Children's interpretation of sentences with multiple scalar terms

Cory Bill, Elena Pagliarini, Jacopo Romoli, Lyn Tieu, and Stephen Crain

Inferences

Sentences often contain meanings that seem to extend beyond their ‘basic’ meaning.

Inferences

The lion ate some of his cookies

Inferences

The lion ate some of his cookies

The lion ate some but not all of his cookies

Inference Computation

There are different proposals regarding the specifics of how these inferences are computed (Grice, 1975; Levinson, 2000; Chierchia, 2004)

Inference Computation

There are different proposals regarding the specifics of how these inferences are computed (Grice, 1975; Chierchia, 2004; among others).

They tend to involve some version of the following process.

Inference Computation

The lion ate some of his cookies

Inference Computation

The lion ate some of his cookies

The lion ate all of his cookies

Inference Computation

The lion ate some of his cookies

NOT [The lion ate all of his cookies]

Inference Computation

The lion ate some of his cookies

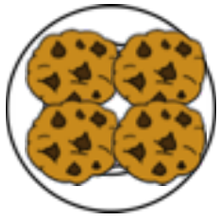
NOT [The lion ate all of his cookies]

The lion ate some but not all of his cookies

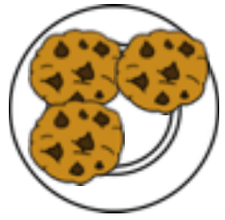
Children & Inferences

Children are less likely than adults to generate certain inferences (Noveck, 2001; Musolino & Papafragou, 2003; Guasti et al., 2005; among others).

Children & Inferences



Children & Inferences



Children & Inferences

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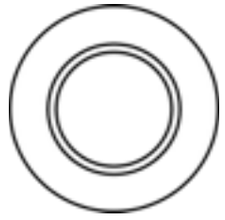
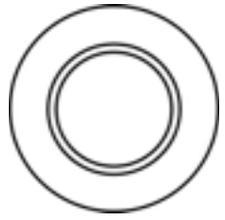


The lion ate some of his cookies

Children & Inferences



The lion ate some of his cookies

Adults = False

Children = True

Children & Inferences

Why?

Children & Inferences

Why?

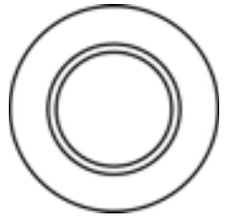
Restricted Alternatives Hypothesis (RAH)

Children & Inferences

Why?

Restricted Alternatives Hypothesis (RAH):
Children have the ability to compute inferences whose construction does not require access to the lexicon (Tieu et al., In press; see also, Chierchia et al., 2001; Barner et al., 2011; Singh et al., 2013;).

Children & Inferences



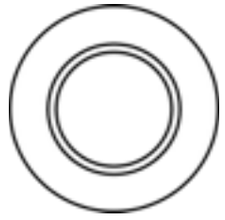
The lion ate some of his cookies

Children & Inferences

The lion ate some of his cookies

The lion ate **all** of his cookies

Children & Inferences

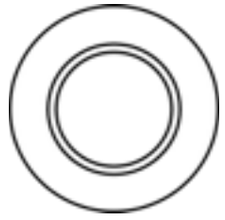


The lion ate some of his cookies

The lion ate **all** of his cookies

The lion ate some, but not all, of his cookies

Children & Inferences

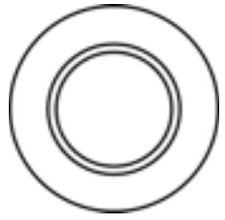


The lion ate some of his cookies

~~The lion ate **all** of his cookies~~

The lion ate some, but not all, of his cookies

Children & Inferences

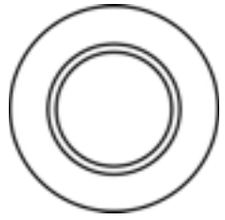


The lion ate some of his cookies

~~The lion ate **all** of his cookies~~

~~**The lion ate some, but not all, of his cookies**~~

Children & Inferences



The lion ate some of his cookies

The lion ate some or all of his cookies

Testing RAH

Children can compute inferences, if the alternatives are explicitly provided

Testing RAH

Every lion ate some of his cookies

Testing RAH

Every lion ate some of his cookies

Testing RAH

Every lion ate **some** of his cookies

Testing RAH

Chemla & Spector (2011) found evidence of adults computing two kinds of SIs for these sentences.

Every lion ate **some** of his cookies

Testing RAH

Chemla & Spector (2011) found evidence of adults computing two kinds of SIs for these sentences.

Every lion ate **some** of his cookies

Weak SI (WSI): Not every lion ate every one of his cookies

Testing RAH

Chemla & Spector (2011) found evidence of adults computing two kinds of SIs for these sentences.

Every lion ate **some** of his cookies

WSI: Not every lion ate every one of his cookies

Strong SI (SSI): No lion ate every one of his cookies

Testing RAH

There are different theories of how these WSIs and the SSIs are derived (locally vs. globally) (e.g., Chierchia, 2004; Sauerland, 2004)

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For our purposes, it is enough to note that the different derivations all use the scalar terms from the assertion.

Testing RAH

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For our purposes, it is enough to note that the different derivations use the scalar terms from the assertion.

Deriving WSI

Every lion ate **some** of his cookies

Deriving WSI

Every lion ate **some** of his cookies

Every lion ate **all** of his cookies

Deriving WSI

Every dog ate **some** of his cookies

NOT[Every dog ate **all** of his cookies]

Deriving WSI

Every lion ate **some** of his cookies

NOT[Every lion ate **all** of his cookies]

Every lion ate some of his cookies, and not every lion ate all of his cookies

Deriving SSI

Every lion ate **some** of his cookies

Deriving SSI

Every lion ate **some** of his cookies

Some lion ate **all** of his cookies

Deriving SSI

Every lion ate **some** of his cookies

NOT[**Some** lion ate **all** of his cookies]

Deriving SSI

Every lion ate **some** of his cookies

NOT[**Some** lion ate **all** of his cookies]

Every lion ate some of his cookies, and no lion ate all of his cookies

Deriving SSI locally

Every lion ate **some** of his cookies

Every lion ate **[some** but **not all** of his cookies]

no lion ate all of his cookies

Testing RAH

Will children generate SIs more readily when presented with sentences containing the relevant scalar terms, as predicted by the RAH?

Experiment

Truth Value Judgment Task

Experiment

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1. Experimenter presents story.

Experiment

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2. Puppet presents a sentence describing what happened in the story.

Experiment

Truth Value Judgment Task

1. Experimenter presents story.

2. Puppet presents a sentence describing what happened in the story.

3. Participant judges whether puppet's description was 'right' or 'wrong'.

Experiment

Truth Value Judgment Task

1. Experimenter presents story.
2. Puppet presents a sentence describing what happened in the story.
3. Participant judges whether puppet's description was 'right' or 'wrong'.
4. Participant is asked to justify their judgment.

Experiment

Design

2x4

- Group: Adults vs. Children

-Readings: False vs. Literal vs. Weak vs. Strong, within subjects

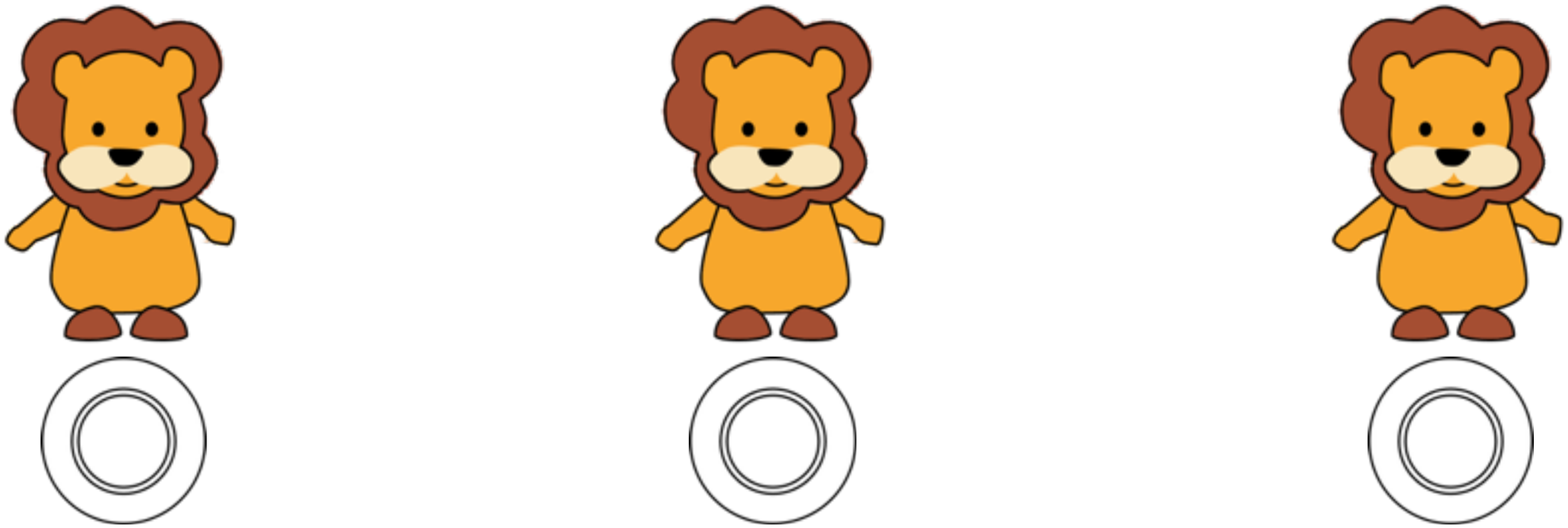
Experiment

False

Every lion ate some of his cookies

Literal ✗ WSI ✗ SSI ✗

Experiment



Literal

Every lion ate some of his cookies

Every lion ate some or all of his cookies

Literal ✓ WSI ✗ SSI ✗

Experiment

Weak

Every lion ate some of his cookies

Every lion ate some of his cookies and not every lion ate all of his cookies

Literal ✓ WSI ✓ SSI ✗

Experiment

Strong

Every lion ate some of his cookies

Every lion ate some of his cookies and no lion ate all of his cookies

Literal ✓ WSI ✓ SSI ✓

Experiment

Participants

Adults = 19 Macquarie University undergraduates

Children = 19 4-5 year olds (4;1-5;8, M=4;5)

Experiment

Procedure

Experiment

Procedure

Two sessions: 7-9 days apart

Experiment

Procedure

Two sessions: 7-9 days apart

Each session included:

Experiment

Procedure

Two sessions: 7-9 days apart

Each session included:

8 Test items (Strong & Literal, Weak & False

Experiment

Procedure

Two sessions: 7-9 days apart

Each session included:

8 Test items (Strong & Literal, Weak & False)

2 Control items

Experiment

Procedure

Two sessions: 7-9 days apart

Each session included:

8 Test items (Strong & Literal, Weak & False)

2 Control items

2 Filler items

Example Trial

This is a story about three lions. It's snack-time for the lions, and each of them have cookies that they can eat if they want to. Let's see what they do.

Example Trial

The first lion says “These cookies do look very tasty,
let’s see I’ll eat one.”

Example Trial

"Hmm, perhaps I'll eat another"

Example Trial

"Ok, that's enough for me."

Example Trial

The second lion says, “Hmm, yes my cookies do look yummy, I’ll eat one.”

Example Trial

"Hmm, and another one"

Example Trial

"And that is enough for me."

Example Trial

The third lion says “Hmm, I’m feeling really hungry today, so let’s see I’ll eat one cookie.”

Example Trial

"Hmm, I think I'll have another…"

Example Trial

"Hmm, I am still hungry, because I didn't eat any breakfast today, so I'll have another…"

Example Trial

"Oh, and I'll have one more…"

Example Trial

"There we go, now I'm nice and full."

Example Trial

Experimenter: “Hey Scruffy, what did the lions do?”

Puppet: “Every lion ate some of his cookies.”

Results

Five children failed the controls, 1 child and 1 adult did not do second session.

Therefore, these participants were excluded from the final dataset.

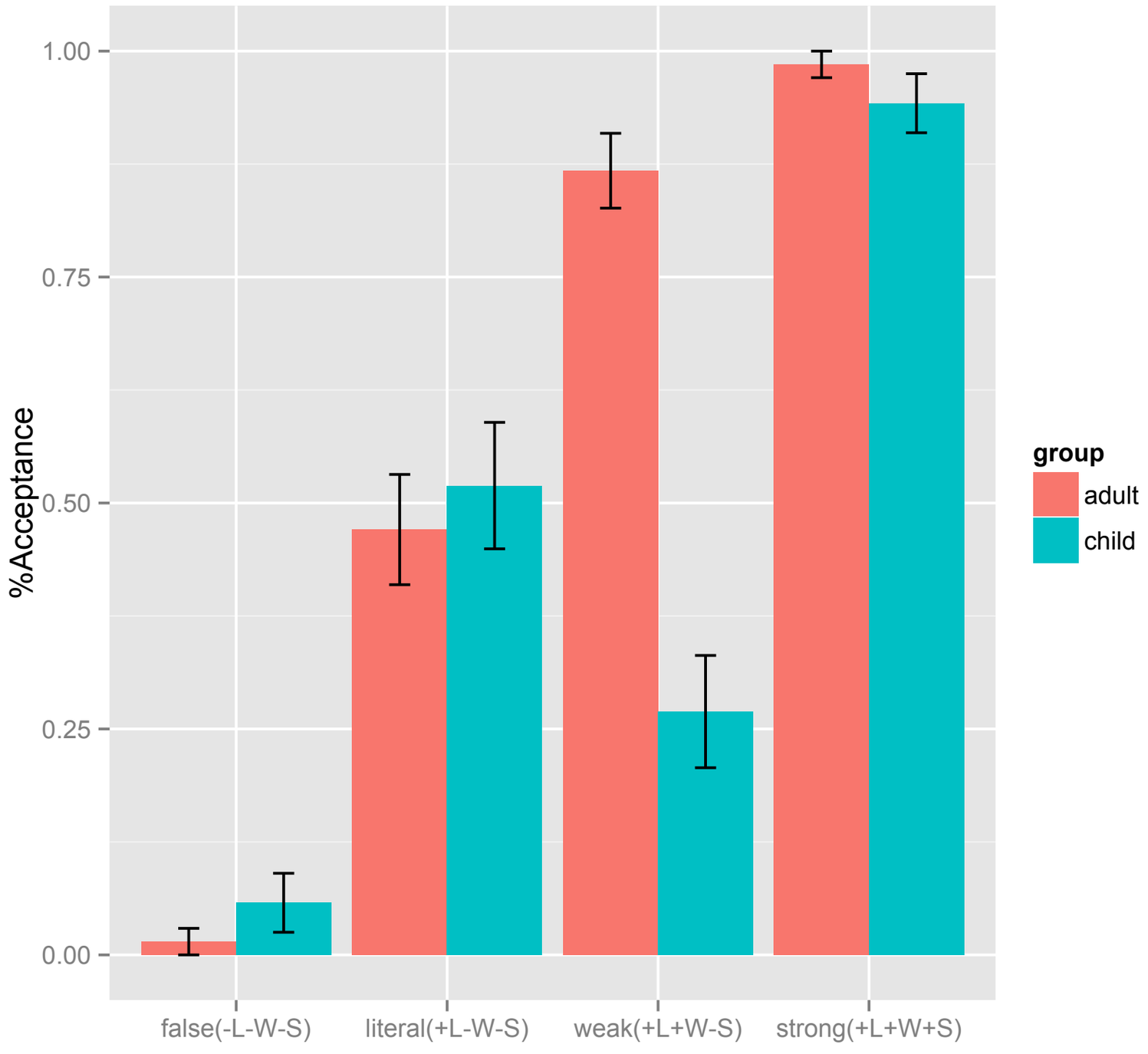
Children = 13

Adults = 18

Analysis

RAH prediction

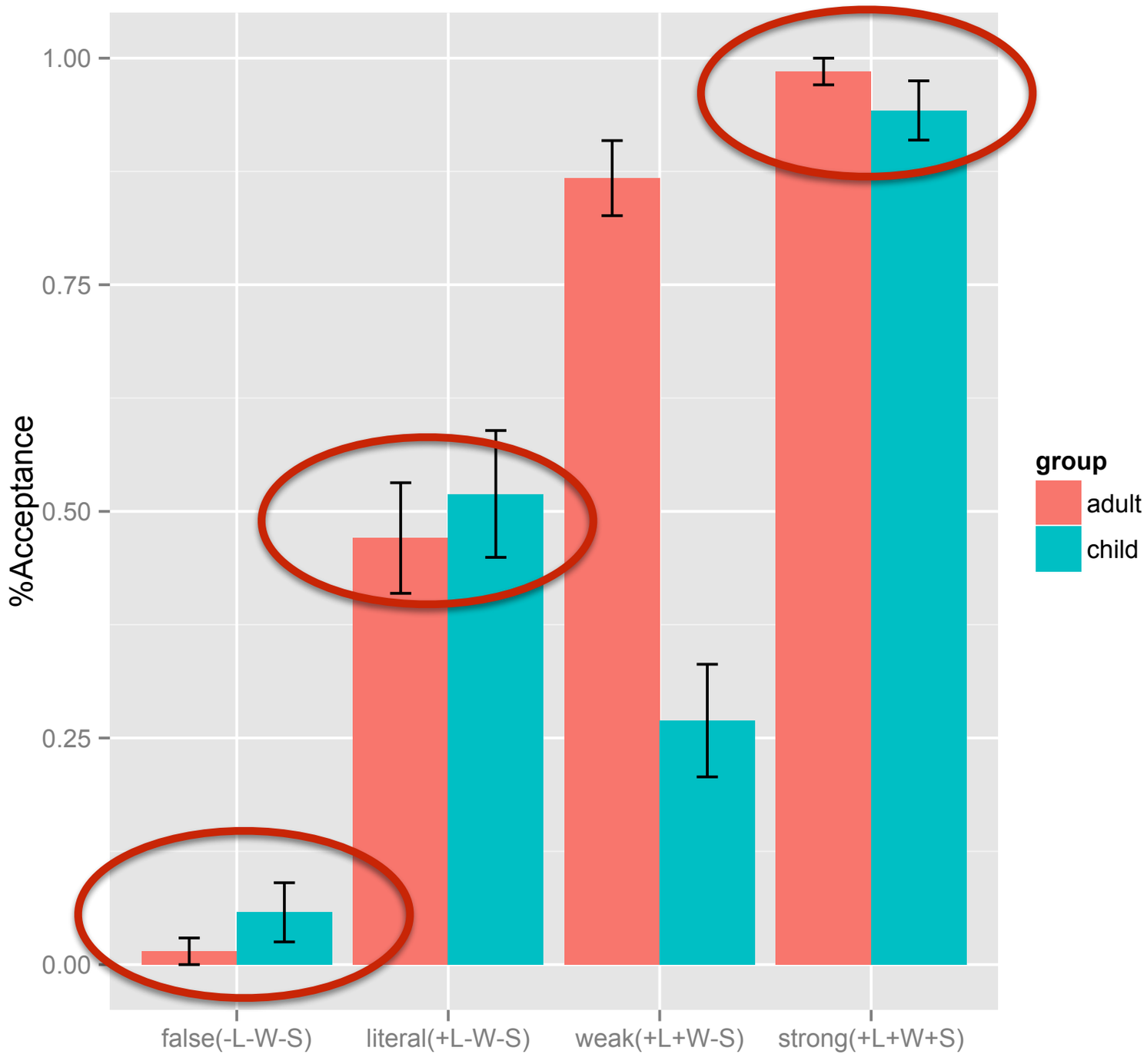
Children's SIs= Adults SIs



RAH verdict

RAH prediction

Children's DIs = Adults DIs

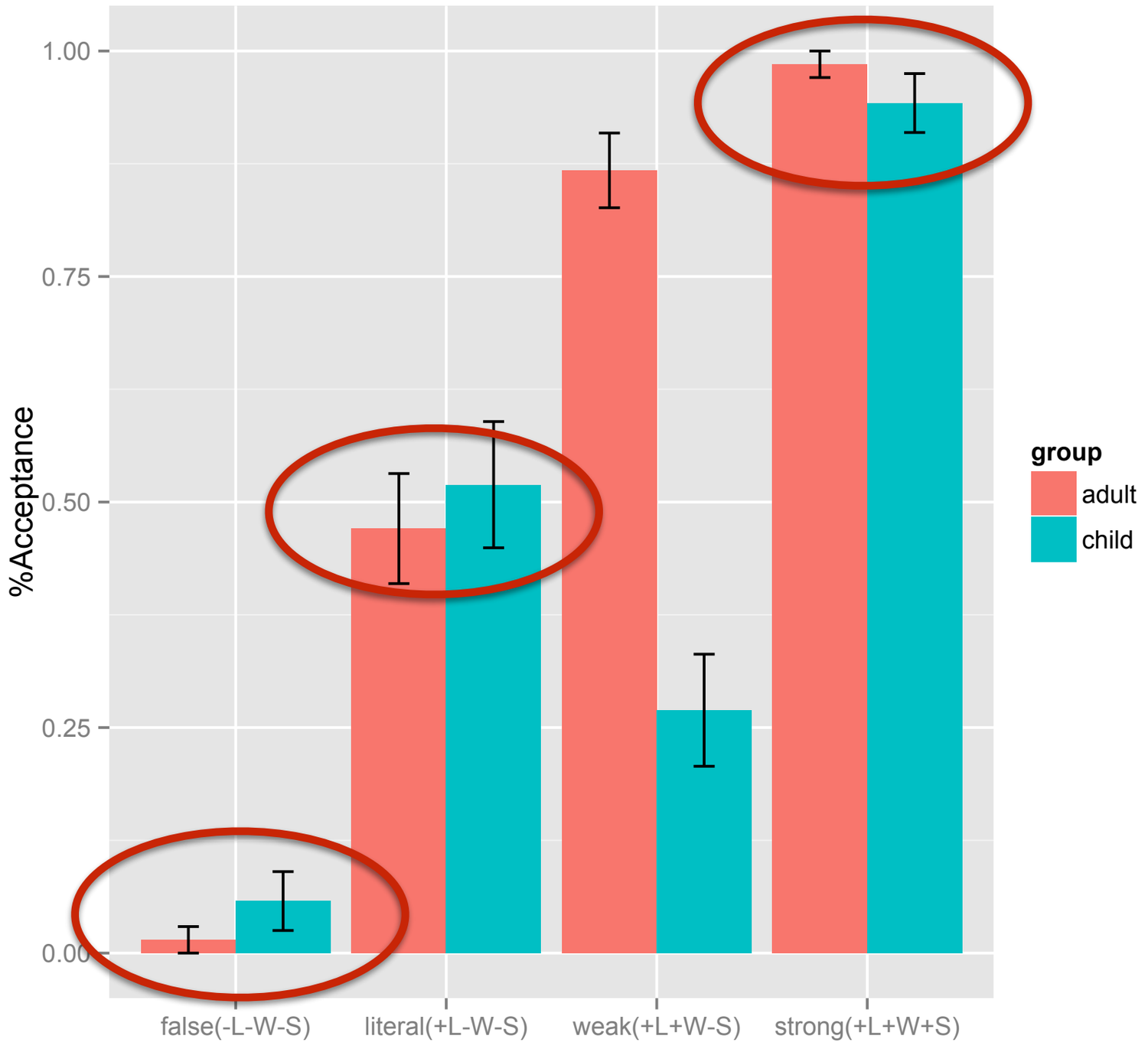


RAH verdict

RAH prediction

Children's DIs = Adults DIs

Sig. difference between these three conditions.



RAH verdict

RAH prediction

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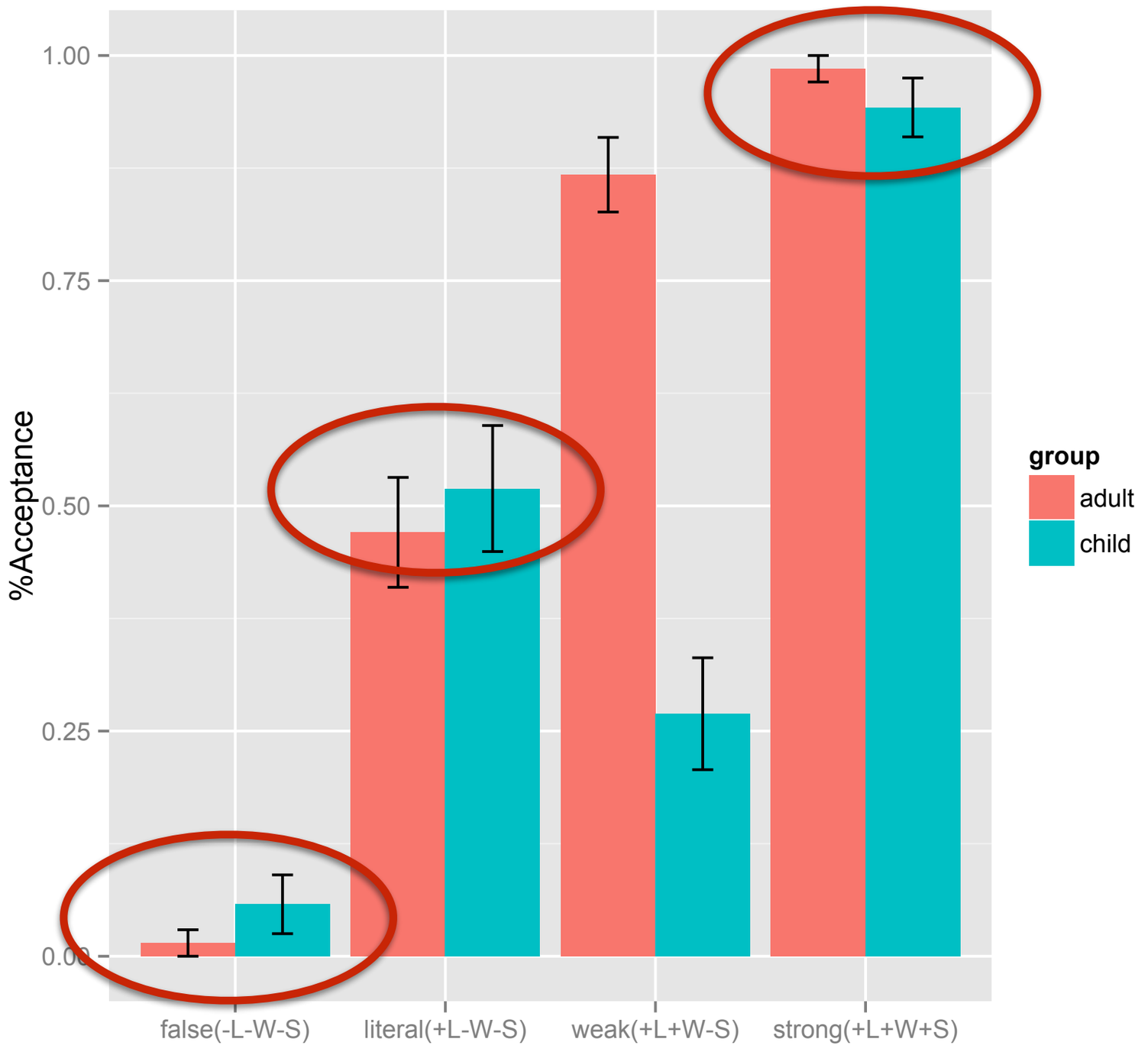
Sig. difference between these three conditions.

No sig. difference between adults and children in each of these conditions.



RAH verdict

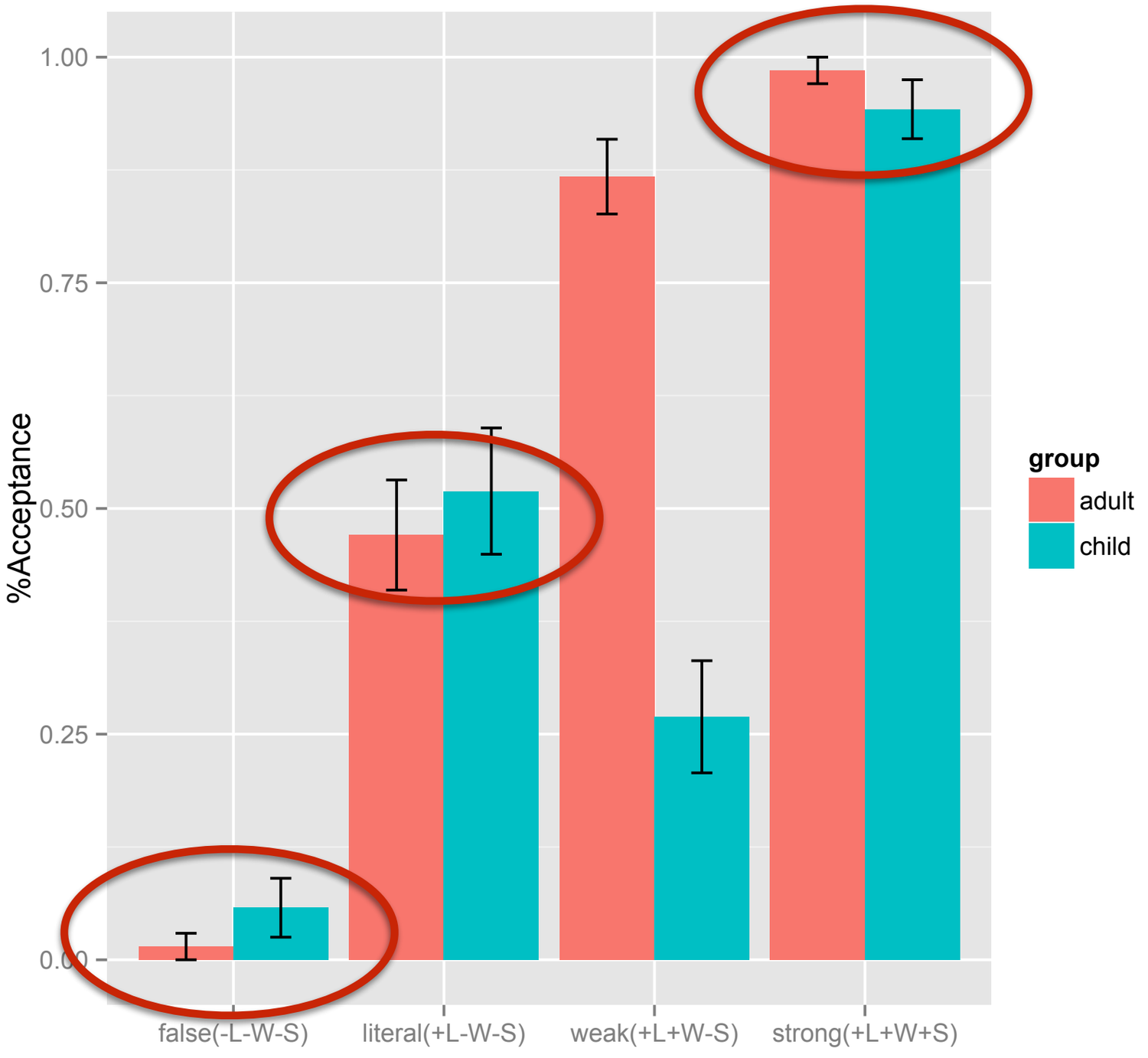
RAH prediction

Children's DIs = Adults DIs

Sig. difference between these three conditions.

No sig. difference between adults and children in each of these conditions.

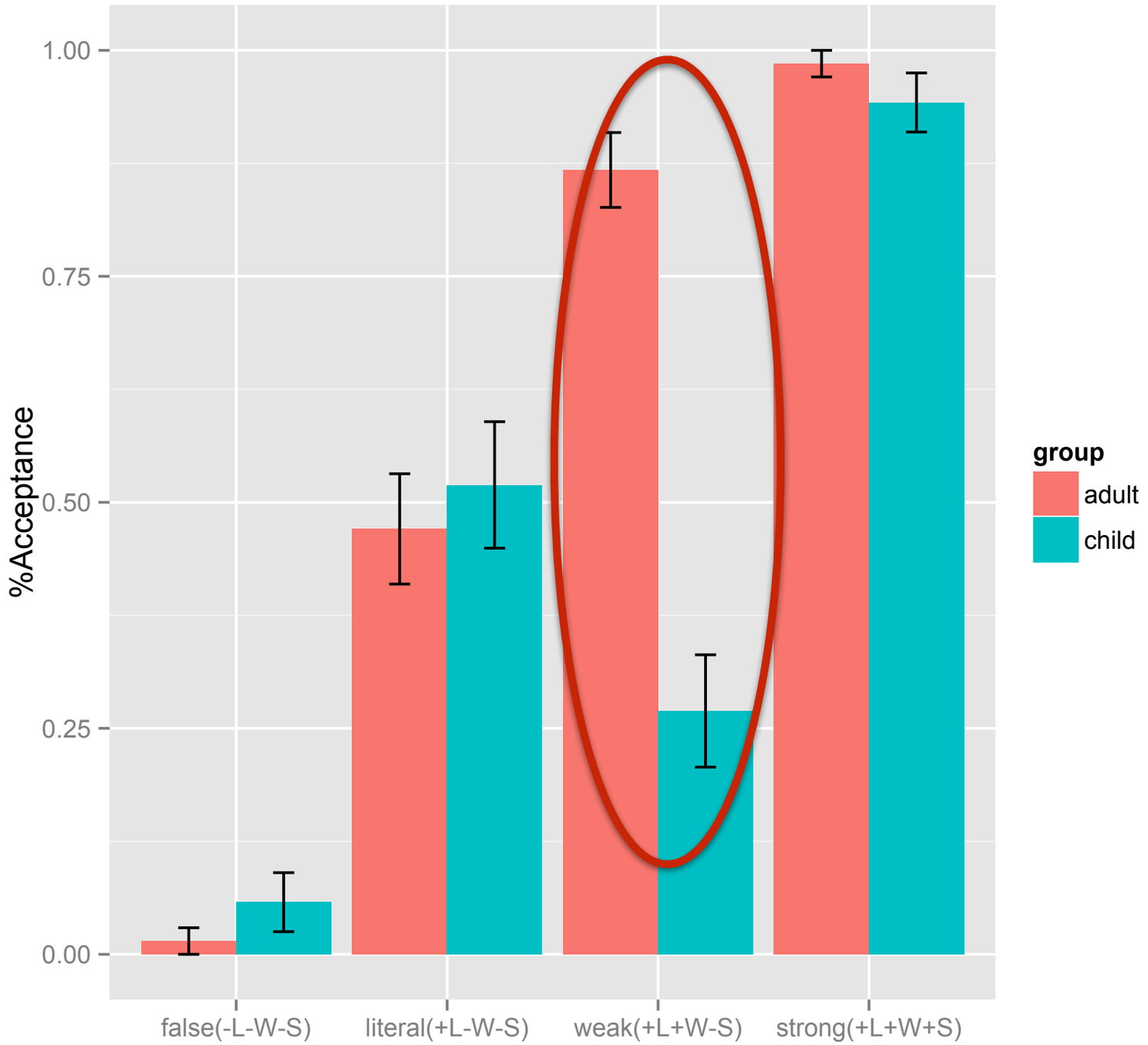
These responses seem consistent with RAH.



RAH verdict

RAH prediction

Children's DIs = Adults DIs

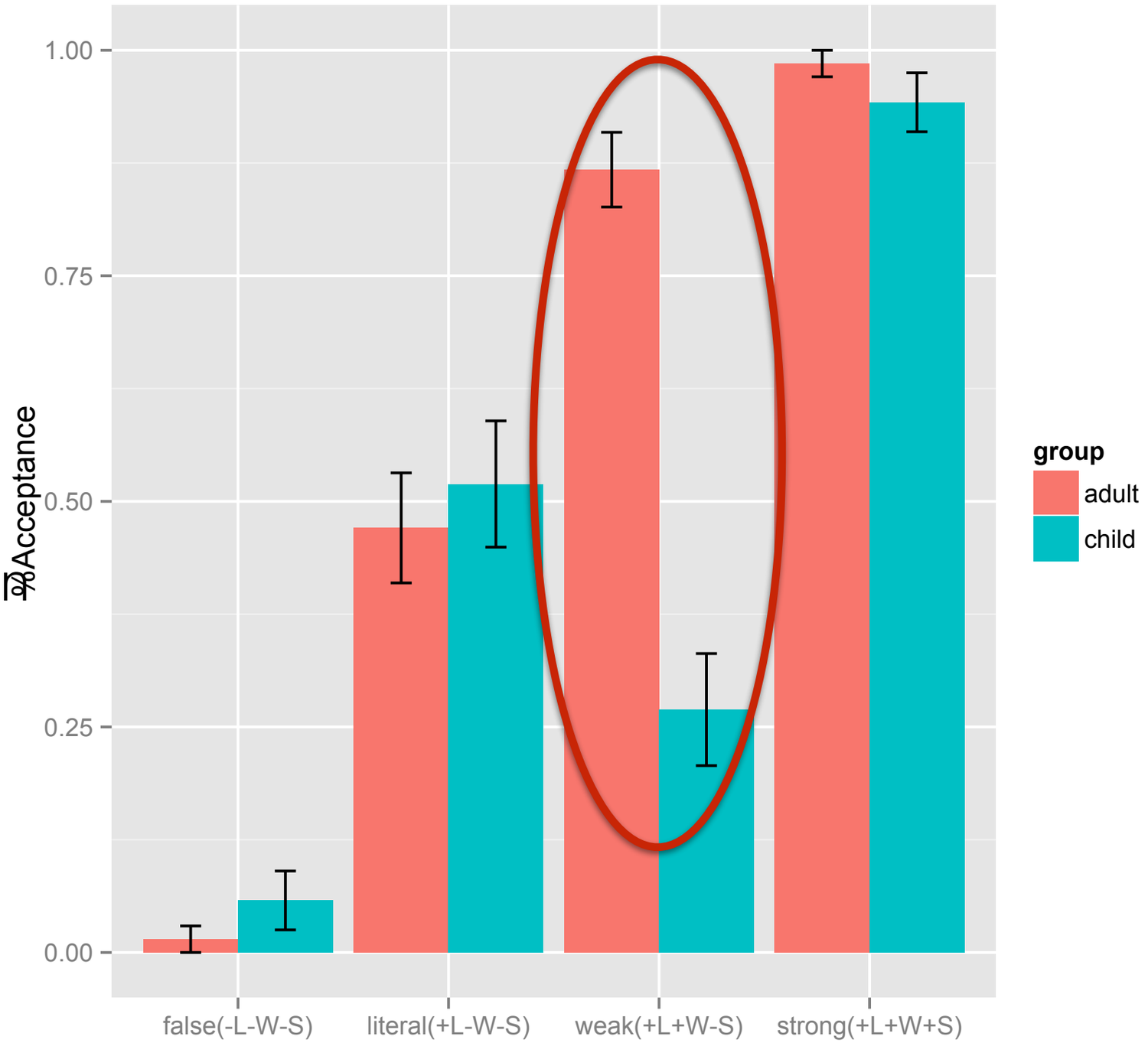


RAH verdict

RAH prediction

Children's DIs = Adults DIs

Sig. difference in Weak condition between adults and children.



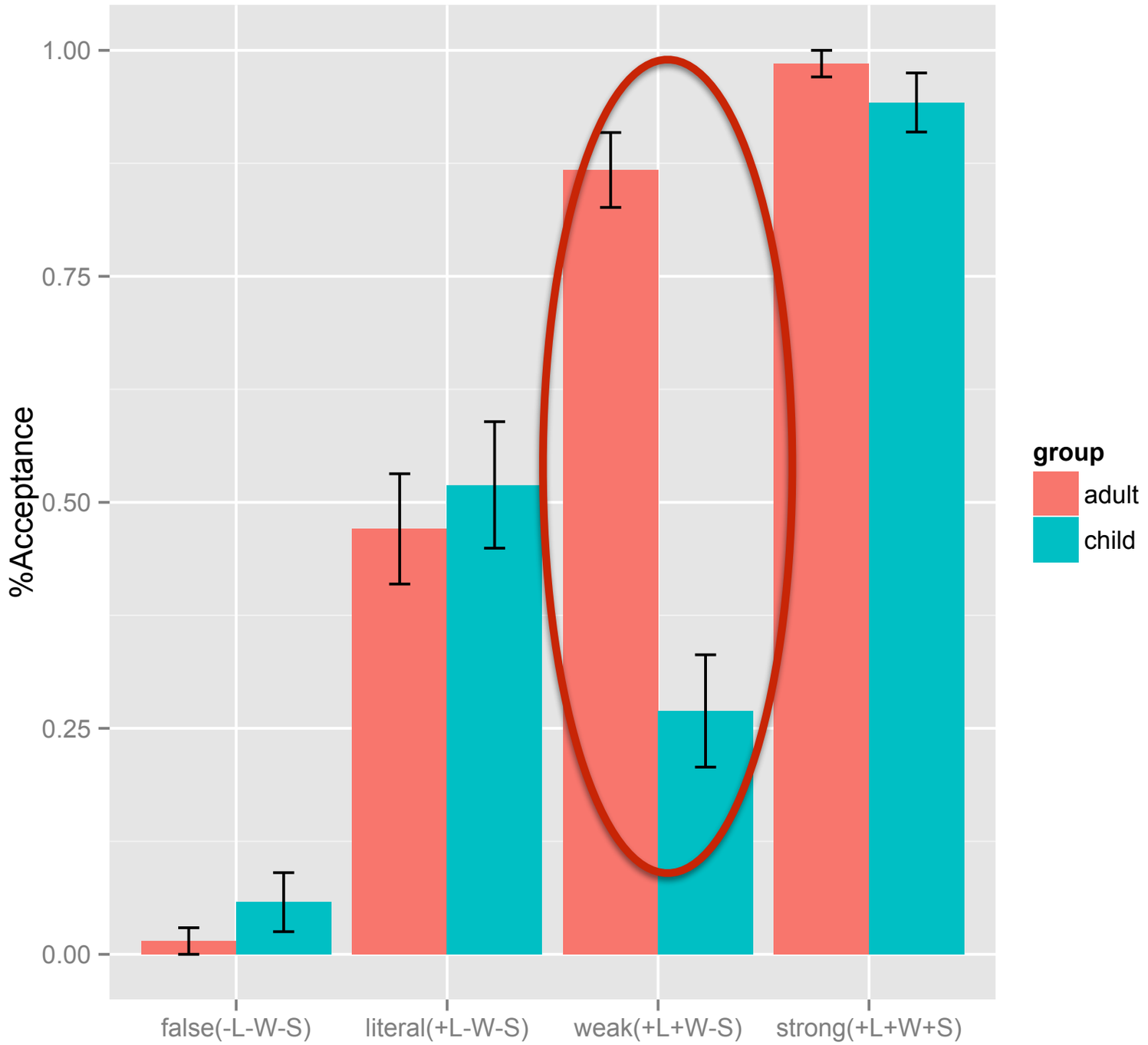
RAH verdict

RAH prediction

Children's DIs = Adults DIs

Sig. difference in Weak conditic
between adults and children.

This difference is not expectec
by the RAH.



RAH verdict

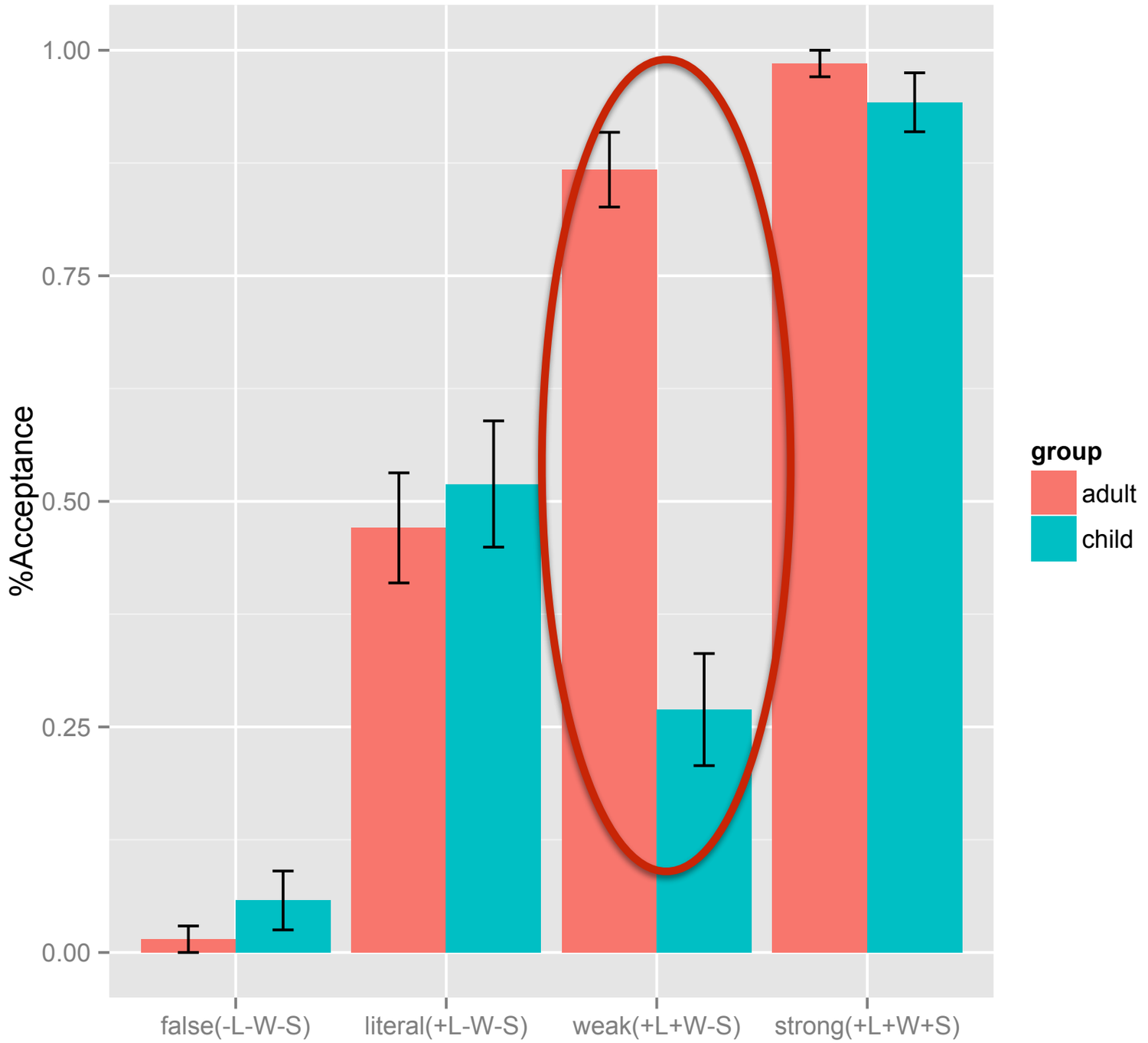
Child Weak Condition Justifications

SSI: No lion ate all of his cookies

“This one ate all of them.”

“This one lit all of them.”

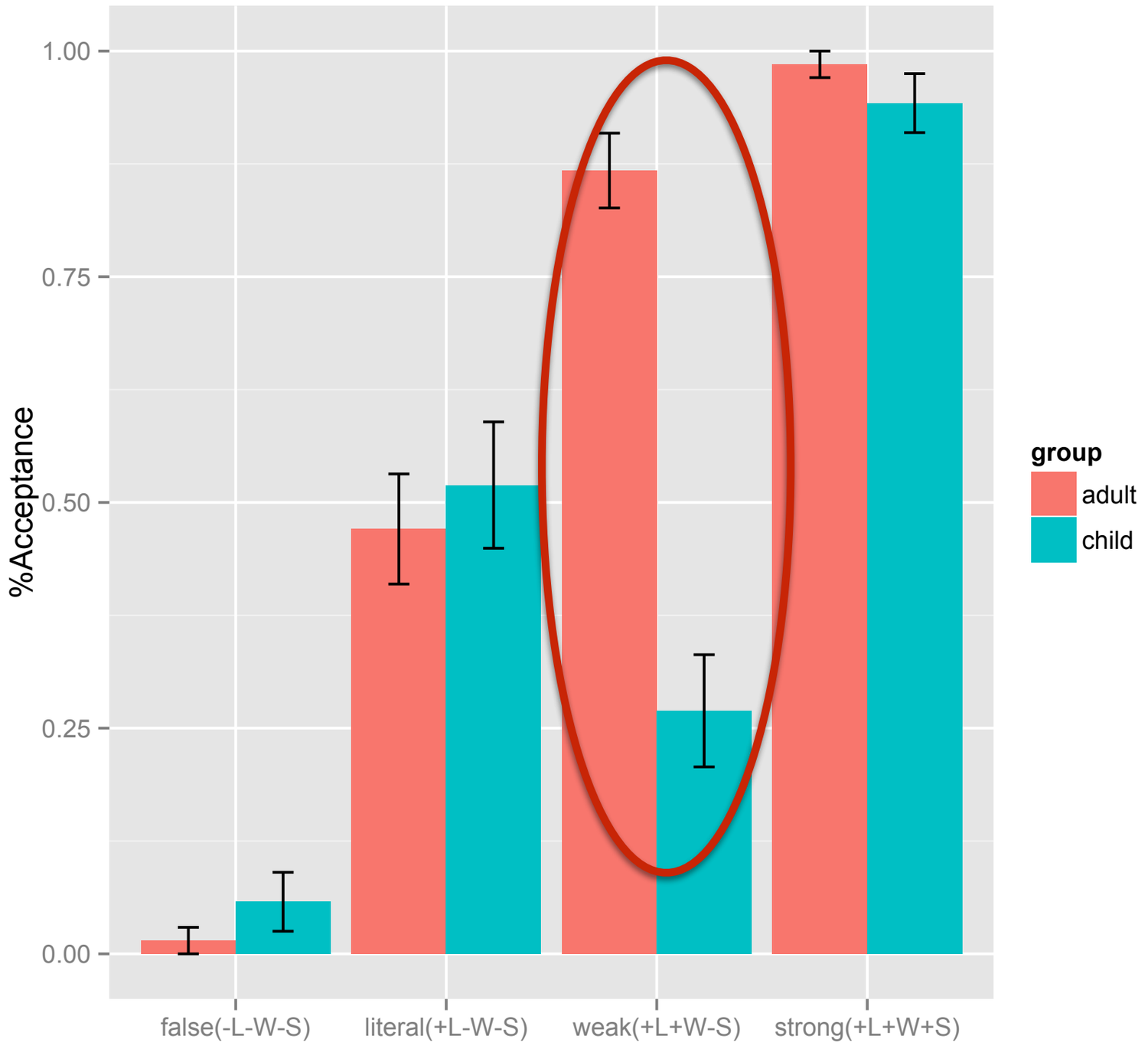
“Those two didn’t really finish them, and that one finished.”



Weak Condition diff.

Possible explanation

1. Characters = Different outcomes.



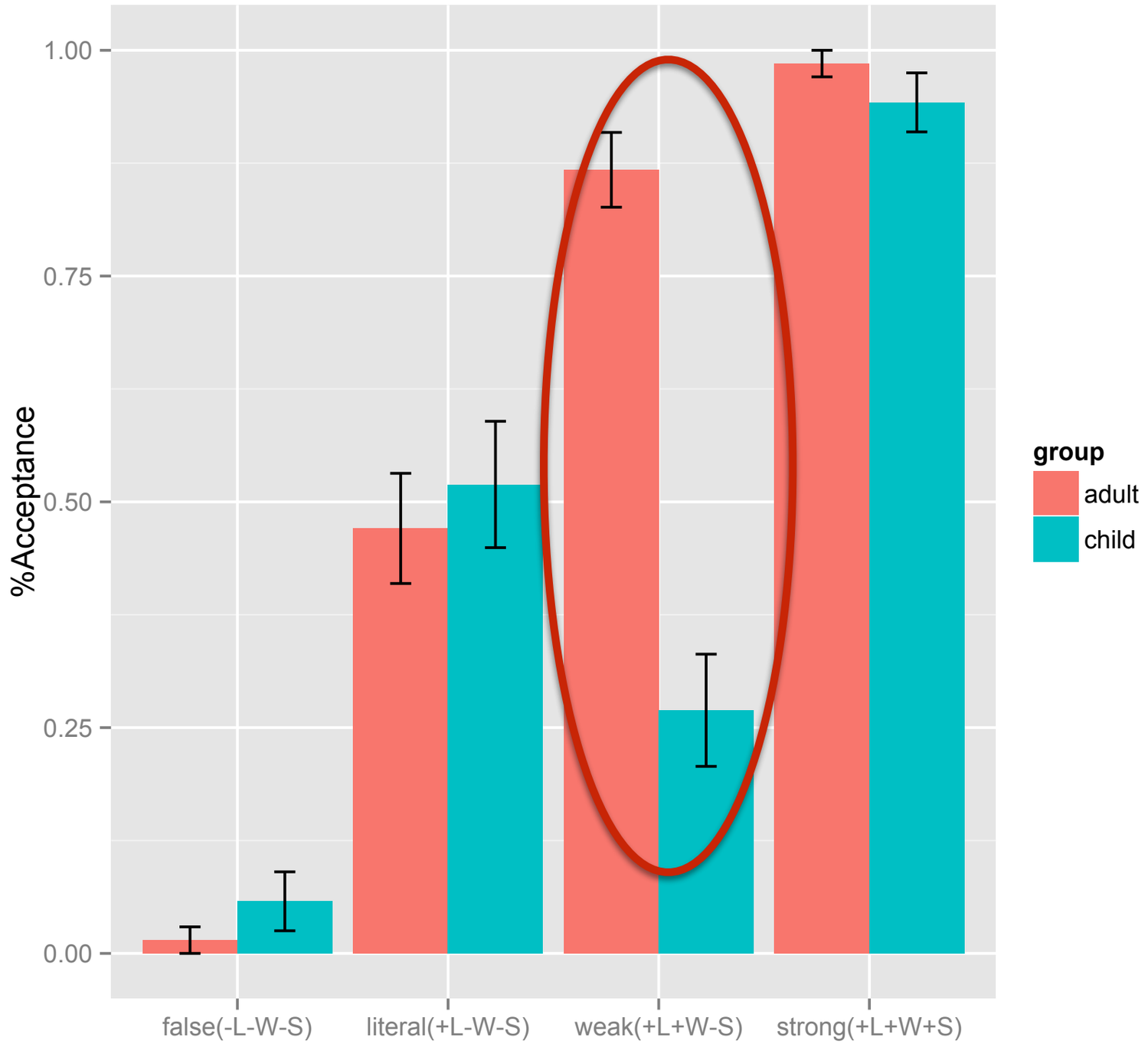
Weak Condition diff.

Possible explanation

1. Characters = Different outcomes.

Every_T control rules out this interpretation.

Every lion ate cookies



Weak Condition diff.

Possible explanation

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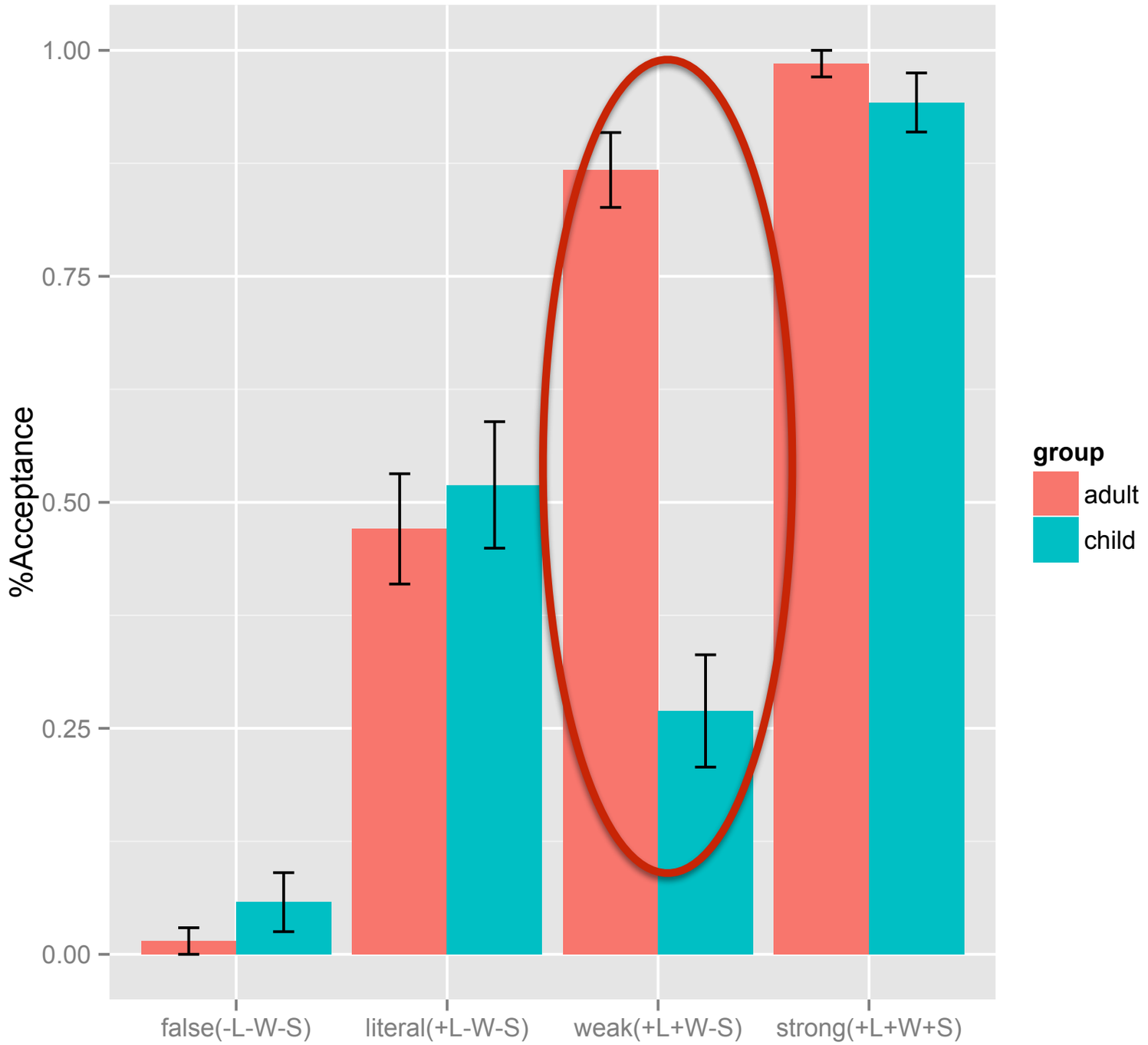
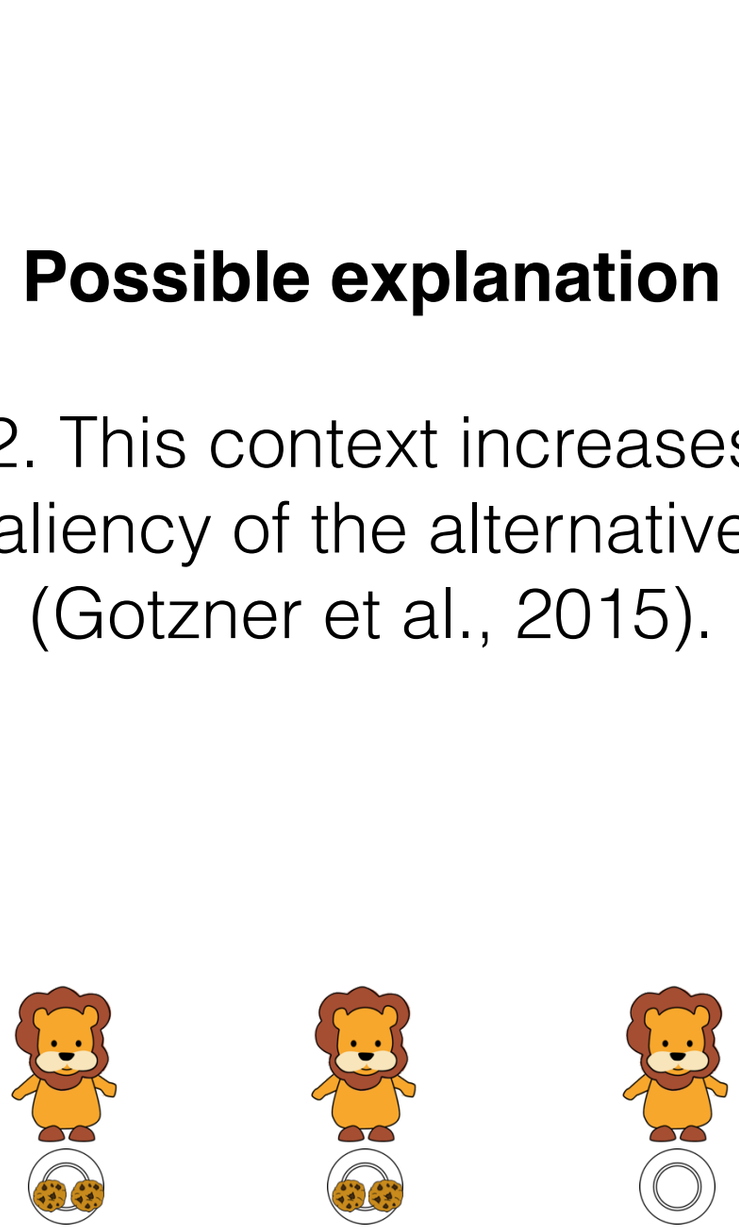
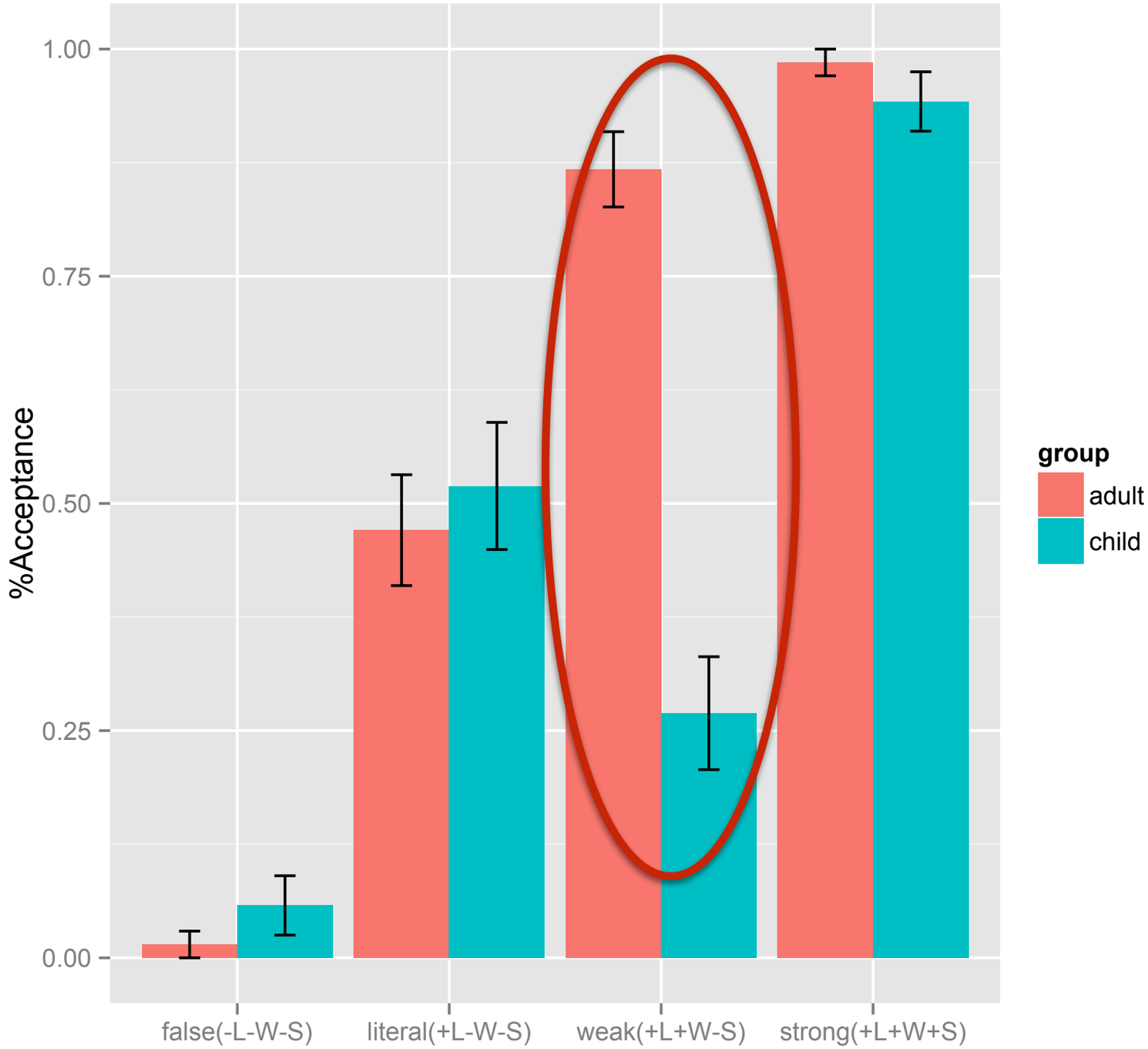


Weak Condition diff.

Possible explanation

2. This context increases saliency of the alternatives (Gotzner et al., 2015).



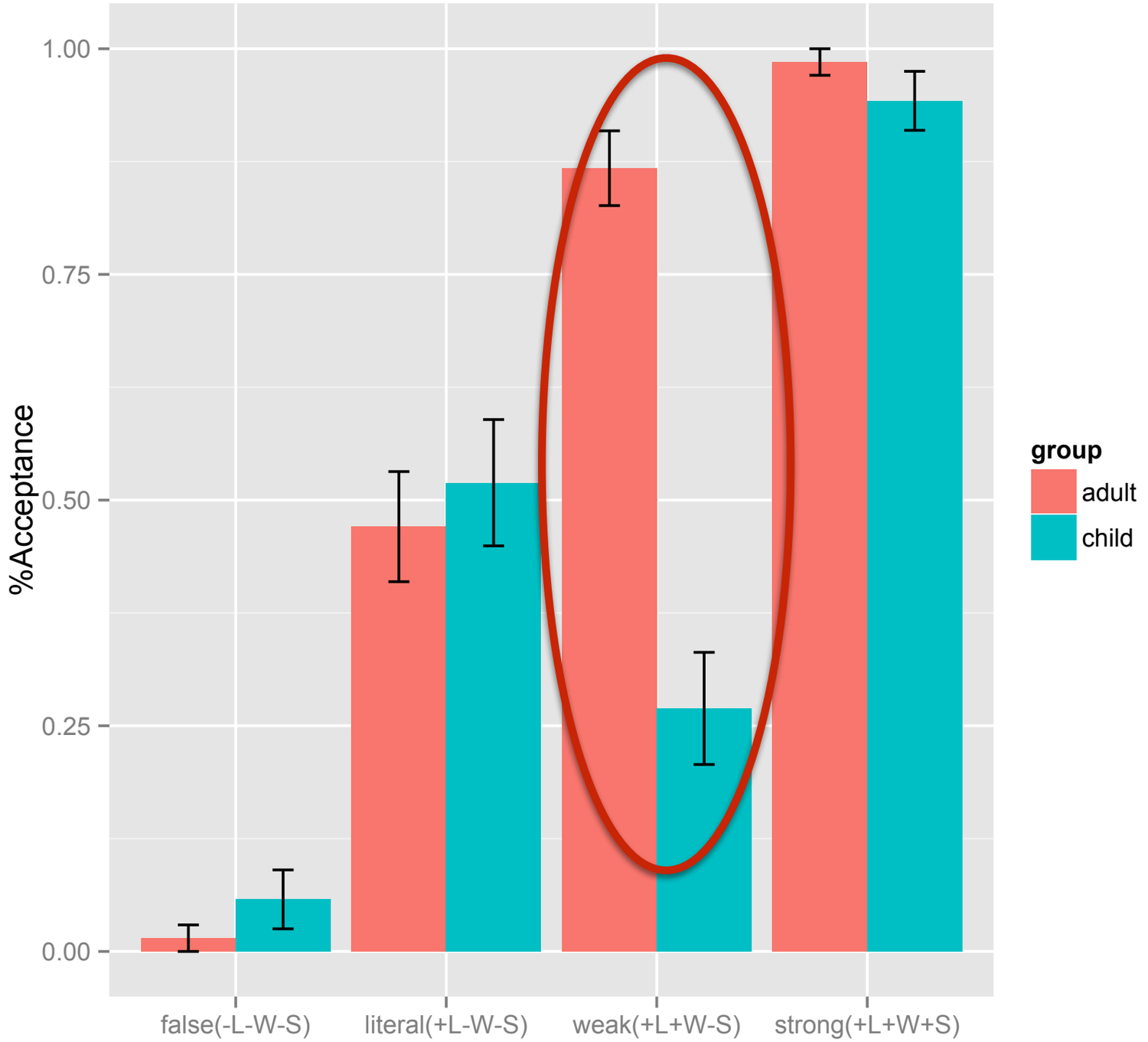


Weak Condition diff.

Possible explanation

2. The lions differed in their activities.

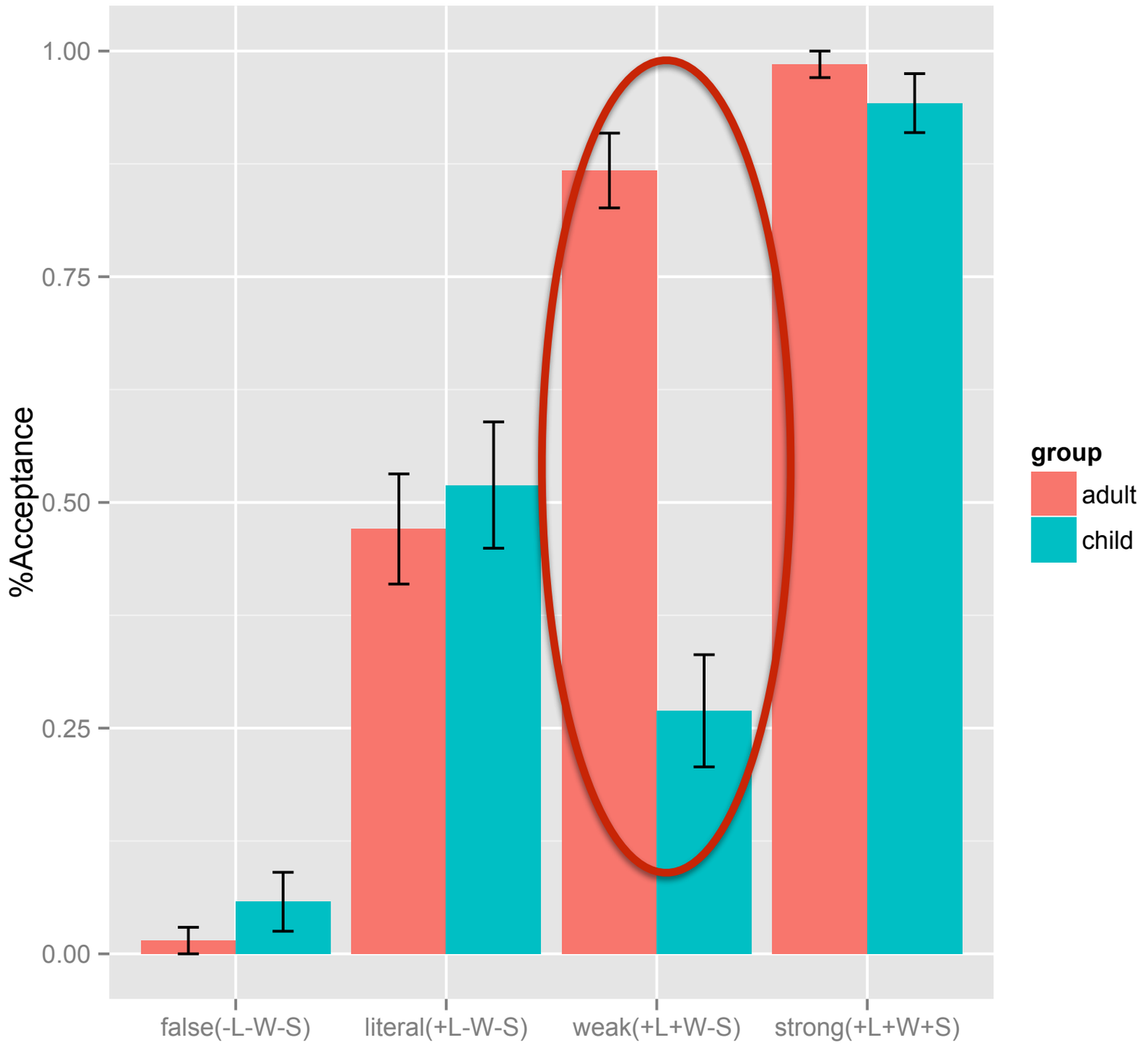
Contrast may have facilitated SI-computation.



Weak Condition diff.

Possible explanation

Why weren't adults facilitated also?



In sum

Children were on a par with adults re. generation of WSIs.

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Children were generating SSIs at a higher rate than adults.

In sum

Children were on a par with adults re. generation of WSIs.

Children were generating SSIs at a higher rate than adults.

These sentences (with multiple scalar terms) do seem to be interpreted differently to the more basic scalar sentences, along the lines of the RAH.

Next Steps

Investigate non-monotonic contexts (as in Chemla & Spector, 2011).

Next Steps

Investigate non-monotonic contexts (as in Chemla & Spector, 2011).

Exactly one lion is eating some of his cookies

Next Steps

Investigate non-monotonic contexts (as in Chemla & Spector, 2011).

Check the stability of this result

Next Steps

Investigate non-monotonic contexts (as in Chemla & Spector, 2011).

Check the stability of this result

Are children locally exhaustifying?

Thanks to Collaborators

Elena Pagliarini

Jacopo Romoli

Lyn Tieu

Stephen Crain

Thank you for your attention

Questions?

Individual response types

Coded participant's into different responders.

	Literal	Weak	Strong
Literal	✓	✓	✓
WSI	✓	✓	✗
SSI	✓	✗	✗
Mixed	?	?	?

Individual response types

Coded participant's into different responders.

✓✗= Accepted/Rejected at least 3/4 items in that condition

	Literal	Weak	Strong
Literal	✓	✓	✓
WSI	✗	✓	✓
SSI	✗	✗	✓
Mixed	?	?	?

Individual response types

	Child	Adult
Literal	2	7
WSI	0	5
SSI	5	1
Mixed	6	4

Non-monotonic

Exactly one lion ate **some** of his cookies

Non-monotonic

Exactly one lion ate **some** of his cookies

WSI

Exactly one lion at **all** of his cookies

Non-monotonic

Exactly one lion ate **some** of his cookies

WSI

NOT[Exactly one lion at **all** of his cookies]

Non-monotonic

Exactly one lion ate **some** of his cookies

WSI

NOT[Exactly one lion at **all** of his cookies]

Exactly one lion ate some of his cookies, and the other lions ate none of their cookies

Non-monotonic

Exactly one lion ate **some** of his cookies

SSI

Exactly one lion ate [Exh]**some** of his cookies

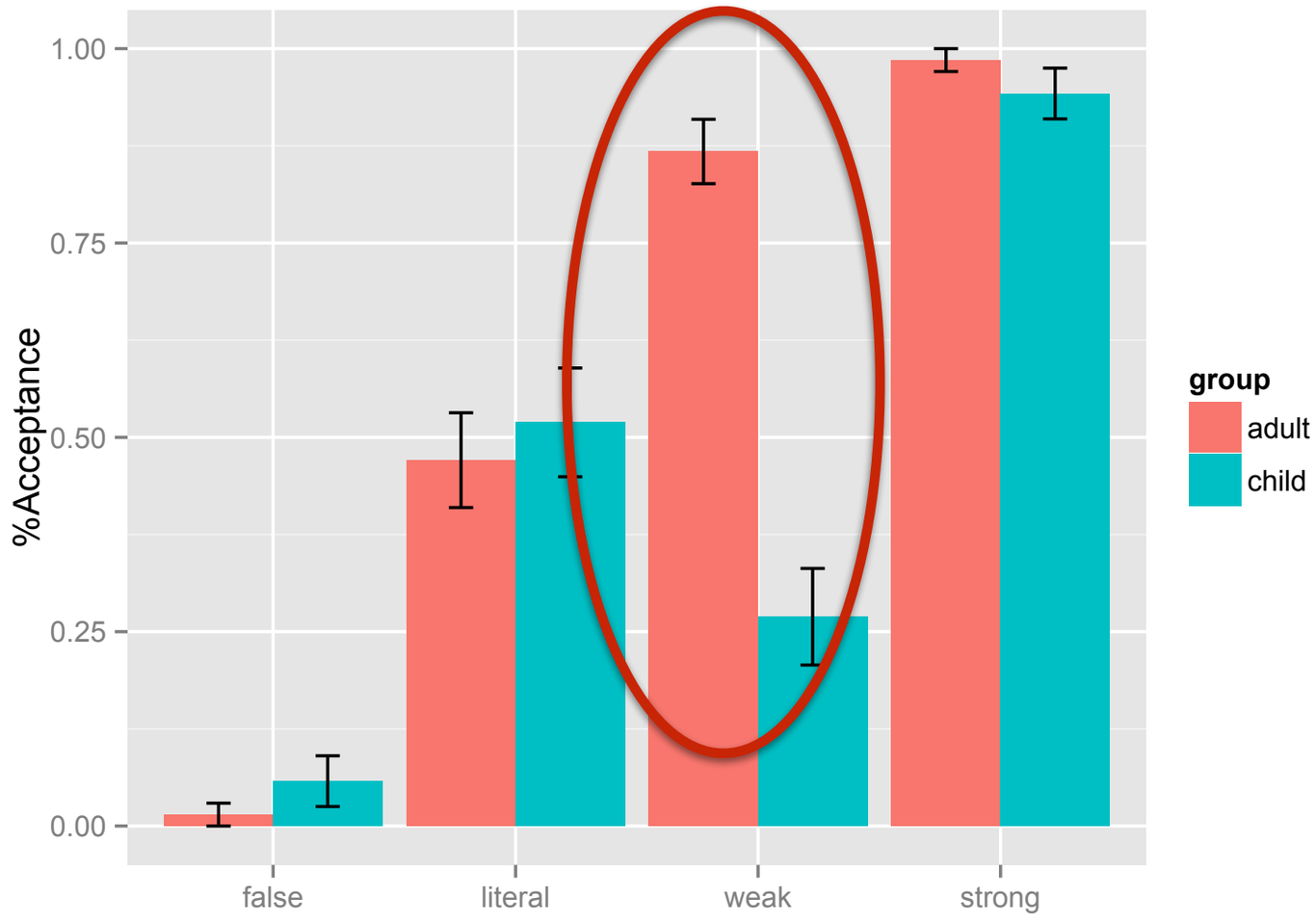
Exactly one lion ate some but not all of his cookies, and the other lions ate either none or all of their cookies

Weak Condition diff.

Possible explanation

The ‘SSI’ is the ‘strongest’ interpretation.

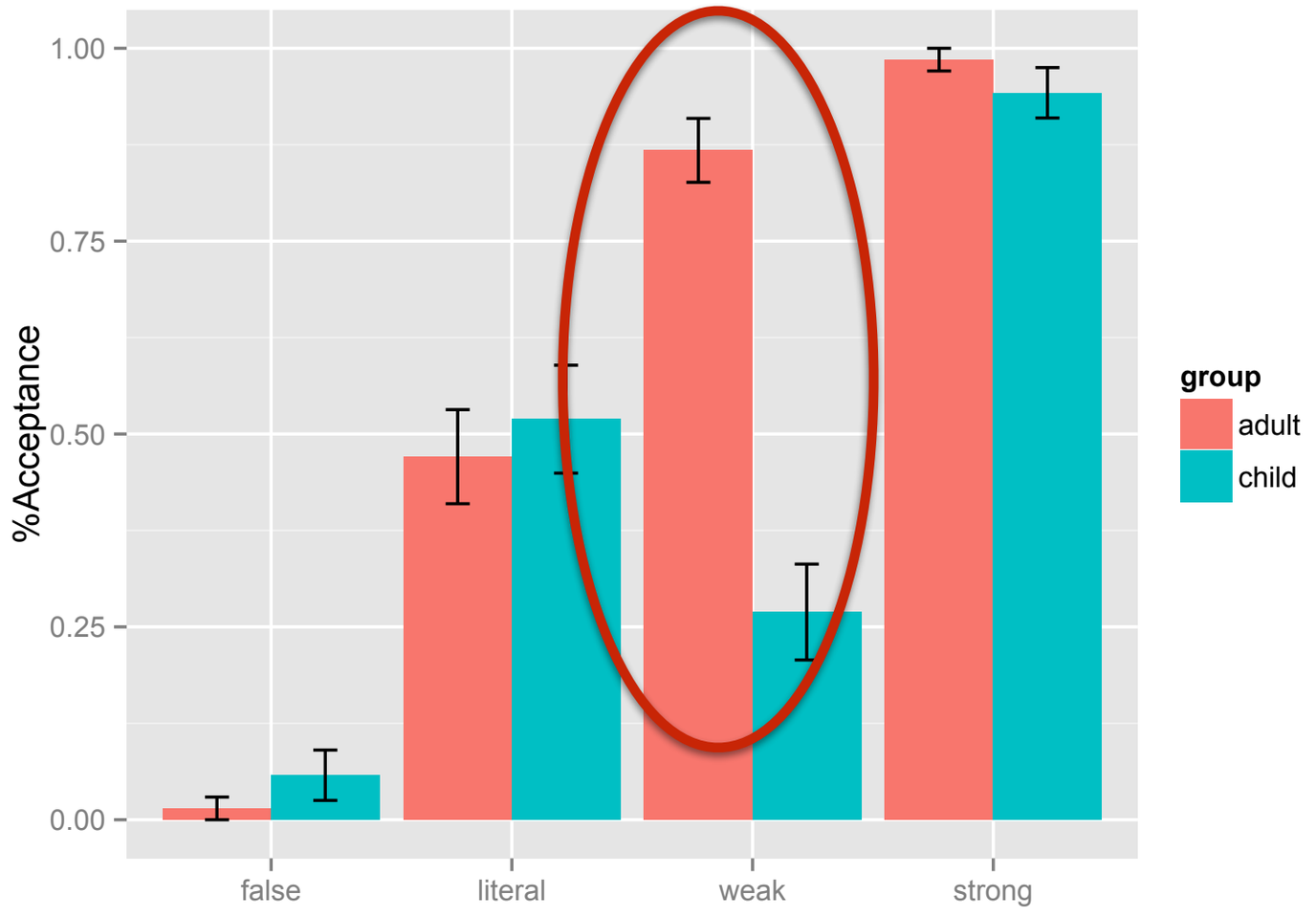
If children gain access to both WSI and SSI, perhaps they prefer SSI due to learnability considerations.



Weak Condition diff.

Possible explanation

If the SSI is interpreted via local SI computation, perhaps children compute SIs at this level ‘first’.



Discussion

This result seems supportive of the idea that presenting alternatives (both contextual and lexical) might facilitate SI-generation.

Discussion

Semantic subset principle? The SSI-reading is the strongest possible interpretation of this sentence. If it is possible for them to generate SIs (both WSI and SSI), SSP might explain why they stick with SSI over WSI?