INTRODUCTION TO MORPHOLOGY

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4. ARGUMENT STRUCTURE

In the previous two chapters, we have seen that many features obey our three basic conventions: the Node Labelling Convention, the Percolation Convention, and the Head Rule. We have even seen that "transitivity features" (which define whether a verb is transitive or intransitive) obey these general conventions to some extent. However, this idea of "transitivity" was over-simplified. Basically, a verb is transitive if it appears with a direct object noun phrase; otherwise it is intransitive. But a direct object noun phrase is only one of a larger range of phrases that verbs may or may not appear with. Some verbs also take a prepositional phrase instead of a noun phrase argument, such as *depend*:

(1)   I depended *on* Chris

        *I depended

        *I depended Chris.

Other verbs take a prepositional phrase in addition to a noun phrase object, such as *put*:

(2)   I put the book on the table

        *I put the book

        *I put on the table

        *I put

Other verbs consistently appear with embedded clauses instead of or in addition to noun phrases and prepositional phrases. These nuances are crucial to using verbs properly in sentences, but they are not captured simply by dividing verbs up into transitive or intransitive. Therefore, in this chapter we will replace the feature transitive with a more complex type of feature, called argument structures. We will see that, to a large extent, argument structures obey the same three conventions as other features. But since argument structures are more complex than other features, they can enter into some new and more complicated relationships as well. The purpose of this chapter is define the notion of argument structure, and to introduce the new rules and principles that concern argument structures. These principles will allow us to capture most of the

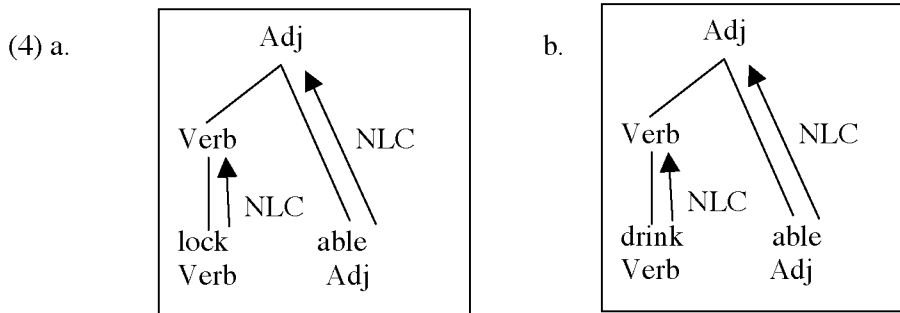important syntactic and semantic regularities that are involved in derivational morphology and compounding.

4.1   Derivation and Argument Structure

Before we explain more carefully what we mean by argument structure, let us give a few illustrative examples to show why it is so important to understanding derivational morphology and compounding. By the time we are finished with the analysis, these are some of the facts that we should have an account of.

Consider first the affix *–able* in English. This is a very productive affix that attaches to verbs and makes them into adjectives, as shown in the following examples:

(3)   a.   lockable, understandable, drinkable, movable ...

           b.   * dogable, *stoolable, *largeable, *blackable

It is easy to draw word structure trees for these examples, as follows:

(4) a.

```
           Adj
          /   ↗
     Verb      NLC
      |↗
      | NLC
     lock      able
     Verb      Adj
```

b.

```
           Adj
          /   ↗
     Verb      NLC
      ↑
      | NLC
     drink     able
     Verb      Adj
```

However, there are important facts about this derivation that are not captured by our theory so far. First of all, it is not the case that *–able* attaches to all verbs. The following examples are bad, for instance:

(5)   *arrivable, *existable, *wonderable, *dieable, *fallable, *cryable

The generalization is clear: all of the verb roots in (5) are purely intransitive verbs (they never appear with a direct object), whereas the verb roots in (3) are transitive. Apparently then, *-able* is required to attach to a transitive verb. This suggests that argument structure features are important in the morphology as well as in the syntax. Furthermore, the adjectives formed by *–able* are not used in the same way in the syntax as the base verbs are. Since the base verbs are transitive, they appear with two noun phrases, a subject and an object. The subject is consistently the one that causes the event to take place, whereas the object refers to the thing that is changed somehow because of the event.

(6)   a.   I locked the door.

          b.   I drank the water.

However, the adjectives derived by *–able* do not have both a subject and an object; they have only a subject. And, somewhat surprisingly, the subject of the *–able* adjective corresponds to the object of the verb root, not to its subject. Thus, examples like those in (3) are bad, in which we have tried to give the *–able* adjective the same kind of doer-subject as the verb root has.

(1)   * I am lockable.   (Potential meaning: I am good at locking things.)

          * I am drinkable.   (Potential meaning: I am capable of drinking .)

In contrast, the following examples are good:

(4)   a. This door is lockable.

          b. This water is drinkable.

Argument structure will enable us to analyse correspondences like this in an insightful way.

There are also systematic differences among affixes that we need a notion of argument structure in order to talk about. Consider, for example, the affixes *–ment, -er,* and *–ee.* All three are suffixes to verbs and create singular nouns.

(2)   a. employ-ment   pay-ment

          b. employ-er   pay-er

          c. employ-ee   pay-ee

Therefore, the word structure trees for all of these examples would be identical according to everything we have studied so far. However, they are far from synonymous, and cannot be used interchangeably. There is a systematic difference in the way the referent of the derived noun relates to the base verb. The *–er* nouns refer to the subject of the base verb, whereas the *–ee* nouns refer to the object of the base verb. Nouns formed by *–ment* refer to neither the subject, nor the object but rather to the whole event of employing or paying.

(3)   a.   I employ you.   I am the employ-er.

                                       You are the employ-ee

                                       My employ-ment of you (was investigated)

          b.   I pay my landlord.   I am the pay-er.

                                       My landlord is the pay-ee.

                                       My pay-ment to my landlord was on time.

Again we are missing something, and need a notion of argument structure—a specification of what kinds of things work as the subjects and objects of words—in order to fill the gap.

Argument structure is important to the understanding of compounding too. We have observed that people can understand new compounds like *turkey-stranglers* on their first use. The principles that we have in place (particularly the Head Rule) explain why this word is a noun, and why it is plural. However, we know something else important about the meaning of the word. Turkey-stranglers are instruments (or people) that are used for strangling turkeys; they are not instruments that turkeys can use for strangling their enemies. Thus, the nonhead of the compound in these forms somehow corresponds to the direct object of the base verb *strangle*, not to the subject. This is quite systematic: a *shark-eater* is someone who eats sharks, not a shark that eats things (the latter might be called a *man-eater* as in the 1970s film *Jaws*), a *dishwasher* is something that washes dishes, not dishes that do the washing (say, in Disney's *Beauty and the Beast*). Again, we need a notion of argument structure in order to understand these regularities. These, then, are some of the patterns that we hope to develop an explanation for by introducing a notion of argument structure.

4.2   Argument Structure I: Verbs

Let us then define more precisely what argument structure is. Along with their category features (V), tense features, and the like, we assume that verbs are also associated with *argument structures*. This is a semantically oriented list of phrases which the word must (or may) appear with in a syntactic structure. For example, some verbs are intransitive, appearing only with a subject, such as *swim*:

(4)   Intransitive Verbs   swim <Agent>

          swim: *The fish swam me.

                    The fish swam.

Such verbs then have only a single element in their argument structure list that corresponds to this single syntactic phrase. We write this single element inside angle brackets. Also since swimming is something that one can do voluntarily, as an act of the will, we say that the subject is semantically an agent. Thus, the argument structure of verbs like swim is <Agent>.

Ordinary transitive verbs such as *hit* must appear with two noun phrases, a subject and also an object:

(5)   Transitive Verbs   bite <Agent <Theme>>

          bite: The dog bit me.

                    *The dog bit.

The subject counts as an agent, just as the subject of *swim* does. The second noun phrase, however, plays a different role in the biting event: it is the participant that is most obviously affected or changed by the event (in this case, it is the one that needs a bandage and possibly a rabies shot). Thus, we call it the theme (or patient, or undergoer). The argument structure of a verb like bite is thus <Agent <Theme>>. (We will come back to reason for the additional layer of angle brackets below.)

Quite a number of verbs in English can be used as either transitive or intransitive verbs. When they are transitive, they have both a subject and an object; when transitive they have only a subject. However, two types of optionally transitive verbs can be distinguished in English, as can be seen by the following comparison:

(xx)   Optionally transitive verbs.

      a.   sing: The soloist sang the aria.   sing <Agent <(Theme) >>

                            The soloist sang.

                            #The aria sang (just before intermission).

      b.   break: Chris broke the vase.   Break <(Agent) <Theme>>

                            The vase broke.

                            #Chris broke (while I stepped out to get the mail).

When used transitively, both verbs have an ordinary <Agent <Theme>> argument structure, just as hit does. The difference is in the semantic role of the single argument in the intransitive sentence. For sing, the subject of the intransitive version is an agent, corresponding to the subject of the transitive verb. To say that Chris sang is to say that Chris sang something, but leaves open just what was performed. For break, the subject of the intransitive version is a theme, corresponding to the object of the transitive verb. To say that a vase broke is to say that something broke the vase, but to leave open who (or what) was responsible. This distinction is one reason for stating argument structure in semantic terms, using labels such as Agent and Theme, rather than syntactic terms such as subject and object: the semantic roles are in some ways more constant across different uses of the verb than the grammatical functions are. We express the fact that one of the arguments of these verbs is optional by the normal linguistic convention of putting the optional material in parentheses: for *sing*, it is the theme argument that is optional, thus we write: "<Agent <(Theme)>>"; for *break*, it is the agent argument that is optional, thus: "<(Agent) <Theme>>". Again, this is a linguistically significant distinction that cannot be captured with a simple feature like + transitive or – transitive.

In addition, there are verbs that require a subject, an object, and a third phrase—either a prepositional phrase or a second object. Such verbs are sometimes known as "Ditransitive verbs"; the verb *give* in English is a good example.

(xx)   Ditransitive Verbs   give <Agent <Theme, Goal>>

        give: You gave a book to Jody.

                     *You gave a book.

                     *You gave Jody.

                     *You gave.

Therefore, there should be three labels inside the angle brackets of the argument structure associated with give. The label "goal" is commonly used for the third phrase, because it expresses where the theme will be at the end of the event. The verb put, illustrated in (xx) above has a very similar argument structure, except that the type of prepositions used with the third phrase are different: we use a range of location prepositions with put, rather than the "goal" preposition to. (*I put the book on/under/in/near the box*, but not **I put the book to the box*.) To express this semantic distinction, we say that the third argument of put is a location, rather than a goal. In other words, put has the argument structure <Agent <Theme, Location>>.

Linguists do not necessarily agree on how many semantic roles there are, nor on exactly how they should be defined. This can become a murky area, with difficult intermediate cases. Fortunately, the details are not too crucial to us, so long as we can keep straight what we are talking about. Here is a rough list of the most commonly used semantic roles, and the ones that we will make use of, together with convenient abbreviations for them.

(6)   Agent   Ag   The thing that is responsible for doing the action [also Actor]

       Theme   Th   The thing that is moved, changed, described [also Patient]

       Goal   Go   The thing where an action ends (or for which the action was done).

       Location   Loc   The place where the theme is.

       Event   Ev   Something that takes place, that happens.

       Experiencer Exp   Someone who experiences a psychological state.

       Referent   R   The thing a noun refers to. (we'll see this below)

The first four semantic roles we have already illustrated in examples. *Try* is a good example of a verb that takes an event as its second argument; this event is expressed as an infinitival clause:

(8)   Chris tried [to find the key].   *Try* <Agent <Event>>

(*Try* can also take a noun phrase object, as in *Chris tried the rutabaga casserole*. In this usage, the verb *try* presumably has the argument structure <Agent <Theme>>. It is not unusual for a verb allow different argument structures, particularly in English.) Experiencer is a special semantic role that is found in some psychological predicates, such as *want* or *like*:

(9)   Chris wants [to find the key].   Want <Exp <Event>>

        Chris likes cats.   Like <Exp <Theme>>

Syntactically, want is not too different from try: it also takes a subject and an infinitival clause. Similarly, like is not too different from hit. However, wanting and liking are not actions that we necessarily do on purpose, as an act of the will. Rather, they are mental states that we find ourselves in. A linguistic reflection of this difference is that want and like sound strange in the progressive tense or as commands, whereas try and hit do not.

(10)   ??Want to find the key!   ??Chris is wanting to find the key.

        ??Like cats!   ??Chris is liking cats.

        Try to find the key!   Chris is trying to find the key.

        Hit the cat!   Chris is hitting the cat.

Thus, it seems wrong to classify the subject of want or like as an agent; rather, it is often classified as an experiencer. R is a role particular to nouns; we return to it in the next section.

Now we return to the extra layer of angle brackets that is found in most of the argument structures we have seen so far. Typically, one of the arguments of a verb is special in that it appears outside the phrase (maximal projection) that contains the verb. In other words, the verb phrase that is built around the verb contains all of the arguments associated with the verb, except one. This special argument is called the *external argument*. The external argument is the subject of a simple clause:

(7)   a.   **The fish** [$_{VP}$ swam].

        b.   **The dog** [$_{VP}$ bit me].

        c.   **The soloist** [$_{VP}$ sang (a song)].

        d.   **You** [$_{VP}$ gave a book to Jody].

        e.   **Chris** [$_{VP}$ tried to find the key].

        f.   **Chris** [$_{VP}$ wants to find the key]**.**

Which of the arguments of a verb is the external one is just as important to using the verb properly in the syntax as having the right number and kind of arguments. For example, the sentence #*The song sang the soloist* is bizarre, even though the sentence contains the right number of noun phrases, one of which is a plausible agent for a singing event and one of which is a plausible theme for such an event. However, the wrong argument was expressed outside the verb phrase, and that is enough to render the sentence unacceptable. Another way of looking at this sentence is that it is grammatical, but the structure forces a meaning that is incompatible with a world knowledge—songs do not perform voluntary actions, nor can a person (a soloist) be

sung. The sentence is thus admitted by the grammar (grammatical) but most speakers will judge it as unacceptable for pragmatic reasons.

Thus, which argument of the verb is the special, external one should also be marked in the argument structure. Linguists mark this in a variety of ways; we choose the mnemonic method of adding an extra layer of bracketing to the argument structure. The arguments that are inside this second set of brackets are the internal arguments of the head; the one argument (at most) that is outside the second set of brackets is the external argument.

(8)   Argument Structure: < External Argument < (Internal Arguments) >>

As you can see from the examples presented so far, which argument is the external one is not random. Rather, it seems that the agent is the external argument if the verb calls for one; otherwise the experiencer is. Only if a verb has no agent or experiencer argument can the theme or some other argument be expressed in this way. (This is part of what is called the *thematic hierarchy*, a hypothesis about the natural or default correspondences among thematic roles and argument structure; this falls in the domain of *lexical semantics*.)

The external argument can also usually be identified by its place in a construction that uses a verb like consider or make. Here is the basic template:

(11)   They consider   *external argument* $[_{\text{PREDICATE}}$ (to be) X].

        or   They made   *external argument* $[_{\text{PREDICATE}}$ X].

The external argument is the phrase that comes immediately after consider or make; the internal arguments are the ones that come later, after the verb being investigated.

(12)   a.   They consider   the dog   [to be biting me].

        b.   They consider   me   [to be biting the dog].

        c.   They made   the dog   [bite me].

        d.   They made   me   [bite the dog].

For verbs, this test for external arguments gives the same results as using simple sentences. However, the test is valuable because it can be used to evaluate the argument structures of nouns and adjectives as well as verbs, as we will see in the next section.

Before turning to nouns and adjectives, however, we need to add a note of clarification about adverbs and adjuncts. We have defined argument structure as a list of the phrases that may or must be used with a given word in the syntax. However, this is a bit too strong. There are some phrases that we have ignored so far that can be used with practically any verb. An example is an expression of time, such as on Tuesday. Such phrases can meaningfully combine with all of the verbs that we have considered so far:

(9)   a.   **The fish** [$_{VP}$ swam on Tuesday].

       b.   **The dog** [$_{VP}$ bit me on Tuesday].

       c.   **The soloist** [$_{VP}$ sang (a song) on Tuesday].

       g.   **You** [$_{VP}$ gave a book to Jody on Tuesday].

       h.   **Chris** [$_{VP}$ tried to find the key on Tuesday].

       i.   **Chris** [$_{VP}$ wanted to find the key on Tuesday]**.**

At first, then, it might seem that we should expand the argument structures of all the verbs to include an optional time phrase. If we did this, the argument structure for *swim* would be <Agent <(Time)>>, the argument structure for hit would be <Agent <Theme, (Time)>>, and so on. However, we will not augment the argument structures in this way. Notice that adding the optional time argument really gives no new information about how these verbs are used in English. This is precisely because such an element can be added to virtually any verb. Thus, this possibility is not really part of what a speaker of English must know about the particular verbs swim and hit and give. As such, it does not belong in the lexical entry of these verbs, along with the argument structure. Rather, it is simply a general principle of syntax that a time-denoting PP can be added to almost any English sentence. Such PPs are called adverbs or adjuncts, and we must put them aside in the study of argument structure. The same point can be made for general expressions of location (like *in the kitchen*), for instrumental expressions (like *with a stick*), and manner adverbs (*reluctantly*). None of these belong in the argument structure of a verb, even though they sometimes appear in verb phrases. One must be alert to put these expressions aside when trying to establish the argument structure of a particular word.

Practice Exercise Agr-1. Below is a list of argument structures we have not seen before, and also a list of new verbs. Which verbs have which argument structure? Are there any argument structures that have no verbs that go with them? Can you think of another English verb that has that argument structure? If so, what is it? If not, why not?

Argument structures: <Ag <Loc>>, <Ag <Go>>, <Th <Go>>, <Ag <Th, Ev>>, <Ag <Th, (Go)>>, <Ag <(Th), Go>>, <Ag <(Th), (Go)>>, <Th <Ag>>, <Loc <Th>>

Verbs: *contain, teach, go, stay, throw, persuade, feed*

4.3   Argument Structure II: Nouns and Adjectives

Next, let us consider how the notion of argument structure extends to nouns and adjectives. It is not as obvious that this is an important distinction for nouns and adjectives as it is for verbs. We are familiar with the notion that verbs are transitive or intransitive, which is a pale foreshadowing of the idea of argument structure; however, there is no similar tradition of saying that nouns and adjectives can be transitive or intransitive. Indeed, if we define argument structure as the list of phrases that occur in construction with a given word, it can easily seem like nouns and adjectives do not have them. The most obvious way to use a noun like dog is as the subject of a sentence:

(xx)   The dog barked.

No other phrase appears with dog here (except the verb phrase barked, but dog is the agent argument of bark here, not the other way around). The most obvious way to use an adjective like big is to modify a noun:

(xx)   The big dog barked.

Again, no other phrase appears with big that is not already present in the structure for some other reason. Simple, obvious examples like these might lead on to the conclusion that the matter of argument structure is not relevant to nouns and adjectives.

      That conclusion would be overly hasty, however. In addition to the structures in (xx) and (yy), nouns and adjectives can be used as the primary predicate of a sentence, as in (xx).

(xx)   Rover is a dog.

      Rover is big.

In these sentences, the noun and adjective are used in a way that is more closely parallel to how verbs are normally used. And, in these sentences there is clearly a subject argument (Rover). This suggests that nouns and adjectives can take subjects just as verbs do, although this property does not show up in all syntactic environments. If so, then nouns and adjectives do have an argument structure after all.   The alternative would be to say that Rover in these sentences is actually the subject of the linking verb 'is'. However, this doesn't seem right, because is means little or nothing in this context. Indeed, we can prove that is is not the crucial ingredient in these examples by using the special environment created by verbs like consider and make, as introduced in the last chapter. Examples like the following are possible:

(xx)   a.   I consider Rover to be a dog.

        b.   I consider Rover to be big.

c.   Hormone injections made Rover be a dog.

d.   Hormone injections made Rover be big.

However, in this context the infinitive form of *be* can also be omitted, and the resulting sentences still have essentially the same meaning.

(xx)   a.   I consider Rover a dog.

e.   I consider Rover big.

f.   Hormone injections made Rover a dog.

g.   Hormone injections made Rover big.

Since *be* is not present in these sentences, but the external argument still is and so is the noun or adjective, we can conclude that Rover really is the external argument of the noun or adjective in all these cases. This clearly implies that nouns and adjectives have argument structures. Not surprisingly, nearly every noun and adjective is shown to have an external argument by these special contexts:

(10)   a.   They consider   me   [(to be) a fool].

b.   They consider   this   [(to be) a good book].

c.   They made   me   [prime minister].

d.   They made   this   [a good show].

(11)   a.   They made   the metal   flat.

b.   They consider   Chris   smart.

c.   That makes   me   hungry.

d.   The other basketball players consider him   short.

Interestingly, there are, however, a few adjectives (and perhaps a noun) that do not have external arguments by this standard. Consider the following:

(11)   a.   This makes   it   unlikely that Chris will win.

b.   They consider   it   mild today.

c.   They consider   it   a cinch that Chris will win.

Here there is still something in the external argument position, but that thing is—and can only be—the neuter singular pronoun it. Moreover, this it does not really refer to anything: it is not replacing some other, more meaningful noun phrase the way it does in other sentences. These *its*

are simply place-holders so that there will be something in the subject position even though the noun or adjective does not take a true external argument. (This can happen with verbs too: *seem* is a verb that has no external argument, as shown by sentences like *The Mafia made it seem that Chris would win.*) However, the fact that some nouns and adjectives take an external argument and some do not confirms that this is a lexical property, worthy of putting into the lexical entry in the form of an argument structure.

The question then arises just what label we should put on the external arguments of nouns and adjectives. For adjectives it is common to use the label Theme. One reason for this is that the external argument of adjectives often corresponds semantically to the theme argument of related verbs. For example, clear is a verb with an <(Ag)<Th>> argument structure, just like break:

(xx)   The wind cleared the sky.

        The sky cleared.

However, clear is also an adjective. As an adjective, its external argument clearly corresponds to the theme argument of the verb clear.

(xx)   The sky is clear.   #The wind is clear.

        I consider the sky clear.   #I consider the wind clear.

Thus, it is reasonable to say that the argument structure of clear is <Theme>; for reasons of parallelism, we say that simple adjectives that do not correspond to verbs like tall, big, and smart also have the argument structure <Theme>. The external arguments of nouns, on the other hand, do not correspond systematically to any particular argument of comparable verbs. This suggests that their external argument is some new semantic role, outside the list of roles associated with verbs. Moreover, the external argument of nouns can be—and very often is—used in quite a different way from the arguments of verbs. It can be expressed as a subject, as in sentences with is, consider, and make. However, it can also remain entirely unexpressed in the syntax, as in the following examples:

(xx)   a.   A fool and his money are soon parted.

        b.   I'm looking for a good book.

        c.   The prime minister visited Japan last week.

Here the nouns, fool, book, and prime minister do not have subjects; rather they refer to something that is a fool, something that is a book, or to someone who is prime minister. Intuitively, the nouns refer to something that could be their subject, and this reference somehow "uses up" the external argument of the noun. (People who have studied formal semantics will be able to fill in the details of this account, but they are not important for us.) For this reason, linguists often call the external argument of nouns *R*, mnemonic for "referent", meaning the thing that a noun can refer to. This also shows why it is so important to use a construction like consider or make in order to see the external argument of a noun; when the noun is used as a

referring noun phrase (the normal use) the external argument is always invisible for principled reasons. Nevertheless, we can see that most ordinary nouns like dog, fool, book, etc. have the argument structure <R>.

Some nouns and adjectives have internal arguments as well as external ones. These can be recognized by the fact some other phrase appears inside the NP or AP, along with the noun or adjective. Here are some examples:

(12)   a.   picture   <R, <(Theme)>>

They consider this   [a nice picture of Montréal]

b.   president   <R, <(Theme)>>

They made George   [president of the chess club.]

c.   proud <Th, <(X)>>

That makes me [proud of my daughter].

d.   unlikely < <Event>>

The injury makes it [unlikely that Chris will win].

e.   fond <Th <X>>

I consider him [too fond of his pets].

Thus, it is reasonable to think of nouns like president and adjectives like proud as being (optionally) transitive, just as verbs like sing are, whereas nouns like dog and adjectives like tall are "intransitive". There are two differences. First, the internal argument of a noun or adjective must always be a PP (often with the preposition of) or a clause, never a noun phrase. Nouns and adjectives never take direct objects, then, in this strict sense. Second, the internal argument of a noun or adjective is almost always optional. Thus, it is also possible to *say I consider this a nice picture*, *They made George president*, or *That makes me proud*, with no internal argument. Fond is one of the very few cases in modern English in which an adjective really requires its internal argument *(*I consider him (too) fond)*. However, these minor differences do not detract from the main point that nouns and adjectives also have argument structures. We can say that the internal argument of "transitive nouns" has a theme role, but for adjectives this is unnatural, because theme is already used as its external argument. There is no commonly excepted label for the internal argument of adjectives; since the label is not actually important in the theory, we will simply use the dummy label X for these arguments.

We can now use this understanding of argument structure to state more precisely some of the interesting generalizations about derivational morphology that we began with. Consider, for example, adjectives derived from verbs by the suffix *–able*, used in the consider construction:

(13)   They consider   *this door*   [(to be) lockable].

       *They consider   *me*   [(to be) lockable]. (not grammatical as 'me' = theme)

The generalization can be stated as follows:

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(14)   The external argument of an adjective made with *–able* corresponds to the object (internal argument) of the verb root.

In this case there is a parallelism in terms of argument structure; the theme of the adjective corresponds to the theme of the verb. But a parallelism of this sort is not always derived.

Consider again the three noun-forming affixes *–er*, *-ee*, and *–ment* in this context. The *consider* construction shows that they all have external arguments, but they are different in how the external argument relates to the arguments of the verb stem:

(16)   I employ you.   Employ <Agent <Theme>>

(15)   They consider   *me*   [(to be) the employer].

       *They consider   *you*   [(to be) the employer].   [i.e. ≠ (3)]

(18)   *They consider   *me*   [(to be) the employee].   [i.e. ≠ (3)]

       They consider   *you*   [(to be) the employee].

(19)   *They consider   me   [(to be) employment].

       *They consider   you   [(to be) employment]

       They consider   that   [(to be) (good) employment]

The generalizations are as follows:

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(16)   The external argument of a noun with *–er* is the subject (external arg.) of the verb root.

       The external argument of a noun with *–ee* is the object (internal arg.) of the verb root.

       The extern arg. of a noun with *–ment* is neither the subject nor the object of the verb root.

Thus, argument structure is indeed an appropriate tool for discussing precisely the generalizations that we want to explain. Of course, stating these generalizations is not the same as explaining them. But it is a first step toward that goal. The second step is to see how the Node Labeling Conventions and other percolation conventions apply to argument structure.
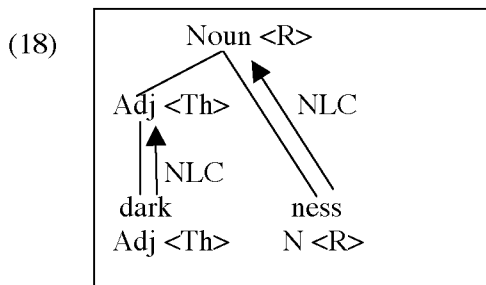
4.4   ARGUMENT STRUCTURE AND NODE LABELLING

While there are principles that apply to argument structure that go beyond the familiar Node Labelling Conventions, it is important to see that those conventions do apply to argument structure as well as to other features.

Consider first the Node Labelling Convention proper. This says in essence that the properties of an affix take precedence over the properties of a root in determining the properties of a derived word. Applied to argument structure, this convention would imply that the argument structure of an affix would win out over the argument structure of the root. As usual, seeing that this is the case is complicated somewhat by the fact that the affix is a bound form, so that we cannot observe its argument structure directly. Rather, the argument structure of the affix must be inferred from the change that it effects in the properties of a derived word that contains it, as compared to the properties of the simple root. However, it is clear that derivational affixes do change the argument structures of the roots that they attach to in systematic ways. Consider, for example the following examples containing the affix –ness, which attaches to adjectives and makes nouns:

(17)   a.   I consider the sky   [(to be) dark].   dark, Adj <Th>

       b.   I consider that   [(to be) darkness].   darkness, N <R>

       c. *I consider the sky   [(to be) darkness].   *darkness, N <Th>

(17a) shows that the simple adjective 'dark' has an external argument, categorized as a theme, in this case the NP 'the sky'. (17b) shows that the derived noun 'darkness' also has an external argument. However, 'the sky' is not an appropriate for this derived word, as shown in (17c). This shows that the external argument of the derived noun is not the same as the external argument of the root adjective. Rather, we can safely assume that the external argument of darkness is an <R> argument, not present in the root dark. (This is, of course, the typical external argument of a noun.) Where did the new <R> argument come from? Since it does not come from the root 'dark', it must come from the noun affix –ness. Thus, we have the following word structure tree, annotated with argument structure features as well as category features:

(18)

(Caution: we will revise this structure later)

Notice that this structure obeys the Node Labelling Convention: the argument structure of the derived word is inherited from the suffix –ness, which is the lexical item immediately dominated
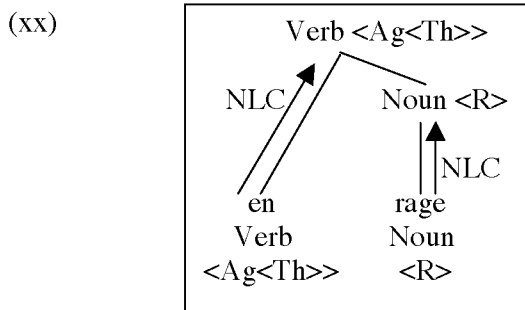
by the top node of the word structure tree. The argument structure of the root, on the other hand, is not inherited. If it were not so, then adding the suffix –ness would have no effect on the argument structure of the root, and that is not what we observed.

The applicability of the NLC to argument structure can also be seen in the following examples, which concern the prefix en-.

(18)   a. I consider that   [(to be) rage].   rage, N <R>

       b. *I consider my mother   [(to be) rage].   *rage, N <Th>

       c. I enraged *(my mother).   enrage, V <Ag <Th>>

           They consider me [to have enraged my mother].

(18a,b) show that the simple noun rage has an <R> external argument, comparable to other nouns.   (18c) shows that the derived verb enrage is a transitive verb, with argument structure <Ag <Th>>. Neither of the arguments of enrage bears any direct semantic relationship to the sole argument of rage. Thus, "I enraged my mother" does not imply that "My mother is rage"; nor does it imply that "I am rage". Thus, neither the subject nor the object argument of the verb is equivalent to the R argument of the simple noun.   Rather, the sentence has a meaning something like "I cause my mother to have/be in a rage."   Now if the two arguments of enrage do not come from the root *rage*, they must come from the prefix *en-*.   Furthermore, the argument structure of *en-* must override the argument structure of *rage* in determining the argument structure of the whole word.   This again illustrates the NLC at work.   The word structure tree looks like this:

(xx)

```
        Verb <Ag<Th>>
   NLC /        Noun <R>
      /
     /             NLC
    en          rage
    Verb        Noun
  <Ag<Th>>      <R>
```

Of course, by attributing the argument structure of *enjoy* to the prefix *en-*, as we must by the NLC, we make the prediction that all verbs beginning with *en-* will share the same argument structure. This is correct.

Notice also that the argument structure for *–ness* is a very typical argument structure for a noun, and the argument structure for *en-* is a typical argument structure for a verb. This fits well with our position in chapter xx, where we argued that derivational affixes really are nouns and verbs. More generally, it fits with our slogan that affixes have the same properties as roots, apart from the fact that they must be attached to something else.

So far, it looks like we're on the right track in treating Argument Structure as a feature. Argument structure information seems to be subject at least to the NLC. Is it subject to the Percolation Convention as well? The Percolation Convention says that in the special case when the affix is not specified for a particular feature, the derived word can get its feature value from the root instead. A paradigm case of this was the prefix non-, which makes nouns from nouns (nonentity) and adjectives from adjectives (nonessential). What would be the consequences of the PC applying to argument structure? It would get a chance to apply if and only if a particular affix had no argument structure of its own. Then the argument structure of the root would be carried over unchanged. With this in mind, consider the effect of attaching the prefix re- to a verb root:

(19) write   <Ag<Th>> rewrite   <Ag<Th>> I rewrote the handout twice.

  inspect <Ag<Th>> reinspect <Ag<Th>> They reinspected my car.

  enter   <Ag>   reenter <Ag>   They entered, left, and re-entered.

  marry   <Ag>   remarry <Ag>   The couple remarried.

  awaken <Th>   reawaken <Th>   I reawakened shortly before ten.

  send <Ag<Th,Go>   resend <Ag<Th,Go>> I resent the package to my parents.

Clearly, the result of attaching re- to a verb is still a verb; this is consistent with saying that re- has no category features of its own. Moreover, the argument structure of the new verb is systematically the same as the argument structure of the original verb: re- plus a transitive verb is a transitive verb (rewrite); re- plus an intransitive verb is an intransitive verb (reenter); re- plus a ditransitive verb is a ditransitive verb (resend). This is exactly the pattern that we expected to find if re- has no argument structure of its own, and the PC applies to argument structure as it does to other features. The word structure trees for two of these examples would be:

(20)
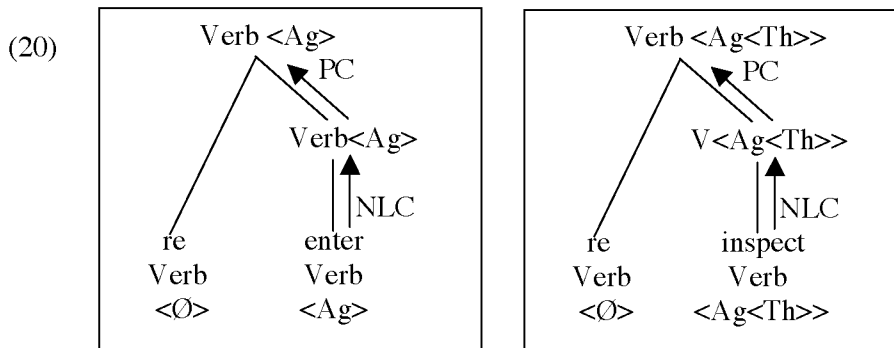
If *re-* had its own argument structure, then we would expect all verbs that begin with a *re-* prefix to have the same argument structure; either they would all be <Agent <Theme>> verbs, or they would all be <Agent> verbs, or they would all be <Agent <Theme, Goal>> verbs, depending on which argument structure *re-* had. But the argument structure of these verbs is clearly not consistent in this way.

Another example of the PC applying comes from the prefix non-. The argument structure of the noun entity is <R>, and so is the argument structure of nonentity; the argument structure of the adjective essential is <Th>, and so is the argument structure of nonessential. (Can you construct examples with the "consider" construction that show that these statements are true?) This suggests that non- has no argument structure of its own, and the argument structure of a word containing non- is established by the PC.

Our third and final node labelling convention was the Head Rule, which applies to compound structures, saying that they get their features from the right hand member of the compound in English, and from the left hand member of the compound in certain other languages. This rule also applies to argument structure. For example, those N+V compounds that exist in English are not only verbs, but have the same argument structure as the original verb root, as shown in (xx).

(20)   N+V = V   *with all the argument structure properties of the V*

    a.   fry <Ag <Th>>   I fried the steak

       pan-fry <Ag <Th>>   I pan-fried the steak.

    b.   wash <Ag <Th>>   I washed the sweater.

       hand-wash <Ag <Th>>   I hand-washed the sweater.

    c.   feed <Ag <Th, Go>>   I fed the corn to the baby.

       spoon-feed <Ag <Th, Go>>   I spoon-fed the corn to the baby.

    d.   nap <Ag>   I napped (all afternoon).

       cat-nap <Ag>   I cat-napped (all afternoon).

    e.   walk <Ag>   I walk on Thursdays

       power-walk <Ag>   I power-walk on Thursdays.

In each case, the compound takes the same argument structure (appears with the same kinds of phrases in syntax) as its righthand member.

This generalization is not limited to compound verbs. On the contrary, endocentric V+N compounds have the same argument structure of the noun head—typically <R>, but sometimes with an additional internal argument as well.

(21) V+N = N   *with the argument structure properties of the N*

    a.   bridge <R <Loc/Go>>   That is the bridge over the Lachine Canal..

        drawbridge <R <Loc/Go>>   That is the drawbridge over the Lachine Canal.

    b.   cloth <R>   I consider that [(to be) a nice cloth].

        washcloth <R>   I consider that [(to be) a nice washcloth].

    c.   way <R>   That is [the best way].

        Runway <R>   That is [the best runway].

On the other hand, the argument structure of these compounds is clearly unrelated to the argument structure of the initial verb. For example, the argument structure of *wash* is <Ag <Th>> (John washed the dishes). If the argument structure of washcloth was also <Ag<Th>>, then one would expect to use it in sentences like **John is a washcloth of dishes*, meaning perhaps something like 'John is the kind of person who washes dishes with a cloth.' This is completely impossible. Thus, the contrast between (xx) and (xx) clearly shows that it is the right hand member of the compound—be it noun or verb—that determines the argument structure of the whole, in accordance with the Head Rule.

The effects of the Head Rule can even be seen in N+N compounds. Typically, the argument structures of the two nouns in a compound is essentially the same: both are <R>. Thus, one might think that the Head Rule would have little discernible effect in such examples. However, such N+N compounds clearly refer to the same kind of thing as the second member of the compound, and not to the same kind of thing as the first member, as already noted in passing in the previous chapter. This is illustrated by the following data.

(22) N+N = N   *where the <R> is the referent of the right-hand member*

    a.   bull <R>   <R>, refers to bulls.   "That is a bull" is True iff "That" = "a bull"

        <u>frog <R></u>   <R> refers to frogs.   "That is a frog" is True iff "that" = "a frog"

        bullfrog <R>   <R> refers to a type of frog, not a type of bull.

    a.   man <R>   <R>, refers to men.   "That is a man" is True iff "That" = "a man"

        frogman <R>   <R> refers to a type of man (or prerson), not a type of frog.

We can now see this as an effect of the Head Rule applying to argument structure. Both bull and frog have an <R> argument, but the <R> of bullfrog is clearly related to the <R> of frog, not the <R> of bull.

Indeed, we can say more generally that a sentence with an endocentric compound typically implies the corresponding sentence with the right-hand member but NOT the

corresponding sentence with the left-hand member (in English). This holds also for V+N compounds and N+V compounds in English, as well as other types.

(23)   This is a bullfrog.   IMPLIES   This is a frog.   NOT   This is a bull.

This is a drawbridge. IMPLIES   This is a bridge.   NOT   This draws (bridges).

I pan-fried the steak. IMPLIES   I fried the steak.   NOT. I am a pan of steak.

My hands are ice-cold IMPLIES   My hands are cold.   NOT   My hands are ice.

These observations are all straightforwardly captured by the percolation of argument structure via the (Right Hand) Head Rule. Here are some word structure trees, illustrating a range of cases:

(24)
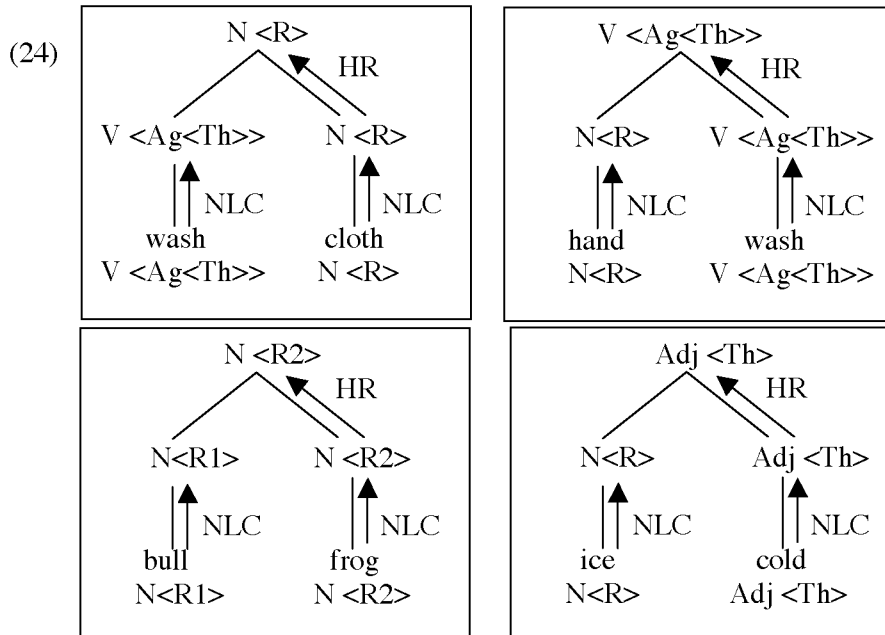
In all these respects, argument structure features behave in very much the same way as other syntactic features—particularly the category features to which they are closely related.

4.5   Beyond Percolation (1): ARGUMENT LINKING

For argument structure, the node labelling conventions are not the end of the story, but only the beginning. We still haven't accounted for the properties of word formation we started with. Although argument structure is a feature subject to the node labelling conventions, it is a more complex feature than the others we have seen. Hence, it is not too surprising that it can

enter into some more complex relationships. As a result, sometimes the argument structure of the whole word is not simply identical to one of its lexical elements; sometimes it is a function of both.

   To see perhaps the simplest way this can happen, let us go back to compounds like *man-eater*, *cheese-cutter*, and *dishwasher* (or *turkey-strangler*). These words contain simple, transitive verbs with the argument structure <Ag <Th>>:

(33)   These sharks [VP eat men]

   This machine [VP washes dishes]

   This knife can [VP cut cheese]

-er makes these verbs into nouns, which seem to have the same argument structure as the verbs-- namely <Ag <Th>>. (We will refine this later, but it will do for now.)

(34)   These sharks are [NP eaters of men]

   This machine is [NP a washer of dishes]

   This knife is [NP a cutter of cheese]

(35)   I consider *John* [NP a good washer of dishes].

   Her culinary training makes *Mary* [NP a great cutter of cheese]

Notice in particular that the subject of the noun is semantically comparable to the subject of the verb, and the phrase inside the NP is comparable to the object of the verb.

Importantly, we can show that the argument structure of the *-er* noun is related to the embedded verb, by examining verbs with other argument structures. Thus, intransitive verbs when combined with the *-er* suffix do not yield nouns that take two arguments, as would be the case if *-er*(like *en-*) had its own argument structure <Ag <Th>>:

(35.5) Tulips bloom (early). →   Tulips are early bloomers.

   * Rain blooms tulips. →   * Rain is a bloomer of tulips.

The observation we need to capture is that the argument structure of an [V*-er*] noun is a function of the argument structure of the verb it contains. Tentatively, we could get this effect by saying that *-er* has no argument structure, and using the PC to allow the argument structure of the verb to percolate up.

Looking at the *-er* nouns in this way will conflict with two hypotheses we have made earlier. First, we will derive nouns (the *-er* nouns) which do not have an <R> argument (see the trees on the next page). Second, we know that the *-er* suffix is providing the syntactic category feature "Noun" and hence, we would need to allow the PC to apply to argument structure at the same

time as the NLC is applying to category features, in contrast to our earlier hypothesis that the NLC applies in an all-or-nothing fashion. We will keep this in mind as we explore the *–er* nouns further. If it turns out that the PC is what we need to get the right results, then we will have to revise or abandon the assumptions just noted. This is the normal pattern of hypothesis testing and revision, and illustrates the important consideration that changes to one part of the theory will have ramifications for other parts that must be considered. As the chapter progresses, we will in fact discover a means to reconcile the *–er* nouns with our earlier assumptions, leaving them intact. For the next few pages, though, we will admit <R>-less N's in trees.

Now let's return to the *–er* nouns we considered just above, and suppose that we use these *-er* nouns to make N-N compounds, like *man-eater*, *dishwasher* and *cheese-cutter*. By the Head Rule, we would expect these to have the same argument structure as the right hand member—in other words, they should be <Ag<Th>>. However, this is not the case:

(36)   *These sharks are [NP man-eaters of swimmers]

        *This machine is [NP a dishwasher of plates]

        *This knife is [NP a bread-cutter of rolls]

(37)   *I consider *John* [NP a good dish-washer of plates].

        *Her culinary training makes *Mary* [NP a great cheese-cutter of Brie].

Of course these compounds can be used in sentences like the following. These are identical to the sentences above, except that there is no object-like phrase inside the NP.

(38)   These sharks are [NP man-eaters]

        This machine is [NP a dishwasher]

        This knife is [NP a bread-cutter]

(39)   I consider *John* [NP a good dish-washer].

        Her culinary training makes *Mary* [NP a great cheese-cutter].

These compounds apparently have the external argument that we expected, but not the internal argument. Their argument structure is something like <Ag> rather than the anticipated <Ag<Th>>. Something other than just the head rule is going on here. (Note that the compounds do not get the <R> argument from their first member, either. Thus, we do not say sentences like *Brie is a good cheese-cutter*, meaning something like 'Brie is a good cheese for cutting.')

Why doesn't the compound acquire the internal theme argument of the *–er* noun that is its head? There is a fairly obvious reason. Notice that the non-head of the compound is itself understood as the theme in these cases. As a result, the examples in (38) and (39) mean almost exactly the same thing as the examples in (34) and (35). Apparently, the theme argument of an

–er noun can be expressed as a phrase in the syntax *or as the nonhead member of a compound.* We can express this possibility as follows:

(40)   ARGUMENT-LINKING:

> The non-head of a word can be interpreted as being the same as an argument of the head.

In word structure trees we will indicate an argument-linking relationship by putting a superscript on the nonhead, and a matching superscript on the argument of the head that it is linked to. Only "sister" nodes that are dominated by the same node in a word structure tree can enter into this kind of argument-linking relationship.

> Although the theme argument of the head can be represented as either a phrase in the syntax or the nonhead in a compound, (36) and (37) show that it can not appear in both places in the same structure. Intuitively, if the argument is linked in the morphology, it is "used up" and cannot be assigned in the syntax as well. (This is reminiscent of the Theta Criterion in syntax, which says that each theta-role can be assigned only once.) This restriction can be expressed as follows:

(41)   SATURATION PRINCIPLE:

> If an argument of the head is linked to the nonhead, then that argument is not passed on to the larger word.

Given these two new principles, the correct word structure tree for these examples is:
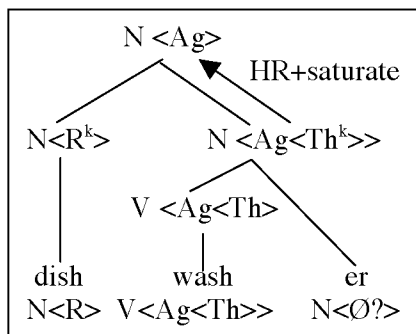
(42)   NOT:
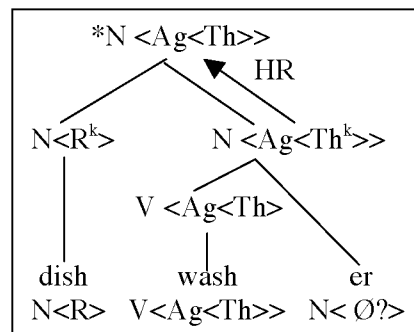
Violates the Saturation Principle

> There is one more regularity in this data to be accounted for. As stated, Argument-Linking could allow the nonhead of one of these compounds to be linked to the Agent argument of the head, rather than to the theme argument. However, this is not the case. Whereas it is easy to interpret the first N as the theme of the second, it is impossible to interpret it as the agent:

(43) (This shark is) a man-eater   *It is a shark-eater (of men)

      (This machine is) a dish-washer   *It is a machine-washer (of dishes)

      (This knife is) a cheese-cutter   *It is a knife-cutter (of cheese)

The bad examples in (43) assume that the theme would still be an internal argument of the compound noun. However, the examples are still bad if the Theme is treated as the external argument now that there is no Agent argument. (This is what often happens for verbs and adjectives that have a theme but no agent.)

(44) #This man is a shark-eater. (cannot mean: This man is eaten by sharks.)

      #This dish is a husband-washer. (cannot mean: The dish is washed by a husband.)

      #I consider Brie cheese [a knife-cutter]. (not: I consider it a cheese to be cut by a knife).

Apparently the following word structure tree is ill-formed:

(45)
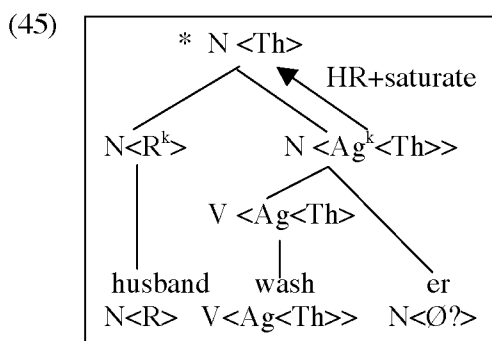
Recalling that the right-hand member of a compound is its head (in English), we can account for this fact by adding the following principle to our theory:

(46) EXTERNAL ARGUMENT CONDITION:

      The non-head of a word cannot be linked to an external argument of the head.

The word structure tree in (45) violates this condition, but the one in (42) does not.

      In fact, this difference between external arguments and internal arguments is what we expect from the basic definition of the ideas. Recall that in syntax the external argument of a word is the phrase that must appear *outside* the phrase headed by that word (in other words, it is the subject). In syntax, an internal argument of a word is a phrase that must appear *inside* the phrase headed by that word. Now we see that the same properties hold in morphology. The external argument of a root must appear *outside* the compound headed by that root (the External Argument Condition), whereas an internal argument of a root may (but doesn't need to) appear *inside* a compound headed by that root.

It is easy to see that compounds involving nouns formed from verbs by the suffix *-ing* work very much the same way. The internal argument of the head noun (which is the same as the internal argument of the root verb) can be expressed by the nonhead of the compound, as in the the (b) examples. If this happens, then the internal argument cannot also be expressed as a syntactic phrase ((c) examples). Moreover, the external argument of the head noun cannot be expressed by the nonhead of the compound ((d) examples).

(47) a. The eating of meat (is enjoyable).

   b. Meat-eating (is enjoyable).

   c. *Meat-eating of pork (is forbidden in various religions.)

   d. *?Child-eating of meat (is important for healthy growth).

(48) a. The washing of dishes (is helpful.)

   b. Dish-washing (is helpful.)

   c. *Dish-washing of plates (is helpful.)

   d. *Husband-washing of dishes (is appreciated by most wives.)

(49) a. (I enjoy) the cutting of cheese.

   b. (I enjoy) cheese-cutting.

   c. (I enjoy) *cheese-cutting of Brie.

   d. *I enjoy *knife-cutting of cheese.

We will be able to complete the analysis of these words once we know more about the argument structure of nouns made from verbs with *–ing* (see the next section). But already the similarity to the *–er* nominals is clear. These special types of compounds, in which argument linking and saturation take place, are sometimes called *synthetic compounds*.

   Argument-linking and saturation can sometimes take place even in compounds with simple nouns, not derived from verbs. The crucial thing is that the head noun must have an internal argument that is qualified to take part in argument linking. A class of nouns that meets this condition are nouns that refer to parts of some larger whole, or to some social relationship.

(50) That is the leg of a table.   Leg <R<X>>

   That is a table-leg.

(51) Chris is the president of the club.   President <R<X.>>

   Chris is the club president.

Note that we can give at least two arguments that these are compounds and not examples of nouns being 'converted' into adjectives. First, while adjectives can be modified by an adverb, the first member of these compounds cannot be so modified (27). Second, while adjectives can be used predicatively to modify a subject, non-head nouns from such compounds cannot (28).

(27) a.   That is a very long leg.

    b.   *That is a very table leg.

(28) a.   That leg is long

    b.   *That leg is table.

The saturation principle also applies in these compounds, explaining why the following sentences are very strange:

(52) a. ??That is a table-leg of the coffee-table.

    b. ??Chris is the club-president of the chess club.

Argument linking and saturation also apparently take place in some cases of N+V compounding—particularly those that are related to synthetic compounds by back formation (see chapter c). We saw above that the argument structure of a N+V compound is often the same as that of its verbal head. However, this is not the case for examples like bartend (related to bartending and bartender). *Bartend* is an intransitive verb, although *tend* by itself is transitive:

(xx) a. Chris tends the bar on Saturday nights.

    b. Chris bartends on Saturday nights.

    c. Chris bartends the bar on Saturday nights.

Clearly, the first part of bartend is argument-linked to the theme argument of the second part, just as it is in *bartender* and *dishwasher*.

Argument linking probably also takes place in some cases of derivational morphology, although as usual it is harder to see because one cannot compare the argument structure of an affix in a complex word to the argument structure of the affix used on its own. (Affixes always appear in complex word structure trees, by definition.) Notice, however, that the following two structures are nearly synonymous:

(53) a.   Chris is full of fear.   This storm made Chris [full of fear]

    b.   Chris is fearful.   The storm made Chris [fearful].

The argument structure of the adjective *full* is clearly <Th<X>>, and it assigns the X theta-role to the NP *fear* in (53a). While there is no direct relationship to the suffix *–ful*, the semantic relationships are similar (and the two evolved historically from the same source). We can

capture this elegantly if we say that –*ful* also has the argument structure <Th<X>>, and it undergoes argument linking with the noun root it attaches to. The word structure tree would be:

(54)
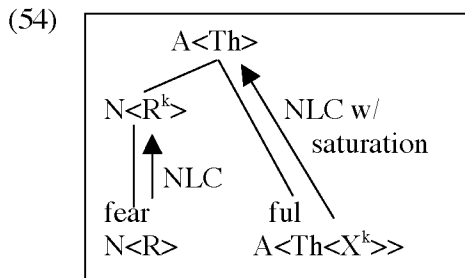
The External Argument Condition is obeyed here, because fear is identified with the X argument of ful, not with the Theme argument. The Saturation Principle also applies, explaining why the following examples are unnatural:

(55)   ?*Chris is fearful of terror.

        ?*The storm made Chris [fearful of terror].

Thus, argument linking and its associated principles are relevant to a rather broad set of morphological constructions.

4.6   Beyond Percolation (2): Substitution LINKING

In the previous section, we saw that the argument structure of a complex word can sometimes be less than we would have predicted based on the Node Labelling Conventions alone, because of the possibility of argument linking. In other cases, the argument structure can be more than one would expect. Perhaps the clearest case of this type comes from causative morphemes. English is not lucky enough to have paradigmatic examples of such morphemes, but many other languages do. We will begin by studying one such a morpheme in Japanese.

4.6.1   The Causative Morpheme in Japanese.

The examples in (25) give a taste for basic Japanese syntax, and illustrate the argument structures of some simple verbs.

(25) a. Kaiga iku.   'Kai is leaving.'

      b. Taroga hataraku.   'Taro is working.'

      c. Taroga hono kawu.   'Taro is buying a book.'

      d. Kaiga sushio taberu.   'Kai is eating sushi.'

      e. Kaiga sushio tabeta.   'Kai ate sushi.'

      f. Kaiga Taroni hono ageru.   'Kai is giving Taro a book.'

The morphemes in these examples can easily be seen to be the following:

(26) Nouns: Verbs: "Inflectional Suffixes:"

      Kai   'Kai'   ik-   'go'   -ga   SUBJECT CASE

      Taro   'Taro' hatarak- 'work'   -o   OBJECT CASE

      hon   'book' kaw-   'buy'   -ni   INDIRECT OBJECT CASE

      sushi 'sushi' tabe-   'eat'   -ta   PAST

                     age-   'give'   -(r)u   PRESENT (-ru / V__;-u / C __)

Japanese syntax also stipulates that words are arranged somewhat different from the way they are arranged in English. While this is only tangentially relevant to our primary interest, it is helpful to know this to be able to interpret the examples correctly, and to discern the argument structure of Japanese words from the sentences in which they appear. Whereas verbs come before objects in English, in Japanese verbs come after objects, at the end of the basic sentence. Thus, the primary word order in Japanese is: Subject - (Indirect Obj) - (Object) – Verb. Moreover, nouns in Japanese take suffixes that indicate the grammatical function of the noun in the sentence as a whole. As you can see in (xx), the subject noun phrase always ends in –ga, the object noun phrase ends in –o, and the indirect object (if there is one) ends in –ni. Such affixes are found in many languages, and are known as Case markers (see chapter I). With this information in hand, it is easy to see that verbs in Japanese have argument structures that correspond quite closely to those of their English translations. For example, hatarak 'work' has the argument structure <Agent>, tabe 'eat' has the argument structure <Agent<Theme>>, and age 'give' has the argument structure <Agent <Theme, Goal>>.

The following examples are presented in a similar format. They illustrate the argument structures of verbs that have the suffix *sase/ase* added:

(27) a.   Hanako-ga Kai-o   ik-ase-ru.   'H. makes K. leave.'

         b.   Hanako-ga Taro-o hatarak-ase-ru.   'H. makes K. work.'

         c.   Hanako-ga Taro-ni hon-o   kaw-ase-ru.   'H. makes T. buy a book.'

         d.   Hanako-ga Kai-ni sushi-o tabe-sase-ru.   'H. makes K. eat sushi.'

         e.   Hanako-ga Kai-ni Taro-ni hon-o age-sase-ru. 'H. makes K. give T. a book.'

Much of the lexical entry of *(s)ase* is rather straight forward: it is a suffix on verbs that means roughly "make" and it undergoes a simple kind of allomorphy. The resulting word is a verb, either because of the NLC or (less likely) the PC. This gives a lexical entry approximately like (29).

(28)

$$
\begin{bmatrix}
\text{-(s)ase-} \\
\begin{Bmatrix} \text{-sase / V\_\_\_} \\ \text{-ase / C\_\_\_} \end{Bmatrix} \\
\text{"make s.o. Verb"} \quad \textsc{causative} \\
[\,V\,\_\,] \\
V \\
<\,??\,>
\end{bmatrix}
$$

The interesting question that remains is what is the argument structure of *(s)ase*. As is usual for affixes, we cannot see its argument structure directly. Rather, we have to deduce it by comparing the argument structures of the simple verbs in (33) to the argument structures of the verbs with *(s)ase* in (36). When we do this, we observe the following:

Adding –*(s)ase*- to a 1-argument verb (intransitive) makes a 2-argument verb (transitive)

Adding –*(s)ase*- to a 2-argument verb (transitive) makes a 3-argument verb (ditransitive)

Adding –*(s)ase*- to a 3-argument verb (ditransitive) makes a 4-argument verb (tritransitive?)

Looking at the meanings of the sentences, it is not hard to identify what's going on. (Indeed, it is not very different from what happens with the English "make ... verb" construction, except that the two verbs end up as one morphologically complex verb in Japanese. Thus, we arrive at the following generalization:

(29)   The CAUSATIVE adds exactly one argument to the clause, and it is an Agent.

Nevertheless, it will not do to simply say that –(s)ase is a verb with the argument structure <Agent>. If that were so, then the <Agent> argument structure would become the argument structure of the whole word, by the Node Labelling convention, as shown in (xx). The argument structure of the root would have no effect on the derived word.

(xx)
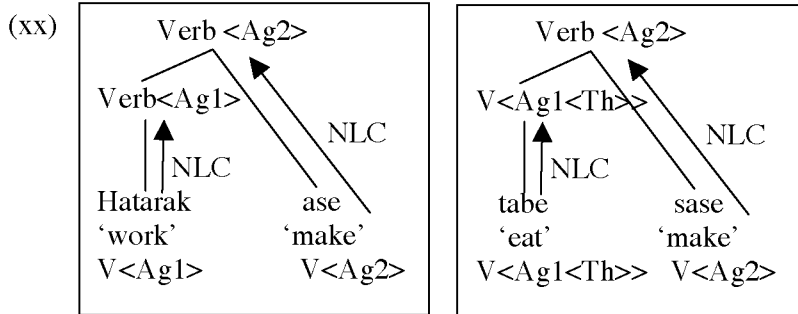
This is partly correct: the resulting verb does have an Agent argument as its external argument, as can be seen in the examples in (27). Moreover, the agent of a derived verb like *tabe-sase-* is not the same as the Agent associated with the inner verb *tabe-*. The subject of *tabe* by itself is the one who eats, but the subject of *tabe-sase* is the one that causes eating. Thus, it is accurate to say that the Agent external argument of the complex word has been inherited from *–sase*. But this analysis is only half right; indeed, its drawbacks are even more obvious than its virtues. The NLC implies that the argument structure of the result will be *only* the argument structure of the affix, and that is not correct. If it were, all verbs with the –sase affix would be simple intransitive verbs. In fact, none of them are intransitive: they all take two or more arguments.

One might experiment with assigning other argument structures to –(s)ase, but in fact there is no argument structure that will work with only the principles that we have so far. For example, we could say that *–(s)ase* has no argument structure and the PC applies. An advantage to this idea is that then the arguments of the verb root will become arguments of the whole word, and there is a large grain of truth in this. However, the argument structure of verbs with *–(s)ase* is not identical to the argument structure of the verb roots, as this theory would have it. Alternatively, we could say that the argument structure of *–(s)ase* is something like <Agent <Theme>>. At least this gets some of the examples right: it predicts *hatarakase* 'cause to work' should have two arguments, as in fact it does. However, it also predicts that verbs like *tabesase* 'cause to eat' will have the same two arguments, when in fact they take a third argument. Perhaps the best answer within current terms would be to say that *–(s)ase* has the argument structure <Agent <Theme, (Goal)>. This argument structure would then become the argument structure of the whole word by the NLC, correctly capturing the fact that verbs with *–(s)ase* can take either two or three arguments. But even this is not correct, because it predicts that *any* verb with *–(s)ase* can take either two or three arguments, as a free option. In fact, *hatarakase* always takes two arguments, and *tabesase* always takes three. This regularity is not explained by any of these analyses.

Intuitively, the effect we need to achieve is something like argument structure addition: we want to add the agent argument of *–(s)ase* to the arguments that the verb root already has in order to get the argument structure of the complex verb. However, we need at least one new principle to make this possible.

For some guidance into how to do this, let us consider the argument structure of the verb root *make* in English, which has close to the same meaning as *–(s)ase*. *Make* takes an agent subject, just as most verbs do. However, it also takes some kind of phrase inside its verb phrase, as shown in (32).

(30)   *make* <Ag <???>>

        Fido barked   →   I [$_{VP}$ made [Fido bark]].

        Fido bit the cat. →   I [$_{VP}$ made [Fido bite the cat]].

This internal argument of *make* is an embedded clause, complete with all its pieces (including its own internal argument). Thus, according to the terminology developed above, the internal argument of *make* is an Event, which (like other sentences) is made up of an external argument and a predicate. (Indeed, it is in fact this property of *make* that allows us to use it as a test for external argument-hood.) This makes good intuitive sense: when I say that I made something happen, I am saying that a certain event took place, and I was responsible for it. Thus, the argument structure of *make* is < Agent <Event >>.

Now Japanese *-(s)ase* means more or less the same thing as *make* in these respects, and it serves a similar function. Thus it is plausible to say that it has the same basic argument structure. However, it doesn't combine with an entire clause. Rather, it attaches to a verb and takes the same phrases as the verb it attaches to *plus* its own Agent external argument. What is happening here is that the argument structure of the verb root is taking the place of—substituting for—the internal event argument of the affix. When this happens, the arguments of the nonhead become arguments of the head. As a result, they become a part of the argument structure of the whole word, not by the PC, but rather by the NLC. When this happens, the argument structures of the two morphemes are said to be *substitution-linked*.

(31)   SUBSTITUTION-LINKING

        The argument structure of the non-head of a word can replace one

        argument of the head.

Substitution-linking results in word structure trees like the following:

(xx)
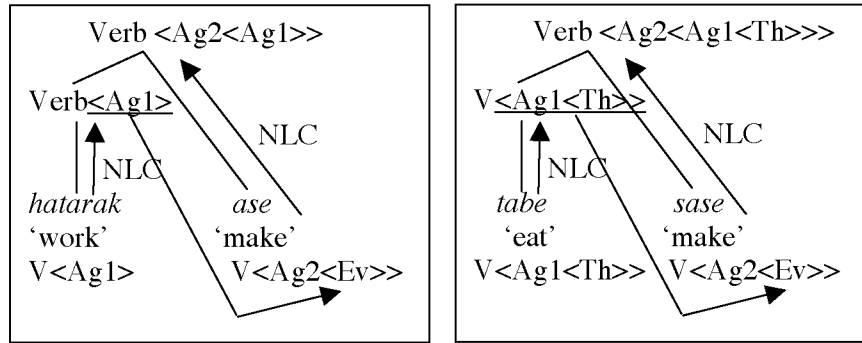
These representations correctly capture the intuition that the whole word has the argument structure of the embedded verb *plus* a new external argument.

Notice also that the derived causative word in Japanese does not take an Event argument phrase in the syntax, even though one is there in its meaning. This follows from the idea that it has been replaced by the other argument structure. Indeed, by calling substitution a kind of linking we are saying that it is the same kind of relation as argument-linking. In the last section, we saw that argument-linking is subject to the Saturation Condition: the linked argument of the head is "used up" in the linking. Since substitution-linking is a second kind of linking relationship, it is natural to expect that it also obeys the Saturation Condition. This then is our explanation for why the event argument of the affix does not show up in the syntax. Just as the noun *truck* expresses the theme argument of *driver* in the compound *truck-driver*, so the verb *tabe* 'eat' expresses the event argument of *–(s)ase* 'make' in the complex verb *tabesase*. The event that is caused is in fact an event of eating.

If substitution-linking is really a second kind of linking, parallel to argument-linking, then we also expect it to obey our second condition on linking, the External Argument Condition. This would mean that the argument structure of the non-head can only substitute for the internal argument of the affix, never for the external argument. This is true for the Word Structure Trees in (47).

What kind of derivations would be possible if substitution linking did not obey the External Argument Condition? We saw that the internal argument of a causative verb can be an event. In fact, the external argument of a causative verb can also be an event, as shown in the example in (49).

(49)   [That Chris ate sushi] made an uproar.

Here the argument structure of *make* is something like <Event <Theme>>. Suppose that *–(s)ase* could also have this alternative argument structure, and the External Argument Condition did not restrict Substitution Linking. Then a Word Structure Tree like (50) should be possible:

(50)
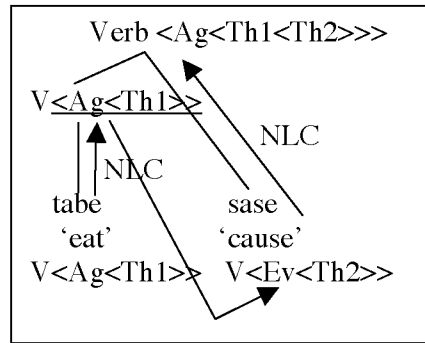
This would create a sentence something like (51) in pseudo-Japanese.

(51)   **Chris-ga sushi-o uproar-ni tabe-sase-ta. OR:

         **Chris-ga sushi-ni uproar-o tabe-sase-ta

         …meaning "Chris eating sushi caused an uproar."

But such a sentence is completely impossible in Japanese and all other known languages. From this, we can conclude that the External Argument Condition does in fact restrict the operation of Substitution Linking as well. Thus, we have two similar kinds of linking, one that adds to the argument structure of the head and one that subtracts from it. Both are the same in that they obey the Saturation Condition and the External Argument Condition.

That *–(s)ase* permits substitution-linking is a special property of this particular affix. Some affixes require such substitution to take place, whereas others do not allow it to. Since it varies from affix to affix, this property should be encoded into the lexical entries. We will do this by putting the tag "substituter" along with the argument structure in the lexical entry of affixes like *–(s)ase*. (It may be that all occurrences of Event arguments in the argument structures of affixes trigger substitution, in whch case the tag is redundant, but we will not explore that at this time.) Therefore the final lexical entry for *(s)ase* will be:

(32)

$$\begin{bmatrix} \text{-(s)ase -} \\ \left\{ \begin{array}{l} \text{–sase / V\_\_\_} \\ \text{-ase / C\_\_\_} \end{array} \right\} \\ \text{"make s.o. Verb"} \\ [\,V\_\,] \\ V \\ <\text{Ag} \ <\text{Ev}>> \\ \text{substituter} \end{bmatrix} \quad \text{CAUSATIVE}$$

To a limited degree, the ability to make causative verbs in Japanese is recursive: one can add a second causative affix to a word that already contains one such affix. Thus, example (c) sounds a little forced to most Japanese speakers, but is not inconceivable:

(xx)　a.　　Inu-ga　　neko-o　　　kam-ta　　　　[kam+ta = kanda]

　　　　　　　dog-NOM　cat-ACC　　bite-PAST

　　　　　　　'The dog bit the cat.'　　　　　　　*kam-*　　　　<Ag, <Th>>

　　　b.　　Taro-ga　inu-ni　　　neko-o　　　kam-ase-ta.

　　　　　　　Taro-NOMdog-DAT　　cat-ACC　　　bite-*(s)ase*-PAST

　　　　　　　'Taro made the dog bite the cat.'　*kam-ase-*　　<Ag, <Ag<Th>>>

　　　c.　　Hanako-ga　　Taro-niinu-ni　neko-o kam-as-ase-ta.

　　　　　　　Hanako-NOM Taro-DAT　dog-DAT　cat-ACC　bite-*(s)as(e)-(s)ase*-PAST

　　　　　　　'Hanako made Taro make the dog bite the cat.'

　　　　　　　　　　　　　　　　　　　　　　kam-as-ase-　　<Ag,<Ag,<Ag<Th>>>>

Practice Problem: Can you draw the Word-Structure Tree for (xxc.)?

4.6.2　　　　Substitution-Linking in English

The fact that English does not have a causative morpheme that attaches to verbs does not mean that it has no substitution-linking. On the contrary, there is plenty of it to be found in English, in examples that involve nouns and adjectives. It is just a little less noticeable, since the argument structures of nouns and adjectives are often less articulated and harder to observe than those of verbs.

In section 4.x, we briefly considered compounds formed from nouns formed from the derivational affix –ing. However, we did not consider carefully the argument structures of such nouns prior to compounding. Now that we know about substitution-linking, we are well-equipped to do so. The suffix *–ing* clearly makes Nouns out of Verbs. Consider then the effect that it has on the argument structure of the verb:

(33)   a.   John washed the dishes.

           i.   John's washing of the dishes (took all day).

           ii.   The washing of the dishes by John (took all day).

           iii.   I consider THAT [John's (fastest) washing of the dishes.]

    b.   The dog chews books.

           i.   The dog's chewing of the books (upsets me).

           ii.   The chewing of books by the dog (upsets me).

           iii.   I consider *this* the last chewing of books by the dog that I will tolerate.

    c.   Fido barks.

           i.   Fido's barking annoys the neighbours.

           ii.   The (constant) barking by Fido drives me crazy.

           iii.   I consider *that noise* [to be the loudest barking by Fido] (I'll tolerate).

           iv.   [That noise] was Fido's barking.

First, if the verb has an internal argument, as in the (a) and (b) examples, that argument survives as an internal argument of the derived noun. More specifically, it shows up as a prepositional phrase with the preposition *of*. Second, the external argument of the verb also shows up as an internal argument of the noun, inside the noun phrase; it is expressed either as a possessive or with the preposition *by*. Finally, the noun takes a new external argument, which is an <R>, as is usual for nouns. More specifically, the noun phrases refer to events of washing, chewing, or barking, and not to the agent or theme of those events. This gives us the following generalization:

(xx)   The argument structure of an –ing noun is the same as the argument structure of the verb root, together with a new R argument, which counts as the external argument of the noun.

(Note that both of the internal arguments of the derived nouns are actually optional; thus one can also say simply *The washing took all day*. It is a general property of English nouns that their internal arguments are typically optional. Thus, even with underived nouns we can say either *the leg of the chair* or simply *the leg*. Thus, the argument structure of an noun represents what *can* be expressed inside the noun phrase, not what *must* be represented there.)

The generalization in (xx) is identical to the generalization in (xx) concerning causatives in Japanese, except that this time a noun-type R argument is added, rather than a verb-type Agent argument. Thus, these facts can be handled in terms of substitution-linking as well. The affix *–ing* has a normal argument structure for Nouns, consisting of an external <R> argument,

together with an <Event> internal argument. The event argument then gets replaced by the argument structure of the verb via substitution linking. The lexical entry for –ing thus looks like this:

(34)

$$\begin{bmatrix} \text{-ing} \\ \text{"the action of Ving"} \\ \text{attaches to verbs} \\ \text{Noun} \\ < R < Ev >> \end{bmatrix}$$

substituter

The word structure tree for an example like washing then looks like this:

(52)
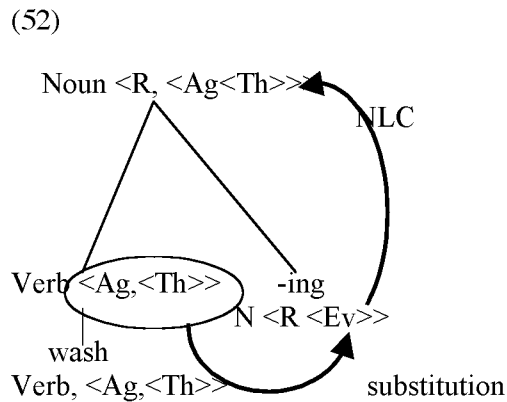
This is exactly parallel to the Japanese causative in (xx), except for the category of the affix and the specific nature of the external argument it calls for.

The argument structure of an –ing nominal can then be fed into the analysis of argument-linking compounds that we discussed in the last section. The innermost argument of *washing* is the theme; this can then take part in argument-linking within a compound, as we have already discussed. Composing these two processes in the obvious way yields the complete word structure tree in (53) (believe it or not):

(53)

Noun <R <Ag>>   HR (+Sat. Princ.)

Noun <R $_i$>   Noun
                        <R <Ag, Th $_i$>>

        NLC   NLC
                                    (+Sat. Princ.)

            Verb
            <Ag <Th>>

                                substitution

                NLC

truck   driv(e)   -ing
Noun <R>   Verb <Ag <Th>>   N <R <Ev>>

(54) gives examples illustrating the full argument structure of these synthetic compounds:

(54)   a.   One problem is   meat-eating   (by lions).

       b.   Another problem is   truck-driving (by politicians).

               <R>   <Th>   <Ag>

These can be compared with the following examples of the –ing noun not in a compound:

(55)   a.   I consider our biggest problem[(to be) the eating   of meat   by lions].

       b.   I consider our biggest advantage [(to be) the washing of dishes by machines].

       c.   I consider a major hazard   [(to be) the driving   of trucks by politicians].

                       <R>   <Th>   <Ag>

The difference is that the compound forms no longer take a theme argument in the syntax, since
it has been used up inside the compound, in accordance with the saturation principle. However,

we can tell that the Head Rule still applies to these compounds for everything but the theme argument, because the rest of the argument structure of the right hand element is passed up in an –ing compound. This residual argument structure always includes the agent argument and the R argument, and can include a goal argument as well (see (56c)).

(56) a.   Meat-eating [<Ag> by vegetarians] has to be stopped.

b.   Truck-driving [<Ag> by politicians] should be encouraged.

c.   Gift-giving [<Ag> by the rich] [<Go> to the needy] is commendable.

Practice exercise: Starting with the examples in (3), can you develop an argument that the affix –ment in English has the same argument structure properties as –ing? Can you find or construct synthetic compounds using nouns with –ment? How many other noun forming affixes in English can you find that take part in these substitution-linking constructions?

Substitution linking is actually quite common. We said that English does not have causative affixes. However, this is not really true. English has no causative affix that attaches to verb roots, but it does have causative affixes that attach to adjectives. An example is *–ize*:

(57) a.   Hitch-hiking is legal.   Legal: A <Th>

This facility is very modern.   Modern: A <Th>

b.   Congress legalized hitch-hiking.   Legalize: V <Ag<Th>>

The company modernized its facility Modernize: V <Ag<Th>>

These examples are not as striking as the Japanese examples. In these cases, we could get approximately the right results by saying *–ize* has the argument structure <Ag<Th>> and always passes it on to the whole word by the NLC and leave it at that. But there is an important semantic relationship that this simple approach would not capture: the sentences in (57b) imply the corresponding sentences in (57a). Thus, if Congress legalizes something, that thing is now legal; if one modernizes something, then it is now modern. This semantic relationship makes sense if the theme of the causative verb is actually the same argument as the theme of the root adjective. In other words, *-ize* in English also does nothing more than add an agent to the argument structure of the root adjective, just like *(s)ase* does in Japanese. The English example is less striking only because adjectives have simpler argument structures than verbs do.

Another use of substitution linking in English is with nouns formed with *–ness*. Earlier we gave the following pattern for *–ness* forms, arguing that the <R> argument of *–ness* over-rides the <Th> argument of the adjective root *dark*—an instance of the NLC in action.

(58)   I consider   the sky   [(to be) dark].   dark, Adj <Th>

     I consider   that   [(to be) darkness].   darkness, N <R>

     *I consider   the sky   [(to be) darkness].   *darkness, N <Th>

But this underestimates the argument structure of *darkness* slightly. One can also say:

(59)   a.   The darkness of the sky (is ominous).

     b.   ?I consider *that* the darkness of the sky.

The theme argument of the adjectival root can be expressed after all, but as an internal argument, inside the NP headed by *darkness*, not as an external argument. The external argument is the <R> argument of *–ness*. Again, this pattern is parallel to a Japanese causative or to an English *–ing* nominal, and can be explained by substitution linking. The Word Structure Trees for *modernize* and *darkness* would be as follows, given these assumptions:

(60)
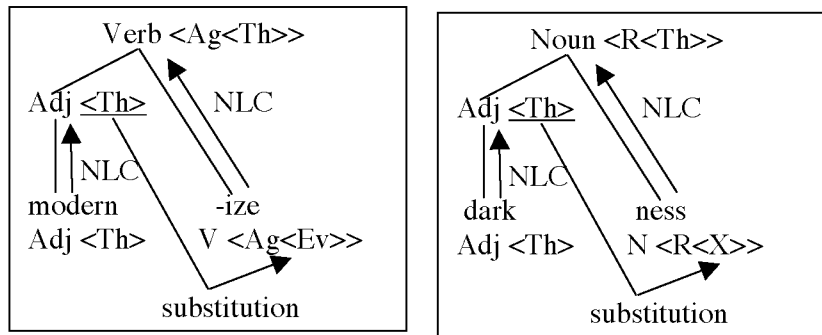
4.7   Beyond Percolation (3): ARUGUMENT BINDING

By now we have accounted for many of the argument structure relationships that caught our interest in section 4.1, but not quite all of them. We have accounts of employment, for example, but only a partial account of employer, and no account at all of employee. We have an account of dishwashing, but not an account of washable. To extend our theory to this last class of examples requires one further kind of argument structure relationship, to supplement substitution linking.

Let us begin by reconsidering the argument structure of *–er* nominals like *eater*. In section 4.xx, we said that they had the argument structure <Ag<Th>>, just like the root verbs they are derived from. This was motivated by data like the following:

(61)   These sharks are [_{NP} eaters of men]

This machine is [_{NP} a washer of dishes]

This knife is [_{NP} a cutter of cheese]

(62)   I consider *John* [_{NP} a good washer of dishes].

Her culinary training makes *Mary* [_{NP} a great cutter of cheese]

The easy way to explain this pattern is to say that *–er* is a noun with Ø argument structure; the argument structure of the derived noun would then be the same as that of the verb, by the Percolation Convention. However, now that we know about substitution, we have another way that the arguments of the verb root can be inherited by the derived noun: they can be substituted for an internal argument of *–er*, and then passed on by the Node Labelling Convention. This could be the basis for an even better theory.

Indeed, saying that –er has Ø argument structure misses one important intuition. Although the external argument of *–er* is comparable in some ways to the subject of the root verb, it is also comparable to the <R> argument of a simple noun. This is brought out by the parallelism of the following two sentences, one of which has an –er nominal and the other of which has a morphologically simple noun:

(61)   These sharks are [_{NP} eaters of men]

These photos are [_{NP} pictures of men]   picture: N <R<Theme>>

In order to capture both of these parallelisms, the most attractive thing to say would be that the external argument of *eater* is *both* the Agent of *eat* and the R or *-er*. We can do this by add the following principle to our theory of argument structure. (This is the last one!).
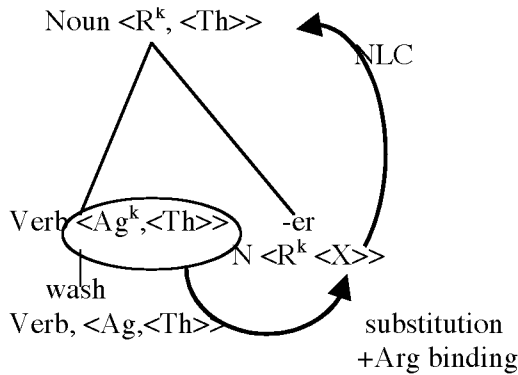
(62)   ARGUMENT BINDING:

A designated argument of the head may *bind* a designated argument of the nonhead as required by the lexical entry. When this happens, no distinct phrase will express the bound argument, and it will be understood that the same thing fulfills both argument roles.

Suppose then that *–er* (like *–ing*) has the argument structure <R<Event>> (a typical noun argument structure), and that it permits substitution. However, (unlike *–ing*) *-er* also has the specification that its external argument binds the external argument of the root. Like the identity that comes from argument-linking, we can represent this by putting the same subcript on the binding argument and the bound argument. This notation indicates that the two arguments must be interpreted as being the same thing:

(63)

Noun $<R^k, <Th>>$

NLC

Verb $<Ag^k, <Th>>$ -er
N $<R^k <X>>$

wash
Verb, $<Ag, <Th>>$ substitution
+Arg binding

This new binding relationship is also like argument linking in that it "uses up" the agent argument of the verb root. Since the agent argument of the verb is now tied to the R argument of -er, it cannot be expressed as a distinct phrase in the syntax; therefore, it does not belong in the argument structure of the derived word. (This is similar to the Saturation Condition, although not quite identical.) The rest of the argument structure of *wash*, however, is subsituted into the argument structure of *–er*, and is passed on to the word by the NLC. The result is a two-argument noun, with an R external argument and a Theme argument that is inherited from the verb root. Furthermore, the R argument of the noun is understood as the Agent argument of the verb. This result matches our intuitions about the data in (61) and (62) very nicely.

Whereas substitution and argument binding seems like a minor upgrade to an analysis of *–er* that uses only the Percolation Condition, these techniques are essential to providing an analysis of words with the suffix *–ee*. To see this, compare the argument structure of nouns formed from verbs with the suffix *–ee* to the *–er* and *–ing* nominals we have discussed. A word like *employee* is similar to *employer* in that it has two arguments:

(64) a.   The IRS considers Chris [the employer of Pat].

b.   The IRS considers Pat [an employee of Chris].

However, the thematic roles are reversed in the two examples. In (64b), the external argument of the noun corresponds to the theme argument of the verb (Pat is the one who someone employs), and the internal argument of the noun corresponds to the agent argument of the verb (Chris is the one who does the employing). Thus, we cannot fall back on the Percolation Convention in this case, because this would not restructure the arguments of the base verb. However, we can explain this reversal elegantly by saying that the argument structure properties of *–ee* are exactly like those of *–er*, except that the external argument of *–ee* binds the *internal* argument of the verb root, not the external one. This gives the following word structure tree:

(65)

Noun $<R^k, <Ag>>$

Verb $<Ag,<Th^k>>$ -ee

NLC

N $<R^k <X>>$

employ
Verb, $<Ag,<Th>>$ substitution
+Arg binding
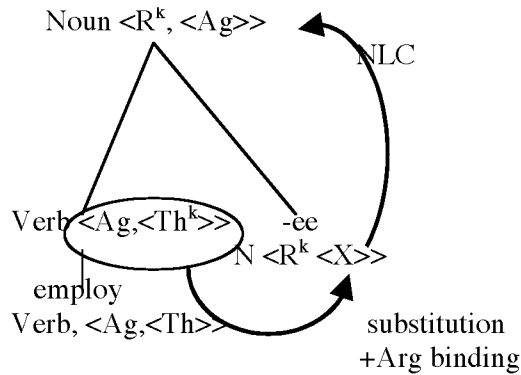
Here the R of the derived noun is the same as the theme of verb root, which is correct semantically. The theme argument is therefore used up, but the agent argument is not; it becomes an internal argument as a result of substitution linking. The Node Labeling Convention then applies as usual. The result is an apparent reversal of arguments, because the agent argument of the verb is an internal argument of the noun, and something identified with the internal argument of the verb is the external argument of the noun.

One of the questions we posed in the introduction is why are –ment, -er, and –ee so different is they are all nouns that affix to verbs. We can now summarize our answer to this question by comparing the lexical entries of these three noun affixes as in Table xx.

(65)

Label	-ing	-er	-ee
Phonology (UR)	/iŋ/	/ər/	/iː/
Attachment properties	[V__]	[V__]	[V__]
Category	N	N	N
Arugument structure	$<R<Ev>>$ substituter {no binding}	$<R<Ev>>$ substituter Ext arg binds Ext Arg	$<R<Ev>>$ substituter Ext arg binds Int. Arg

All three affixes have the same basic argument structure, and all three undergo substitution linking. The differences have to do with binding properties. *–Ing* introduces an R argument as an additional argument, which undergoes no argument binding, *-er* introduces R and binds it to the external argument of the verb (usually the agent), *-ee* introduces R and binds it to the internal

argument of the verb. These are all the logical possibilities that one can readily imagine within this system.

As a final example, consider adjectives formed from verbs by attaching *–able*. Previously we have seen that the verb attached to must be transitive—i.e. it must have an internal argument. At the beginning of this chapter, we also saw that the external argument of the adjective corresponds to the internal argument of the verb, not to the external argument:

(66)   The door is lockable.   Cf.   I locked the door.

   This water is drinkable   cf.   I drank the water.

(67)   * I am lockable.

   * I am drinkable.

To these previous observations, we now add the fact that the external argument of the verb can sometimes be expressed in an *–able* sentence, but only as a prepositional phrase internal to the adjective phrase:

(68)   These letters are [$_{AP}$ readable by a machine].

      (Compare: A machine can read these letters.)

   This problem is [doable by undergraduates].

      (Compare: An undergraduate can do this problem.)

Here again we see to see an inversion of argument structure: the external argument of the verb is the internal argument of the adjective, and vice versa. This pattern can readily be explained if we analyse *–able* in the same way we analysed *–ee*: it is an adjective that allows substitution, where the external argument of the adjective binds the internal argument of the root. The word structure tree would be:

(69)

$$Adj <Th^k, <Ag>>$$

NLC

$$Verb <Ag,<Th^k>>$$ -able

$$A <Th^k <X>>$$

drink

$$Verb, <Ag,<Th>>$$

substitution
+Arg binding
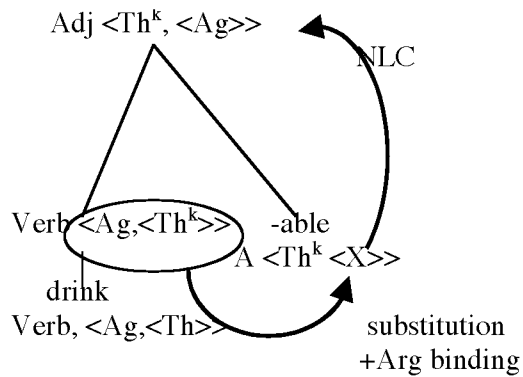
The result is an adjective with a theme external argument and an agent internal argument. (Moreover, the internal agent argument is optional, as internal arguments almost always are with nouns and adjectives.) The theme argument is also understood as being the same as the theme of the verb root. The lexical entry for –*able* would be:

(70)

Label	-able
Allomorphy	V bI1 -- V b1 (conditioned by stress)
Attachment properties	[V__]
Category	Adj
Arugument structure	<Th<Ev>> substituter Ext arg binds Ext Arg

Thought Question: Can you think of an affix in English that forms adjectives, but where the External argument of the adjective binds the *external* argument of the root. (Such an affix would be the adjectival equivalent of –*er*, just as –*able* is the adjectival equivalent of –*ee*.)