LSci 51/CogS 56L: Acquisition of Language

Lecture 9

Phonological development III

Announcements

Be working on the phonological development review questions

Be working on HW3 (due 8/22/25)

Prelinguistic “speech” production

Language-specific effects

"From the moment of birth, babies cry in the accent of their mother's native language…" – Annie Murphy Paul, 2011 *Ted Talk: What We Learn Before We're Born*

"…the foundation for the richness of variants of later intonation patterns in speech is already laid during crying." (Wermke, Robb, & Schluter 2021)

https://www.sciencedaily.com/releases/2021/02/210224100904.htm

Language-specific effects

Even Mandarin Chinese newborn cries carry the tonal contours of Mandarin (Wermke, Teiser, Yovsi, Joscha Kohlenberg, Wermke, Robb, Keller, & Lamm 2016).

https://www.sciencedaily.com/releases/2016/08/160819084631.htm

Stages of prespeech vocal development

Newborns make biologically-related sounds: reflexive crying, burping, breathing, sucking

Helpful: infants' vocal cords vibrate & airflow through the vocal apparatus is stopped and started

Stages of prespeech vocal development

Around 6-8 weeks: infants start cooing (sounds that result from being happy).

First coos sound like one long vowel - but over many months, babies acquire a variety of different vowel sounds.

Stages of prespeech vocal development

Around 16-30 weeks: vocal play. Infants use a variety of different consonant-like and vowel-like sounds. At the end of this stage, infants form long combinations of the sounds (marginal babbling).

Recognizable vowel sounds heard at the beginning, while recognizable consonant sounds (usually velars like k/g) are usually heard around 2-3 months. Recognizable consonant sounds occurring near the front of the mouth (n/m/p/b/d) come in around 6 months of age.

Things that matter for babbling

Hearing their own vocal output motivates infant vocalizations, It also allows for calibration - matching what they produce to what they hear (Fagan 2014, 2015).

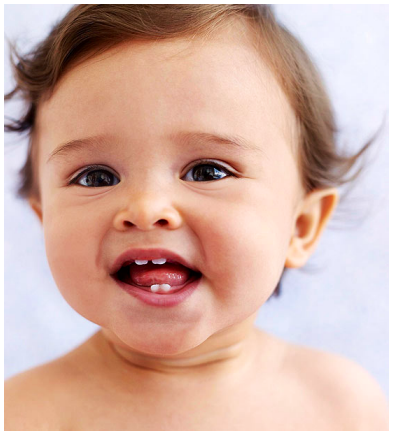
Absence of auditory feedback may explain why deaf infants produce less elaborate vocal play than hearing infants, and reach the canonical babbling stage later.

Stages of prespeech vocal development

Around 6-9 months: canonical/reduplicated babbling, with actual syllables in the sounds produced (ex: [dadada]). These syllables are often repeated in a row.

Social aspect: babies don't give any indication that they're initially babbling to communicate (no intentionality at this point) even though sometimes it may look like it. They babble in the car and their crib, showing no sign that they expect any reply.

Note: even deaf infants babble, but they tend to produce marginal babbling instead of canonical babbling.



Stages of prespeech vocal development

After canonical babbling: nonreduplicated/variegated babbling, with non-repetitive syllables and more variety in consonant and vowel sounds. Infants also incorporate prosody (the rhythm of the language) into their babbling, which makes it sound much more like they're trying to talk. However, the "words" in this kind of babbling are usually only 1 or 2 syllables.

http://www.youtube.com/watch?v=_JmA2ClUvUY

Stages of prespeech vocal development

0 weeks

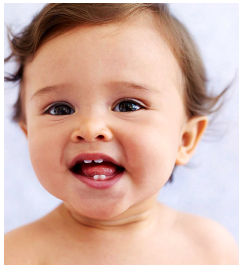
reflexive crying, biological-based sounds

6-8 weeks

cooing

16 weeks

vocal play begins



36 weeks

reduplicated/canonical babbling

48 weeks

nonreduplicated babbling

First Word

Babbling variation

Gender: Boy babies make 10% more vocalizations than girl babies in the first year (Oller, Gilkerson, Richards, Hannon, Griebel, Bowman, Brown, Yoo, & Warren 2023)

https://www.sciencedaily.com/releases/2023/05/230531150135.htm

Things that matter for babbling

Hearing the speech adults produce (this influences the sounds children choose to babble and the prosodic character of later babbling)

Choi, Cutler, & Boersma 2017:

> Speech heard before six months impacts a child's ability to produce those sounds later, even if the child switches to a completely different language environment afterwards: "The subconscious knowledge can then be tapped to speed up learning of the pronunciation of sounds of the lost tongue."

https://www.sciencedaily.com/releases/2017/01/170118082828.htm

Things that matter for babbling

Babies' babbling is also influenced by the language they hear.

How do we know?

(1) Test competent native speakers.

Record the babbling of babies who are learning to speak different languages (ex: French, Arabic, Chinese, English). See if native speakers can identify which baby's babble is from their language (ex: asking French mothers to choose between Arabic babble and French babble as French.)

De Boysson-Bardies, Sagart, and Durand (1984): recordings of 8-month-old babblings can be recognized by language.

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Lee, Jhang, Chen, Reylea & Kimbrough Oller 2016: recordings of 8-month-olds, 10-month-olds, and 12-month-olds can be recognized by language (English vs. Chinese), though only when the babblings are word-like.

Things that matter for babbling

Babies' babbling is also influenced by the language they hear.

How do we know?

(2) See if babbling features accord with language features

Determine which vowels and consonants (and other features) appear in babbling, and how frequently they appear. Compare to target language's features.

Ex: Japanese & French words contain more nasal sounds than Swedish & English words; Japanese & French babbles contain more nasal sounds than Swedish & English babbles.

Nasal Vowels

Things that matter for babbling

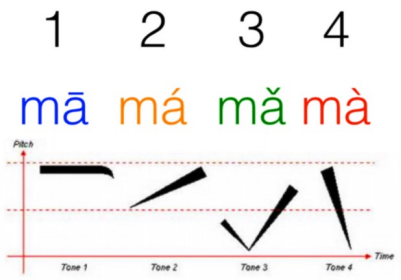
Babies' babbling is also influenced by the language they hear.

How do we know?

(2) See if babbling features accord with language features

Determine which vowels and consonants (and other features) appear in babbling, and how frequently they appear. Compare to target language's features.

Ex: Mandarin Chinese uses tone-like pitches to distinguish meaning, and Mandarin babbles also use these tone-like pitches while English babbles do not (Meltzoff et al. 2009).



Things that matter for babbling

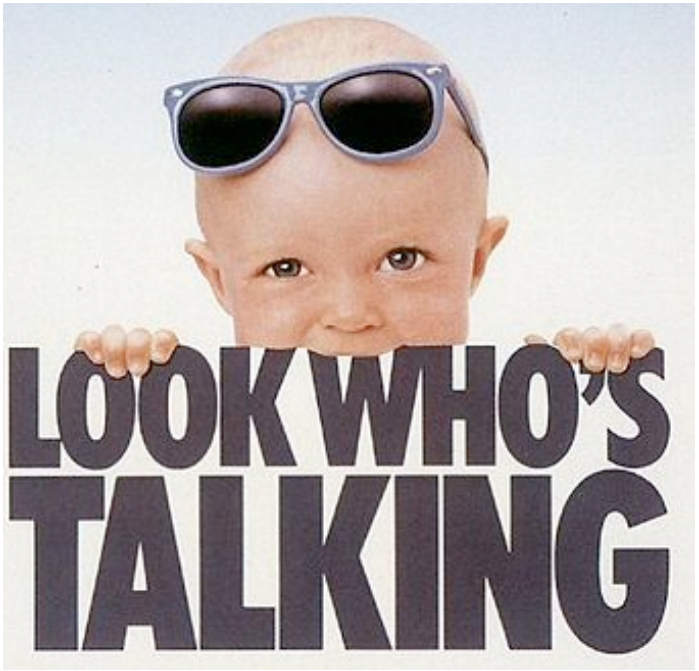
Important: There appears to be a social component involved.

Infants learn foreign sounds (ex: American infants learning Mandarin phonemes) only when the input comes from a live speaker interacting with them (and not from a television broadcast of that same speaker, for example). (Kuhl, Tsao, & Liu 2003)

Links to first words

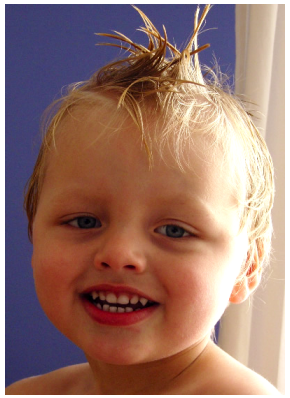
Infants tend to use the sounds that they've babbled in their first words rather than the sounds that are most common in the speech that adults use with them.

Word forms



Phonological process development

18 months: children have developed systematic ways to alter the target language so it fits the sounds they're able to produce (baby accent). These systematic transformations are called phonological processes. Most often children either drop the tough sounds (deletion) or replace them with sounds they can produce (substitution).



This happens a lot! More than 90% of words produced by some children show deletion or substitution processes.

Phonological process development

18 months: More than 90% of words produced by some children show deletion or substitution processes.

Meylan, Foushee, Bergelson, & Levy 2021, Meylan, Foushee, Wong, Bergelson, & Levy 2023: Adults (especially caregivers) engage in "child-directed listening", learning to adapt to the specific child they're trying to communicate with and decode that child's productions, often based on conversational context.

https://www.sciencedaily.com/releases/2023/10/231026131435.htm

Example of altered pronunciation

http://www.youtube.com/watch?v=4azD_gNz0rw&feature=player_embedded

Pronouncing “popsicle”

Example of phonological development

The evolution of “water”

http://www.ted.com/talks/deb_roy_the_birth_of_a_word.html

(4:19 - 5:40 of 19:52)

Deletion processes

Deletion processes

Deletion happens a lot to word-final consonants.

Final consonant deletion examples:

“dog” /dɑg/

“bus” /bʌs/

“boot” /but/

“because” /bikʌz/

Deletion processes

Deletion happens a lot to word-final consonants.

Final consonant deletion examples:

“dog” /dɑg/ —> “dah” /dɑ/ “bus” /bʌs/ —> “buh” /bʌ/

“boot” /but/ —> “boo” /bu/ “because” /bikʌz/ —> “becah” /bikʌ/

Deletion processes

Deletion can also happen when more than one consonant appears together (consonant clusters).

Consonant cluster deletion examples:

“blanket” /blejŋkət/

“bring” /bɹɪŋ/

“bump” /bʌmp/

“stop” /stɑp/

“desk” /dɛsk/

“school” /skul/

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“bring” /bɹɪŋ/ —> “bing” /bɪŋ/

“bump” /bʌmp/ —> “bup” /bʌp/

“stop” /stɑp/ —> “top” /tɑp/

“desk” /dɛsk/ —> “dek” /dɛk/

“school” /skul/ —> “kool” /kul/

Deletion processes

Deletion of unstressed syllables:

Delete a syllable (usually more than one sound, and must include a vowel-like sound) if it is unstressed. (Unstressed syllables in English usually have the ə as their vowel.)

Unstressed syllable deletion process examples:

“giRAFFE” /dʒəɹæf/

“aWAY” /əwe/

“AlliGAtor” /ælәgetəɹ/

“baNAna” /bənænə/

“BUtterFLY” /bʌtəɹflaj/

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"aWAY" /əwe/ —> "way" /we/

"AlliGAtor" /ælәgetəɹ/ —> "agay" /ægе/

"baNAna" /bənænə/ —> "nana" /nænə/ or just "na" /næ/

"BUtterFLY" /bʌtəɹflaj/ —> "bufly" /bʌflaj/

Substitution processes

[Extra]

Substitution processes

Substitution: Stopping process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Stopping process: 2:16-3:21

Substitution processes

Substitution: Stopping process

Replace a sound with a different manner of articulation (like a fricative) with a stop (consonant where air flow is completely stopped in the mouth). Note that the place of articulation (lips, alveolar ridge, velum, etc.) and voicing (vocal cords vibrating or not) does not change.

Stopping process examples:

"church" /tʃəɹtʃ/

"sing" /sɪŋ/

"zebra" /zibrə/

"thing" /θɪŋ/

"this" /ðɪs/

"shoes" /ʃuz/

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Stopping process examples:

"church" /tʃəɹtʃ/ —> "turt" /təɹt/

"sing" /sɪŋ/ —> "ting" /tɪŋ/

"zebra" /zibrə/ —> "debra" /dibrə/

"thing" /ɵɪŋ/ —> "ting" /tɪŋ/

"this" /ðɪs/ —> "dis" /dɪs/

"shoes" /ʃuz/ —> "tood" /tud/

[Extra]

Substitution processes

Substitution: Stopping process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Stopping examples: 3:21-4:06

[Extra]

Substitution processes

Substitution: Gliding process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Gliding process: 4:06-4:20

Substitution processes

Substitution: Gliding process

Replace a liquid sound like /l/ or /ɹ/ with a glide sound like /j/ or /w/.

Gliding process examples:

"lion" /lajən/

"rabbit" /ɹæbət/

"look" /lʊk/

"rock" /ɹɑk/

"story" /stɔɹi/

Substitution processes

Substitution: Gliding process

Replace a liquid sound like /l/ or /ɹ/ with a glide sound like /j/ or /w/.

Gliding process examples:

"lion" /lajən/ —> "yion" /jajən/

"rabbit" /ɹæbət/ —> "wabbit" /wæbət/

"look" /lʊk/ —> "wook" /wʊk/

"rock" /ɹɑk/ —> "wock" /wɑk/

"story" /stɔɹi/ —> "stowy" /stɔwi/

[Extra]

Substitution processes

Substitution: Gliding examples

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Gliding examples: 4:20-4:58

[Extra]

Substitution processes

Substitution: Fronting process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Fronting process: 4:58-5:35

Substitution processes

Substitution: Fronting process

Replace a sound with a sound that is made more towards the front of the mouth. Note that the manner of articulation and the voicing do not change – just the place of articulation does.

Fronting process examples:

"thumb" /ɵʌm/

"ship" /ʃɪp/

"jump" /dʒʌmp/

"chalk" /tʃɔk/

"key" /ki/

"go" /go/

Substitution processes

Substitution: Fronting process

Replace a sound with a sound that is made more towards the front of the mouth. Note that the manner of articulation and the voicing do not change – just the place of articulation does.

Fronting process examples:

"thumb" /θʌm/ —> "fumb" /fʌm/

"ship" /ʃɪp/ —> "sip" /sɪp/ or "thip" /θɪp/ or "fip" /fɪp/

"jump" /dʒʌmp/ —> "dzump" /dzʌmp/

"chalk" /tʃɔk/ —> "tsalk" /tsɔk/

"key" /ki/ —> "tey" /ti/ or "pey" /pi/

"go" /go/ —> "doe" /do/ or "boe" /bo/

[Extra]

Substitution processes

Substitution: Fronting examples

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Fronting examples: 5:36-6:36

[Extra]

Substitution processes

Substitution: Denasalization process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Denasalization process: 6:36-7:12

Substitution processes

Substitution: Denasalization process

Replace a nasal sound with a non-nasal sound. Note that the place of articulation (ex: labial), approximate manner of articulation (ex: stop) and the voicing (ex: +voice) do not change. (You can get this effect yourself by holding your nose when you say words.)

Denasalization process examples:

"jam" /dʒæm/

"spoon" /spun/

"sing" /sɪŋ/

Substitution processes

Substitution: Denasalization process

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"jam" /dʒæm/ —> "jab" /dʒæb/

"spoon" /spun/ —> "spood" /spud/

"sing" /sɪŋ/ —> "sig" /sɪg/

[Extra]

Substitution processes

Substitution: Denasalization process

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Denasalization examples: 7:12-7:34

Substitution processes

Substitution: Assimilation process

A sound becomes more similar to another (usually nearby) sound by taking on one or more of that other sound's features – voicing, place of articulation, manner of articulation. This is sometimes called consonant harmony or vowel harmony.

Assimilation process examples:

"pig" /pɪg/ —> "big" /bɪg/

"push" /pʊʃ/ —> "bush" /bʊʃ/

"duck" /dʌk/ —> "guck" /gʌk/

"doggy" /dɑgi/ —> "goggy" /gɑgi/

"self" /sɛlf/ —> "felf" /fɛlf/

"Kathleen" /kæθlin/ —> "Kakleen" /kæklin/

Substitution processes

Substitution: Assimilation process

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Assimilation process examples:

"pig" /pɪg/ —> "big" /bɪg/ (/p /takes on +voice of /g/)

"push" /pʊʃ/ —> "bush" /bʊʃ/ (/p/ takes on +voice of vowel)

"duck" /dʌk/ —> "guck" /gʌk/ (/d/ takes on +velar of /k/)

"doggy" /dɑgi/ —> "goggy" /gɑgi/ (/d/ takes on +velar of /g/)

"self" /sɛlf/ —> "felf" /fɛlf/ (/s/ takes on +labiodental of /f/)

"Kathleen" /kæθlin/ —> "Kakleen" /kæklin/ (/θ/ takes on +stop, +velar of /k/)

Multiple processes

Often, more than one process will apply to a word - which makes the original word harder to decipher.

/bu/ = ???? (referent in world = poop)

/pup/ --->

final consonant deletion —> /pu/

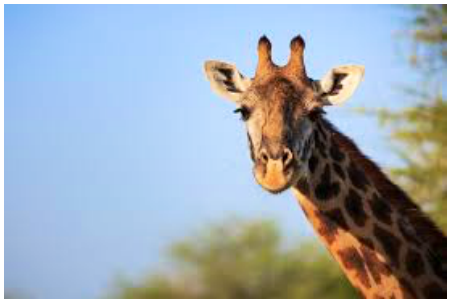
assimilation [+voice] with vowel —> /bu/

[Extra]

Multiple processes

https://www.youtube.com/watch?v=EDymvzP0uac&feature=youtu.be
Multiple process examples: 7:34-7:56

Multiple process examples



“giraffe” /dʒəɹæf/ —> “faffe” /fæf/

/dʒəɹæf/ —> /ɹæf/

[unstressed syllable deletion]

/ɹæf/ —> /fæf/

[assimilation: /ɹ/ picks up +labiodental, -voice from /f/]

Multiple process examples

“room” /ɹum/ —> “woob” /wub/

/ɹum/ —> /ɹub/

[stopping or denasalization]

/ɹub/ —> /wub/

[gliding]

Multiple process examples

“tent” /tɛnt/ —> “det” /dɛt/

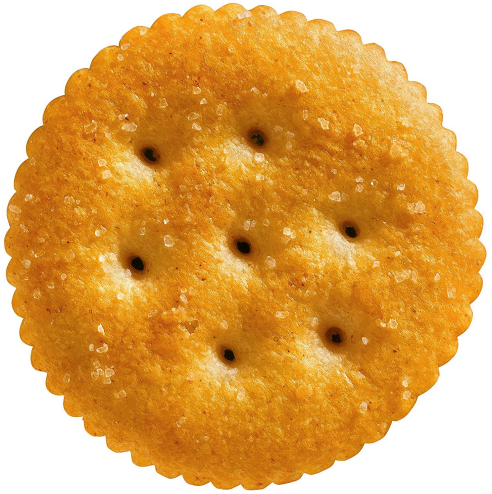
/tɛnt/ —> /dɛnt/

[assimilation: /t/ picks up +voice of vowel (or /n/)]

/dɛnt/ —> /dɛt/

[consonant cluster deletion]

Multiple process examples



“cracker” /kɹækəɹ/ —> “gwa” /gwæ/

/kɹækəɹ/ —> /gɹækəɹ/

[assimilation: /k/ picks up +voice of /ɹ/ (or vowel)]

/gɹækəɹ/ —> /gwækəɹ/

[gliding]

/gwækəɹ/ —> /gwæ/

[unstressed syllable deletion]

Multiple process examples

“water” /wɑrəɹ/ —> “gaga” /gɑgə/

/wɑrəɹ/ —> /gɑrəɹ/

[stopping: voiced, velar /w/ becomes /g/]

/gɑrəɹ/ —> /gɑgəɹ/

[assimilation: voiced tap /ɾ/ picks up +velar, +stop of /g/]

/gɑgəɹ/ —> /gɑgə/

[final consonant deletion]

Why do they make these errors?

Idea: Just a motor limitation. They can't physically produce it all fast enough, but they can perceive the differences.

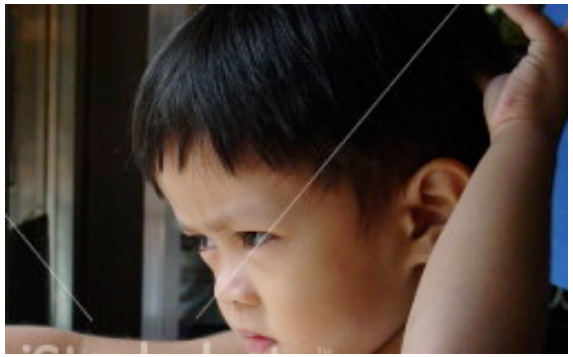
Child: "Gimme my guk!"

Father: "You mean your duck?"

Child: "Yes, my guk!"

Father (hands child the duck): "Okay, here's your guk."

Child (annoyed): "No, Daddy - I say it that way, not you."



Why do they make these errors?

Idea: Just a motor limitation. They can't physically produce it all fast enough, but they can perceive the differences.

But some contrasts are actually difficult for them to distinguish, such as /ɵ/ from /f/ and /ɻ/ from /w/. Production errors for these may have a basis in perception - their speech sound representation isn't quite right yet.

Speech perception & speech production

Speech production capabilities also seem to impact early speech perception

Inhibiting [6-month-old] infants' tongue movements impedes their ability to distinguish between speech sounds, researchers have found. The study is the first to discover **a direct link between infants' oral-motor movements and auditory speech perception**.

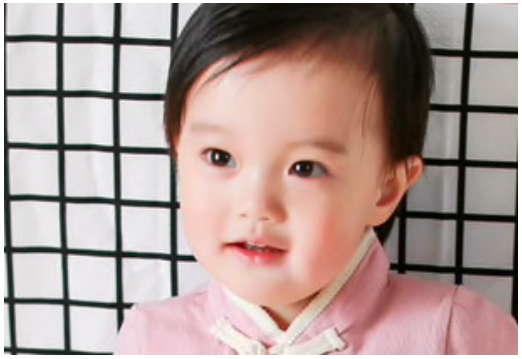
https://www.sciencedaily.com/releases/2015/10/151012180801.htm, reporting findings of Bruderer, Danielson, Kandhadai, & Janet F. Werker 2015.

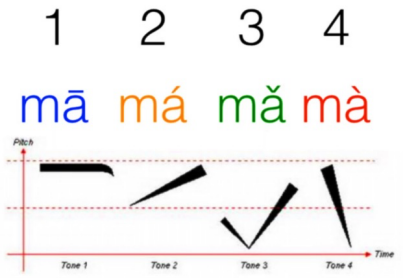
"The freedom to make small gestures with their tongue and other articulators when they listen to speech may be an important factor in babies' perception of the sounds." - Janet Werker

Recap: Phonological development

Children's earliest vocal output prepares them to make the speech sounds that will be relevant for their language.

Babies' babbling is influenced by the sounds they hear in the surrounding language, as well as their own vocal output (which they can use to tune their production).





Recap: Phonological development

Given children's incomplete development and lesser experience with the words of the language, they often make mistakes even producing words they're familiar with. However, they make systematic mistakes, reflecting the underlying system they have for representing sounds.

Most of children's errors may stem from motor limitations, since they seem able to perceive incorrect pronunciations but not correct their own. However, there are also some sounds that children have trouble perceiving correctly – which makes errors on those sounds likely due to perception issues.

Questions?

You should be able to do all of HW3, and all the questions from the phonological development review sheet.