To "Err" is Human:
The Nature of Phonological "Errors" in Language Development[1]

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Abstract

In children, two types of phonological "errors" may occur: slips of the tongue and pathological speech. A slip of the tongue is considered a normal, non-systematic "error", whereas a series of consistent speech "errors" is labeled as a speech pathology. Both types of "errors" follow phonotactic constraints defined by the target grammar, and may result in substitutions and omissions of sounds in conversation. They differ traditionally in two key ways: (1) while slips are unique utterances that generally occur only once, the disfluencies are consistent in a pathology, and (2) the speaker is able to notice and correct their error when they make a slip, but it is not the case in a speech pathology. Relevant research to both types of "errors" will be presented for comparison purposes, and theoretical explanations will be offered. I will propose that a deficit in self-monitoring exists in those with disordered phonology, in order to explain why "errors" repeat.

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1.0 Introduction

Phonological ”errors", both pathological and slips of the tongue, are not ”errors” in the sense of deviation from a learnable grammar. Rather, ”errors” follow a grammar, although it may be different from the target grammar native speakers acquire regularly. Children with a language pathology make consistent ”errors” that follow identifiable rules. As a consequence, the word “error” is a complete misnomer in regards to speech pathologies. Pathological errors can be compared to and contrasted with slips of the tongue, which are momentary deviations from targeted speech that are considered “normal”. Slips are not exactly rule-based, although they obey the phonotactic constraints and are classifiable into forms or types. Evidence for these claims comes from observational and experimental research, further supporting for the idea that grammar is strictly rule-governed and required for language production. The prevailing views on slips of the tongue are vastly different from those of pathological speech, and the two schools of thought rarely contribute to each other. I will present both without a specific focus on either slips or pathology in order to illustrate a bigger connection between what “errors” represent. Theories of self-monitoring and self-repair during speech production are as important to understanding phonological pathology, and as I will hypothesize, a deficit in self-repair and monitoring may be to blame for phonological pathologies, not deviation from rule-governed grammatical systems. In what follows, I will present and discuss the relevant research, and attempt to apply linguistic theory

to speech-language pathology therapy. Throughout this paper, I will use the term "error" to describe disfluency and deviance from target speech. I am borrowing the term not to validate it, but to increase comprehension in the paper by using a high frequency, recognizable word. Because I consider it a misnomer, it will be found in quotes.

2.0 Speech "Errors" – Slips of the Tongue

2.1 Phonological Constraints

Each language has a number of phonological restrictions that speakers subconsciously adhere to. These are known as phonotactics, and they govern the possible sound combinations in a particular language. In English, it is impossible for a syllable to begin with the phonetic segment/ŋ/. This possibility exists in languages such as Vietnamese, so it is physically possible to produce the sound in initial position, but a native English speaker is unlikely to do the same without forced effort. Rather, given the constraints imposed by English grammar,/ŋ/ can only be found at the end of a syllable. Native speakers rarely violate such learned phonotactic constraints in speech production, with few, purposeful exceptions such as producing non-native terms and names with illegal sounds if they are not particularly difficult. For instance, native speaker of English can begin a syllable with the phonetic segment /ʒ/ even though no native English words begin with that sound. It isn't difficult to force a speaker to make that

pronunciation because the voiceless counterpart to /ʒ/is /ʃ/, which is allowed to exist word-initially.

Constraints are generally described as either first- or second-order. First-order constraints are not dependent on any aspect of the syllable other than the position that they fill. The English constraint that /ŋ/ cannot be a syllable onset is an example of a first-order constraint. Second-order constraints take into account the association of a segment with a syllable position, which depends on some other property of the syllable. For example, assume that there exists a constraint that states /f/ is an onset if the vowel is /ɑ/. This would be considered a second-order constraint because it depends on the secondary property of vowel location. As we acquire language, these constraints are learned through exposure and practice (Warker & Dell 2006).

Native speakers will not produce violations of these constraints unless making a determined physical effort to try. Even when speakers make an unintentional "error", it will not result in a violation of their phonotactic constraints. An English speaker can realistically mispronounce the target word *king* as /gɪŋ/ but never as /ŋɪŋ/ (Warker & Dell 2006). This phonological obedience is known as the Phonotactic Regularity Effect.

Victoria Fromkin, a well-known researcher on speech "errors", agrees with Wells' (1951) original statement about slips of the tongue known as his "First law" of tongue slips: "A slip of the tongue is practically always a phonetically possible noise" (Fromkin 1971). She references an earlier article

from 1968 where she states that "The segments constituting each syllable must have sequential ordering, so that only initial consonants, vowels, and final consonants may interchange, if and only if the transpositions are in keeping with the phonological rules of the language" (Fromkin 1971). An example of this is a Spoonerism ("Spoonerism" is another term for "slip of the tongue", named for Reverend William Archibald Spooner who was known for his often-humorous mispronunciations) :

(1) <sphinx in the moonlight> → <**m**inx in the **sp**oonlight>

[**sf**ɪŋks … **m**unlaɪt] → ✓[**m**ɪŋks … **sp**unlaɪt]

not: *[**m**ɪŋks…**sf**unlaɪt]

The [sf] cluster is permitted as an onset in English words such as *sphinx, sphere* and *sphincter* because the following vowel is a front vowel. In English, there is a phonotactic constraint banning [sf] sequences from preceding central or back vowels so the word *sphoonlight* would thus incur a violationof this particular constraint. Consequently, the speaker upholds the constraint by altering the underlying /f/ to surface as an acceptable cluster consonant. This is an example of a second-order constraint because it is stated in terms of a rule that involves both a consonant and vowel sound. Other illustrations of the influence of second-order phonotactic constraints in slips of the tongue include:

(2) a. <play the victor> → <**fl**ay the **p**ictor>

[**p^{h}l**eɪ … **v**ɪktəɹ] → ✓ [**fl**eɪ … **p^{h}**ɪktəɹ]

not: *[**vl**eɪ … **p**ɪktəɹ]

b. <tab stops> → <tap stabs>

[t^{h}æ**b** stɑ**ps**] → ✓[t^{h}æ**p** stɑ**bz**]

not: *[t^{h}æ**p** stɑ**bs**]

c. <plant the seeds> → <plan the sea**ts**>

[p^{h}læn**t** … sij**dz**] → ✓ [p^{h}læn … sij**ts**]

not: *[p^{h}læn … sij**tz**]

d. <bloody students> → bloode**nt** studi**es**

[blʌd**i** stuwdən**ts**] → ✓ [blʌdən**t** stuwd**ijz**]

not:*[blʌdən**t** stuwd**ijs**] (Fromkin 1971)

All of these ”errors” are examples of phonological transposition ”errors”, where sounds are switched. The sounds that the speakers are producing are forced to adjust to the language’s phonotactic constraints. In the case of 2b. “tab stops”, the speaker begins by subconsciously switching the bilabial stops [b] and [p] in the coda of each word, but given that the fricative must retain the voicing marker on the preceding stop, a phonotactic constraint of English, so it takes on the voicing of the switched stop. Even though an “error” is occurring on the phonological

level, some process is making sure that the constraint is obeyed. The same phenomenon can be seen in examples of the determiners *a/an*:

(3) a. <**a c**urrent argument> →< **an a**rrent curgument>

[**ə k**ʌɹənt …] → ✓ [**ən ɑ**ɹənt…]

not: *[**ə ɑ**ɹənt…]

b. **an e**ating marathon → **a m**eeting arathon

[**ən i**ɾəŋ…] → ✓[**ə m**iɾəŋ…]

not: * [**ən m**iɾəŋ…]

c. **a h**istory of **an i**deology → **an i**sotry of **a h**ideology

[**ə h**ɪstɔri əv **ən ɑɪ**dipɒlədʒi]→ ✓[**ən ɪ**stɔri əv **ə h**ɑɪdipɒlədʒi]

not: *[**ə ɪ**stɔri əv **ən h**ɑɪdipɒlədʒi]

d. **an i**ce cream cone → **a k**ice ream cone

[**ən ɑ**ɪs krim kon → ✓[**ə k**ɑɪs krim kon]

not: *[**ən k**ɑɪs krim kon] (Fromkin 1971)

From this data, linguists have concluded that ”errors” or deviations of transposition are occurring at the level of speech processing planning, that is, before the corresponding neural muscular commands governing speech production are activated.

Much of the early speech “error” data, including Fromkin’s, come from adult speech ”errors”. These slips of the tongue have provided insight into how the phonological process works on a normally developed grammar. However, speech ”errors” also occur in children at ages when a native grammar is not fully developed, leaving room for theorists to question what these “errors” in children reveal about grammar in comparison to “errors” in adult populations.

2.2 Classification of “Errors”

Phonological slips are ”errors” that involve phonological units which do not carry semantic content, including phonetic features, segments (consonants or vowels), sub-syllabic sequences of segments (consonant clusters, rimes), syllables, and lexical stress (Jaeger 2005). Phonological ”errors” are assumed to have two different causes: perceptual misidentification of sounds, or accurate perception but inability to reproduce the sound, leading to substitution of an unpronounceable syllable for a friendlier one (Stemberger 1989). ”Errors” are thus generally divided into the classes contextual and non-contextual. The source of contextual ”error” can either be found in the utterance itself or in the planning of the utterance. The above examples of speech errors are considered contextual because no new sounds were added to the utterance. In the example of "kice ream cone" the [k] sound simply moves to a different position in the utterance; the sound is within the target context. Conversely, a non-contextual ”error” has no linguistic source in the utterance context. Slips are most commonly

contextual; the above examples would be classified as such. An example of a non-contextual slip comes from Stemberger's (1989) corpus of slips:

(4) a. What **k**ime is it?

b. Pre**k**end – pretend you hold your breath and fall down

In both examples, the phoneme [k] has been substituted for [t], though in different positions. Example 4a. was uttered by an adult speaker, and 4b. is from a child. Many non-contextual errors will appear to be whole-word substitutions, thus it may be the case that the speaker is thinking about another word while trying to pronounce the target.

"Errors" can be further classified as either *paradigmatic* or *syntagmatic*. Paradigmatic "errors" have target and "error" units that share a quality of some linguistic paradigm, such as they are both words, both morphemes or both phonemes, and they are competing for the same spot in the utterance. The following example of a paradigmatic "error" is borrowed from Jaeger's (2005) child research (the ellipses indicate that the child has corrected themselves to the target utterance):

(5) I like DeeDee on the Micker [mɪkɚ] …Mickey Mouse Club

Instead of producing the [i] sound at the end of Mickey ([mɪki]) as was intended, a competing phoneme takes the spot in the utterance. This error is also non-contextual, because the [ɚ] is not found anywhere else in the sentence. In syntagmatic "errors", the target and "error" units are planned for different spots in the speech string and one influences the other. The following is an example of this type of "error":

(6) Mommy, when **it** chews, it …when **I** chew, it hurts (Jaeger 2005)

In this example, *it* was planned for production later in the syntactic string, but it was executed early. Phonological "errors" are usually contextual and syntagmatic, as we can see with transposition "errors" in Fromkin's work where phonemes are switched in utterances. Contextuality is a difficult feature to measure if it is considered possible that it is contextual within the speaker's mind. The location becomes ambiguous if it is not evident within the utterance.

Research has resulted in the classification of six different types of "errors": substitution, addition, omission, movement, exchange and blend. Features of these forms will be discussed in a way that is relevant to phonological "errors" only. Substitution "errors" occur when one element of the utterance is substituted for another, which can occur on the phonological, morphological and lexical levels. Example (6) is classified as a substitution because *it* is inadvertantly substituted for *I.* Addition "errors" of phonology involve an inserted element

into an incorrect location. If the "error" is contextual, the source is still spoken in the correct location. An example that Jaeger cites is her daughter at 2 years and 2 months:

(7) It's a [k^{h}**w**æm**w**ʌ] (camera) (Jaeger 2005)

The [w] sound was added to the onset consonant and clustered. At her age, it is unlikely that the [ɹ] phoneme is learned, which is why [w] is produced instead of the adult English target form [k^{h}æm**ɹ**ʌ]. This particular "error" also gives support to the thought that a slip of the tongue, therefore, must be based on already learned phonology.

Omission "errors" occur in two different ways phonologically. First, there are assimilation "errors", where a phonological unit is omitted in the context of another phonological string which also lacks the element, making the "error" and source more structurally similar. This is illustrated in the following "error", which was produced after the child noticed their toe was sticking out of their torn stocking:

(8) My toe! My toe [_t^{h}ɪks] (**st**icks) out (Jaeger 2005)

According to Jaeger (2005), the onset cluster of *sticks* omits the [s] in order to assimilate to the onset of *toe.* The other type of omission "error" is the dissimilation "error", which occurs when a segment is planned for several slots in an utterance, and one of these instances is deleted. It is difficult to judge an "error" as dissimilation or assimilation because often, both possible sources occur in the utterance:

(9) Hey, there's still some [s_ɪ.kɚz] (**st**ickers) (Jaeger 2005)

In this example, it is arguable that the [t] was dissimilated from *still*, leading to the pronunciation of [s_ɪkɚz]. Likewise, it could be an example of assimilation to the onset of *some*.

Movement "errors" are a combination of omission and either addition or substitution. One element is deleted from its originally planned location and either added or substituted elsewhere. In the following example, there is a deletion of a consonant in a cluster followed by a substitution:

(10) Here's Snow White. Here's [s__o nɑɪt] (**Sn**ow **W**hite) (Jaeger 2005)

The [n] from *Snow*'s onset cluster is deleted, and then substituted for the [w] onset of *White*.

Exchanges and blends are strictly contextual and syntagmatic. *Exchange* "errors" occur when two elements exchange positions. Examples (1), (2) and (3) in this paper are perfect examples of this type of "error", where phonemes switch positions within the utterances. Blend "errors" involve two different lexical units that are planned for the same slot in a phrase and their phonological forms blend together in a single unit:

(11) That's a great big [fɑpɑ] bear! **(f**ather and **p**apa) (Jaeger 2005)

This example from a child resulted in a blend of the words *father* and *papa*, two related lexical items planned for that position in the sentence. It is also possible for multiple combinations of "errors" to co-occur within the same utterance.

2.3 Self-Monitoring

When a speaker makes any of these slips, they are generally able to recognize the mistake and correct themselves. Even children are capable of this recognition, often looking confused or embarassed after producing the error. This process has been attributed to a self-monitoring system in adult speakers, but can be seen in children as well. The prevailing idea is that some cognitive process is responsible for monitoring the deviations, forcing adherence to the constraints as described above, and allowing the speaker to fix the "error". The following discussion of related theories follows from the "slips of the tongue"

tradition, with notable contributions from literature on normal speech production and certain language disorders.

Linguists have attempted to explain language production in a systematic way that relates to the self-monitoring system. One recent example of such an attempt is based on a frame-based model. In a frame-based model, language production is first separated into content and structure. Phonetic segments are considered phonological content, whereas the structure is the frame that enforces constraints on the language. These units are retrieved independently during production, filling in the frames with phonological content. Based on this model, Dell is credited with developing a theory of speech production called the Spreading Activation Model (Dell & Kim 2005). The model consists of two networks of units: a lexical network, which contains word and phoneme units, and a structural network, which contains wordshape (e.g., CVC) and phoneme category units. When we start to form a word, the selected word unit (what we intend to produce) activates the necessary phoneme units, singling them out from other phonemes in the lexicon. The appropriate wordshape unit is also activated, which subsequently activates a class of phoneme units in the lexical network. A phoneme is selected and produced when it receives what Dell calls "sufficient activation" from both the current word unit and the current phoneme category unit. To better understand this theory, we can examine a simple word like *bat*. *bat* is a word unit that will excite three phonetic segments: the onset /b/,

vowel /æ/ and coda /t/. *bat* also activates the CVC wordshape, triggering the $C_{initial}$, V, C_{final} sequence (Dell & Kim 2005).

According to Dell and Kim (2005), speech errors arise through this model through activation. The phonetic segment /b/ is not the only one that will receive some excitement during activation; its neighboring phonetic segments like /p/ will also be activated, and if sufficiently so, can result in a speech error. Activation is assumed to be heavily influenced by attentional resources, which may explain the prevalence of speech "errors" during times of anxiety and fatigue.

Levelt et al. (cited by Nooteboom 2005) expanded on some properties of the spreading activation theory. Speech production is described as a strictly serial and feedforward process. There is no immediate feedback, although there are checkpoints. Self-monitoring requires the speech comprehension system, which is also used when we listen to others speak. This system does not pay attention to whether or not the output is the actual target word, rather, it makes sure it is phonotactically constrainted. There are two routes to the comprehension system: the first is an inner route the feeds a covert form of the not-yet-articulated speech into the system. The other is the route to the auditory systems of both speaker and listener. The perception-based self-monitoring system that we rely on for detection and correction also contributes to a lexical bias, an effect found in the production of speech errors that asserts we are more likely to produce a real word already stored in the lexicon than undefined, possible combinations of

phonetic segments (Nooteboom 2005). In short, our self-monitoring system is made up of two loops. One examines our speech overtly, allowing us (and the listener) to hear the production and consequently make corrections. The other acts covertly, catching errors in pre-production and forcing our speech to adhere to phonotactic constraints.

For these reasons, self-monitoring is important for the production and perception of normal speech. Likewise, there are important implications for language pathologies in an attempt to bridge the non-systematic slips and the systematic disorders. Research has targeted the pathology of stuttering in particular. Although stuttering is considered to be a disorder of speech motor control traditionally, other causes seem to underlie the misarticulations. The most influential theory regarding the relationship between self-monitoring and disordered speech is the Covert Repair Hypothesis developed by Postma and Kolk (1993). According to the hypothesis, the monitoring of pre-articulatory speech can result in interruptions that cause the speaker to restart and attempt to repair, resulting in speech disfluency (in both stuttering and "normal" speech). Restarting during this repair stage may result in the repetitions that are characteristic of stuttering. It could also produce a pause while the speaker is forced to wait until a new speech plan is realized. Vasiç and Wijnen (2005) expand on the Covert Repair Hypothesis with their Vicious Circle Hypothesis. In people who stutter, more effort is invested in monitoring speech than in the actual production. The monitor is focusing on potential disfluencies and the

threshold for acceptable output is set high enough so that even normal and unavoidable discontinuities are perceived as "errors" or disfluencies (Vasiç & Wijnen 2005). Because so much attention is devoted to avoiding problems they are aware of, monitoring is back-firing and the system overcompensates.

Although I noted earlier that the research on self-monitoring is based heavily on non-systematic slips, the Covert Repair Hypothesis is an example of how this theory can be used to potentially explain systematic phonological disorders. In the section that follows, I examine pathological "errors" in order to compare and contrast them to slips, as well as attempt to apply relevant theory to construct new possibilities for explaining the pathological system. The production of a slip is clearly tied to perception through self-monitoring and repair, leaving room to question whether this is also true for speech pathologies.

I would also ask you to keep in mind the types of slips and their corresponding examples above when reading the next section regarding phonological pathology and how it is manifested in speech.

3.0 Pathological "Errors"

3.1 Normal Acquisition Patterns

In order to understand the rules under which childhood speech "errors" are constrained, it is important to have knowledge of the normal acquisition patterns that the utterances are being compared against. Phonological trends vary from individual to indivudal and therefore development cannot be rigidly defined with benchmarks such as "by 16 months, certain sounds should be acquired". However, children do seem to begin producing phonetic segments with certain given manners and places of articulation at certain times. In infancy, children are able to produce prelinguistic vocalizations often known as babbling and cooing. Cooing is generally used to describe production of vowel sounds during the first four months, whereas babbling begins during the middle months of the first year when the child begins producing labial consonants such as [p] and [b]. During the first two years, children begin learning the phonology of their first 50 words. Following this stage, they begin producing single morphemes and expanding their phonemic inventory. Until around age 4, children will have trouble producing complex words, but single morphemes will not pose as great a challenge. This is the time when speech "errors" are considered normal. It is a period marked by mispronunciations that parents describe as "cute forms", such as pronouncing *cat* as *tat*.

By age 7, children should have the most difficult phonemes acquired and their speech will begin to sound fluent. As noted earlier, the first sounds that appear in child speech are the labial consonants. Ingram (1976) summarizes a number of descriptions of the acquisition period as described by Jakobson & Halle (1956), who suggest a universal order to phonological acquisition. Generally, the first syllables acquired are CV units or reduplicated CVCV patterns. For example, many English-speaking parents become excited to hear "mama" and "papa", thinking that this signifies the child's attachment to them, but it is actually a reflection of phonological acquisition: labial consonants and the [a] vowel are among the first phonemes to be produced. After [p] and [m], the next consonants to be acquired are [t] and [k]. Fricatives are difficult to acquire because of the manner in which they are produced. They are not learned until the homorganically matched stops are acquired. Although these are not straightforward guidelines for judging phonological development, children are compared against them roughly in determining whether a language delay or disfluency exists.

3.2 "Error" Analysis

To review the information previously presented, slips of the tongue are generally considered "normal" speech "errors" because of the conditions under which they occur. Children and adults making slips tend to make them uniquely and only once. There is no pattern to predict "errors" by, although we can

analyze them afterwards to determine their form as I have demonstrated. Also, speakers making ”errors” can and typically do notice them through a process of self-monitoring, an important step in the speech process. Children are able to self-monitor, even at a young age. A child that makes a slip is able to correct themselves, and they may even appear embarrassed. Among adults, ”errors” are more likely to occur when the speaker is tired and their attention is reduced, which is common linguistic knowledge for those who investigate slips. In the case of children, it’s unlikely that they make these ”errors” because they are having trouble paying attention, as this is a normal condition for a developing child. Children begin learning language by making systematic ”errors”. When learning the principles of morphology and syntax, for instance, it’s common to hear a child say ”I comed to the game” or “I runned around the block” because they do not have the grasp of irregular verb forms. Many researchers believe that this systematic production of ”errors” is a crucial part of the development of language, and that our developing systems are designed to do this (Stemberger 1989). However, systematic deviations from what is considered developmentally appropriate are labeled as pathological.

The issue of pathological speech is widespread and worrisome for parents and educators, who must be vigilant during development in order to detect disorder or delay. As they normally develop, children are constantly learning new sounds and making ”errors” along the way, which makes the audience role for an adult difficult. A child with a language pathology is even more difficult to

understand in conversation. Children with phonological problems are generally labeled as either phonologically delayed or disordered. A child is labeled as *delayed* if their system of sound is comparable to that of a younger child. The *disorder* label is applicable to children who show consistent patterns of substitution or omission, as previously demonstrated, that are rarely observed in children at any age, or to children whose development might be stalled in one area but advancing in another. It becomes difficult to judge what is normal development because each child hits milestones at differing times, making it hard to tell whether they will end up with a normal grammar if they deviate slightly at an early age. In the case of phonology, all we know from delayed and disordered children is that their grammar differs from what we observe in children acquiring language normally, as previously discussed, but that knowledge does not help us identify the phonological processes that are in fact occurring in the child. It turns out that, after consistent exposure to a child with a phonological disorder, it becomes simple to decode the omissions and substitutions. For example, Chiat (2000) has speech samples from a 5-year-old child named Joseph:

(12) a. [aɪ ɑʔ ə wæsɪʔ ɑʔ ɪʔ aɪz]

I got a rabbit but it died.

b. [ən aɪ ʌlər ɪʔ ɪn ɚs]

Can I color it in first?

Listening to these utterances would be confusing for any adult native speaker of English, as their first exposure to the types of "errors" specific to Joseph. However, it is possible to discern the intended words from this speech after repeated exposure. Even though the production of [ɑʔ] could have been a number of words, such as *pot, tot, dot, cot, got, shot* or *jot*, we're able to figure out that he meant *got* once we know what specific rules his speech is following. Chiat (2000) claims that the only consonants Joseph is able to produce are [s], [z], [m], [n], [w], [ɹ], [l] and [ʔ]. If another consonant is required, he either omits it completely or substitutes it with a [s] or [z], as we can see in *rabbit* [wæsɪʔ]. Interestingly, he seems unable to produce [ɹ] in coda position, but can be found medially. In this regard, his speech patterns remain systematic.

Another example of a rule-based "error" is the conversion of fricatives to stops. Fricatives are a difficult class of phonemes for children because it involves a near-complete closure of the oral cavity in order to create friction when air passes through the mouth, unlike stops, which simply involve a complete closure of the vocal tract. Difficulty with producing fricatives lies in part in oral muscular development, but at a certain age, that development should be in place. One of Chiat's (2000) examples is from a child who performs the process of stopping to

alter both the place and manner of articulation for the words *share, for,* and *some*, which are pronounced as *dare, bor,* and *dum*, respectively.

(13) a. [aɪ dɑə **d**ɛəwəm ɑʊʔ]

I gotta share them out

b. [wʌm **b**ɔ mi]

One for me

c. [aɪm dɪ.ɪn ju **d**ʌm]

I'm giving you some (Chiat, 2000)

During the course of language development, this is not uncommon. However, it is imaginably difficult to decide whether, at the time such speech is produced, the child has progressed "normally", a task parents may have trouble completing alone.

Now we have seen some examples of deviant speech with a defined process of how the child arrives at the output. David Ingram's *Phonological Disability in Children* (1976) contains many more examples of rule-governed language deviations. One such example comes from a child named Kevin and his collection of utterances that reveal a pattern:

(14)

a. *Kevin* [teɬʷin] b. *was* [wəz]

c. *up* [ʔɑp]
d. *once* [wʌns]
e. *green* [tin]
f. *good* [dud]
g. *time* [taim]
h. *fish* [diθ] or [tis]
j. *that* [dæ]
k. *mouth* [nɑs]
l. *friends* [ʔənts]

(Ingram 1976)

According to Ingram, Kevin's speech was varied with respect to the alternation between [t] and [d]. It was reported that [d] and [t] appear to be contrastive. Kevin is pronouncing an apical stop ([d] or [t]) when targeting [f], revealing a pattern of stopping. Ingram explains Kevin's phonological deviations in the following way, with examples:

(15) f → t /#__ Example: *fish* [tis]

ð → d / #__ Example: *that* [dæ]

{θ, ʃ, z} → s /___#

Examples: *mouth* [nas]

fish [tis]

friends [ʔənts] (Ingram 1976)

Although this is an abbreviated analysis of one child's speech patterns, it indicates a pattern of phonological deviance that is ruled by constraints specific to Kevin. It would be unlikely, and I propose, impossible, to locate a child with

just a language disorder who produces ”errors” in a non-systematic, random way.

One of the reasons why language pathology is considered so damaging is that it is assumed that the child doesn't realize they are producing sounds different from adult speech. The implication that receptive language (what is received and processed by the listener) is as deviant as expressive speech (what is produced) makes sense – after all, why would the child continue to produce erroneous speech if they could hear that it was wrong? Children do, however, understand that they are having a hard time being understood. One example comes from Chiat (2000), speaking to a 10-year-old with a diagnosed language pathology (the speech in the following example is presented in standard English orthography, not IPA):

(16) Ruth: My mum and dad – dan me. And my brothers.

Adult: Your mum and dad -?

Ruth: My daddy and mum – h – they sidan me.

Adult: They send you?

Ruth: No dand me. Beechin.

Adult: What do they do?

Ruth: Nothing!!

Chiat was purposely attempting to demonstrate Ruth's frustration with being understood, leading to Ruth's unwillingness to continue. However, Chiat is able to probe further:

(17) Ruth: My mum and daddy, those two – those stand me.

Adult: Understand?

Ruth: Yes!!

After some time, the code is broken. Ruth alters her utterance on each attempt and is eventually able to produce the [st] cluster that is the key to the word "understand". It looks like she has the capability to produce target speech and indeed, she physically does. A child with a phonological disorder can, with effort, force themselves to produce the targeted utterance in accordance with the standard native language. Recall the information I have already presented on phonotactic constraints, and how a native speaker will not violate their learned constraints without a determined physical effort. Ruth's efforts to be understood require her to violate her own constraints. Thus, in examining these types of language problems, we can only count on spontaneous instances of speech. The conversational implications of a language disorder are a constant source of frustration for children, who are simply producing language according to rules that are different from those of a standard native speaker. It is of particular interest to note that once the phonological code is broken, the syntax and

semantics of a phonologically disordered or delayed child are generally intact, although there may be more pervasive cases. Thus, it can be assumed that the child's problem lies within the domain of phonological processing. Articulation could certainly be to blame as well, but children are in fact able to physically produce the target sounds, though they do not in actual conversation. For example Ruth is able to produce the [st] cluster after numerous tries and presumably more forced effort.

Another hypothesis lies in the child's input. If their ability to receive language is somehow abnormal, their perception of what they receive may result in deviant output. To test whether children were able to discriminate the sounds they have trouble producing, Dodd, Leahy and Hambly (1989) performed an experiment designed to investigate a group of 3- to 5-year-olds who were making a variety of phonological "errors". The children were recorded and played the tape of their own production, then asked to choose the picture for the word they heard from a set of four pictures. Each set included an illustration of the object the child was attempting to name, and three other words that were the same or as phonologically similar to the actual pronunciation. When the mispronunciation resulted in a different lexical item, children chose the image corresponding to the output adults would hear. For example, if they were targeting the word *tree* but omitted the [ɹ] to produce *tea,* they chose the picture of tea, which is what the adult would be hearing and thus how the adult would be responding. This demonstrates that even disordered children are able to

phonologically discriminate (Chiat 2000). Using the terms disordered or delayed seems inaccurate at this point. Comparable to other normally developing children of the same age and cognitive development, these children might seem delayed or disordered, but it's clear that they have formed complex, rule-governed grammars that they adhere to in conversation. For example, producing *tea* instead of *tree* is indicative of an onset cluster simplification where the [ɹ] is omitted. Children with phonological problems still understand what they are receiving, but there is a slight glitch in their expression. A more appropriate term for these occurrences is "deviance".

3.3 Applying Theory to Therapy

When thinking about phonological deviance in children, it's important to take into consideration their ages and levels of cognitive development. It's entirely possible that a child is simply going through some phonological "growing pains" or is a late bloomer. Although this research is not meant to discredit the practice of speech-language pathology, there is something to be said for a wait-and-see approach. According to some research, 40-60% of children with expressive language delay outgrow their difficulties. A study published in the *British Medical Journal* by Glogowska et al. (2000) states that approximately one in five British parents are concerned with speech and language delay in their child, one of the most common developmental impairments. The study's purpose was to compare routine speech and language therapy in preschool children with

delayed speech and language, and a method they deemed "watchful waiting" for twelve months. Children in the therapy group received one-to-one routine speech therapy with a therapist. In the watchful waiting group, children did not receive any therapy, although parents were given the option to request it if the problems seemed to require it. The therapy group only benefited in the area of auditory comprehension. All participating children still had language difficulties by the end of the trial that would require further therapy, although the researchers recommended revisiting therapy timing and methodology (Glogowska et al 2000). What is reassuring is that the child is not entirely unable to produce language correctly. The foundation for constraints and ordering exists, and so they have an established grammar, even if it deviates from that of a target grammar.

From the data on phonological deviance in children, both in slips of the tongue and in areas that extend to language pathology, it is evident that there is consistent governance of language. Slips are random deviations, but generally predictable and classifiable into a form and direction. Pathologies seem to reflect an understanding of rules, though the rules the children have formed are simplified versions of the native language of their environment. Not everything is "wrong" or an "error", although I do not mean to imply that phonological disorders and delays should not be taken seriously. Rather, they should be evaluated in a light that notes how rule-based and constrained the child's language is, and recognize that the "error" lies in the final target production.

We've already seen that children with these disorders can perceive words correctly, so the problem does not lie there. However, there is a strong correlation between production and perception, so maybe a system of self-monitoring, which allows us to correct our slips of the tongue, is failing to occur in children with pathological speech.

4.0 Conclusions

4.1 Discussion

As previously discussed, theories of self-monitoring have already been applied to one speech disorder: stuttering. The Covert Repair Hypothesis and similar theories explain the disfluencies of stuttering by implicating the self-monitoring system and, as Yaruss and Conture (1996) note, the rate of speech of stutterers may affect their ability to repair. Stutterers tend to speak faster and with shorter response times than their non-stuttering peers. Additionally, approximately 30-40% of children who stutter also exhibit disordered articulation or phonology. Because these disorders are so often co-morbid, and many speech pathologies are simply repeated and univerally consistent slips (like substitutions and omissions), I propose a deficit in self-monitoring is at least partially to blame for phonological disorders in children.

From my own observations at the Communicative Disorders Department of West Chester University, I have learned a few things about how speech-language pathologists operate with children presenting speech-sound disorders. One memorable case was a five-year-old child who presented with phonological difficulties, particularly with developing fricatives. In place of fricatives, he would produce stops. For example, when asked to produce the word *fish,* he would instead say *pish.* This substitution occurred consistently in other words such as *four (pour)* and *five (pive*). The child also had difficulty producing [s] in onset position, replacing words like *sip* with *tip*, which looks like the stopping of

fricatives we saw earlier. The speech-language pathologist (SLP) would spend the therapy session trying to get the child to pronounce these words correctly. One way in which he did this was by overarticulating the correct form of the word, and asking the child to repeat back what he said. At first, the child would reproduce *pish* if asked to say *fish*, but with continued therapy and correction, the incidence rate of correct target speech went up.

Most children with phonological, speech-sound disorders do improve. The American Speech-Language-Hearing Association (ASHA) produced a report claiming 70% of children with phonological disorders exhibit improved intelligibility and communication functioning. Additionally, intelligibility increases for approximately one half of the children who were not understandable among familiar and unfamiliar individuals at the beginning of the treatment (ASHA 2003). The questions that remain are how and why the problems originally developed and how progress is made. As research has shown, self-monitoring is vital to the production and comprehension of spoken language. Children with speech-sound disorders are generally able to comprehend spoken language. The child who said *pish* instead of *fish* could distinguish between the correct and incorrect forms, but he was not producing them. In normal speech "errors", the monitoring can detect overt, already spoken speech, but it misses the mistake before it is uttered. It is likely that in children with phonological disorders, this element of repair and monitoring is either missing or has not developed yet. I am inclined to believe that it has not

developed fully. Additionally, in noting that SLPs make progress with children suffering from phonological difficulties, they must be somehow aiding the development of self-repair. When SLPs correct speech through repetition in a focused environment, they are acting as an overt monitoring and repair system. With this in mind, I suggest two reasons why children in therapy improve. (1) It could be the case that they simply haven't reached the developmental language milestone yet, and during their therapy time, it emerges. Other developmental cognitive abilities emerge at differing ages in each individual child, and speech may be similar. The repeated exposure and focus children receive in therapy may help speed up the development. (2) Children with phonological disorders, like stutterers, have a problem with their self-monitoring system. As I have shown, slips of the tongue and speech pathologies are very similar in "error" quality. Imagine a child that continually produces a substitution slip. Could it be the case that an underdeveloped system of self-monitoring allows the children to keep making these deviations? Based on what we know about slips and how similar they are to pathology, differing primarily on systematicity, I hypothesize that these children are in need of self-repair, but a separate party that repairs and monitors for them (namely, SLPs) outside of their language process seems to jumpstart the development of this system.

4.2 Future Research

To further explore the nature of phonological "errors", primarily pathologies, extensive research should be conducted in the area of speech-language pathology therapy. The information I have presented comes from a theoretical linguistics perspective. It would be insightful to see how much theory is applied in a real-world setting. Similarly, it would be beneficial for anyone researching this topic to observe a session of therapy as I have previously, which sparked my interest in childhood phonological disorders. In light of the research, I would also attempt to interview the therapist as to what they believe is happening with the child's language, in an attempt to see if it correlates with theoretical notions of pathology.

In the future, I would also like to develop a method for testing the hypothesis that phonological disorders entail some problem with self-monitoring and self-repair. This would require a more extensive review of the literature, including studies that have already been performed (e.g., Yaruss & Conture 1996) and related theories to the Covert Repair Hypothesis.

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