INTRODUCTION

The field of speech–language pathology has witnessed a remarkable growth in the area of phonology over the past decade. *Phonology,* a term once restricted to linguistics, has become commonplace in speech–language pathology. Along with phonology comes the term *phonological process.* Stampe (1973) introduced the concept of phonological processes to explain systematic sound changes made by children in producing adult words. As children grow, these processes are suppressed or eliminated until the child's phonological system matches that of the adults. Speech–language pathologists now use the term *phonological processes* to describe sound-change patterns that occur in children's speech.

This workbook is about phonology and phonological processes. It is intended to provide background and practice for clinicians and students who will be assessing children with phonological disabilities.

In recent years, the term *phonological process* has been associated with the literature on reading development. In that context, it refers to the ability to use phonological information in processing written and oral language. In referring to sound change errors, Hodson and others have encouraged a change to the term *phonological pattern* rather than *process* to avoid confusion. However, the original label, *phonological process,* continues to be used by the field in textbooks, assessment instruments, and journal articles. For this workbook, the terms *process* and *pattern* will be used interchangeably, with a preference for the term *process.*

Articulation and Phonology

One change brought about by the increased interest in phonology has been in the use of the terms *articulation* and *phonology.* While some writers use the two terms interchangeably, the current trend is to make a distinction between them.

Phonology is a broader term that refers to the organization and classification of speech sounds that occur as contrastive units within a given language (Stoel-Gammon & Dunn, 1985). A simpler definition was supplied by Edwards and Shriberg (1983), who defined phonology as the study of the sound component of language.

Both definitions refer to phonology as part of the language system. Ingram (1982) described this shift as a general trend in the research, which has moved from a study of how a child produces sounds to a study of sound production in the context of the linguistic system. In his words, "The phonologist is not just concerned with whether or not 'f' is produced, but also with target sounds and the contrastive status of substitutions" (p. 1).

Articulation has come to be viewed as one part of phonology. It is referred to as the overt level of speech production, which consists of the speech sounds we hear and produce (Edwards & Shriberg, 1983). Articulation relates to the physical movements and motor abilities that are required to produce speech sounds.

Phonology also has a *covert* level, or level of phonological knowledge. Edwards and Shriberg (1983) designated four parts to this level: (a) an inventory of contrastive sounds (phonemes), (b) morpheme structure rules and sequential constraints that determine permissible word and syllable formations, (c) morphophonemic rules for correctly producing combinations of morphemes, and (d) allophonic rules for correctly producing allophones of phonemes.

Phonology is one of five components of the language system, the others being syntax, semantics, morphology, and pragmatics. Edwards and Shriberg (1983) described the relationship between these components and phonology: "These other components and functions are concerned with choice and ordering of words in accordance with appropriate social contexts and individual histories, needs, and intentions. The task of the phonological component is to translate the message into manifest speech" (p. 37).

Phonological Processes

A comparison of adult and child phonological systems reveals that child speech production errors are typically simplifications of adult models. These simplifications are not random. For example, a child does not substitute a [w] for /r/ during one production and a [t] for /r/ the next. Instead, the substitutions are fairly consistent. Some variation is expected due to phonetic context and the fact that the child is in the process of learning the adult system, but generally once the system is known, errors are predictable. In fact, once the adult figures out the system, the child's intelligibility greatly increases.

Children with more severe articulation problems also demonstrate predictable errors. These children show systematic patterns of sound change that affect whole classes of sounds. These sound-change patterns are referred to as *phonological processes* or *patterns,* and they can influence classes of sounds or sound sequences. For example, one common phonological process is *stopping,* in which fricative sounds are replaced by stop-plosives.

DEFINITION

A phonological process is a systematic sound change that affects classes of sounds or sound sequences and results in a simplification of production.

It should be noted that the sound change does not have to affect all the sounds within a class, but it must affect at least two. In the example of stopping, there are nine fricatives that might be affected. If only two of them were systematically changed to stops, this could still be labeled stopping, because two is the smallest sampling that can still be considered a class of sounds. Simply put, one sound error in a class does not make a process.

Other criteria for identifying phonological processes have been suggested. McReynolds and Elbert (1981), for example, demonstrated how criteria could significantly change identification results. In their study they suggested that a sound change should have the possibility of occurring four times and be used at least 20% of the time before qualifying as a process. At

present no standardized criteria have been established for the identification of processes. On most of the published phonology instruments, if a particular sound change occurs even once, it identifies a phonological process.

It is suggested that in identifying processes the clinician keep the following in mind as minimal requirements for qualifying a sound change as a phonological process:

1. A process must affect more than one sound from a given sound class.
2. The sound change must occur at least 40% of the time.

Processes Affecting Consonants

Several phonological processes have been identified in the research literature. As early as 1980, Shriberg and Kwiatkowski listed more than 40 processes in their text on natural process analysis. Ingram (1989) suggested grouping these processes into three categories: (a) processes that affect the syllable shape of words, (b) processes that substitute one sound for another, and (c) processes that result in sounds becoming more like other sounds (assimilation). Bernthal and Bankson (1993) suggested two categories: (a) whole-word processes, which simplify a word or syllable structure and segmental contrast within a word, and (b) segment change processes, which involve some form of substitution for specific segments or types of segments, regardless of syllable or word position. Since Ingram's system has been used more frequently, the processes covered by this book and presented in Table 1 are grouped by syllable structure, substitution, and assimilation processes.

TABLE 1

Phonological Processes Involving Consonants and/or Syllables

Syllable Structure Processes	Substitution Processes	Assimilation Processes
Syllable deletion	Stopping	Labial assimilation
Reduplication	Stridency deletion	Alveolar assimilation
Epenthesis	Fronting	Velar assimilation
Final consonant deletion	Depalatalization	Nasal assimilation
Initial consonant deletion	Palatalization	Prevocalic voicing
Cluster deletion	Affrication	Postvocalic devoicing
Cluster substitution	Deaffrication	Metathesis
	Backing	Coalescence
	Alveolarization	

Processes Affecting Vowels

In addition to discussing processes affecting consonants, this workbook presents information and exercises dealing with vowel processes. Vowel processes are sound changes that affect vowels.

DEFINITION

A vowel process is a systematic vowel change that affects features, complexity, or vowel harmony.

Feature changes are changes in vowel height, frontness, or roundness. Complexity changes occur when the vowel quality changes from monophthong to diphthong or from diphthong to monophthong. Vowel harmony changes occur when a vowel change is influenced by phonetic context. The vowel processes discussed in this workbook are presented in Table 2.

Workbook Format

The format of this workbook is simple. Groups of phonological processes are presented along with their definitions. The definitions may vary according to different phonology assessment instruments, and any such variations are pointed out. Exercises are provided at the end of each major section to help the reader develop a working knowledge of various processes, in many cases following formats used by the most common phonology assessment instruments. Answers to these exercises, and to two mini-quizzes, appear at the end of the book.

Phonological processes from the following instruments were used in developing this workbook (abbreviations are used throughout):

ALPHA Test of Phonology–Revised
(ALPHA–R; Lowe, 2000)

Bankson–Bernthal Test of Phonology
(BBTOP; Bankson & Bernthal, 1990)

TABLE 2
Phonological Processes Involving Vowel Changes

Feature Change Processes	Complexity Changes	Vowel Harmony Processes
Vowel backing	Diphthongization	Tenseness harmony
Vowel lowering	Diphthong reduction	Height harmony
Vowel raising		Complete vowel harmony
Centralization		
Vowel unrounding		

Clinical Assessment of Articulation and Phonology
  (CAAP; Secord & Donohue, 2002)

Diagnostic Evaluation of Articulation and Phonology
  (DEAP; Dodd, Hua, Crosbie, Holm, & Ozanne, 2006)

Hodson Assessment of Phonological Patterns–Third Edition
  (HAPP-3; Hodson, 2004)

Khan-Lewis Phonological Analysis–Second Edition
  (KLPA-2; Khan & Lewis, 2002)

Smit–Hand Articulation and Phonology Evaluation
  (SHAPE; Smit & Hand, 1997)

Structured Photographic Articulation Test featuring Dudberry II
  (SPAT-D II; Dawson & Tattersall, 2001)

These tests are described in the Appendix.