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Confusion About Speech Sound Norms and Their Use

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This presentation is about a philosophical issue that comes up frequently when addressing speech sound disorders.

That issue can be framed as a question.

The question is:

Do We Know When Speech Sounds Are Learned?

“Do we know when speech sounds are learned?”

There are two related clinical questions that follow directly from this question.

One of the follow up questions is:

Do We Know When Speech Sounds Are Learned?

Determine eligibility for therapy?

Base on the information about the development of speech sounds,

“Can we use this information to determine if a child is eligible for therapy?”

The second related clinical question is:

Do We Know When Speech Sounds Are Learned?

Determine eligibility for therapy?

Therapy target selection?

“Can we use this information on development to choose targets to work on in therapy?”

Developmental “Norms”

Of course, most of the information on the development of speech sounds comes from developmental speech sound norm studies.

Coming from Boston, it is hard not to think of Norm from the TV series “Cheers” when the word Norm is mentioned.

Developmental “Norms”

So here is a developmental NORM from Boston!

But there are other developmental norms that you may also be familiar with.

Frequently Used Speech-Sound Norms

THE CLASSICS

- Sander (1972)
- Prather, Hedrick, & Kern (1975)
- Templin (1957)

MORE RECENT NORMS

- Smit et al. (1990)
- Goldman-Fristoe Test of Articulation (2000)

Of course there are the classic norms that clinicians typically use.

There are those by Sander (1972) which actually are data from other studies that were complied in a unique way.

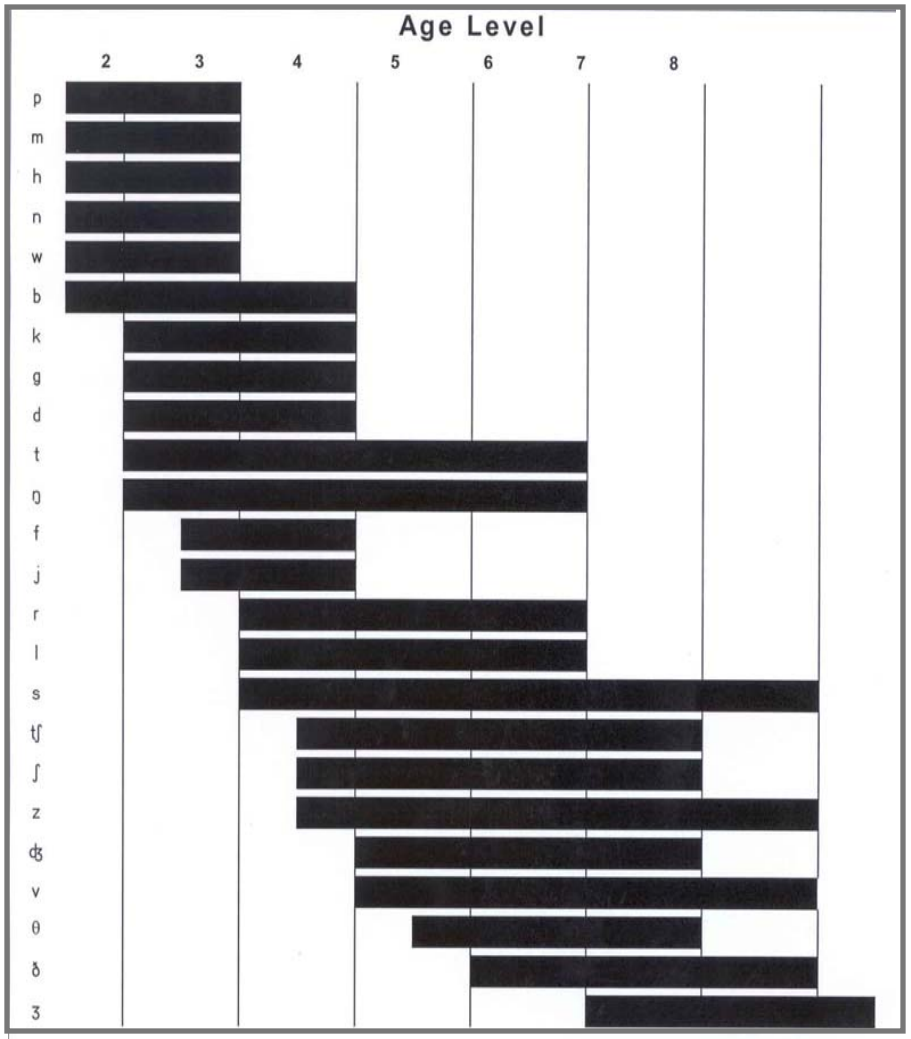
Prather et al. (1975)

Templin (1957)

There are more recent norms have been developed by Smit et al. (1990).

And there is the norm set from the widely used articulation test, the *Goldman-Fristoe Test of Articulation*.

Sander (1972) "Norms"



When I speak with clinicians around the country, I usually hear that the Sander (1972) chart is what is usually used to determine when speech sounds are learned.

I am surprised when I hear how this chart is used incorrectly. Most clinicians report that these bars represent a developmental sequence of speech sound learning. But this is not the actually the case.

Sander (1972) "Norms"

Left hand beginning of the bar =

Customary Production (50%)

This chart is not showing the typical developmental progress to full use of a speech sound.

Rather it shows the point where 50% of the children in the sample set correctly produced the sound. This is the left hand beginning of the bar, called “customary production.”

So on this chart, where the bar begins, is where half of the subjects in the studies correctly produced the speech sound.

Sander (1972) "Norms"

Right hand end of the bar =

Mastery Production (90%)

The right hand end of the bar is where 90% of the children in the sample set produced the speech sounds correctly. This is called ”mastery production.”

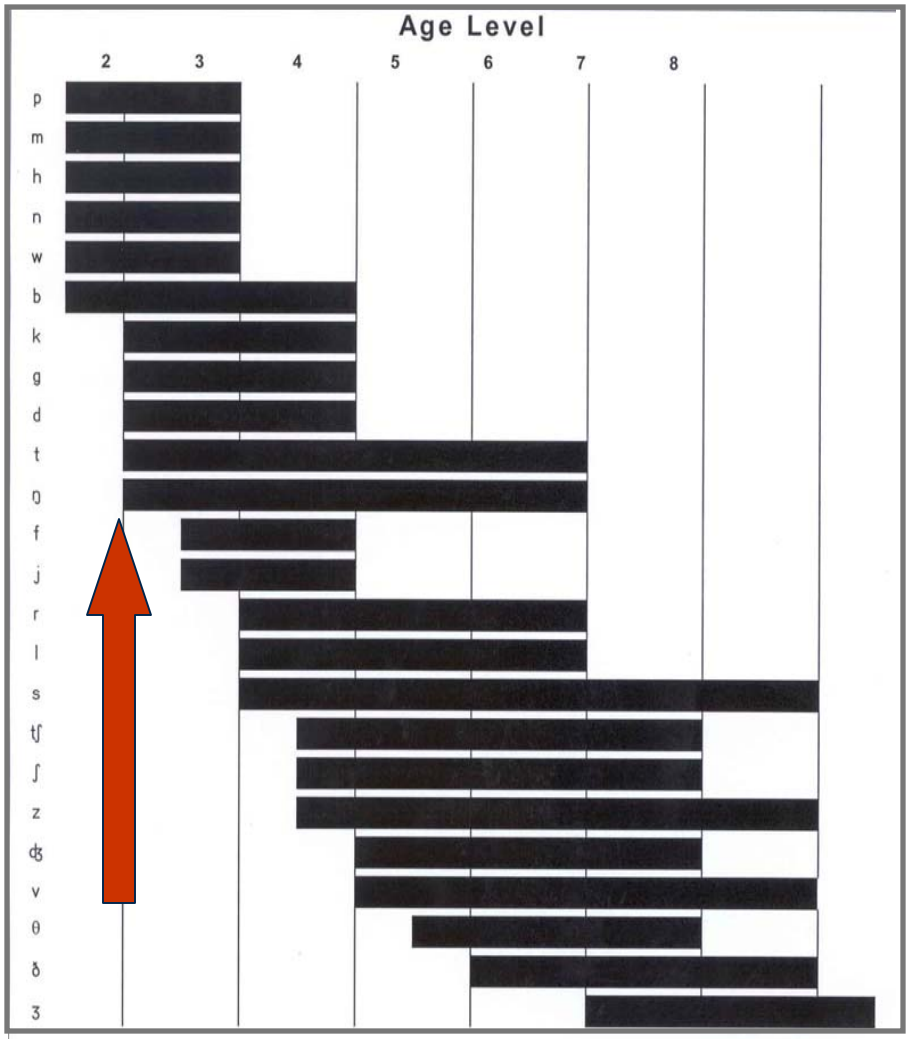
Sander (1972) "Norms"

This is **NOT** a

developmental progression!!!

This is really not a developmental progression chart as the bars would lead us to believe.

Sander (1972) "Norms"



Rather, the development of speech sounds begins way before it is shown here.

Remember, half of the children produce the sound correctly when the bar is beginning.

This chart really is misleading. It looks like this is the developmental period when it actually is not.

In fact, there are data to show that this development is not smooth and constant; rather it appears to be acquired in a much more “all or nothing” way, and not a progression at all.

Frequently Used Speech-Sound Norms

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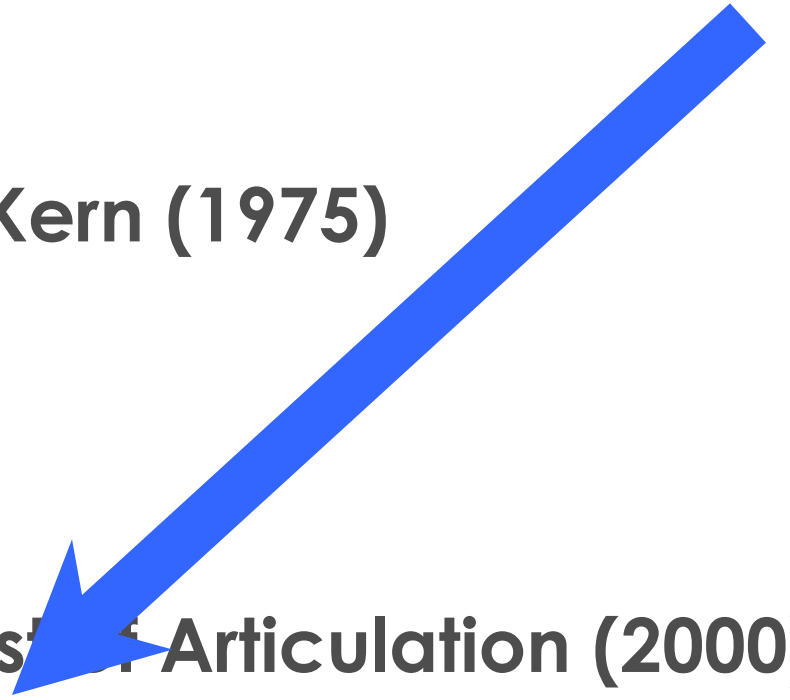
DEVELOPMENTAL SEQUENCE

- Shriberg (1993)



Shirberg (1993) viewed the developmental patterns a bit differently when he reported on a developmental sequence.

A "Sequence" of Development

Early 8

Middle 8

Late 8

He divided the 24 English speech sounds into 3 categories:

Early

Middle

Late

A "Sequence" of Development

Early 8	m b j r w d p h
Middle 8	t k g ŋ f v tʃ dʒ
Late 8	ʃ θ ð s z l r ʒ

The speech sounds are shown here in their specific categories.

Back to the main question…

Do we know when speech sounds develop based on the normative studies?

Lets go back to the original question:

“Using normative studies, do we know when speech sounds are learned?”

I will use the three early/middle/late categories to organize the data for you.

⊗ = Prather et al. (1975)

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
m		⊗											
b			⊗										
j		⊗											
n	⊗												
w	⊗												
d		⊗											
p		⊗											
h	⊗												

Early 8

Here are the data from Prather et al. (1975) for the 8 Early sounds.

Age in years appear across the top with the speech sounds down the right hand column.

* = Templin (1957)

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
m			*										
b					*								
j				*									
n			*										
w			*										
d			*										
p			*										
h			*										

Early 8

Here are the data from Templin (1957).

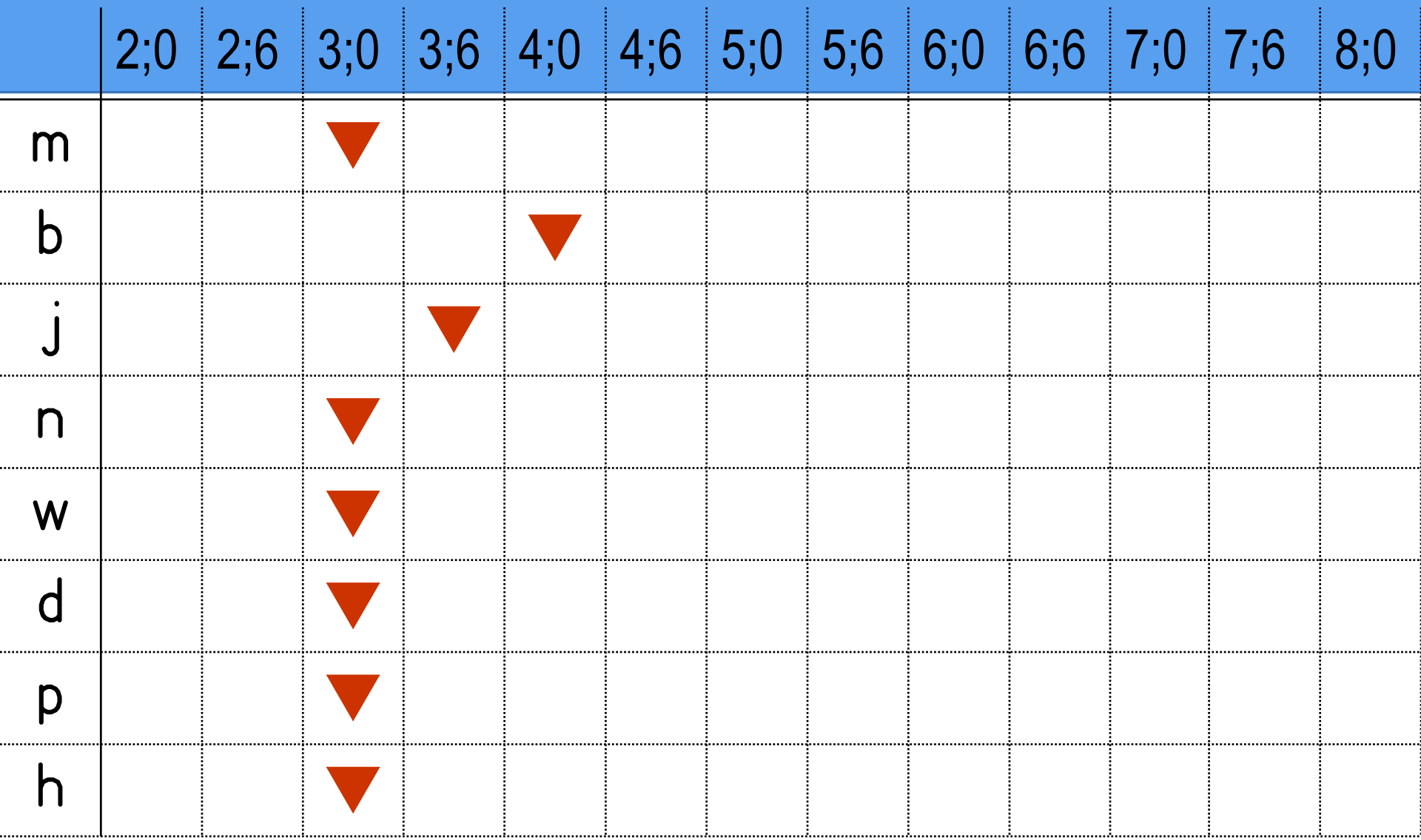
♣ = Sander (1972)

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
m			♣										
b					♣								
j					♣								
n			♣										
w			♣										
d					♣								
p			♣										
h			♣										

Early 8

Here are the data from Sander (1972).

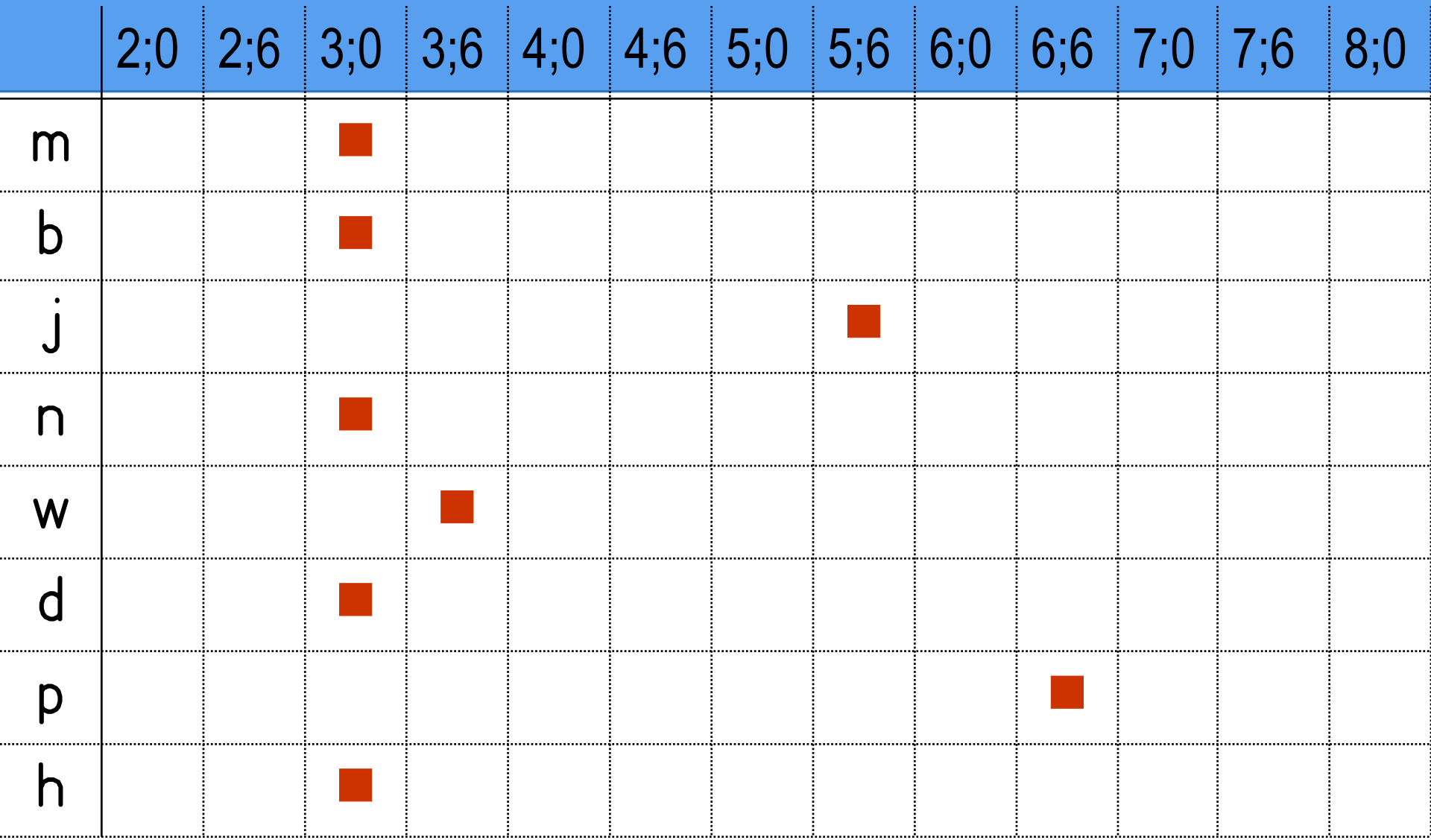
▼ = Smit et al. (1990)



Early 8

And the data from Smit at al.(1990).

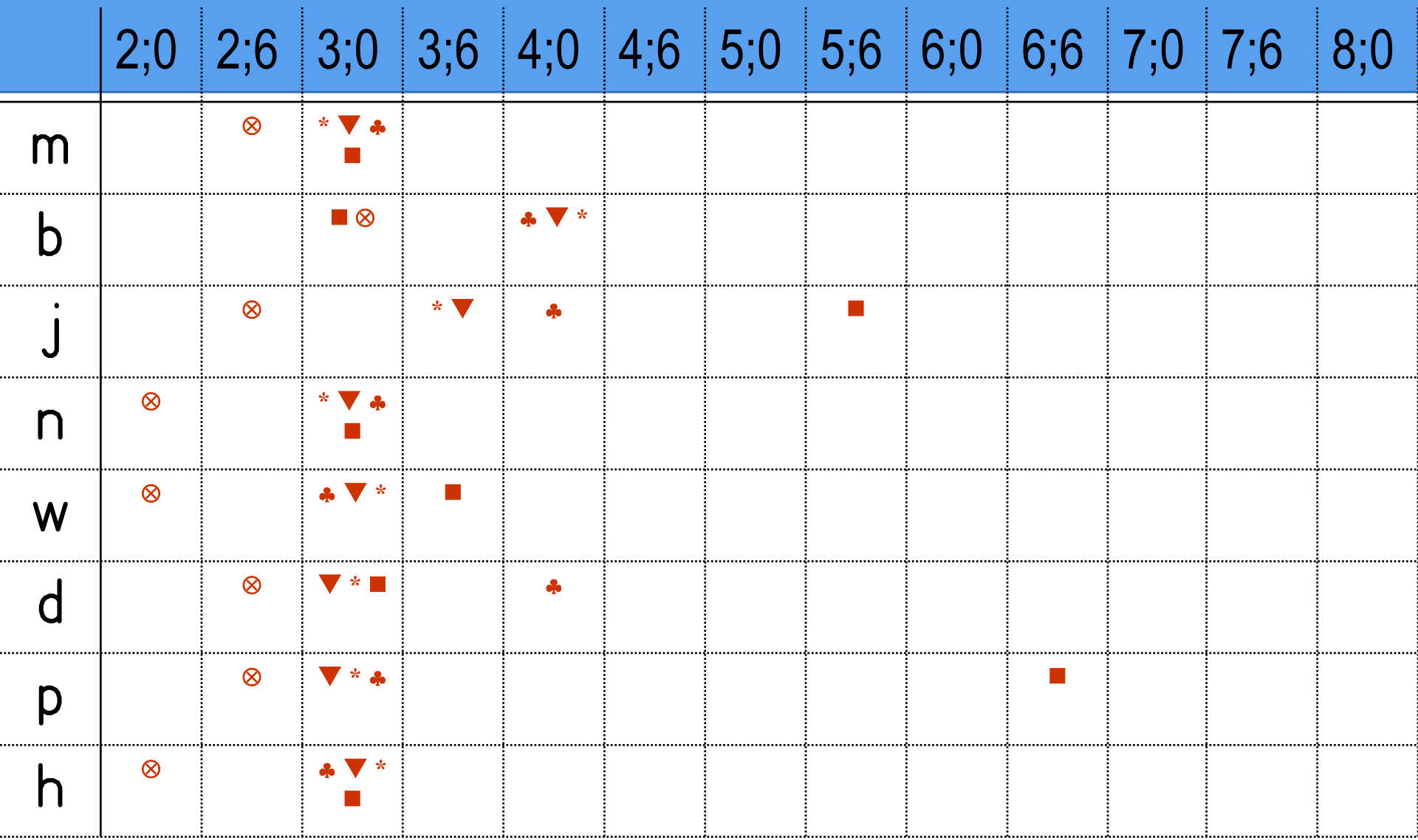
■ = Goldman/Fristoe (2000)



Early 8

And finally, the data from the *Goldman-Fristoe Test of Articulation* (2000).

Combined Data



Early 8

When all of the data are combined, we do see that for most of the speech sounds, there is a generally good “clumping” in the early years.

Combined Data

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
m		⊗	* ▼ ♣ ■										
b			■ ⊗		♣ ▼ *								
j		⊗		* ▼	♣			■					
n	⊗		* ▼ ♣ ■										
w	⊗		♣ ▼ *	■									
d		⊗	▼ * ■		♣								
p		⊗	▼ * ♣							■			
h	⊗		♣ ▼ * ■										

Early 8

But as you can see, some sounds have a lot of dispersion, specifically the /j̇/ which is reported to be developed as early as 2;6 years in one study but another study reports that it is developed a full 3 years later, at 5;6 years.

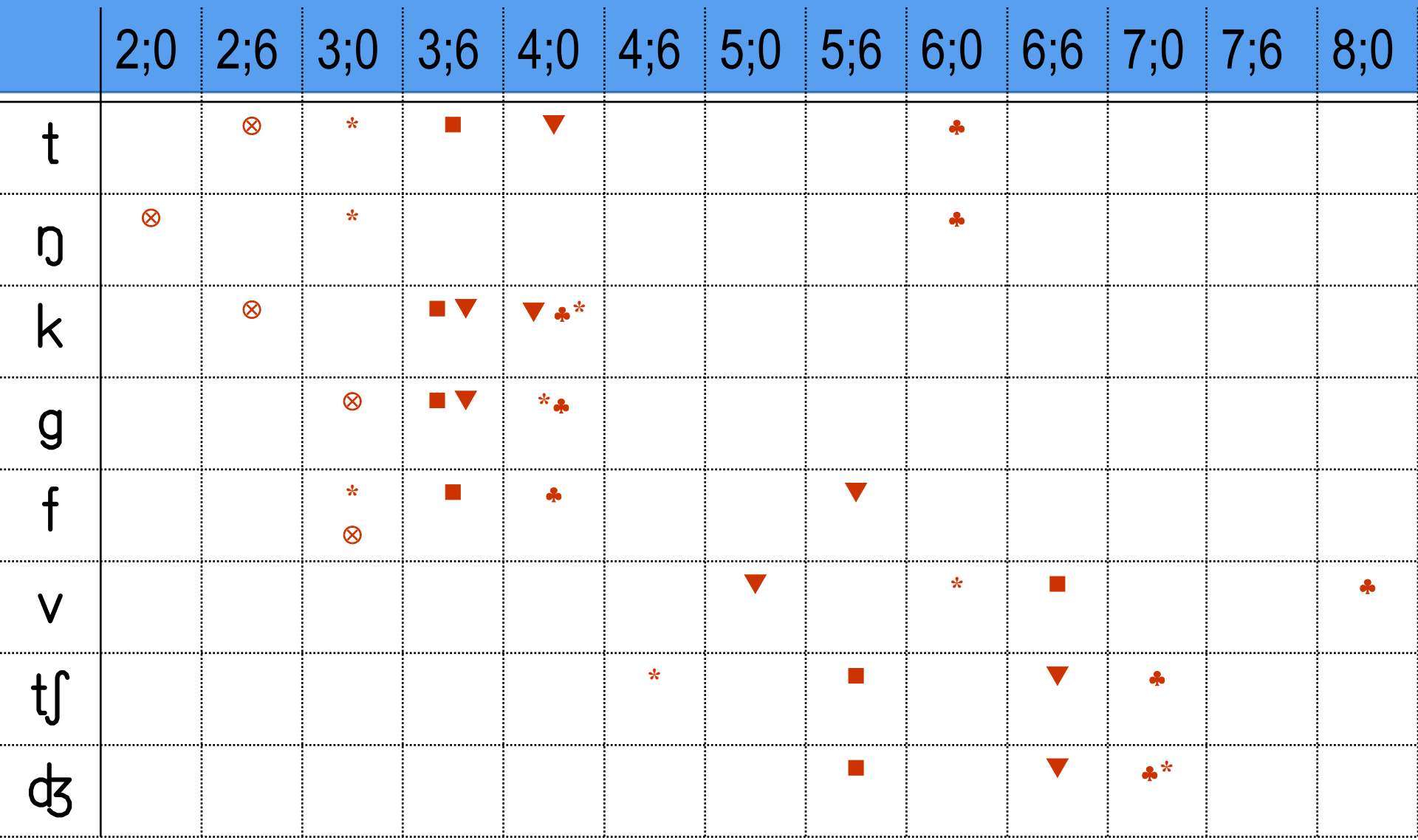
Combined Data

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
m		⊗	* ▼ ♣ ■										
b			■ ⊗		♣ ▼ *								
j		⊗		* ▼	♣			■					
n	⊗		* ▼ ♣ ■										
w	⊗		♣ ▼ *	■									
d		⊗	▼ * ■		♣								
p		⊗	▼ * ♣							■			
h	⊗		♣ ▼ * ■										

Early 8

The /p/ sound has even more discrepancy in developmental mastery. Note the range is anywhere from 2;6 years to 6;6 years!

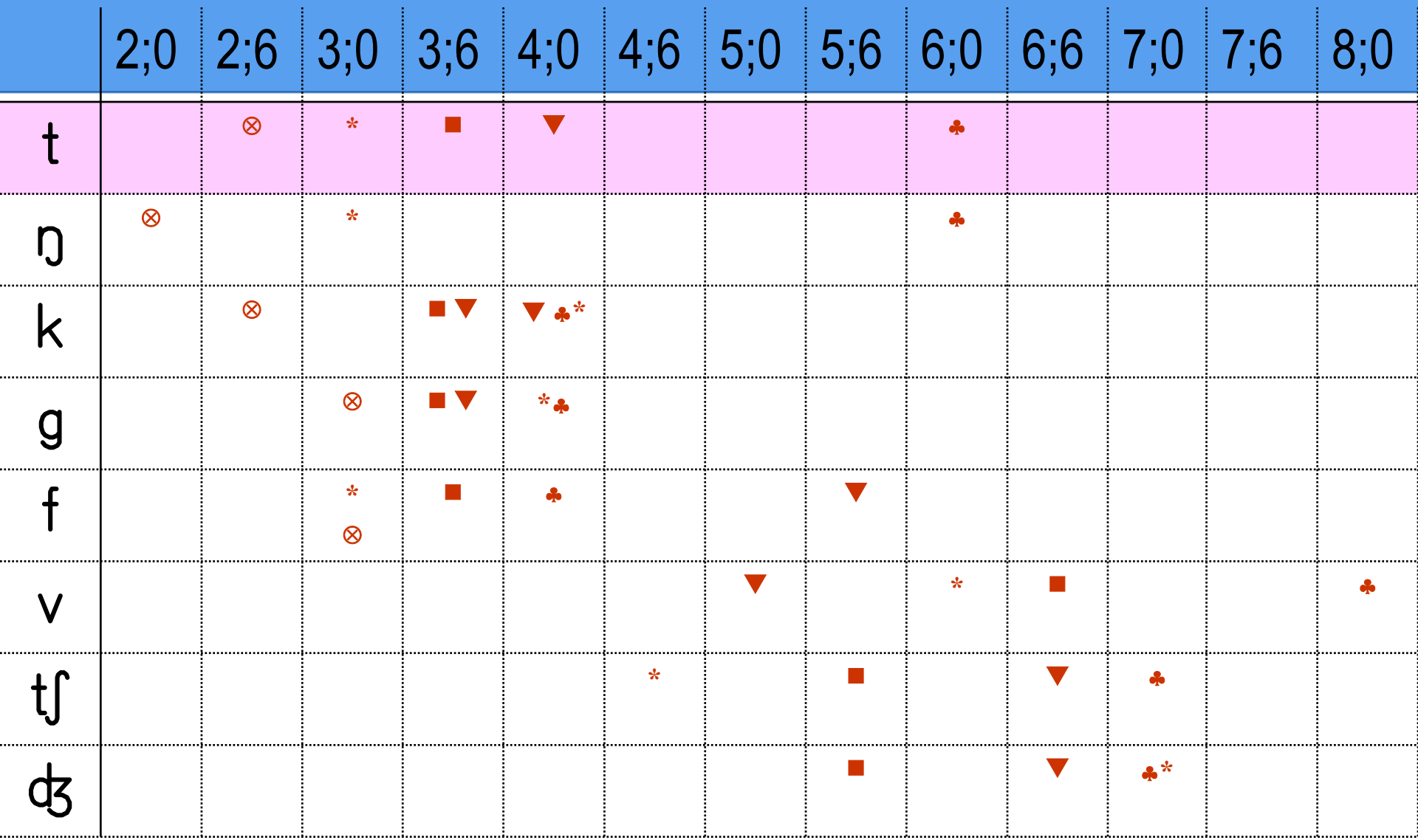
Combined Data



Middle 8

Using the same studies for the Middle 8 that I used for the Early 8, you see a much wider range of ages for mastery.

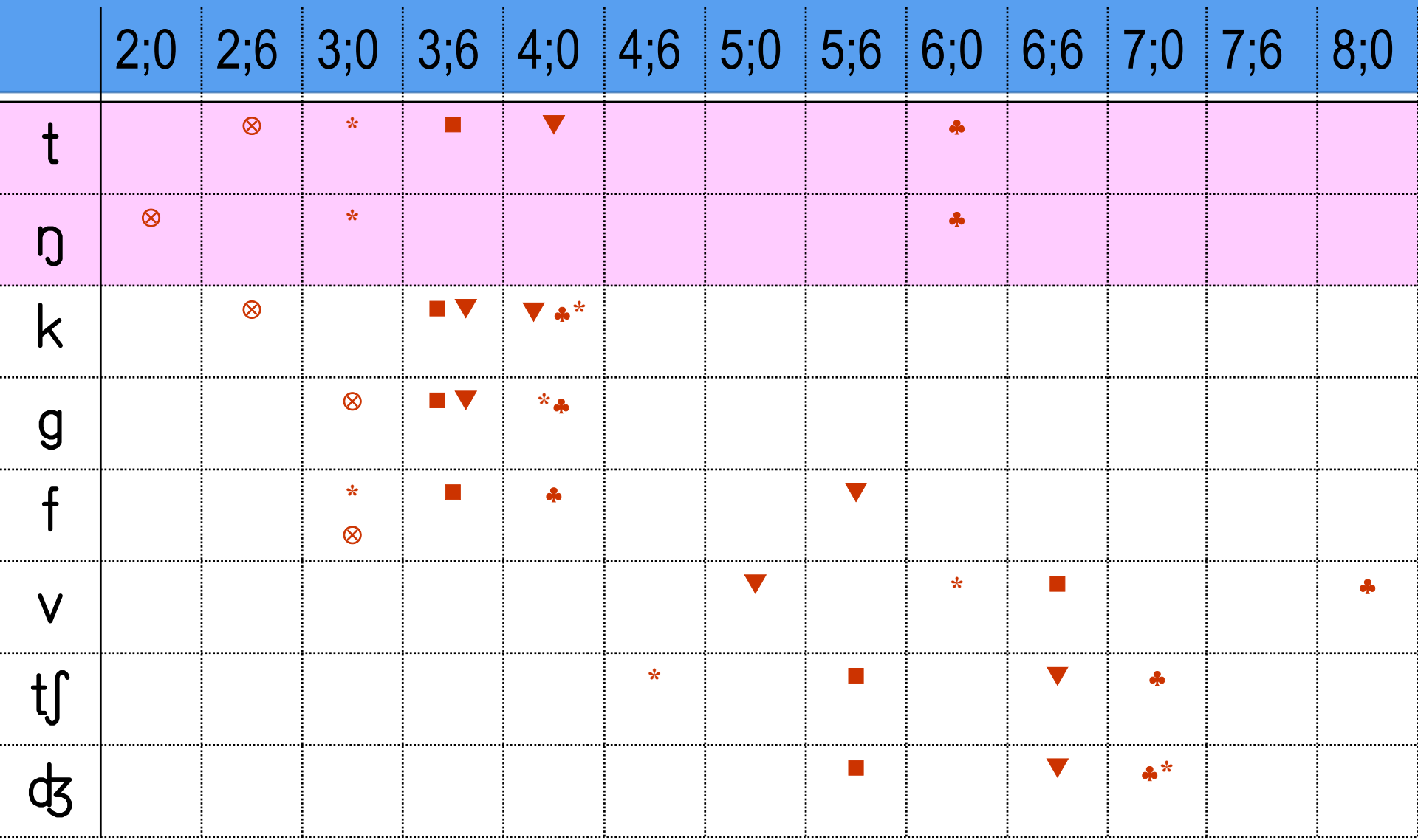
Combined Data



Middle 8

For example, the /t/ has a range from 2;6 to 6;0 years.

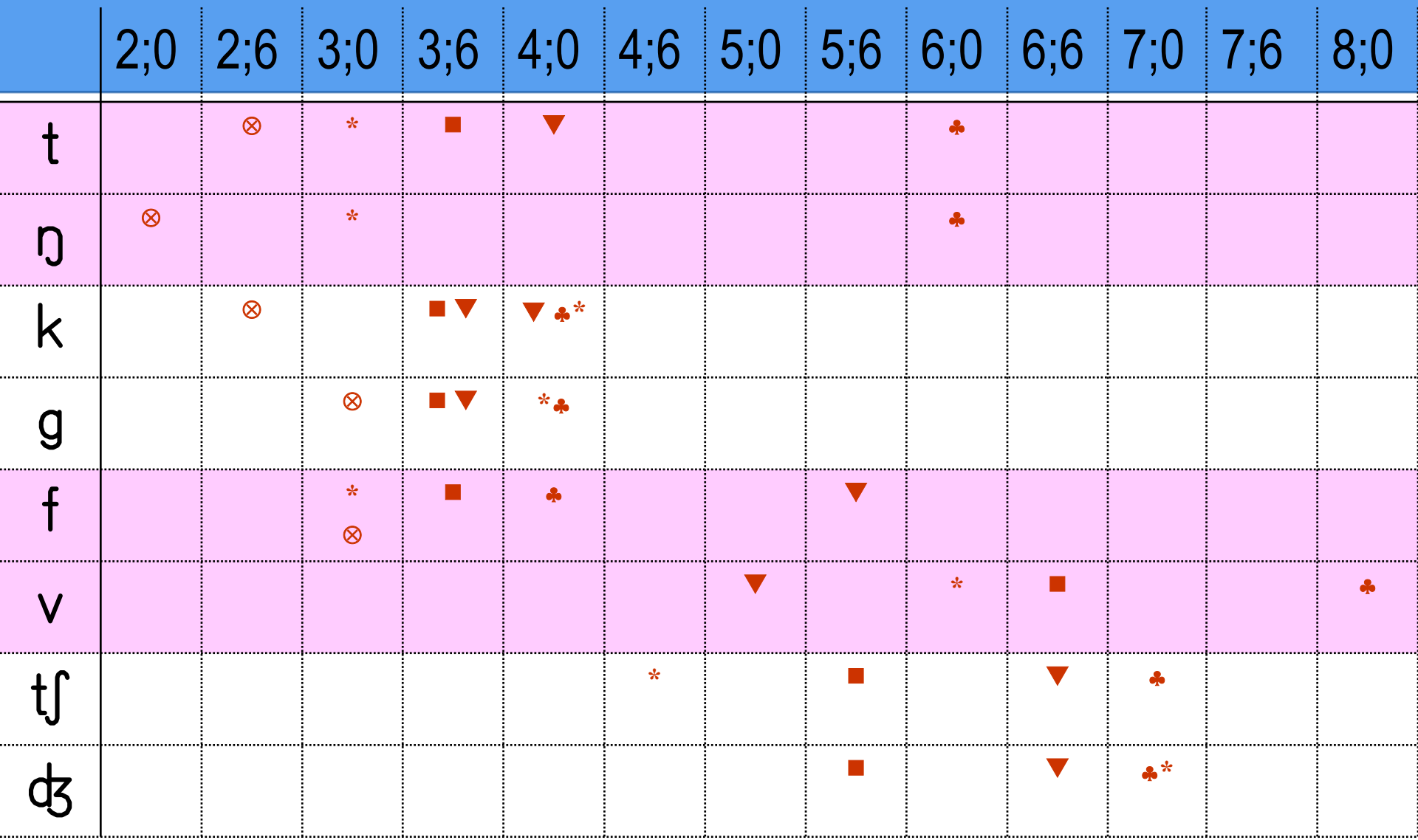
Combined Data



Middle 8

The /ŋ/ has a range from 2;0 to 6;0 years.

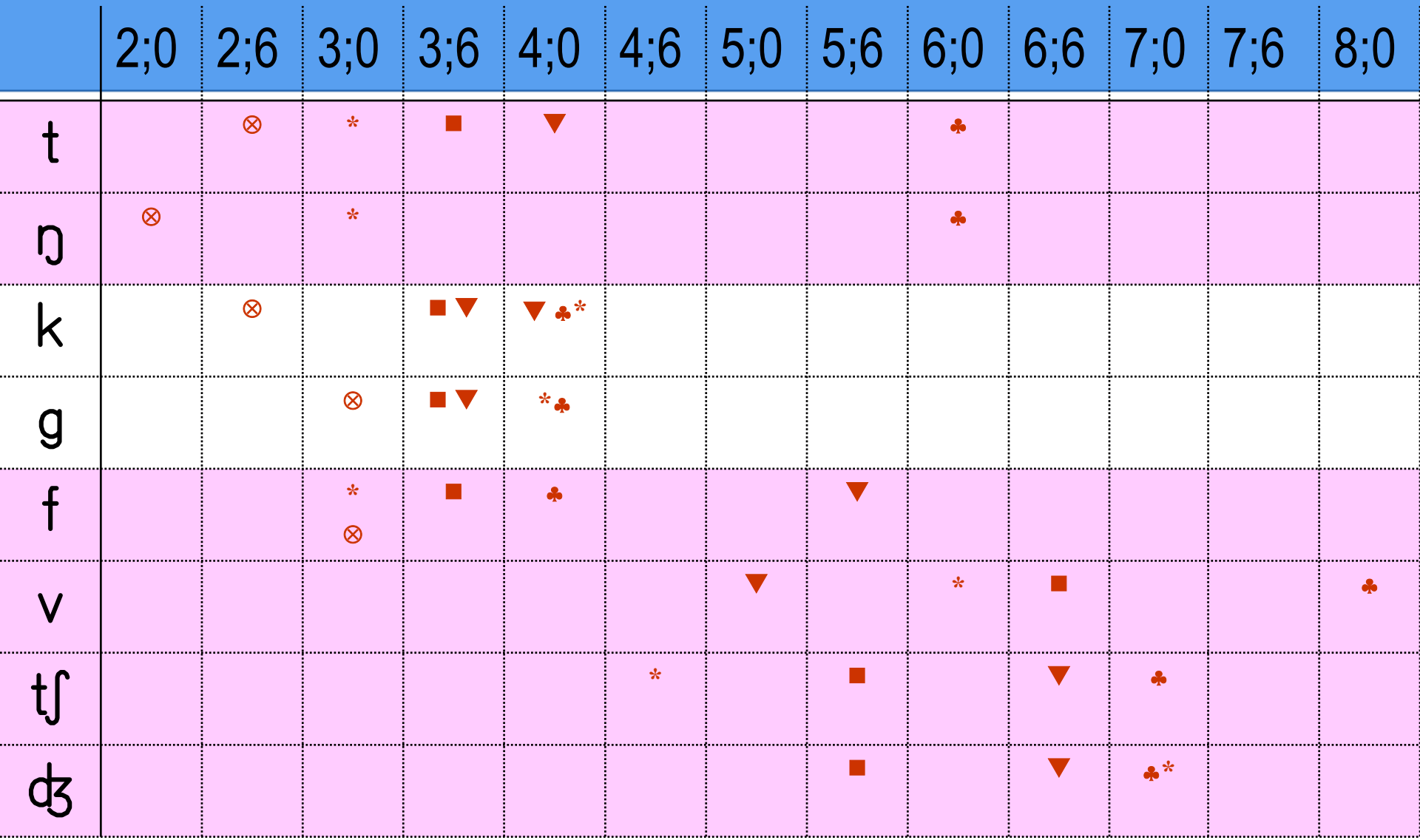
Combined Data



Middle 8

Note the wide age range of mastery for /f/ and /v/.

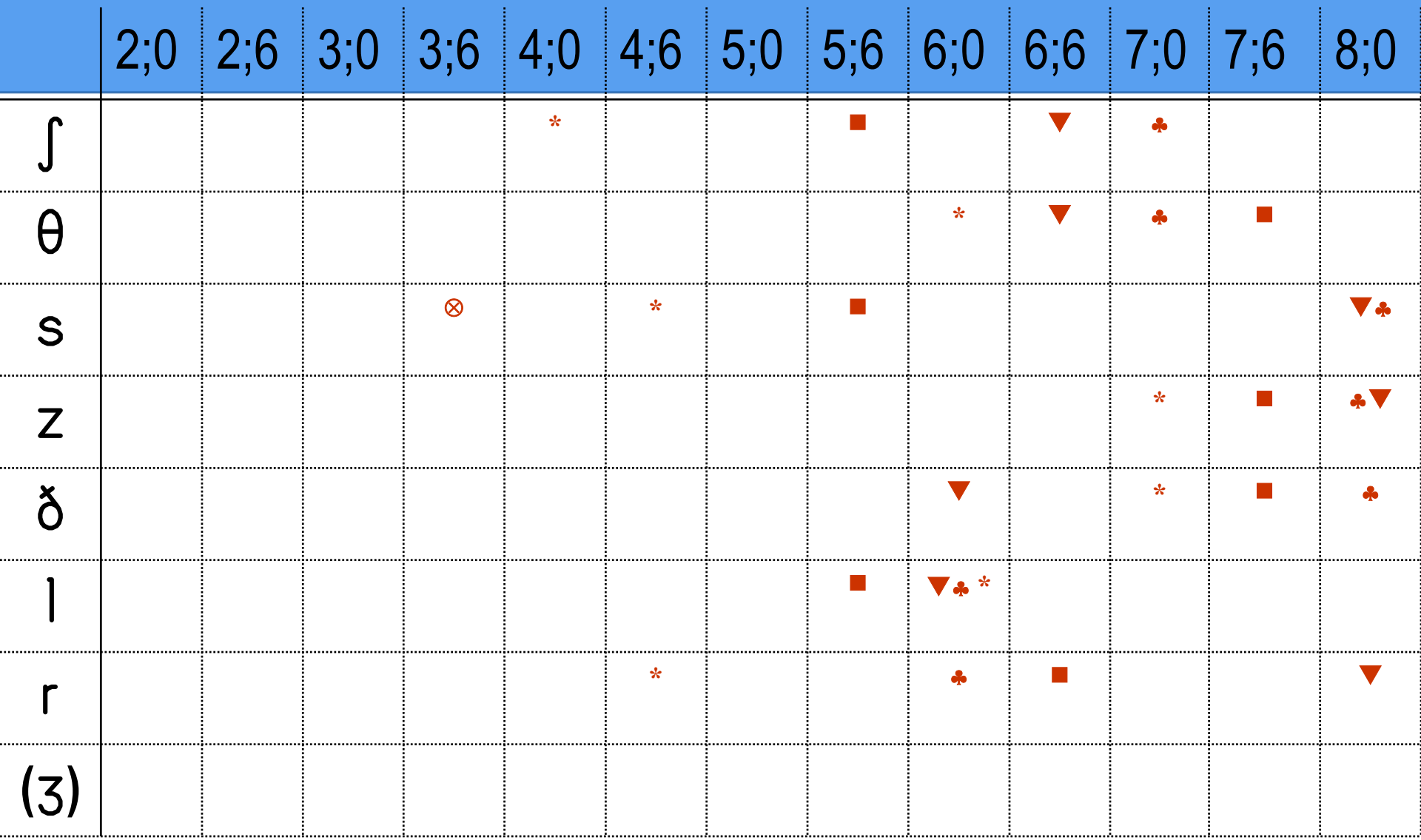
Combined Data



Middle 8

And for the affricates /tʃ/ and /ʤ/.

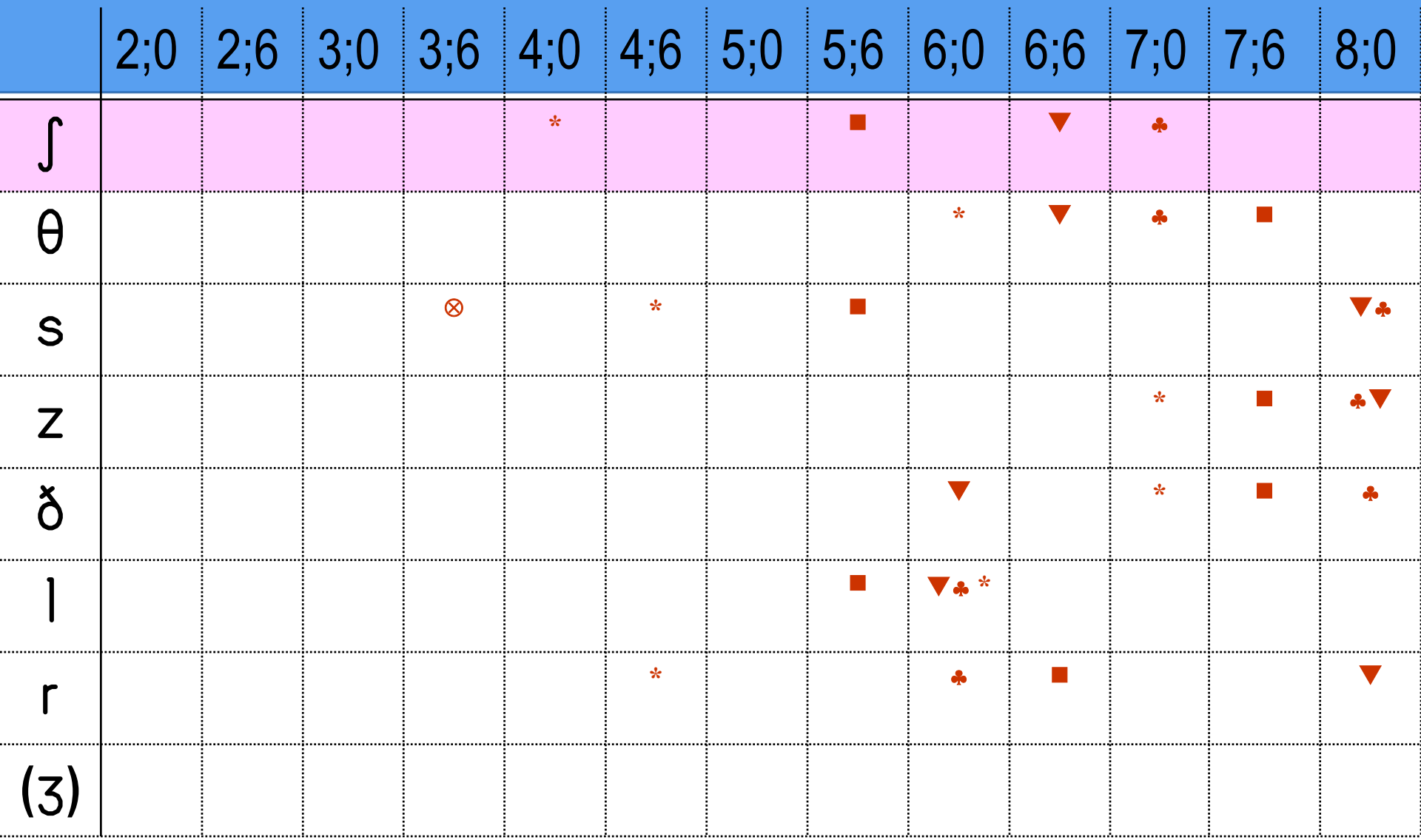
Combined Data



Late 8

Here are the combined data for the Late 8 sounds.

Combined Data



Late 8

Again, notice the wide range of supposedly mastery of the /ʃ/ sound.

Combined Data

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
ʃ					*			■		▼	♣		
θ									*	▼	♣	■	
s				⊗		*		■					▼♣
z											*	■	♣▼
ð									▼		*	■	♣
l								■	▼♣*				
r						*			♣	■			▼
(ʒ)													

Late 8

The wide range for `/s/`.

Combined Data

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
ʃ					*			■		▼	♣		
θ									*	▼	♣	■	
s				⊗		*		■					▼♣
z											*	■	♣▼
ð									▼		*	■	♣
l								■	▼♣*				
r						*			♣	■			▼
(ʒ)													

Late 8

For the voiced th (/ð/).

Combined Data

	2;0	2;6	3;0	3;6	4;0	4;6	5;0	5;6	6;0	6;6	7;0	7;6	8;0
ʃ					*			■		▼	♣		
θ									*	▼	♣	■	
s				⊗		*		■					▼♣
z											*	■	♣▼
ð									▼		*	■	♣
l								■	▼♣*				
r						*			♣	■			▼
(ʒ)													

Late 8

And for `/r/`.

Back to the main question…

Do we know when speech sounds develop based on the normative studies?

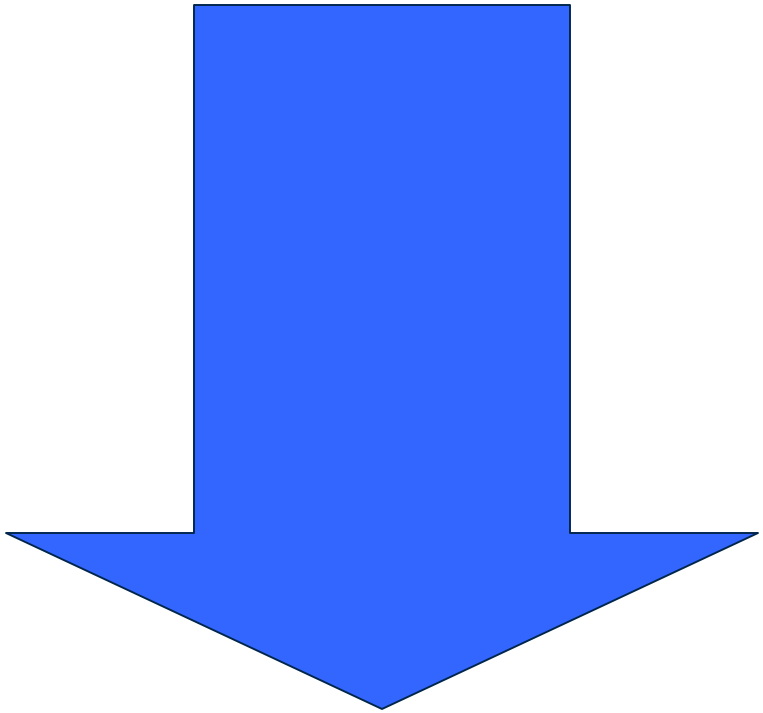
OK, with all of this information, lets go back to the main question.

“Do we know when speech sounds are learned?”

Back to the main question…

Do we know when speech sounds develop based on the normative studies?

PROBABLY NOT

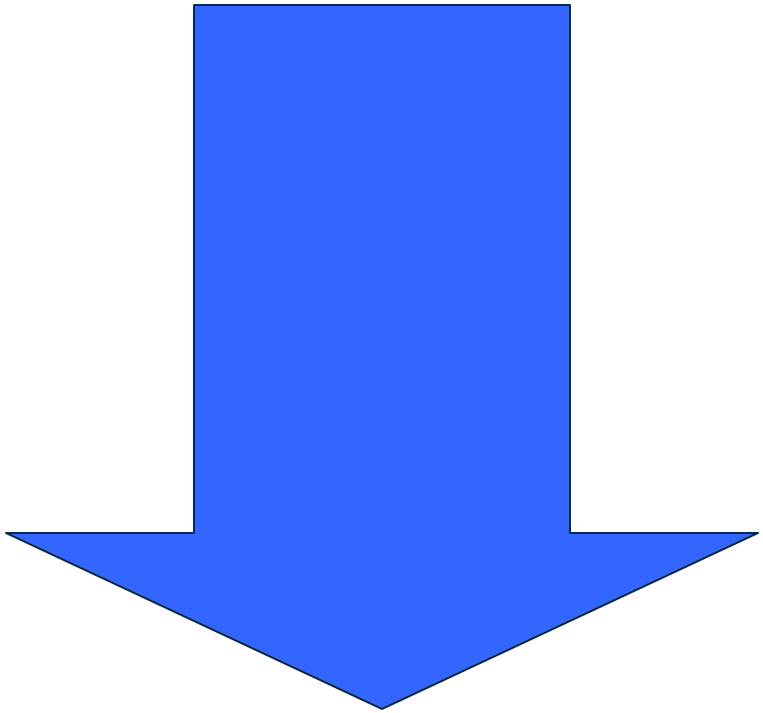


Probably not.

Back to the main question…

Do we know when speech sounds develop based on the normative studies?

PROBABLY NOT



PROBABLY NOT WELL

Or probably we don’t know very well when they are actually developed.

Methodological Issues

- Children with speech-sound disorders
- No conversational samples
- Both imitation & spontaneous
- Specific geographical regions
- Single word productions
- No control for important variables
- Experience of examiners

Of course there are many reasons for the wide disparity in mastery ages.

These reasons, most of them because of the research methodology used in gathering the norms, were accurately reported by Smit (1986).

Norms for Treatment Eligibility?

One problem with using these norms, then, deals with the first of two related clinical questions about speech sounds development.

This first problem deals with selecting children for therapy based on the norms.

Norms for Treatment Eligibility?

Two potential problems with this…

I see two potential problems with selecting children for therapy based solely on norms:

Norms for Treatment Eligibility?

1. Which set of norms can you believe?

The first problem has to do with which set of norms should be used? Which data set is the most accurate?

The “best” set is unknown, as far as I can tell.

The second problem for treatment eligibility is:

Norms for Treatment Eligibility?

1. Which set of norms can you believe?
2. **Holding children with disorders to a HIGHER standard.**

That we seem to be holding a child with a speech sound disorder to a HIGHER standard than other children.

By this I mean, why are we enrolling children in therapy only when at least 90% of their peers are producing the sound correctly?

We are saying, “Lets not enroll a child to begin them down the path to development of a sound until all of the other children have MASTERED the sound.”

It seems we are withholding treatment for kids with disorders because they are being held to a higher standard.

Norms for Target Selection?

This leads to the second clinical question related to norms.

“Can we use norms and a developmental sequence to determine what targets to select for treatment?”

Norms for Target Selection?

Three issues with this…

Well, I have three issues with this:

Norms for Target Selection?

Universal Order

The first issue has to do with the assumption that there is a fixed, universal, orderly development to speech sounds.

Norms for Target Selection?

Universal Order

Is there a universal order?

But I doubt that there is a universal order, as described by Jakobson (1968).

In fact, Ingram (1997) wrote how some sounds considered later developing in English appear early in other languages.

If development was from easy (early) to harder (later), shouldn't the developmental progress be the same for all languages? But this does not seem to be the case.

Norms for Target Selection?

Universal Order

Is there a universal order?

Do children with disorders follow the "normal" sequence?

Another problem with the universal order assumption is that children with a disorder follow the same developmental sequence as do typically developing children.

But is this true? Could one of the reasons that children are determined to be disordered is because they failed to follow the typical path?

Norms for Target Selection?

Universal Order

Developmental Prerequisites

My second issues concerns the tacit assumption that earlier developing sounds act as a prerequisite for later developing sounds.

Norms for Target Selection?

Developmental Prerequisites

Is mastery of earlier developing sounds necessary before production of later developing sounds?

Is there something about the earlier developing sounds that are needed for the production of later developing sounds?

I doubt it. Learning to produce the earlier developing /d/, for example, probably does not have an impact on learning the later developing /ʃ/.

The early sounds probably are not a prerequisite for later sounds. But it would appear that clinicians believe to be true when they select sounds following a developmental sequence.

Norms for Target Selection?

Universal Order

Developmental Prerequisites

Early vs. Late

The final issue about target selection and norms deals with selecting early vs. late developing sounds.

Norms for Target Selection?

Early vs. Late

Which sounds treated in therapy will produce the best long-term outcomes?

Currently there are conflicting data on which to choose.

Some researchers report that by selecting the later developing sounds first, this can lead to more widespread generalization to other sounds, both early and late ones. This generalization probably will not occur if earlier sounds are selected first (Gierut, Morrisett, Hughes, & Rowland, 1996)

However, this is a controversial topic, with some researchers finding just the opposite effects (Rvachew & Nowak, 2001).

Powell (1991) Selecting Targets

21 factors to think about when deciding what targets to select for articulation and/or phonological therapy

Too bad speech sound clinical decisions are not as simple as just pulling out a set of norms to help a clinician decide who is eligible and what targets to work on in therapy.

Powell (1991) outlined 21 things that need to be considered when selecting targets.

Powell (1991) Selecting Targets

- Age of child
- Age appropriateness of error(s)
- Normative order
- Ease of production
- Effect on intelligibility
- Error consistency
- Frequency of sound occurrence
- Homonymy
- Markedness
- Morphological status
- Number of errors
- Perceptual saliency
- Phonetic inventory
- Phonetic error type
- Phonological error type
- Phonotactic constraints
- Phonological knowledge
- Relevance to child
- Resources available
- Severity of disorder
- Stimulability

Only three of them seem to be related to a normative progression.

There are many more things that need to be considered when it comes to treatment eligibility and target selection. Norms are just a small piece of the puzzle.

MUCH more research is needed to help answer these clinical questions.

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