: $x = (1+0+Ø+4) \times 1$
        $x = 5$

The highest value among the three meanings is 5. Therefore, Meaning 3 is declared optimal and gets a checkmark by term (iv) of the ω-*algebra* as shown in (35).

(35) Table

|	Meanings	TC	RC	AIC	IC
	Meaning 1	1	0	Ø	0
	Meaning 2	1	2	Ø	0
√	Meaning 3	1	0	Ø	4

Let us now take the example introduced in (5) and show the wide applicability of the Integrated Ambiguity Analysis Model (IAAM). We already know that the ambiguous expression '*a mighty empire*' in the sentence *If you attacked the Persians, you would destroy a mighty empire* allows at least three distinct interpretations as shown in (6), repeated here as in (36). The detection of the three readings is accounted for by the Ambiguity Detection (*AD*) together with the Shared-Knowledge Parameter (*SKP*).

(36) a. *the Empire of Persia*
      b. *the Empire of Lydia*
      c. *some other empire*

The Integrated Ambiguity Representation (*IAR*) provides three distinct representations as pictured in (37).
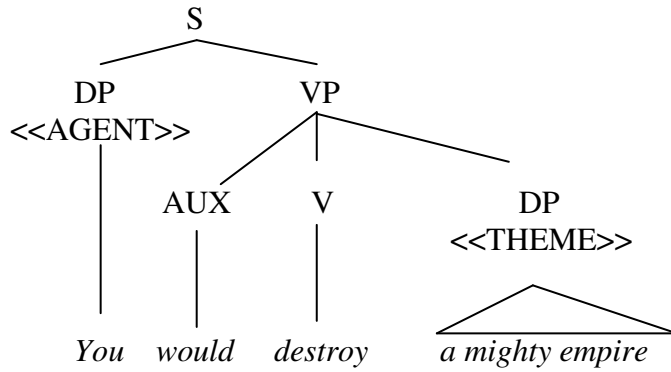
(37) Meaning 1:

PHON: [yu: wud dɪstrɔɪ ə maɪti empaɪər]
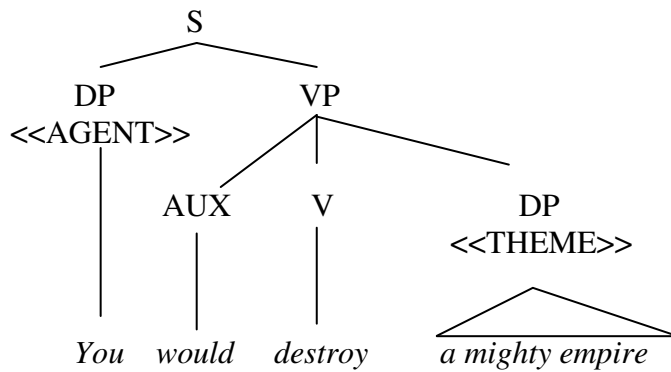INT: *You would destroy the empire of Persia.*
SYN-SEM:
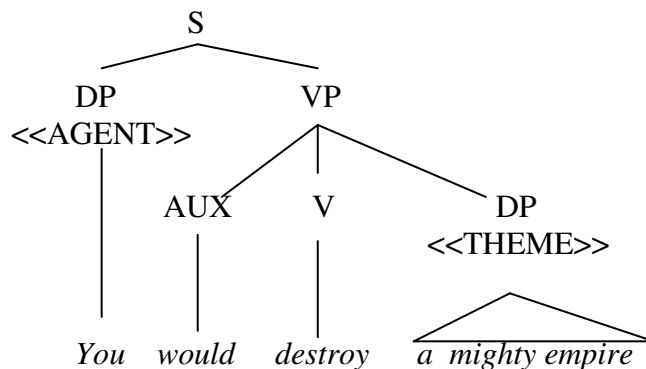
Meaning 2:

PHON: [yu: wud dɪstrɔɪ ə maɪti empaɪər]
INT: You would destroy the empire of Lydia.
SYN-SEM:

```
                        S
              _____/ _____
            DP                   VP
        <<AGENT>>        ____/ |_____
                       AUX   V          DP
                        |    |      <<THEME>>
                        |    |        /\
                        |    |       /  \
                        |    |      /____\
       You     would   destroy   a mighty empire
```

Meaning 3:

PHON: [yu: wud dɪstrɔɪ ə maɪti empaɪər]
INT: You would destroy some other empire.
SYN-SEM:

```
                        S
              _____/ _____
            DP                   VP
        <<AGENT>>        ____/ |_____
                       AUX   V          DP
                        |    |      <<THEME>>
                        |    |        /\
                        |    |       /  \
                        |    |      /____\
       You     would   destroy   a mighty empire
```

The procedure for determining the best possible interpretation among the above three meanings is provided in (38).

(38)

Application of Meaning Evaluation (*ME*)

Text Criterion (TC):
    Meaning 1, Meaning 2, and Meaning 3 are consistent with the given context.
Relevance Criterion (RC):
    Unlike Meaning 3, Meaning 1 and Meaning 2 are immediately relevant to both Croesus and the reader.
Authorial Intent Criterion (AIC):
    An articulated author's intent is not available.
Inference Criterion (IC):
    If the author's intent is to keep the reader in suspense until the outcome of Croesus's action, then Meaning 2 is optimal.

In terms of term (iii) of the ω-*algebra* in (29), we obtain the following results.

(39) $x = \Sigma \cdot \omega$

$\quad$ Meaning 1: $x = (1+2+\emptyset+0) \times 1$
$\qquad\quad x = 3$
$\quad$ Meaning 2: $x = (1+2+\emptyset+4) \times 1$
$\qquad\quad x = 7$
$\quad$ Meaning 3: $x = (1+0+\emptyset+0) \times 1$
$\qquad\quad x = 1$

By following term (iii) and term (iv) of the ω-*algebra*, we arrive at the conclusion: Meaning 2 is declared optimal and gets a checkmark.

(40) Table

	Meanings	TC	RC	AIC	IC
	Meaning 1	1	2	Ø	0
√	Meaning 2	1	2	Ø	4
	Meaning 3	1	0	Ø	0

The Integrated Ambiguity Analysis Model (IAAM) can account for other examples such as example (25) by following the analogous procedure. The optimal interpretation of (25) is the one in which each Flintstones kid in the group is growing and at the same time the whole group of ten million Flintstones kids is growing. This can be arguably said because, as Norvig (1988: 4) asserts, it is the point of the pun and considered to be the most favorable interpretation intended by the sponsor/creator of the advertisement slogan.

The above elaboration paves the way for the final objective of this paper, an integrated ambiguity analysis of Zen kōan samples taken from *The Blue Cliff Record* and *The Gateless Gate*.[13]

4. Integrated Ambiguity Analysis of classic Zen Kōans

In presenting multiple-ambiguous expressions written in Chinese characters, it is sometimes next to impossible to give an equitable translation to an original expression in form and sound. Therefore, the reader is warned in advance that the original visual and auditory beauties/pleasure of expressions in Chinese/Japanese texts may be lost in the corresponding English translations. The important message I wish to get across to the reader is to give a clear and straightforward linguistic exposition of Zen kōan ambiguity, thereby exemplifying a general practicality and applicability of the IAAM.

4.1 Sample I: The 55th Case of the *Hekiganroku*

The background knowledge of the sample kōan should be provided first for heuristic purposes. A Zen dialogue between a master and student often involves a heated exchange of words and physical contact such as slapping and hitting with a fist or by a stick. This escalation of action is understandable since Zen dialogues often contain a matter of life-or-death. Here is an exemplary story: A monk named Zengen has been deeply

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[13] *The Blue Cliff Record* is a collection of Zen Buddhist kōans originally compiled in China during the Song Dynasty in 1125 and then expanded into its present form by the Zen master, Yuanwu Keqin (1063–1135). *The Gateless Gate* is a collection of forty eight Zen kōans and commentaries compiled in the early 13th century by a Chinese monk, Wumen. Along with *The Blue Cliff Record*, *The Gateless Gate* is still much used in the Rinzai School of Zen today (See Iriya et al. 2000; Nishimura 1995).

disturbed by a lingering problem of life and death for a long time. As an attendant, he visits a house to express condolences and takes the occasion of tapping on the coffin and asks his master Dōgo if the deceased is dead or alive. Dōgo replies "I do not say he is alive; I do not say he is dead." Failing to understand what it meant, Zengen demands a one-way-or-the-other answer saying he will hit the master if no answer is given. Dōgo answers, "Hit me if you like but 道即不道." The expression, 道即不道 ([dɑʊ tsi̯ək pi̯ə̯ʊ dɑʊ] in Chinese ; [doː sok ɸu doː] in Japanese) is at least two-way ambiguous between 'I will not say' and 'saying is no-saying'. (The English translation in (43) only expresses the first interpretation.) In this connection, Tseng's (2002) remark is pertinent:

> Zen Masters are witty, in that their responses are intended not only to teach their disciples something about enlightenment, but also to skillfully avoid telling them directly what it is. Moreover, Zen kōans do not simply evoke contradictions; instead, they attempt to resolve and conflate them as unity in diversity, as manifestation of non-duality.[14]

Consider now the sample kōan.

(41)   Chinese text[15]

<div align="center">

碧巌録第五十五則

道吾漸源弔慰

</div>

舉。道吾與漸源、至一家弔慰。源拍棺云、生邪死邪。吾云、生也不道、死也不道。源云、為什麼不道。吾云、不道不道。同至中路、源云、和尚快與某甲道。若不道、打和尚去也。吾云、打即任打、道即不道。源便打。

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[14] A Zen master's awakening experience is unique and original in its manifestation in action or words. In manifesting an attainment in words, expressions used are often metaphorical, suggestive and ambiguous. Therefore, the detection and explanation of Zen kōan ambiguities demand both concentration and dedication. Not only the understanding of Zen Buddhism doctrine but also the knowledge of classical Chinese literature is of crucial importance. In this respect, Hori's (2003: 44) claim is right to the point: "a good allusion masks but also reveals its object of reference in a clever way, such that the dawning revelation brings pleasure to the reader or listener of the verse." Without realizing the allusive style of Zen kōans, it is sometimes difficult to grasp a fine nuance of harsh words deliberately delivered by Zen masters and monks.

[15] The text is taken from Iriya et al. (2000: 221).

(42) Japanese kun-yomi text[16]

<div align="center">

碧巌録第五十五則

道吾、漸源と弔慰す

</div>

擧す。道吾、漸源と一家に至って弔慰す。源、棺を拍って云く、「生か死か」。吾云く、「生とも道わじ、死とも道わじ」。源云く、「為什麼にか道わざる」。吾云く、「道わじ、道わじ」。同りて中路に至り、源云く、「和尚快かに某甲が與に道え。若し道わずんば、和尚を打ち去らん」。吾云く、「打つことは即ち打つに任す、道うことは即ち道わじ」。源、便ち打つ。

(43) English translation[17]

<div align="center">

55th Case of the *Hekiganroku*: Dōgo's "I Will Not Say!"

</div>

Dōgo went with his disciple Zengen to a certain house to offer condolences for someone's death. Zengen rapped on the coffin and said to Dōgo, "Tell me, please, is this life or is this death?" Dōgo replied, "I do not say he is alive; I do not say he is dead." Zengen then asked, "Why don't you tell me (one way or the other)?" Dōgo answered "I will not say! I will not say!" On their way back to the temple, Zengen said, "Master! Do tell me! If you don't, I'll knock you down!" Dōgo replied, "Strike me if you like—but you won't get a word out of me." Zengen thereupon struck him. (Supplement: Afterwards, when Dōgo was dead, Zengen went to Sekiso, [another of his disciples,] and told him what had happened. Sekiso said, "I do not say he was alive, I do not say he was dead. Zengen said, "Why don't you tell me?" Sekiso said, "I will not say! I will not say!" Zengen suddenly realized the truth.)

By saying 道即不道, Dōgo tries to help Zengen grasp the truth. The ambiguous expression suggests at least two simple but significant truths. First, the answer to the problem of life and death should be sought nowhere but inner-self, therefore Dōgo's reply, "*I will not say!*" Second, the other interpretation, 'saying=no-saying' points towards a deeper understanding of life and death, life=death: To live is to get closer to death, and to get closer to death is to live. The universe and everything in it are constantly changing. Therefore, any object at any point in time and space is

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[16] Iriya et al. (2000: 221). Kun-yomi means a Japanese way of reading a Chinese character based on its meaning.

[17] The text is taken from Blyth (1942: 340).

simultaneously at the beginning and end. Thus, Dōgo aptly answered, *"I do not say he is alive; I do not say he is dead."* Consider finally Blyth's (1942: 320) English translation of the twenty fourth case of *Mumonkan* and his comment given under (44), which is directly relevant to the present case.

(44) Blyth's translation and comment

> A monk asked Fūketsu, "Both speaking and silence belongs to the relative world: how can we escape these two errors?" Fūketsu said,
> > I always think of Kōnan in March;
> > Partridges chirp among the scented blossoms.
> Fūketsu did not speak, he was not silent. A voice came out of the Nothing; the question was answered.

The above exposition reveals yet one more interpretation of the ambiguous expression under consideration: Both *"I will not say!"* and "saying=no-saying" at the same time. [18] This third interpretation conforms to the purpose of the kōan as the above discussion corroborates.

4.2 Ambiguity representation and optimal meaning selection

We have reviewed the ambiguous expression, 道即不道 and identified its possible interpretations in the given context. The next step is to show an integrated ambiguity representation for each interpretation.

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[18] Most Zen kōans are at once both direct and simple with very little trace of background knowledge like haiku. As a result, many different interpretations are possible according to the reader's/listener's level of attainment and the depth of knowledge. Among many possible interpretations, an optimal one eventually emerges. The optimal interpretation tends to be a simultaneous amalgam of competing interpretations. This is not surprising because the 'simultaneity' is a quintessential aspect of Zen. The simultaneity is also seen in Zen drawings, and in Zen-influenced martial arts such as kendo, aikido, and karate. For example, in those martial arts a defensive move is at the same time an offensive move.

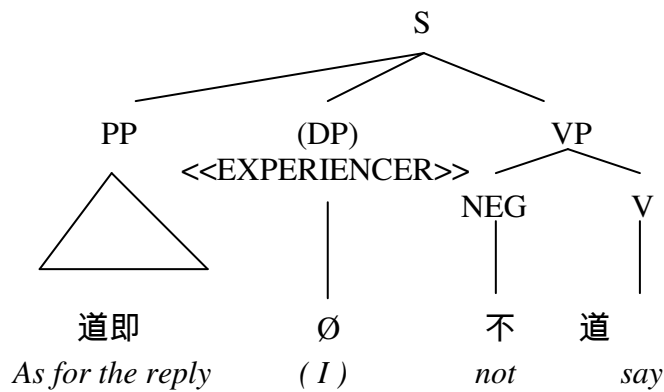(45) Integrated Ambiguity Representation (IAR)

Meaning 1

PHON: Chinese [dɑʊ tsi̯ək pi̯ə̯ʊ dɑʊ]
Japanese [doː sok ɸu doː]
INT: *I will not say. (You should find the answer for yourself.)*
SYN-SEM:

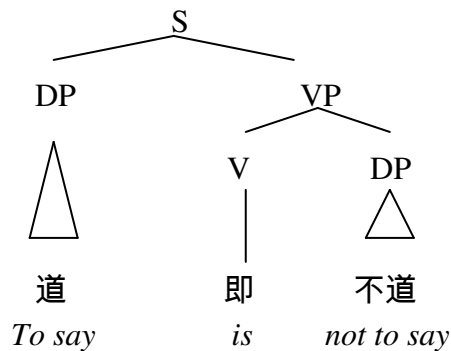|		
道即	Ø	不 道
As for the reply	*(I)*	*not say*

Meaning 2

PHON: Chinese [dɑʊ tsi̯ək pi̯ə̯ʊ dɑʊ]
Japanese [doː sok ɸu doː]
INT: *To say is not to say. (Likewise, living is dying and dying is living; the two are indivisible.)*
SYN-SEM:

道	即	不道
To say	*is*	*not to say*

Meaning 3

PHON: Chinese [dɑʊ tsi̯ək pi̯ə̯ʊ dɑʊ]
Japanese [doː sok ɸu doː]
INT: Both Meaning 1 and Meaning 2 at the same time.
SYN-SEM: The SYN-SEM of both Meaning 1 and Meaning 2.

The evaluation procedure for the optimal meaning selection among the three perceived meanings is shown in (46).

(46)

Application of Meaning Evaluation (*ME*)
Text Criterion (TC): 　　All of Meaning 1, Meaning 2, and Meaning 3 are consistent in the given context. Relevance Criterion (RC): 　　Although Meaning 1 is of immediate relevance to the devoted truth-seeking monk, Meaning 2 and Meaning 3 are directly relevant to the reader because they convey the profound truth. Authorial Intent Criterion (AIC): 　　An articulated author's intent is not available. Inference Criterion (IC): 　　Master Dōgo's answer, 道即不道 is both skillful (in the sense that it is two-way ambiguous) and direct to the point. In one interpretation, 'I will not say!,' Dōgo gives a lesson to the monk: You should find the answer for yourself. In the other interpretation, Dōgo plants a hint in the monk's troubled mind torn between the thought of life and death. In the course of time, the monk grasps the simultaneity of reality: Living is dying and dying is living, the two are indivisible. The monk and the reader are challenged here to perceive the simultaneity of the ambiguous expression, therefore Meaning 3 is optimal.

In terms of term (iii) of the *ω-algebra* in (29), the selection procedure produces the results illustrated in (47).

(47)

Meaning 1: $x=(1+0+\emptyset+0)\times1$
　　　$x=1$
Meaning 2: $x=(1+2+\emptyset+0)\times1$
　　　$x=3$
Meaning 3: $x=(1+2+\emptyset+4)\times1$
　　　$x=7$

Meaning 3 has the highest value, therefore it is declared optimal and gets a checkmark as shown in (48).

(48) Table

	Meanings	TC	RC	AIC	IC
	Meaning 1	1	0	Ø	0
	Meaning 2	1	0	Ø	0
√	Meaning 3	1	2	Ø	4

4.3 Sample II: The 1st Case of the *Mumonkan*

The 1st Case of the *Mumonkan* can be analyzed as follows. As described in the Mahaparinirvana Sutra, the Buddha-nature means

the true, immutable, and eternal nature of all beings. Since all beings possess the Buddha-nature, it is possible for them to attain enlightenment and become a Buddha, regardless of what level of existence they occupy (Diener et al. 1991).

Well aware of this teaching, a devoted monk anticipating a positive answer cunningly challenges Master Jōshū and asks the following question: "Does a dog have the Buddha nature or not?" If Master Jōshū gives an affirmative answer, not only does he fall into the error of yes-no relativity but also loses the dual to the monk giving away an easy and penny-worth answer. Baffling the monk's expectations, Master Jōshū answers "無" ([moʊ]/[wu] in Chinese; [mu] in Japanese). [19] This word is multi-ambiguous: (i) 無 is the negative answer "nay"; (ii) 無 is an onomatopoeic word resembling a murmuring sound of approval; (iii) 無 is an onomatopoeic word resembling a dog's growl; and (iv) 無 is a long voiceless fricative sound passing through the nose produced with closed mouth, which is concentrated upon while in practicing zazen, a form of meditation sitting cross-legged. Through the arduous Zen practice, a student of Zen can become one with 無 and achieve the complete unification where there is no distinction between self and other.

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[19] The word 無 has at least two phonetic variants in Modern Chinese: [moʊ] in Cantonese and [wu] in Mandarin. There are two phonetic variants of 無 in Japanese: [bu] and [mu]. The [bu] form appears in compound words such as 無精 [buʃo] 'laziness,' and 無事 [budʒɪ] 'safe,' while the [mu] form occurs in words like 無形 [mukeɪ] 'formless,' and 無心 [muʃɪn] 'no-mindedness'. Only the [mu] form, however, is allowed when the Chinese character, 無 occurs alone.

With the above explanation in mind, let us now consider the sample kōan.

(49)   Chinese text[20]

<div align="center">

無門関第一則

趙州狗子

趙州和尚、因僧問、狗子還有佛性也無。州云、無。

</div>

(50)   Japanese kun-yomi text[21]

<div align="center">

無門関第一則

趙州の狗子

</div>

趙州和尚、因みに僧問、「狗子に還って佛性有りや他た無しや」。州云く、「無」。

(51)   English translation[22]

<div align="center">

1st Case of the *Mumonkan*: Jōshū's "Mu"

</div>

A monk asked Jōshū, "Has a dog the Buddha Nature or not?" Jōshū answered, "無, Mu."

Master Mumon, the editor-author, commentator and advocate of the *Mumonkan*, offers a commentary on the kōan under discussion in the following verse:[23]

(52)   狗子佛性　全提正令

狗子佛性　全提正令
纔渉有無　喪身失命

The dog, the Buddha Nature,
The pronouncement, perfect and final.
Before you say it has or has not,
You are a dead man on the spot.

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[20] The text is taken from Nishimura (1995: 21).
[21] Nishimura (1995: 21).
[22] The text is taken from Sekida (1977: 18), to which I made a slight modification.
[23] The Chinese text is taken from Nishimura (1995: 23), while the English translation is taken from Sekida (1977: 28).

Moreover, in the post-text comment on the 1ˢᵗ Case of the *Mumonkan*, Master Mumon writes: "Do not believe 無 means nothing. It is not nothing, the opposite of existence. Concentrate your whole energy into this 無, and you will attain the state of no distinction between subject and object."

4.4 Ambiguity representation and optimal meaning selection

Given below are the integrated ambiguity representations for the expression, 無 . Here, the symbol EX stands for exclamation; OP, onomatopoeia; and DP, determiner phrase.

(53) Integrated Ambiguity Representation (IAR)

Meaning 1

PHON: Chinese [moʊ]/[wu]
                Japanese [mu]
INT: *"No (with a shake of his head)"*
SYN-SEM:

                S
                |
               EX
               無
               No.

Meaning 2

PHON: Chinese [moʊ]/[wu]
                Japanese [mu]
INT: *"Yes. (with a nod of approval)"*
SYN-SEM:

                S
                |
               OP
               無
               Yes.

Meaning 3

PHON: Chinese [moʊ]/[wu]
              Japanese [mu]
INT: A low growl.
SYN-SEM:

                        S
                        │
                        OP
                        無

Meaning 4

PHON: Chinese [moʊ]/[wu]
              Japanese [mu]
INT: A barely audible long, deep exhalation in zazen.
SYN-SEM:

                        S
                        │
                        OP
                        無

Meaning 5

PHON: Chinese [moʊ]/[wu]
              Japanese [mu]
INT: Absolute nothingness (or undifferentiated state).
SYN-SEM:

                        S
                        │
                        DP
                        無
              Absolute nothingness

The evaluation of the five perceived meanings is now executed in terms of the Meaning Evaluation.

(54)

Application of Meaning Evaluation (*ME*)

Text Criterion (TC):
     Meaning 1, Meaning 2, Meaning 3, Meaning 4 and Meaning 5 are all consistent with the given context.
 Relevance Criterion (RC):
     Meaning 1 and Meaning 2 are of immediate relevance seen from the point of view of the monk's anticipation and the reader.
 Authorial Intent Criterion (AIC):
     An articulated author's intent is not available. However, Mumon's comment in (52) seems to falsify Meaning 1 and Meaning 2.
 Inference Criterion (IC):
     If the kōan author's intention is to help the reader/students of Zen attain enlightenment by direct experience, then Meaning 3, Meaning 4 and Meaning 5 have equal weight.
 Optimal meaning selection by term (ii) of ω-*algebra*:
     Among the three candidates, Meaning 3 shows the most penetrating insight since it conveys profound multiple messages:
     1. Without saying 'yes' or 'no,' the question was answered.
     2. By transforming into a dog, Jōshū showed that a dog has the Buddha nature. (It is present in all sentient beings.)
     3. Jōshū showed an instance of undifferentiated state in a concrete fashion: Jōshū is Jōshū, and at the same time Jōshū=dog, achieving nonduality of the enlightened state. Recall that the original Chinese title is 趙州狗子, whose literal translation is 'Jōshū dog'.

Each of the five meanings in (53) is now associated with $x = \Sigma \cdot \omega$ in terms of the ω-*algebra*. Notice that Meaning 3 gets the highest value among the three candidates according to term (ii) of the ω-*algebra* as illustrated in (55). Therefore, Meaning 3 is declared optimal and gets a checkmark as illustrated in (56).

(55) $x = \Sigma \cdot \omega$

    Meaning 1: $x = (1+2+Ø+0) \times 1$
        $x = 3$
    Meaning 2: $x = (1+2+Ø+0) \times 1$
        $x = 3$
    Meaning 3: $x = (1+0+Ø+4) \times 3/2$
        $x = 7.5$
    Meaning 4: $x = (1+0+Ø+4) \times 1$
        $x = 5$
    Meaning 5: $x = (1+0+Ø+4) \times 1$
        $x = 5$

(56) Table

	Meanings	TC	RC	AIC	IC	$\Sigma \cdot \omega$
	Meaning 1	1	2	Ø	0	3×1
	Meaning 2	1	2	Ø	0	3×1
√	Meaning 3	1	0	Ø	4	5×3/2
	Meaning 4	1	0	Ø	4	5×1
	Meaning 5	1	0	Ø	4	5×1

As the above exposition shows, the Integrated Ambiguity Analysis Model (IAAM) is formulated as a generalized ambiguity analysis model and it has proven effective in analyzing concrete examples of jokes, slogans, and literary work.

5. Possible problems and solutions

Three possible problems should be addressed: (i) Why is the Inference Criterion (IC) ranked over the Authorial Intent Criterion (AIC)?, (ii) Are the Ambiguity Detection (*AD*) and the Ambiguity Evaluation (*AE*) legitimate?, and (iii) How does the Integrated Ambiguity Analysis Model (IAAM) cope with hypothetical situations where the same value results as illustrated in (57a) and (57b)? Notice that the hypothetical situations are completely different from the case we have dealt with in (55).

(57) Table

a.

Meanings	TC	RC	AIC	IC
Meaning 1	0	0	3	
Meaning 2	1	2	0	

b.

Meanings	TC	RC	AIC	IC
Meaning 1	0	0	0	4
Meaning 2	1	0	3	0

Let us now consider the solution for each of the above possible problems. There are a couple of reasons why I put the IC over the AIC. First, authors rarely express their intended meanings for their deliberate ambiguous expressions. Even if an intended meaning is provided, it is usually concealed in carefully chosen words and skillfully arranged phrases and sentences as exemplified in the kōan examples discussed in section 4.1–4.4. Therefore, a reconstruction of the author's intended meaning or its approximation is up to the reader's ability to draw a legitimate inference. (See also the discussion in section 3.3.) Second, the methods of determining authorial intention and its legitimacy has been one of the central issues in the history of literary criticism. Among various viewpoints, theories, and approaches, the basic assumptions of New Criticism and Reader Response theory are relevant to the authorial intention under consideration. Commenting on the New Criticism, Garćia and Angel (1991) claim that

> the critic's meaning is as good as the author's. The best meaning, in these critic's [Wimsatt and Beardsley's (1954)] view, overrides the authorial meaning, especially if the authorial meaning has to be determined by means of information not accessible to the reader.

Hirsch (1967), an advocate of the Reader Response Criticism, claims that although the reader may not determine an authorial intent for sure, he/she is constrained by his/her estimate of the probable intent. Two more additional justifications can be put forward for the reader's vantage point in constructing an authorial intent or its approximation. An author writes for readers with the intention of sharing his/her sense and thought with the

reader. Moreover, once a piece of work is published it is in the hands of the general public.

The second possible problem implies that if the result of ambiguity detection and optimal meaning selection of an ambiguous expression varies from reader to reader, then generalization would be lost. The issue raised here is a quite natural one. The ambiguity analysis is an intellectual challenge, which requires insight as well as wide and deep knowledge. Therefore, the shared knowledge between the writer/speaker and the reader/listener is essential for the detection and the optimal meaning selection of intended ambiguity. In this sense, the Shared-Knowledge Parameter is well-motivated.

Let us now consider the third possible problem. Meaning 1 of (57a) is unlikely for two reasons. First, it gets the value zero in the Text Criterion (TC). This means that Meaning 1 is incoherent with the given context. Second, Meaning 1 also gets the value zero in the Relevance Criterion (RC) indicating that it is not immediately relevant to the reader. Meaning 1, however, gets the value 3 in the Authorial Intent Criterion (AIC). In such a case, the Inference Criterion (IC) can determine the legitimacy of the AIC taking the above two reasons into consideration. On the other hand, Meaning 1 of (57b) is unlikely since it gets the value zero in both the TC and RC. However, Meaning 1 is declared optimal by the IC. In such a case, term (ii) of the ω-algebra can determine the best possible meaning among Meaning 1 and Meaning 2 of (57b) in terms of the 'insightfulness' criterion.

6.   Conclusion

The present paper offers a formalized system of Integrated Ambiguity Analysis Model (IAAM). The IAAM accounts for intended ambiguities and produces the following three major results. First, the Ambiguity Detection together with the Shared-Knowledge Parameter accounts for the detection procedure of ambiguous expressions. Second, the Integrated Ambiguity Representation provides a unified phonetic/phonological, syntactic, semantic and pragmatic representation of ambiguous expressions. Finally, the Optimal Meaning Detector together with the Shared-Knowledge Parameter establishes the optimal meaning selection procedure and its application to concrete examples in English and Zen kōans in Chinese/Japanese. Therefore, the paper not only contributes towards

opening the door to the integrated linguistic analysis of intended ambiguity but also helps enhance a study of a linguistics-literature interface.

References

Aoun, Joseph & Li, Yen-Hui Audrey (1993) *Syntax of Scope*. Massachusetts: MIT Press.

Archangeli, Diana & Langendoen, Terence (1997) *Optimality Theory: An Overview*. Massachusetts: Blackwell Publishers.

Asher, Nicholas & Lascarides, Alex (1995) Lexical Disambiguation in a Discourse Context. *Journal of Semantics* 12: 69–108.

Asudeh, Ash & Crouch, Richard (2001) Glue Semantics for HPSG. *Proceedings of the 8th International HPSG Conference*, pp. 221–234. Norwegian University of Science and Technology.

Bloor, Thomas & Bloor, Meriel (1995) *The Functional Analysis of English: A Hallidayan approach.* New York: Arnold.

Blyth, Reginald Horace (1942) *Zen in English Literature and Oriental Classics.* Tokyo: Hokuseido Press.

Chomsky, Noam (1965) *Aspects of the Theory of Syntax*. New York: MIT Press.

Clark, Herbert H. (1999) *Using Language*. Cambridge: Cambridge University Press.

Diener, Michael, Erhard, Franz-Karl & Fisher-Schreib, Ingrid (1991) *The Shambhala Dictionary of Buddhism and Zen*. Translated by Michael Kohn. Boston: Shambhala.

Dowty, David R., Wall, Robert E. & Peters, Stanley (1981) *Introduction to Montague Semantics*. Holland: D. Reidel Publishing Company.

Fromkin, Victoria, Rodman, Robert & Hyams, Nina (2003) *An Introduction to Language*. 7th ed. Massachusetts: Thomson Heinle.

Garćia, Landa & Angel, José (1991) Authorial Intention in Literary Hermeneutics: on Two American Theories. *Miscelánea* 12: 61–92. Online. [http://www.unizar.es/departmentos/filologia_inglesa/garciala/publicaciones/inte].

Grice, Paul (1975) Logic and Conversation. In Peter Cole & Jerry Morgan, *Syntax and Semantics 3: Speech Acts*, pp. 41–58. New York: Academic Press.

Hirsch, Donald (1967) *Validity in Interpretation*. London: Yale University Press.

Hobbs, Jerry R. (1985) On the Coherence and Structure of Discourse. *Technical Report No. CSLI-85–37*, Center for the Study of Language and Information, Stanford University.

Hori, Sogen (2003) *Zen Sand: The Book of Capping Phrases for Kōan Practice.* Honolulu: University of Hawaii Press.

Huang, C. T. James (1995) Logical Form. In Gert Webelhuth (ed.) *The Government and Binding Theory and the Minimalist Program*, pp. 125–147. Cambridge, Mass.: Blackwell.

Iriya, Yoshitaka, Mizoguchi, Yuzo, Sueki, Fumihiko & Ito, Fumio (Transl. and annot.) (2000) 碧巌録 *Hekiganroku*. 7th ed., Tokyo: Iwanami Shoten.

Jurafsky, Daniel & Martin, James H. (2000) *Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition.* New Jersey: Prentice-Hall, Inc.

Kirchner, Robert (1998) *An Effort-Based Approach to Consonant Lenition.* UCLA: PhD dissertation.

Larson, Richard & Segal, Gabriel (1995) *Knowledge of Meaning: An Introduction to Semantic Theory.* Cambridge, Mass.: MIT Press.

Lasnik, Howard & Uriagereka, Juan (1988) *A Course in GB Syntax: Lectures on Binding and Empty Categories.* Cambridge, Mass.: MIT Press.

Leclerc, Paul (2004) Existentialism Perceptual Interpretation: The Duck-rabbit Figure. Online. [http://faculty.ccri.edu/paleclerc/existentialism/perc_figure.shtml].

Nishimura, Eshin (1995) 無門関 *Mumonkan*. 4th ed., Tokyo: Iwanami Shoten.

Norvig, Peter (1988) Multiple Simultaneous Interpretations of Ambiguous Sentences. Online. [http://www.norvig.com/mult-amb.pdf].

Pehar, Drazen (2001) Use of Ambiguities in Peace Agreements. International Conference on Language and Diplomacy 26–28 January 2001, Malta.

Poesio, Massimo (1996) Semantic Ambiguity and Perceived Ambiguity. In Kees van Deemter & Stanley Peters (eds.), *Semantic Ambiguity and Underspecification*. CSLI Lecture Notes No. 55, pp. 159–201. Stanford, California USA: CSLI Publications.

Prince, Alan & Smolensky, Paul (1993) *Optimality theory: Constraint Interaction in Generative Grammar.* Rutgers University Center for Cognitive Science Technical Report 2.

Radford, Andrew, Atkinson, Martin, Britain, David, Clahsen, Harald & Spencer, Andrew (1999) *Linguistics: An Introduction*. Cambridge: Cambridge University Press.

Rissinger, Matt & Yates, Philip (1996) *Biggest Joke Book in the World*. New York: Sterling Publishing Co. Inc.

Roca, Iggy & Johnson, Wyn (1999) *Phonology.* Malden, Massachusetts: Blackwell Publishers.

Sekida, Katsuki (1977) *Two Zen Classics: Mumonkan and Hekiganroku.* 4th print. New York: Weatherhill.

Sperber, Dan & Wilson, Deirdre (1984) *Relevance: Communication and Cognition.* London: Blackwell.

Sturt, Patrick, Fabrizio, Costa, Lombardo, Vincenzo & Frasconi, Paolo (2003) Learning First-pass Structural Attachment Preferences with Dynamic Grammars and Recursive Neural Networks. *Cognition* 88, 2: 133–169.

Tseng, Ming-Yu (2002) On the Interplay between Speech and Writing: Where Wordsworth and Zen Discourse Meet. *Journal of Literary Semantics* 31: 171–198.

Walton, Douglas (1996) *Fallacies Arising from Ambiguity*. Dordrecht: Kluwer Academic Publishers.

Wilson, Deirdre (1994) Relevance and Understanding. In Gillian Brown, Kirsten Malmkjaer, Alastair Pollitt & John Williams (eds.), *Language and Understanding*, pp. 38–58. Oxford: Oxford University Press.

Wilson, Deirdre & Sperber, Dan (2004) Relevance Theory. In Laurence R. Horn & Gregory Ward (eds.), *Handbook of Pragmatics*, pp. 607–632. Oxford: Blackwell.

Wimsatt, William K. & Beardsley, Monroe C. (1954) *The Verbal Icon: Studies in the Meaning of Poetry*. Lexington: University of Kentucky Press.

Wittgenstein, Ludwig (1967) *Philosophical Investigations*. 3rd ed. Transl. by G. E. M. Anscombe. New York: Macmillan.

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