Tense in Williams Syndrome
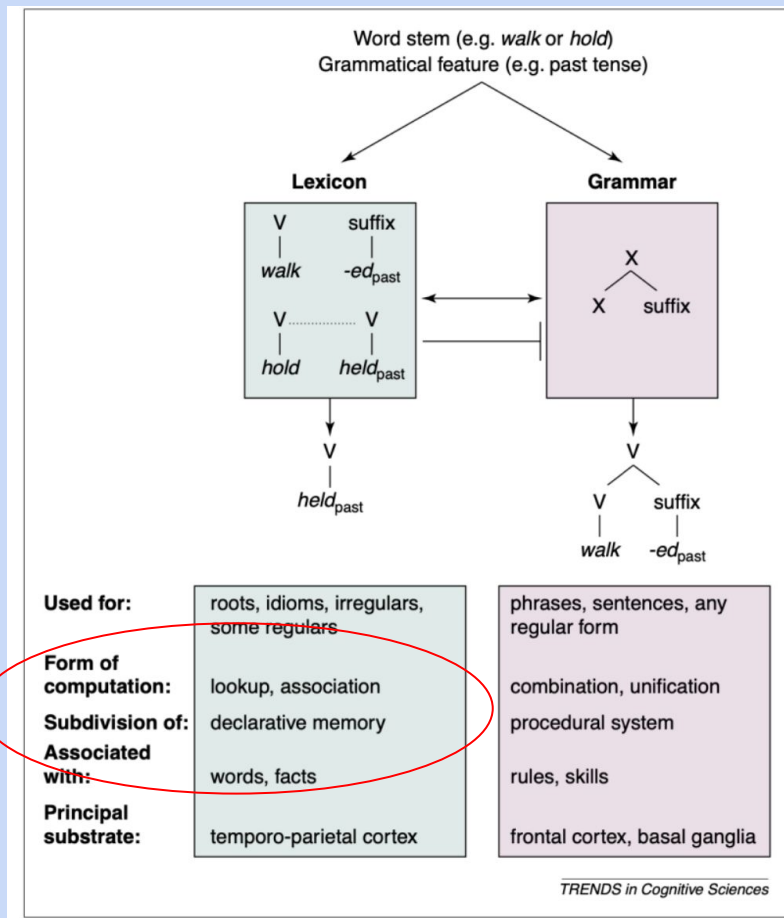
Laila Paredes & Micaela Leroux Burch

How is tense learned and produced?

Theory: Tense is a rule-based system

Words & Rules Theory

Word stem (e.g. *walk* or *hold*)
Grammatical feature (e.g. past tense)

Lexicon

Grammar

Used for:	roots, idioms, irregulars, some regulars	phrases, sentences, any regular form
Form of computation:	lookup, association	combination, unification
Subdivision of:	declarative memory	procedural system
Associated with:	words, facts	rules, skills
Principal substrate:	temporo-parietal cortex	frontal cortex, basal ganglia

TRENDS in Cognitive Sciences
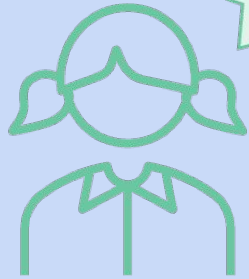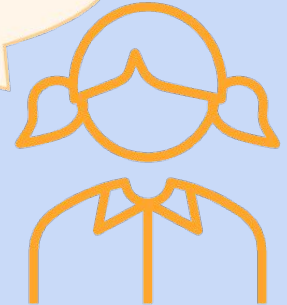
Why do we study people with Williams Syndrome?

○ Fluent complex language but atypical spatial cognition but now their linguistic abilities are like to younger typical developing children

○ Severe deficits in memory due to abnormal hippocampus

Clahsen and Almazan (1998)

- 4 WS children between 11-15 years
- 4 TD children between 5-7 years
  - Mental ages matched

- Wug test
  - "Every day I run. Just like every day, yesterday I…"
  - Used real verbs and novel verbs

- Irregularized correct novel verbs
  - Spling → splang

Real irregular verbs

sang/splang
singed/splinged
sing/spling

Novel irregular verbs
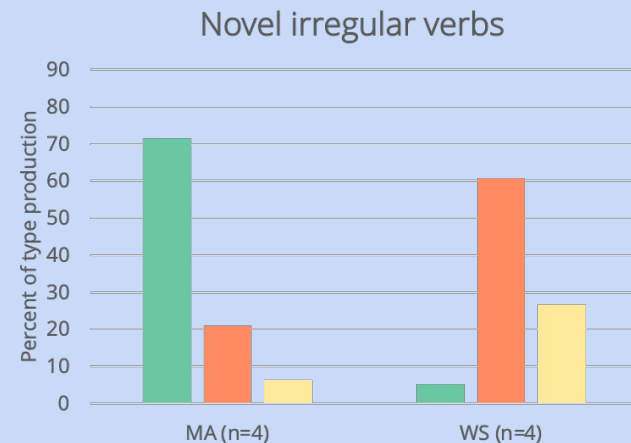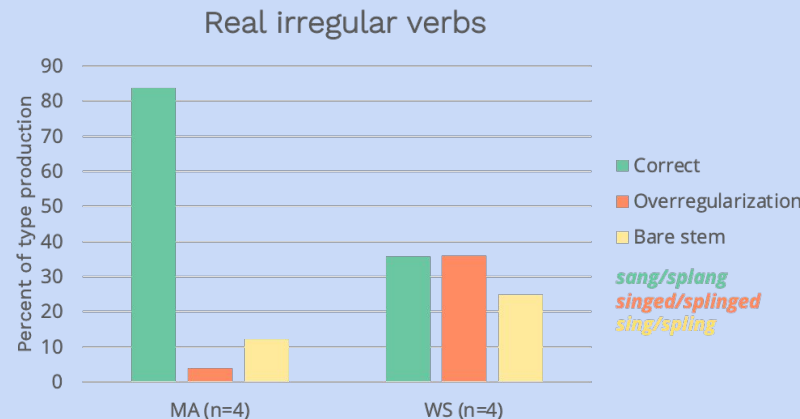
Findings suggest...

- ○ Support for <u>Dual Mechanism Theory for Tense</u>

- ○ WS have <u>intact</u> grammar mechanism

- ○ WS have <u>impaired</u> memory system

Further Testing the Words & Rules Theory...

1. Corpus study

2. Tense and Memory Study

Corpus Analysis Study

- 12 William syndrome (WS) participants

  Age: 7-14 years

- 12 typically developing (approximate) mental-age matched (MA) participants

  Age: 3-6 years

 Task: Presented 80 short motion event to participants

  → 80 trials

  Experimenter asked "What happened?"

- Prediction:
  - Both groups make almost no regular errors
  - Both groups make overregularization errors.
  - WS make more overregularization errors

Findings

- ○ Both groups made errors on both verb types
- ○ Both groups unmarked both verb types
- ○ Did not make more errors on irregulars compared to regulars
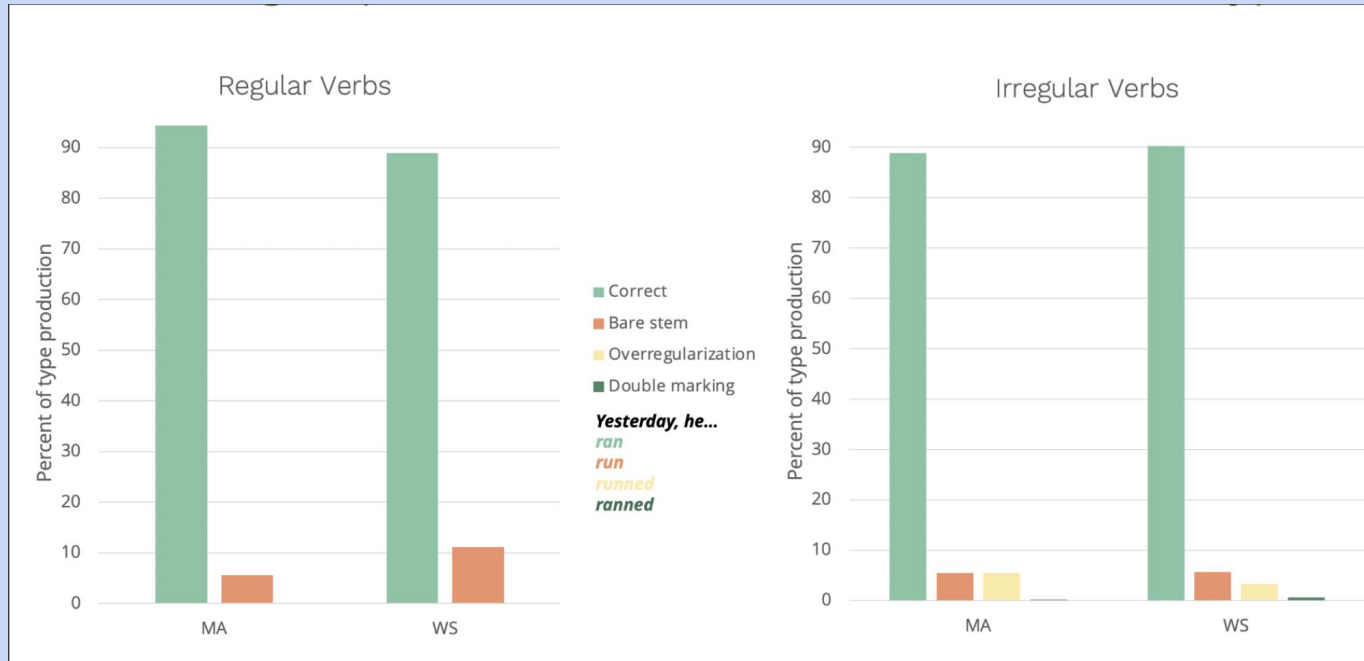
Questions that follow from the corpus study...

- Why are errors made on both verb types?

- Do individuals with WS make tense errors into adulthood?

- Do typical developing adults make tense errors?

- Does associative memory contribute specifically to the production of irregular verbs?
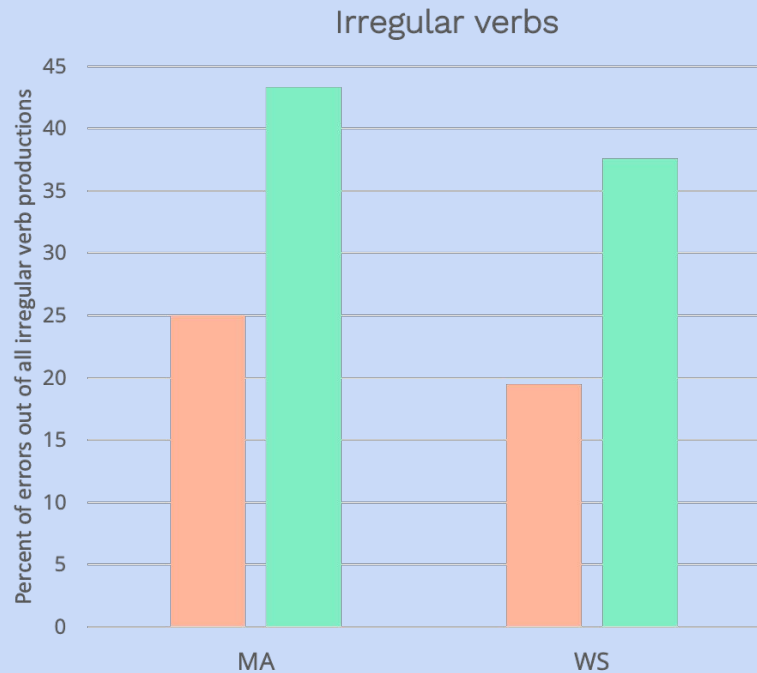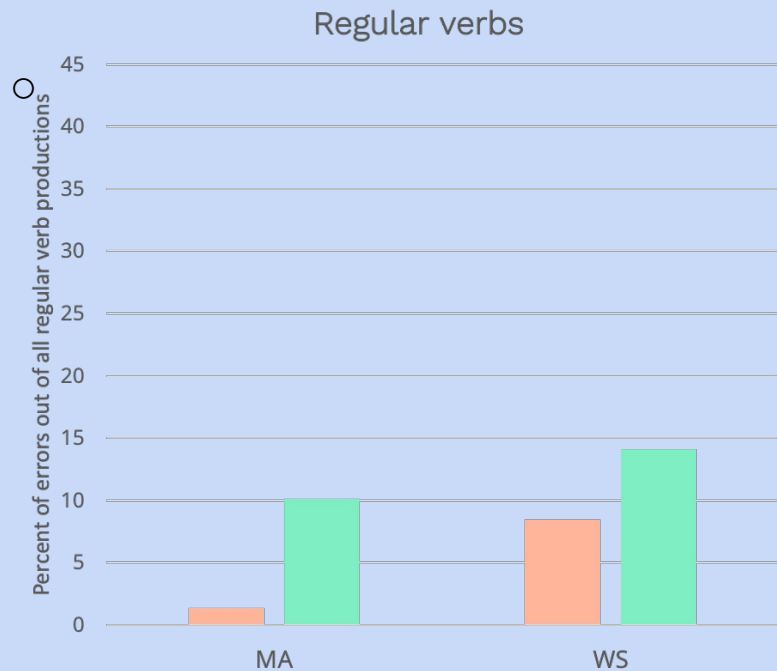
Tense and Memory Study - Task 1 - Wug Test

- 18 William Syndrome (WS) participants

  Age: 12 - 44 years

- 18 Typical Developing (TD) participants

  Age: 5 - 7 years

- Matching Mental Ages (6 years old)

- Participant received 32 real English word
  - Responses where measured based on <u>verb type</u> and <u>frequency</u>
  - half regular/irregular,
  - half high frequency/low frequency

Gerald knows how to sing. Every day, he sings. What did he do yesterday?

Yesterday he **sang/singed/sing/etc...**

Findings

Regular verbs

Irregular verbs

Percent of errors out of all regular verb productions

Percent of errors out of all irregular verb productions
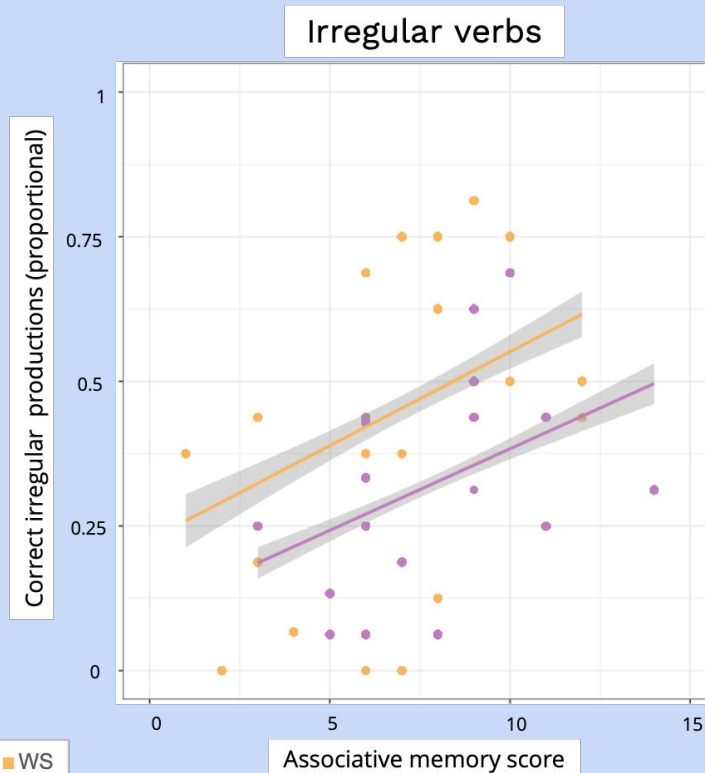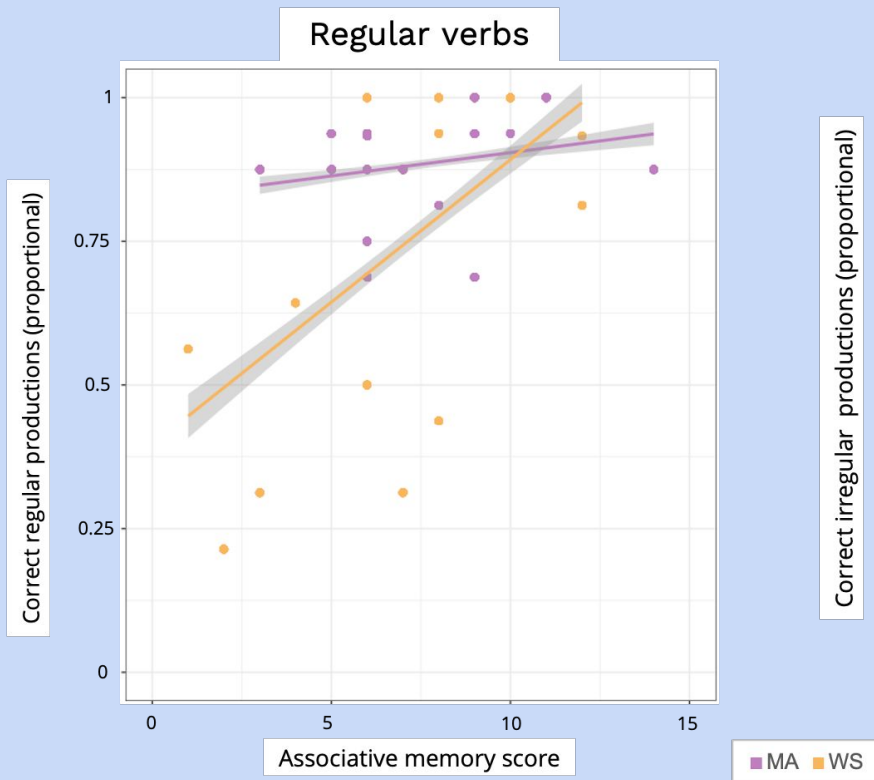
High frequency   Low frequency

Tense and Memory Study - Task 2 - NEPSY List Learning Task

- Test: Associative Memory

- Task: Recall as many words as possible from a list after a delay

- List: 15-word list

- Delay: 25 min

Findings

Regular verbs

Irregular verbs

CONCLUSIONS:

Results do not support the dual route model.

But what about a single route model?

A single route system: Albright & Hayes

- <u>Single route model of tense</u> entertains the possibility that knowledge of all verbs inform the past tense production of novel verbs.
- <u>Islands of reliability (IOR)</u> phonological contexts where a particular morphological change works especially well in the lexicon
    - Influence production and judgement of IRREGULAR verbs

Albright & Hayes, 2003

A single route system: Albright & Hayes

Verb in regular island of reliability: *nace*	
	Adults' average rating (1-7)
naced (regular)	6.5
noce (irregular)	2.96

Verb in irregular island of reliability: *gleed*	
	Adults' average rating (1-7)
gleeded (regular)	3.98
gled (irregular)	6.15

- Ratings data from Albright & Hayes supports a single route system of past tense production

Albright & Hayes, 2003

PREDICTION: TD adults should show preference for regularization or irregularization based on the IOR of the nonce verb.

Method: Replicating A&H TD adult results

- Production task
  - 26 TD adult participants
  - 40 verbs from A&H set of "core" verbs
  - Prompt: "Every day, I [VERB]. I love [VERBING]. It's so fun!"
    - Response: "Yesterday, I [PAST TENSE PRODUCTION].

Method: Replicating A&H TD adult results

- **Ratings task**
  - 25 TD adults
  - 40 nonce verbs, two past tense inflections for each nonce verb: one regular past tense form, one irregular past tense form.
  - Audio recording: "Every day I [VERB]. I love [VERBING]. It's so fun! Yesterday I…[verb]"
  - Rate what the speaker said she did yesterday on a 3 point scale indicated by smiley faces:
    - (1) *not good,* (2) *good,* (3) *great*

Not good   Good   Great

Reliability coding for production task

Separate Audio

Audio of the prompt and full sentence response for each verb is separated out. Audio files are renamed to a random, distinct noun. The nonce verbs and their corresponding file names are documented in an excel file.

Transcribe Individually

We individually transcribe the past tense verb production from the randomly generated noun file names

Compare

We compare transcriptions of the past tense productions and disagreements on production are resolved by listening to the audio files again. Final productions are then transcribed into IPA.

Adult ratings data: replication of Albright & Hayes
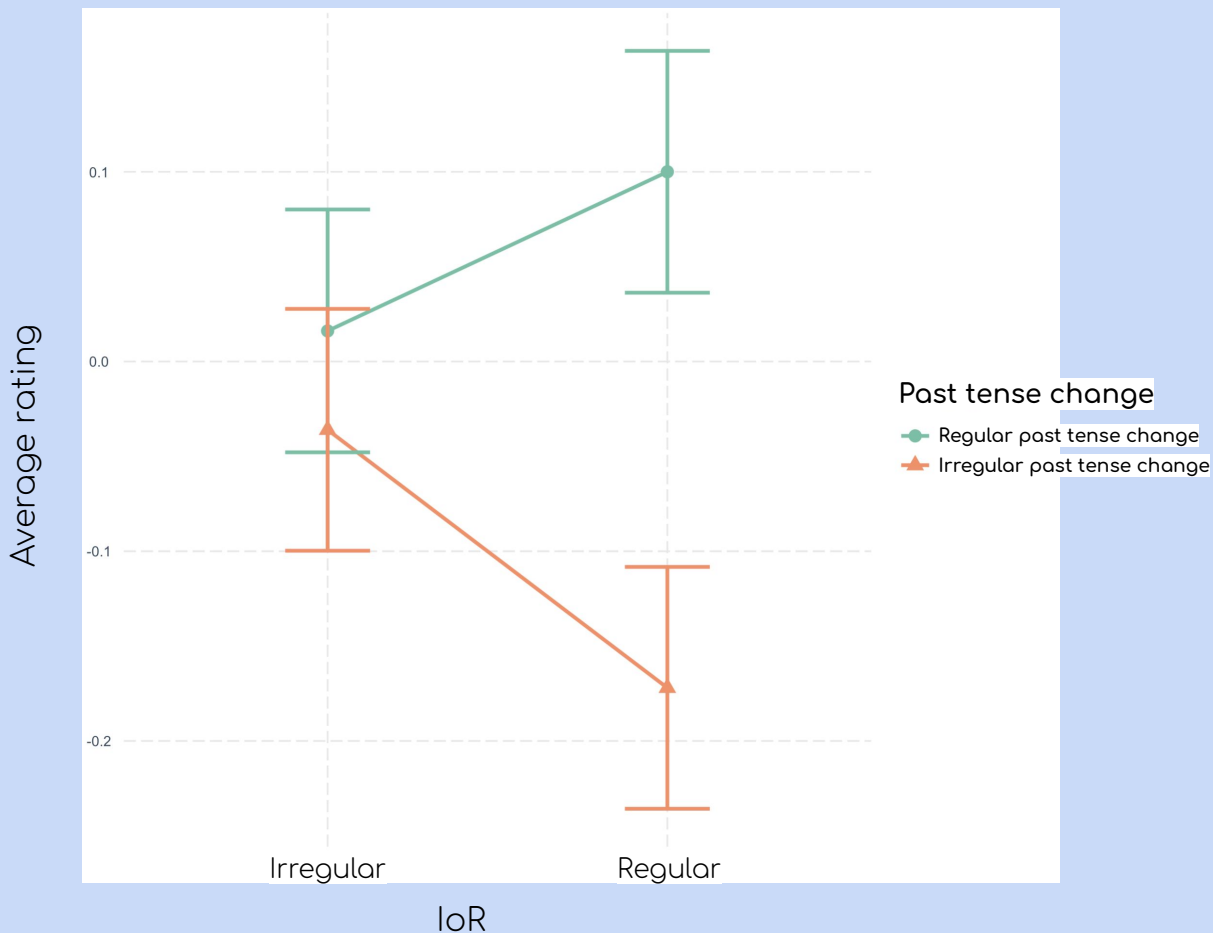
- Verbs belonging to regular IoRs are rated significantly higher when they are produced with a regular past tense change
- They're rated significantly lower when they're produced with an irregular past tense change
- The difference between past tense changes is significant for regular IoR verbs, but not irregular IoR verbs

TD adult past tense ratings data replicates A&H!

Next steps: Testing single route system in participants with WS and MA children

Method: Does the single-route system apply to WS and MA participants?

- Participants with WS 12 years+
- MA participants between 5-7 years
- Forced choice task: modified A&H ratings task
  - Audio recording: "Every day I [VERB]. I love [VERBING]. It's so fun! Yesterday I...[verb]"
  - The participant was given two options for past tense endings for novel verbs
  - Rate what the speaker said she did yesterday on a 3 point scale, represented by smiley faces

Method: Does the single-route system apply to WS and MA participants?

- Participants with WS 12 years+
- MA participants between 5-7 years
- Production task
  - Prompt: "Gerald loves [VERB]. Every day, Gerald [VERBS]. He loves [VERBING]. It's so fun! What did Gerald do yesterday?"
  - Response: "Yesterday, Gerald [past tense].

Example forced choice trial

What's next...

Prediction:

IF speakers with WS show similar preference for producing past tense forms according to the IOR

THEN single route theory accounts for both individuals with WS and typically developing individuals...more evidence against a different linguistic system

Thank you!

Laila and Micaela RA Work

- Literature discussions
  - Clahsen & Almazan (1998) "Syntax and morphology in Williams syndrome"
  - Carlson, et. al. (2013) "Theory of Mind'"
  - Albright & Hayes (2003) "Rules vs. analogy in English past tenses: a computational /experimental study"
  - Blithing, et. al. (2018) "Children's Acquisition of the English Past-Tense: Evidence for a Single-Route Account From Novel Verb Production Data"
  - Ambridge (2010) "Children's Judgments of Regular and Irregular Novel Past-Tense Forms: New Data on the English Past-Tense Debate"
- KBIT training
- Reliability coding