MAIN POINTS

- Parsing is the process of <u>assigning elements of surface structure to linguistic categories</u>. Because of limitations in processing resources, we begin to parse sentences as we see or hear each word in a sentence.

- We use syntactic, semantic, and pragmatic knowledge to comprehend sentences. An ongoing debate is <u>whether we use these forms of knowledge simultaneously or whether we process syntactic information first.</u>

- <u>Figurative language</u> is language that literally means one thing but is taken to mean another. Although we may sometimes use literal meaning as a guide to figurative meaning, we can also comprehend figurative language directly.

- We ordinarily remember the gist of a sentence and quickly forget its surface form. An exception is pragmatically significant statements, such as insults, whose exact wording is often well remembered.

INTRODUCTION

We hear thousands of sentences every day and respond to many, perhaps most, with barely any notice of their structure. In others, the wording is so cumbersome that we find ourselves struggling to unravel what has been said. And still others are clearer in meaning than in intent: When a coworker asks over coffee whether you are feeling all right, you may perfectly well understand the question without knowing precisely what the person means by it. We often forget the exact words a person uses to convey a message, but some sentences linger in our memories for years. In short, we respond to sentences in a variety of ways. In this chapter, we will try to identify and understand the many facets of the way we comprehend sentences.

Comprehending a sentence involves attention to syntactic, semantic, and pragmatic factors. Consider a simple active declarative sentence, such as *The actor thanked the audience.* At the syntactic level, we identify the constituent or phrase structure of the sentence; that is, we identify *the actor* as a noun phrase (NP), *thanked* as a verb (V), and *the audience* as another NP. <u>At the semantic level, we identify the semantic or thematic roles played by various words in the sentence.</u> *Actor* is the **agent** and *audience* the **recipient** of the action. <u>At the pragmatic level, we probably have some knowledge about the real–world circumstances in which this sentence would make sense. It might, for instance, describe the end of a play after an actor has taken a bow.</u>

It is one thing to say that these factors are involved in comprehension and quite another to identify what part each factor plays. Do we use our syntactic, semantic, and pragmatic knowledge simultaneously when we comprehend a sentence? Or do certain factors take priority at various stages of the comprehension process? And what kinds of cognitive processes are involved when a sentence, unlike this simple declarative one, is complex enough to be a burden for working memory? These are some of the issues we will be looking at in this chapter. In the

first section, we look at how we identify the syntactic structure of a sentence. Then we discuss the role of semantic and pragmatic context in sentence comprehension. Finally, in the last section, we discuss memory for sentences.

IMMEDIATE PROCESSING OF SENTENCES

Parsing is a procedure

A first step in the process of understanding a sentence is to assign elements of its surface structure to linguistic categories, a procedure known as **parsing**. The result of parsing is an internal representation of the linguistic relationships within a sentence, usually in the form of a tree structure or **phrase marker**. Figure 6.1 depicts some of the successive points in parsing a sentence. We recognize *the* as a determiner, which signals the beginning of a noun phrase (Kimball, 1973). Our knowledge of noun phrases is that they take the form of NP → det + (adj) + N, so at this point we are looking either for an optional adjective or a noun. We recognize the next word, *actor,* as a noun and add it to the noun phrase. The remaining items are added as shown in Figure 6.1.
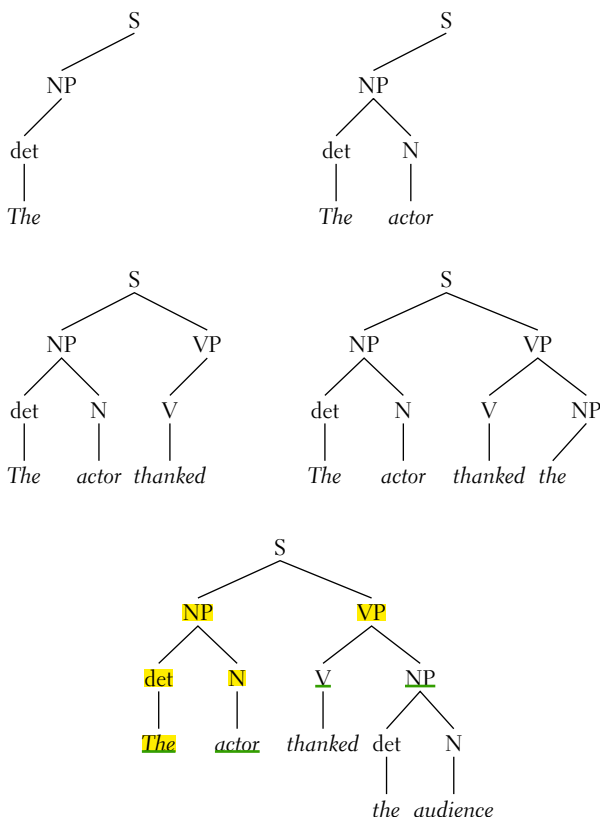

F I G U R E 6.1 Five stages in the parsing of a sentence.

Immediacy Principle vs wait-and-see Approach

We may think of parsing as a form of problem solving or decision making in the sense that we are making decisions (although not necessarily in a conscious manner) about where to place incoming words into the phrase marker we are building. Just and Carpenter (1980) suggest that we make these decisions immediately as we encounter a word, a principle they call the **immediacy principle**. According to this view, when we first see or hear a word, we access its meaning from permanent memory, identify its likely referent, and fit it into the syntactic structure of the sentence. The alternative to immediate processing is to take a "wait–and–see" approach: to postpone interpreting a word or phrase until it is clearer where a sentence is going. However, considerable evidence for the immediacy principle is available. Although we sometimes postpone decisions, more often than not we interpret the words as we hear or see them.

The primary reason that we use immediate processing is that the number of decisions involved in understanding even a single sentence can be quite large and thus can overload our cognitive resources. Suppose we heard sentence (1):

(1)   John bought the flower for Susan. *the sentence was heard, it could mean as a phool and it could mean as aata*

This sentence is syntactically ambiguous. It might mean that John bought the flower to give to Susan or that John bought a flower as a favor for Susan, who intended to give it to another person. This ambiguity is encountered when we hear the word *for*. Suppose further that we kept in mind both meanings of the sentence. But then *flower* has more than one interpretation also. It could mean *flower* or flour (remember, the sentence was heard). Suppose we take a wait-and–see approach and wait for further information before deciding which interpretation to use. Such an approach has a major disadvantage, however: If we retained two or more interpretations of each of the several choice points, we would rapidly overwhelm our working memory (see Singer, 1990).

Although immediacy of processing reduces memory load, it may lead to errors in parsing. For example, consider sentence fragment (2):

(2)   The florist sent the flowers . . .   *fallacy to go into ungrammatical or Garden Path*

Where might this sentence be going? At this point it looks like a simple declarative sentence in which *the florist* is the subject and *sent the flowers* is the main verb phrase. But suppose it continues as indicated in (3):

(3)   . . . was very pleased.

Although it at first appears to be ungrammatical, in fact this is a grammatical sentence with an embedded **relative clause** (a clause that modifies a noun). One of the reasons that the sentence is difficult to comprehend is that the embedded clause is a reduced relative clause; it is not signaled with a relative pronoun, as in sentence (4):

(4)   The florist who was sent the flowers was very pleased.

Another reason is that declarative sentences are more familiar than relative clauses, so we are more likely to "place our bets" on that outcome. If we took a wait-and–see approach, we would not be surprised by the continuation in (3). But we are surprised, so it appears that we immediately interpret the fragment in (2).

Parsing Strategies

If we are making decisions about where words fit into the syntactic structure of a sentence, on what are these decisions based? Much work has been done on the strategies we use in parsing. Strategies are thought of as approaches to parsing that work much of the time, although they are hardly foolproof. We will discuss two strategies that have gathered considerable empirical support.

Late Closure Strategy   One parsing strategy is called the **late closure strategy**. This strategy states that, wherever possible, we prefer to attach new items to the current constituent (Frazier, 1987; Frazier & Fodor, 1978; Kimball, 1973). A primary motivation for this strategy is that it reduces the burden on working memory during parsing (Frazier, 1987).

One example of late closure is sentence (5):

(5)   Tom said that Bill had taken the cleaning out yesterday.

Here the adverb *yesterday* may be attached to the main clause (*Tom said* . . .) or the subsequent subordinate clause (*Bill had taken* . . .). Frazier and Fodor (1978) argue that we tend to prefer the latter interpretation. Another example is (6), in which the prepositional phrase *in the library* could modify either the verb *put* or the verb *reading*. We tend to prefer attaching the prepositional phrase to the latter verb (Frazier & Fodor, 1978).

(6)   Jessie put the book Kathy was reading in the library . . .

Further evidence for the late closure strategy comes from Frazier and Rayner (1982), who examined eye fixations of subjects reading structurally ambiguous sentences, such as this one:

(7)   Since Jay always jogs a mile seems like a very short distance to him.

The ambiguity in this sentence is a little artificial because it lacks a comma after *jogs*. Nonetheless, the participants' eye fixations were interesting. Frazier and Rayner found that fixation times on the last few words were longer than on the earlier ones, implying that readers had misinterpreted the term *a mile* and had to make some later adjustments.

Sentences such as (7) are garden path sentences. As we saw in Chapter 1, in a garden path sentence, we interpret a sentence in a particular way only to find out near the end that we misinterpreted it. The subjective impression is that of being led down a garden path until discovering at the end that we took the wrong way and have to retrace our steps. The garden path experience lends further support to the immediacy principle, for if we did not commit ourselves to an immediate interpretation, we would not have found ourselves in this predicament.

Minimal Attachment Strategy   A second strategy is referred to as the **minimal attachment strategy**, which states that we prefer attaching new items into the phrase marker being constructed using the fewest syntactic nodes consistent with the rules of the language (Frazier, 1987; Frazier & Fodor, 1978). For
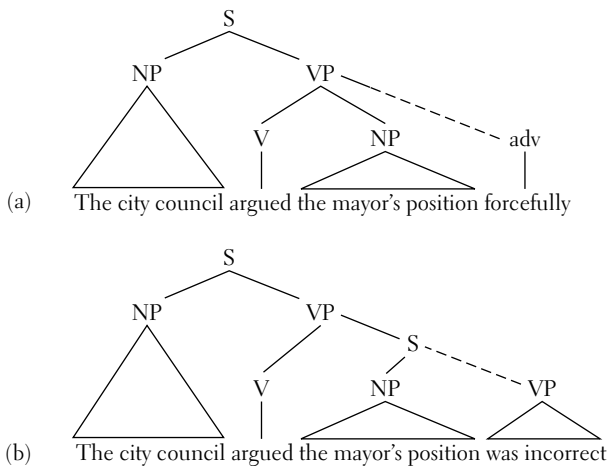
FIGURE 6.2 Tree diagrams for (a) *The city council argued the mayor's position forcefully* and (b) *The city council argued the mayor's position was incorrect.* (Based on "Making and Correcting Errors During Sentence Comprehension: Eye Movements in the Analysis of Structurally Ambiguous Sentences," by L. Frazier and K. Rayner, 1982, *Cognitive Psychology, 14*, p. 181, Academic Press.)

example, a sentence fragment such as (8) could be interpreted as either a noun phrase conjunction (that is, both Marcie and her sister were recipients of a kiss) or as the beginning of a new noun phrase. According to minimal attachment, we prefer the former interpretation (Frazier, 1987).

(8)   Ernie kissed Marcie and her sister . . .

Frazier and Rayner's (1982) study cited earlier also found evidence for the minimal attachment strategy. For example, consider sentences (9) and (10):

(9)   The city council argued the mayor's position forcefully.

(10) The city council argued the mayor's position was incorrect.

Sentence (9) is consistent with minimal attachment in that the adverb *forcefully* is attached to the current constituent, the VP (see Figure 6.2a). In contrast, sentence (10) is a complement construction that requires building a new constituent (Figure 6.2b). Frazier and Rayner found that reading times were faster for (9) than for (10).

only one module that is syntactic
Modular Versus Interactive Models

The parsing strategies identified by Frazier are consistent with the modular approach to language comprehension in which comprehension as a whole is the result of many different modules, each devoted to a particular aspect of comprehension (Fodor, 1983). In this view, parsing is performed initially by a syntactic module that is not influenced by higher-order contextual variables such as the meaning of the sentence or by general world knowledge. Frazier (1987, 1995), for example, claims that parsing is executed by a syntactic module, and these contextual factors influence comprehension at a later stage.

An alternative view is that syntax and semantics interact during the comprehension process (Britt, Perfetti, Garrod, & Rayner, 1992; Crain & Steedman, 1985;

Taraban & McClelland, 1988; Tyler & Marslen-Wilson, 1977). One type of inter-active view is called the **constraint-based model** (MacDonald, Pearlmutter, & Seidenberg, 1994; McClelland, 1987; Trueswell, Tanenhaus, & Garnsey, 1994). In this model, we simultaneously use all available information in our initial parsing of a sentence—syntactic, lexical, discourse, as well as nonlinguistic, contextual infor-mation (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995).

Much of the research that has compared these two proposals has examined structurally ambiguous sentences. In particular, attention has been given to sen-tences such as (11). As we are listening to it, this sentence fragment may be parsed in one of two ways. The parsing favored by the minimal attachment principle is that *sent* is the verb (MV), as in sentence (12). This interpretation leads to a garden path effect later in the sentence. The other interpretation is a reduced relative clause (13). This ambiguity occurs because English permits the reduction or dele-tion of relative clauses such as *who was*.

(11) The florist sent the flowers was very pleased.

(12) The florist sent the flowers to the elderly widow.

(13) The florist who was sent the flowers was very pleased.

Rayner, Carlson, and Frazier (1983) examined whether the plausibility of real-world events influenced the immediate parsing of sentences. When we dis-cussed sentence (11) earlier, you may have wondered whether the garden path effect is related to the fact that we expect florists to send flowers, not receive them. In sentence (14), the interpretation that the performer received the flowers is considerably more plausible:

(14) The performer sent the flowers was very pleased.

Rayner and colleagues measured eye fixations on segments of these sentences and found that initial analyses of the sentences were unrelated to the plausibility variable. Clear garden path effects were found with both plausible and implausible sentences.

Ferreira and Clifton (1986) examined whether a paragraph context would override the minimal attachment strategy:

(15) The editor played the tape and agreed it was a big story.

(16) The editor played the tape agreed it was a big story.

(17) John worked as a reporter for a big-city newspaper. He sensed that a major story was brewing over the city hall scandal, and he obtained some evidence that he believed pretty much established the mayor's guilt. He gave a tape to his editor and told him to listen to it.

(18) . . . He ran a tape for one of his editors, and he showed some photos to the other.

The researchers presented subjects with sentences that could ([15]) and could not ([16]) be parsed by means of minimal attachment. In some instances, the para-graph context biased the reader toward a minimal attachment interpretation of the target sentence, as in (17). In other instances, such as (18), the context primed

the nonminimal attachment interpretation. Nevertheless, the researchers found that readers continued to use the minimal attachment principle. Reaction times for the critical region of the sentence (*agreed*) were longer for sentences that violated minimal attachment than for those that did not, but no differences were observed between different paragraph contexts. These results suggest that the parser operates with structural biases that are not influenced by prior semantic context.

Other results have been more favorable to the constraint-based framework. Trueswell and colleagues (1994) examined eye fixations to sentences such as (19) and (20):

(19) The defendant examined by the lawyer turned out to be unreliable.

(20) The evidence examined by the lawyer turned out to be unreliable.

Although these two sentences are structurally similar, the eye fixations were much greater when the subject was animate ([19]). Trueswell and colleagues suggest that comprehenders immediately utilize their lexical knowledge to determine that the main verb or minimal attachment interpretation of (20) is not possible (in other words, evidence does not examine; it is examined by someone). In contrast, (19) permits the incorrect main verb interpretation and thus leads to a garden path effect. This result suggests that comprehenders immediately use lexical knowledge to guide parsing. Similar results are reported by Trueswell, Tanenhaus, and Kello (1993).

It appears, then, that some information other than syntactic strategies such as minimal attachment and late closure are influencing initial parsing decisions. Moreover, some recent evidence from brain studies converge on the same conclusion (Hagoort, Hald, Bastiannsen, & Petersson, 2004). We will discuss the role of brain mechanism in language in Chapter 13.

Working Memory and Comprehension

The preceding section indicates that we have to consider a great deal of information during the course of comprehension. Although some debate persists regarding what information is considered at what part of the process, there is agreement that comprehension involves, at some point, a consideration of syntactic, semantic, pragmatic, lexical, and extralinguistic factors.

Let us try to tie our discussion of sentence comprehension with what we have already learned about working memory. In Chapter 3, we discussed modern conceptions of working memory that emphasize the role of executive control. In Baddeley's model of working memory, the executive controls attention and thus determines what information is attended and what is ignored. As we saw in Chapter 3, individuals with relatively larger working memories perform better at a variety of complex cognitive tasks, such as reasoning.

Given the complexity of comprehension, we would expect that working memory capacity is also related to individual differences in comprehension performance. Gernsbacher and Faust (1991) provide evidence for this claim. They

found that less skilled comprehenders were less efficient in rejecting the inappropriate meanings of ambiguous words. For example, when presented with sentences such as *He dug with the spade*, less skilled comprehenders were slower to reject the meaning of *spade* that pertains to playing cards in favor of the meaning that pertains to gardening.

Gernsbacher and Faust (1991; Gernsbacher, Varner, & Faust, 1990; see also McNamara & McDaniel, 2004) propose that the mechanism of suppression is a component of general comprehension skill. That is, less skilled comprehenders are less efficient in suppressing irrelevant information, a skill associated with the central executive of working memory. Gernsbacher and colleagues suggest that this mechanism is not specific to comprehending written versus spoken language, and similar findings are found with both tasks. Furthermore, they found that similar results occur in a visual, nonlanguage task. Thus, they saw the mechanism of suppression as a component of general comprehension skill.

Just and Carpenter (1992; see also Carpenter, Miyake, & Just, 1994) also discuss individual differences in working memory and how they pertain to language comprehension. For example, they found that individuals with smaller working memories were more likely to show garden path effects in sentences such as *The evidence examined by the lawyer....* Those with larger working memories recognized that the head noun (*evidence*) is not animate, hence is incapable of examining anything. Individuals with larger working memories thus might be better able to identify this pragmatic cue and integrate it with the syntactic information to guide parsing and avoid the garden path effect. The interesting implication of this result is that the ongoing debate of the preceding section—whether all available information is simultaneously considered during sentence comprehension—may not have a single resolution. There may be different answers for individuals with differ working memory capacities.

Just and Carpenter's (1992) analysis suggests that the argument that parsing might not be a syntactic module in the sense discussed by Fodor (1983). According to the modularity view, only certain kinds of information may be available to the language processor at a given time. If so, the assumption is that the language processor is hard-wired to handle only certain kinds of input at certain times of the process. By demonstrating that working memory capacity influences parsing performance, Just and Carpenter suggest that the concept of modularity is not necessary to explain parsing performance.

Similarly, studies of memory load interference in syntactic processing support the conclusion that syntactic processing is not modular but rather influenced by a general working-memory system. Gordon, Hendrick, and Levine (2002) presented participants with a short set of words while they read syntactically simple or complex sentences. In some instances, the words in the set matched those in the sentences; in other cases, they did not. Performance on sentence comprehension was worse for the more complex sentences. Also, more comprehension errors were made when the word set matched the words in the sentences, suggesting interference between the two tasks. Finally, the difference between the two types of sentences was greater when the words matched as opposed to when they didn't. These results

indicate that the two tasks drew upon the same set of resources. Fedorenko, Gibson, and Rohde (2006) present similar results.

Several avenues of research remain. If working memory is related to language comprehension, what determines individual differences in working memory capacity? We know that performance on many tasks improves with practice, and many investigators contend that the amount of working memory capacity needed to perform a task decreases with practice (for example, Ericsson & Kintsch, 1995; MacDonald & Christiansen, 2002). We do not know much of how language experience influences an individual's language comprehension skill.

Incomplete or Inaccurate Representations

Perhaps this is a good time to step back and look at some larger issues. For all their differences, the modularity and interactive models both assume that we construct a representation of a sentence that is complete, detailed, and accurate. Recently, Ferreira and her colleagues (Christianson et al., 2001; Ferreira, 2003) have called this assumption into question. They have suggested that comprehenders sometimes misinterpret garden path sentences and that misinterpretations may persist even after syntactic reanalysis has taken place.

Christianson and colleagues (2001) presented participants with sentences such as (24):

(24) While Anna dressed the baby played in the crib.

As with other garden path sentences, comprehenders initially assumed that Anna dressed the baby. It is assumed that they reexamine the sentence and eventually correct this interpretation. However, unlike other studies, Christianson and colleagues (2001) actually examined whether comprehenders eventually got the sentence meaning right. They gave their participants questions such as these:

(25) Did the baby play in the crib?

(26) Did Anna dress the baby?

Participants were virtually 100% correct in responding that the baby played in the crib, but many answered the second question incorrectly. Although the initial interpretation of the second question is that Anna dressed the baby, the reinterpretation should correct this. But Christianson and colleagues (2001) found that comprehenders do not necessarily make this correction.

Ferreira (2003) makes a similar point with passive sentences. In one study, participants read sentences such as (27–30) and were asked to determine whether the event described in the sentence was plausible. Performance on active sentences was nearly 100% correct, but error rates of 25% were found with the passive sentences.

(27) The man bit the dog.

(28) The man was bitten by the dog.

(29) The dog bit the man.

(30) The dog was bitten by the man.

Ferreira and colleagues (2002) refer to these incomplete representations as "good-enough representations." That is, comprehenders have not extracted the complete meaning of a sentence but have gotten some of the meaning correct and some incorrect. Foertsch and Gernsbacher (1994) have made similar points at the discourse level.

The observation that comprehenders may develop incomplete or inaccurate representations of sentences is not new. In one classic example (Erickson & Mattson, 1981), participants were asked, "How many animals of each sort did Moses put on the ark?" Most people respond by saying "two," instead of noticing that it was Noah, not Moses, who gathered the animals.

The significance of incomplete or inaccurate representations is twofold. First, in naturalistic situations people frequently misinterpret what others are saying, for a host of reasons (they are distracted by others' comments, noise in the environment, and so on). Psycholinguists have focused on people's ability to comprehend sentences in controlled laboratory environments, and in that context errors are relatively infrequent. Although they are infrequent, these errors perhaps tell us more about comprehension in the natural environment than correct performance (Ferreira et al., 2002).

Second, studies of incomplete representations emphasize the influence of expectations in sentence comprehension. As the "Moses illusion" illustrates, we come to the process of sentence comprehension with some preexisting ideas or preferences. When sentences that do not match our expectations are presented, we sometimes misinterpret them initially and ultimately correct ourselves, as the original garden path studies suggested. But other times, the expectations win out and the meaning that we carry from the sentence is fundamentally flawed.

Summary

Parsing, the process of assigning elements of the surface structure of a sentence to linguistic categories, is the first step in understanding a sentence. As a result of processing limitations, we begin to analyze sentence structure as soon as we see or hear the first words.

Two theories of parsing have been discussed. The modular approach suggests that the words of a sentence activate syntactic processing strategies that are used to organize the words into a phrase marker. These strategies indicate that we prefer to attach incoming words to the most recent constituent as opposed to attaching them to earlier constituents or developing new ones. Although the strategies are generally useful, they sometimes lead to errors and subsequent reanalyses of syntactic structure.

The interactive approach emphasizes that we use all available information, including lexical, discourse, and contextual factors. Whereas the modular approach insists that syntactically based strategies are used first, with lexical and discourse factors coming in later, the interactive model asserts that we simultaneously use all available information to parse sentences. Current research supports the role of lexical and contextual factors in parsing, but the role of discourse factors is less evident.

Recent research suggests that we sometimes develop incomplete or inaccurate representations of the sentences we encounter. This is more commonly the case when the sentence violates our expectations.

COMPREHENDING FIGURATIVE LANGUAGE

The parsing mechanism we have just considered has as its output a syntactic structure of the incoming sentence. This provides a basis for determining the literal meaning of the sentence. But many of the sentences we use on an everyday basis are not meant to be taken literally. For instance, suppose we heard someone say sentence (31):

(31) George went through the roof.

No one takes this sentence literally; rather, we understand that means that George got very angry. Similarly, sentence (32) refers literally to the behavior of birds, but we easily see the relevance for human affairs:

(32) Birds of a feather flock together.

Figurative language is language that means one thing literally but is taken to mean something different. It is a ubiquitous aspect of language. Honeck (1997) has noted the prevalence of figurative language in advertising. Studies of language use in television news programs have found that speakers use one unique metaphor for every 25 words (Graesser, Mio, & Millis, 1989). Another study found figurative language in psychotherapeutic interviews, various essays, and the Kennedy–Nixon debates (Pollio, Barlow, Fine, & Pollio, 1977). Figurative language is present in our daily discourse, in our poetry, and in our religious worship. As Cacciari and Glucksberg (1994) note, "figurative language is no longer perceived as merely an ornament added to everyday, straightforward literal language, but is instead viewed as a powerful communicative and conceptual tool" (p. 448).

This section will examine how we comprehend figurative language. We will begin by exploring the many different types of figurative language. Then we will turn to research that has studied the processes of figurative comprehension.

Types of Figurative Language

Table 6.1 shows examples of various types of figurative language in English. Two of these types have been examined most intensively in psycholinguistic research: **indirect speech acts** and **metaphor**.

Indirect Speech Acts   To understand indirect speech acts, we need to first understand the concept of speech act. And to do this we need to define some terms.

Austin (1962) inspired a good deal of research into the various ways a speech utterance might function. He was especially interested in certain utterances that