THE ACQUISITION OF TENSE/ASPECT

Sabine Stoll, Elena Lieven
Max Planck Institute for Evolutionary Anthropology

Productivity: Sampling Issues (Tomasello & Stahl 2004)

- 2 important factors
  - Occurrence (frequency) of the linguistic feature
  - Sample size and density of data collection
    - Influence the probability to detect a feature in the corpus
    - Influence the reliability of the estimates we make
    - Influence the estimated age of the first occurrence

Sampling Issues (Tomasello&Stahl 2004)

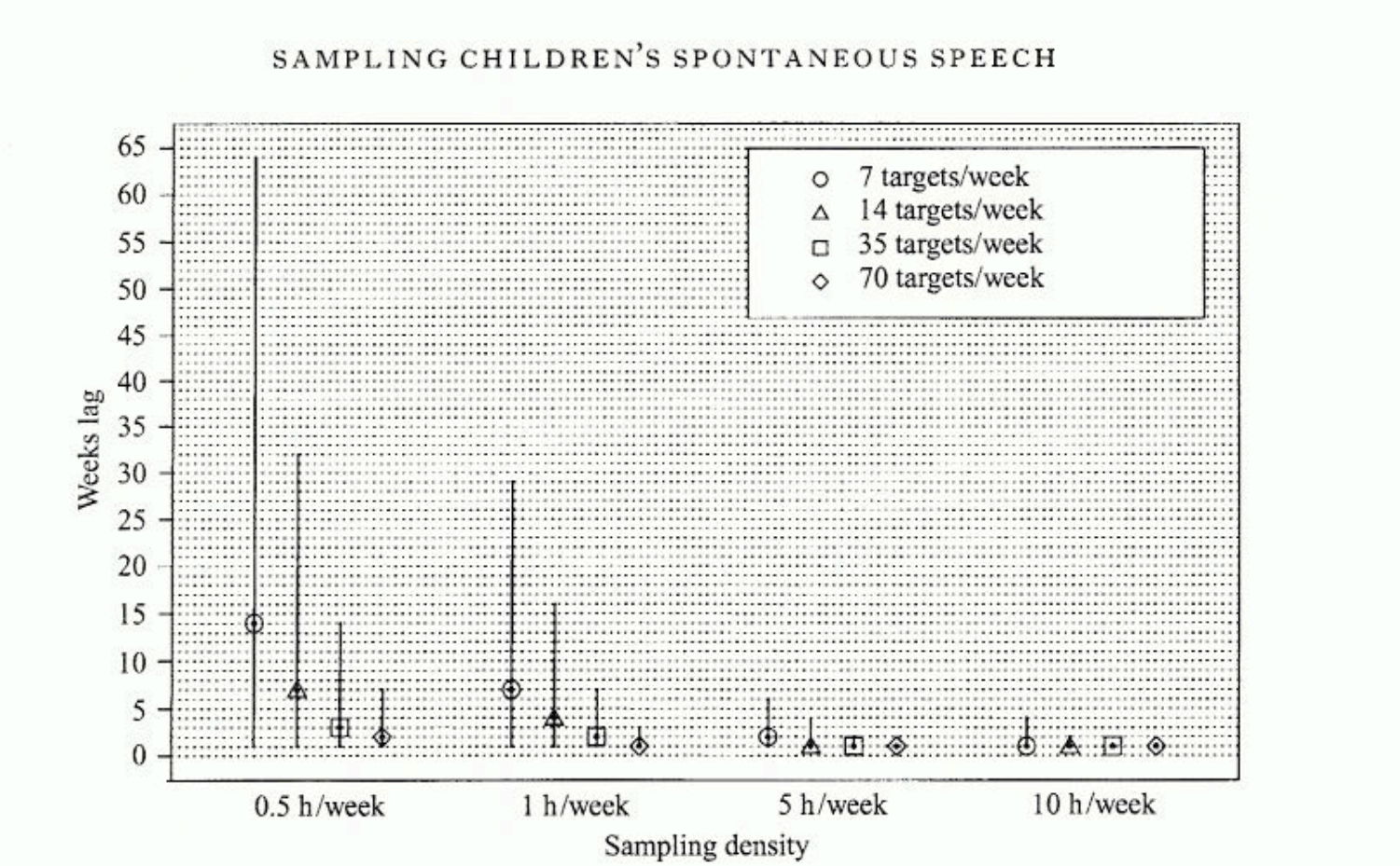
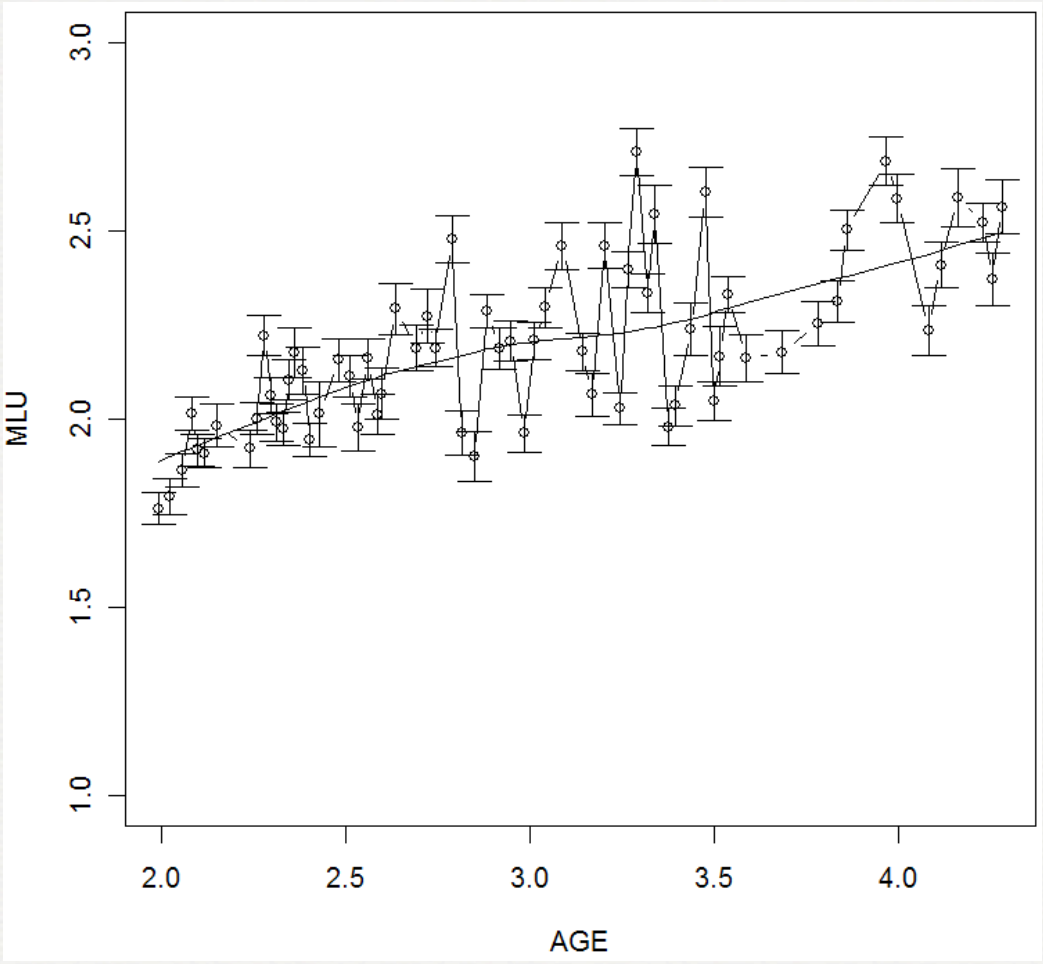


Fig. 7. Lag (delay) in estimated age of emergence (median and 95% confidence intervals) as a function of rate of occurrence and sample density.

Sampling issues: MLU of one Russian child



(Gries & Stoll, 2009)

Time in acquisition

- Crucial part in understanding reality
- No direct experience, but to experience time is to remember changes of events (experienced or reported)
- 2 main categories to express time in language:
  - Tense
  - Aspect

Tense and Aspect

- Tense: “grammaticalisation of location in time.” (Comrie, 1985: 1) (past-present-future)
- Aspect: “grammaticalisation of expression of internal temporal constituency” (Comrie, 1985: 6) (perfective-imperfective)
- Often tense and aspect are interwoven, e.g. perfective aspect and past tense

Aspect

- Perfective vs. imperfective
- Rendille (East Cushitic, Kenya)

(a) khadaabbe chiirta

letter.PL write.IMPF

(b) *khadaabbe chiirte*

letter.PL write.PFV

(Dahl & Velupilllai 2005)

Grammatical aspect

- Perfective aspect

- Imperfective aspect

Lexical aspect: Aktionsarten

- Time schemata (Vendler 1967):
  - Achievements
  - Accomplishments
  - States
  - Activities
- not universally applicable => other classifications such as Dowty (1979), Sasse (1991), Bickel (1996)

Research questions

- How do children learn aspect?
- How can we trace their development?
- When can we state that they have acquired aspect?

How do children learn aspect?

- Correlation between Aktionsarten and aspect and tense and aspect.

  Aspect Hypothesis:

  - Strong empirical tense/aspect patterning in early acquisition:
    - perfective aspect & telic Aktionsart ∞ past tense
    - imperfective aspect & atelic Aktionsart ∞ present tense

Acquisition of aspect cross-linguistically

- Longitudinal observational data
  - English: Brown (1973); Bloom, Lifter & Haffitz (1980); Shirai & Andersen (1995)
  - Italian: Antinucci & Miller (1976)
  - Turkish: Aksu-Koç (1988)
  - Greek: Stephany (1988,1997)
  - Mandarin: Li (1990)
  - Japanese: Rispoli&Bloom (1985), Shirai (1998)
  - Polish: Weist et al. (1984, 1991)
  - Russian: Gagarina (2000), Stoll (2009)
- Experimental data
  - English: Harner (1981) age 3-7; McShane & Whittaker (1988), Bloom et al. (1980)
  - French: Bronckart & Sinclair (1973)
  - Mandarin: Li (1990)
  - Russian: Stoll (1998, 2001, 2003, 2005)

Acquisition of Russian aspect

Question:

Do we find this correlation of tense and aspect in Russian as well?

Methods:

- Longitudinal data (Stoll & Gries in press, JCL)
- Experiments (Stoll 1998, 2001, 2003, 2005)

Russian aspect: What do children have to learn?

- Difference between perfective and imperfective verbs
  - Morphology
  - Function/pragmatics
  - Semantics

Russian aspect: What do children have to learn?

- Grammatical differences between perfective and imperfective aspect

	Imperfective *rasskazyvat'* 'tell'	Perfective *rasskazat'* 'tell'
Future	*budu rasskazyvat'*	*rasskazhu*
Present	*rasskazyvaju*	----
Past	*rasskazyvala*	*rasskazala*

Russian aspect: What do children have to learn?

- To use a verb adequately, a child needs to know about the aspect of the verb, i.e. whether the verb form is perfective or imperfective, (influence for temporal interpretation)

- Problem: there is no uniform marker, neither for the perfective nor the imperfective aspect. How do children learn which verb form is perfective and which is imperfective?

Russian aspect: What do children have to learn?

Imperfective	Perfective
dumat'	*dat'*
vorozhit'	*vorotit'*
brosat'	*brosit'*
poluchat'	*podumat'*

Russian aspect: What do children have to learn?

- Morphology of Russian aspect

Rule 1:

Verbs with the suffixes {-a/-aj}, {-va/-vaj} or {-iva/-ivaj} are imperfective.
e.g. *perepis-yv-at'* 'copy', *rasskaz-yv-at'* 'tell'

Exceptions: double prefixation, z.B. *po-vy-task-yv-at'* 'pull out'

Rule 2:

Prefixed verbs are perfective
e.g. *pere-pisat'* 'copy', *po-dumat'* 'think for a while', *za-plakat'* 'start crying'

Exceptions: e.g. *pred-videt'* 'forsee', *pred-čuvstvovat'*, *pri-xodit'* 'come'

Rule 1 and 2 are ordered hierarchically. Rule 1 wins over Rule 2 if both could apply. e.g. *pere -pis-yv-at'* 'copy'

(Stoll 1998)

Russian aspect: What do children have to learn?

Rule 3:

Simplex verbs are imperfective.

e.g. *dumat'* 'think', *spat'* 'sleep', *čitat'* 'read'

Exceptions: verbs of conjugation class V, ending in *-it'*, *e.g. brosit'* 'throw'; *dat'* 'give', *vzjat'* '*take*'.

Rule 4:

Verbs with the suffix *-nu* are perfective.

e.g. *pryg-nu-t'* 'jump once', *krik-nut'* 'scream once'

Exceptions: z.B. *tonut'* 'drown', *gnut'* 'bend', *tjanut'* 'pull'.

(Stoll 1998)

Russian aspect: What do children have to learn?

Functions of Russian aspect

- **Perfective aspect**:
  - Expression of sequentiality

(1) *On vstal.pfv i otkryl.pfv okno.*
He stand.up.PST.pfv and open.PST.pfv. window
'He got up and opened the window.'

- Sequentiality is not a necessary condition.

(2) *Včera zaxodil Saša. On s vosxiščeniem posmotrel.pfv na Natalku, i Serega zamečal, čto ona pri etom opustila.pfv glaza.*
'Yesterday, Sasha came by. With excitement he looked at Natasha and Serega observed that she lowered her eyes (while he looked at her).'

Russian aspect: What do children have to learn?

Imperfective aspect:

- Durative function

  (3) *A von Maša edet.ipfv na velosipede.*

  'Over there, Masha is riding on (her) bike.'

- Statement of fact function

  (4) *Ty čital.ipfv Annu Kareninu?*

  'Have you read Anna Karenina?'

- Not all verbs can be used with all functions

Russian aspect: What do children have to learn?

Semantics of Russian aspect

- The perfective aspect signals or emphasizes one or more boundaries in the semantics of verb (e.g. *napisat' pis'mo* 'write a letter', *zaplakat'* 'start crying', *počitat'* 'read for a while'). The imperfective aspect is unmarked with respect to boundaries of the described by the verb. (cf. Forsyth, Timberlake, Breu)

How is Russian aspect learned?

- Rules are complicated with lots of exceptions and lots of rote learning required
- It is unlikely that aspect is decoded by morphological rules alone.
- How is aspect learned?
  - As a unified grammatical category? or
  - In a piecemeal fashion via lexical aspect/ Aktionsarten?

Aktionsart classification

Time Schemata (Vendler 1967):

- Achievements: reaching the top
- Accomplishments: drawing a circle
- States: knowing
- Activities: running

- classification is not sufficient for Russian (Flier, 1985)

Aktionsarten in Russian

Aktionsart	Schema	Example
Durative	---------	*igrat'* 'play'
Ingressive	|--------	*zaplakat'* 'start crying'
Delimitative	|-------|	*podumat'* 'think for a while'
Semelfactive	|	*prygnut'* 'jump once'
Telic	---------|	*perepisat'/perepisyvat'* 'copy'

(Stoll, 1998)

Aktionsarten in Russian

Aktionsart	Schema	Example	Aspect
Durative	---------	*igrat'* 'play'	IPFV
Ingressive	| --------	*zaplakat'* 'start crying'	PFV
Delimitative	| ------- |	*podumat'* 'think for a while'	PFV
Semelfactive	|	*prygnut'* 'jump once'	PFV
Telic	--------- |	*perepisat'* / *perepisyvat'* 'copy'	PFV / IPFV

(Stoll, 1998)

Results from other languages

Aspect Hypothesis:

- Strong empirical tense/aspect patterning in early acquisition:
  - perfective aspect & telic Aktionsart ~ past tense
  - imperfective aspect & atelic Aktionsart ~ present tense

Acquisition of aspect cross-linguistically

- Longitudinal observational data
  - English: Brown (1973); Bloom, Lifter & Haffitz (1980); Shirai & Andersen (1995)
  - Italian: Antinucci & Miller (1976)
  - Turkish: Aksu-Koç (1988)
  - Greek: Stephany (1988,1997)
  - Mandarin: Li (1990)
  - Japanese: Rispoli&Bloom (1985), Shirai (1998)
  - Polish: Weist et al. (1984, 1991)
  - Russian: Gagarina (2000), Stoll (2009)
- Experimental data
  - English: Harner (1981) age 3-7; McShane & Whittaker (1988), Bloom et al. (1980)
  - French: Bronckart & Sinclair (1973)
  - Mandarin: Li (1990)
  - Russian: Stoll (1998, 2001, 2003, 2005)

Aspect in the input?

- Brown (1973) and Stephany (1988) hypothesized that the distributions in the input are similar to that of the output.

  Distributional Bias Hypothesis:

  - The input provides a similar distribution of tense-aspect forms as found in the child data (Shirai & Anderson 1995: 747).

  However:

  - There are few studies relating the child's output to the child's input in this area. Thus, we do not know whether the patterns in children's speech are also found in child-directed speech and in adult-adult speech

How is aspect learned?

Stephany (1981) was first to look at the input and compare it to the output of children (Greek)

Results: very similar distributions

- In the mothers 96% of all past forms are perfective
- In children 100% of all past forms are perfective.
- In adult to adult speech there are more imperfective verbs in the past tense than in child directed speech.

How is aspect learned?

- Shirai & Andersen (1995)
- data: Adam: 2;3 – 4;10, Eve: 1:6 – 2;3, Naomi: 1;6 – 4;9
- Each child‘s data were grouped into MLU- based stages.

How is aspect learned?

Results (Shirai&Anderson 1995):

- No differences found between the mothers' speech
- Some differences were found for between the stages of the children (but not statistically evaluated).

However:

- We learn only in detail about MLU stage 1 but we don't know about development.
- We don't know about how the speech of the mothers compares to the speech of the children.

How is aspect learned?

- Aksu-Koç (1998)
- Data: One Turkish mother/child pair, (1;3-1;10) 19 sessions
- Methods: Frequency data for Tense × Aktionsart pooled for mother and child and then split into five stages according to the flexibility of use of aspect morphology (analysis of % for Tense × Aktionsart)

  Results:
- Stage 1: mother doesn't use past tense much (like the child)
- Strong correspondence between the mother and the child --> support for the Distributional Bias Hypothesis
- The child is more conservative at the beginning of the development: support for the aspect hypothesis
- However
  - The pooling of the data rules out the analysis of interactions
  - No standard statistical tests were performed (e.g., to determine differences between the postulated stages)

Distribution of tense and aspect in Russian children and their caregivers

- How is the distribution of tense and aspect in spontaneous language? (Aspect Hypothesis (Shirai&Andersen 1995))
- Do we find a development in the use of tense and aspect distributions? If yes, how does this development look like?
- How do the distributions look like in child directed speech? Are they similar? (Distributional Bias Hypothesis (Andersen, 1993)).

Tense aspect distributions in a longitudinal corpus of Russian

General goal: Introduce a statistical method

- that allows to trace development in longitudinal corpora (in general).
- that correlates the input of the child with the output

- Specific goal: longitudinally trace the children's acquisition and development of tense/aspect in corpora

(Stoll & Gries, 2009)

Data

- Corpus of Russian Child Language (Stoll)
  - 4 target children video-recorded over several years (weekly hour long recordings)
  - orthographic transcription of all utterances
  - stochastic Tagger, (Roland Meyer, University of Regensburg)
  - hand-correction of the tags

(Stoll & Gries, 2009)

Glossing (Roland Meyer)

```
*ANJ:a   ja        zhuju
%mor:  SOJUZ MEST-LICH:1p:im:ed GL:nast:1:ed:nevozvr:nesov
   zhevachku.
        SUW:zhen:ed:vin:neodush
*PAP:zhuesh'        zhevachku?
%mor:  GL:nast:2:ed:nevozvr:nesov SUW:zhen:ed:vin:neodush
*PAP:a     s     kakim
%mor:  SOJUZ   PLG:tvor  MEST-VOPR:tvor:ed:muzh:pril
       ona             vkusom?
       MEST-LICH:3p:im:ed:fem    SUW:muzh:ed:tvor:neodush
```

Data

- Exclusion of verbs with ambiguous coding and imperatives
- Manual checking of grammatical tags of all verb forms.
- For each verb form, we retrieved its tense marking and its aspect marking

TABLE 1. *Summary of the analyzed recordings*

Child	Age span	Recordings	Child utterances	Caregiver utterances
Child 3	1;11.28–4;3.12	80	6,796	31,687
Child 4	3;1.8–6;7.12	117	19,652	50,611
Child 5	2;3.17–5;6.26	66	11,447	20,749
Child 6	11;7.18–13;11.1	42	5,524	12,697

(Stoll & Gries, 2009)

Data analysis

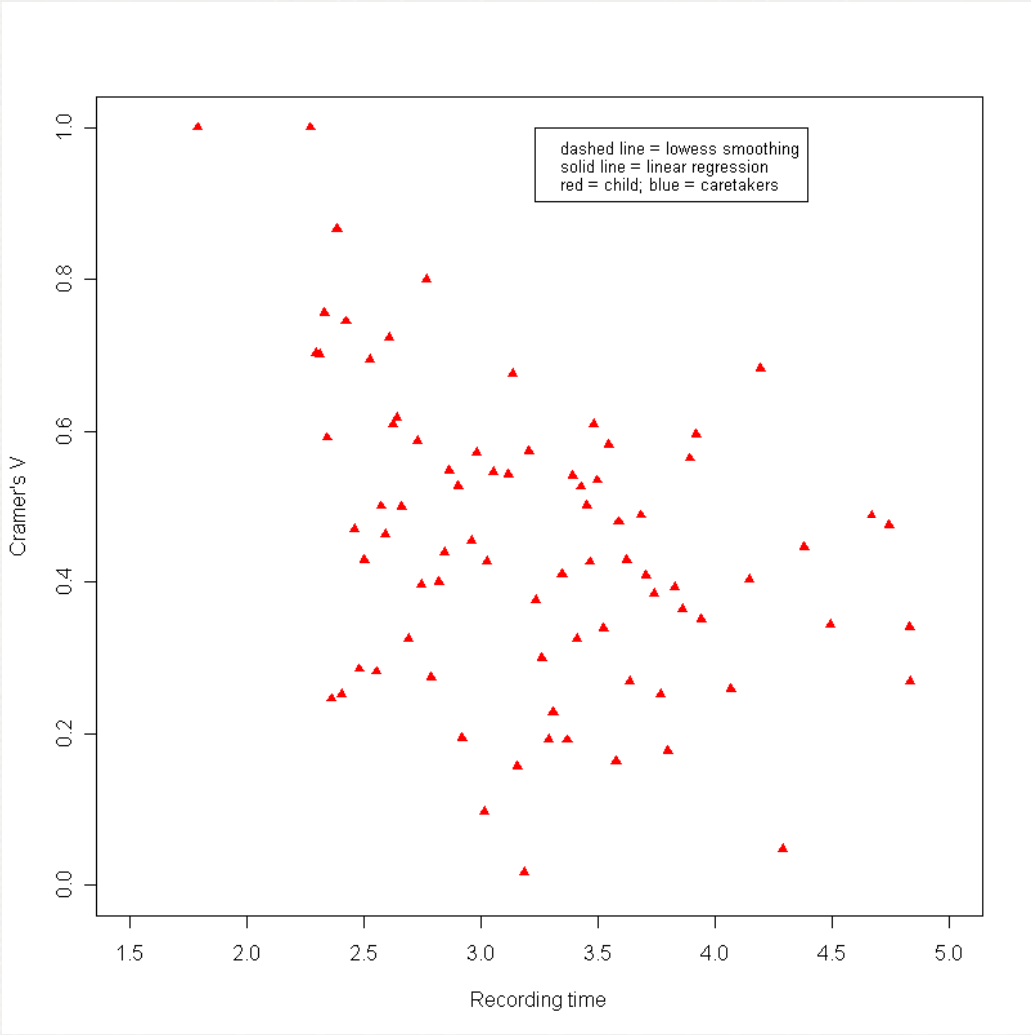
- Since we are interested in the association between tense and aspect, we use an association measure as our most central statistic: Cramer's V
- Measure of correlation
- ranges from 0 to 1
- is (close to) 0 when tense and aspect are not correlated
- is (close to) 1 when tense and aspect are strongly correlated
- is an effect size, i.e. unaffected by (different) sample sizes

Data analysis

- Plotting the data
  - for each recording (on the x-axis), we plotted
    - the Cramer's V values of the child (on the y-axis)

(Stoll & Gries, 2009)

Results for Child 3



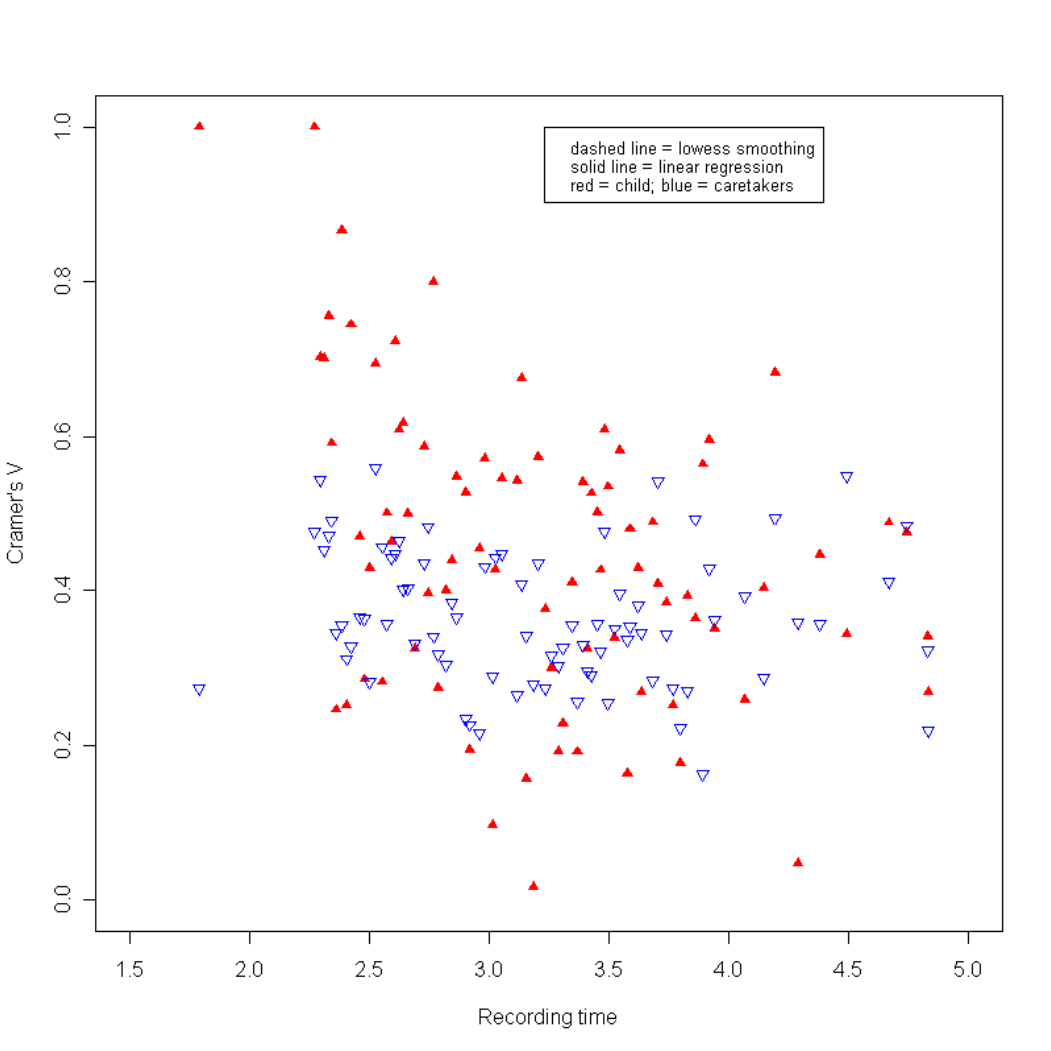
(Stoll & Gries,2009)

Data Analysis

- Plotting the data
  - for each recording (on the x-axis), we plotted
    - the Cramer's V values of the child (on the y-axis)
    - the Cramer's V values of the caretakers (on the y-axis)

(Stoll & Gries, 2009)

Results for Child 3



(Stoll & Gries, 2009)

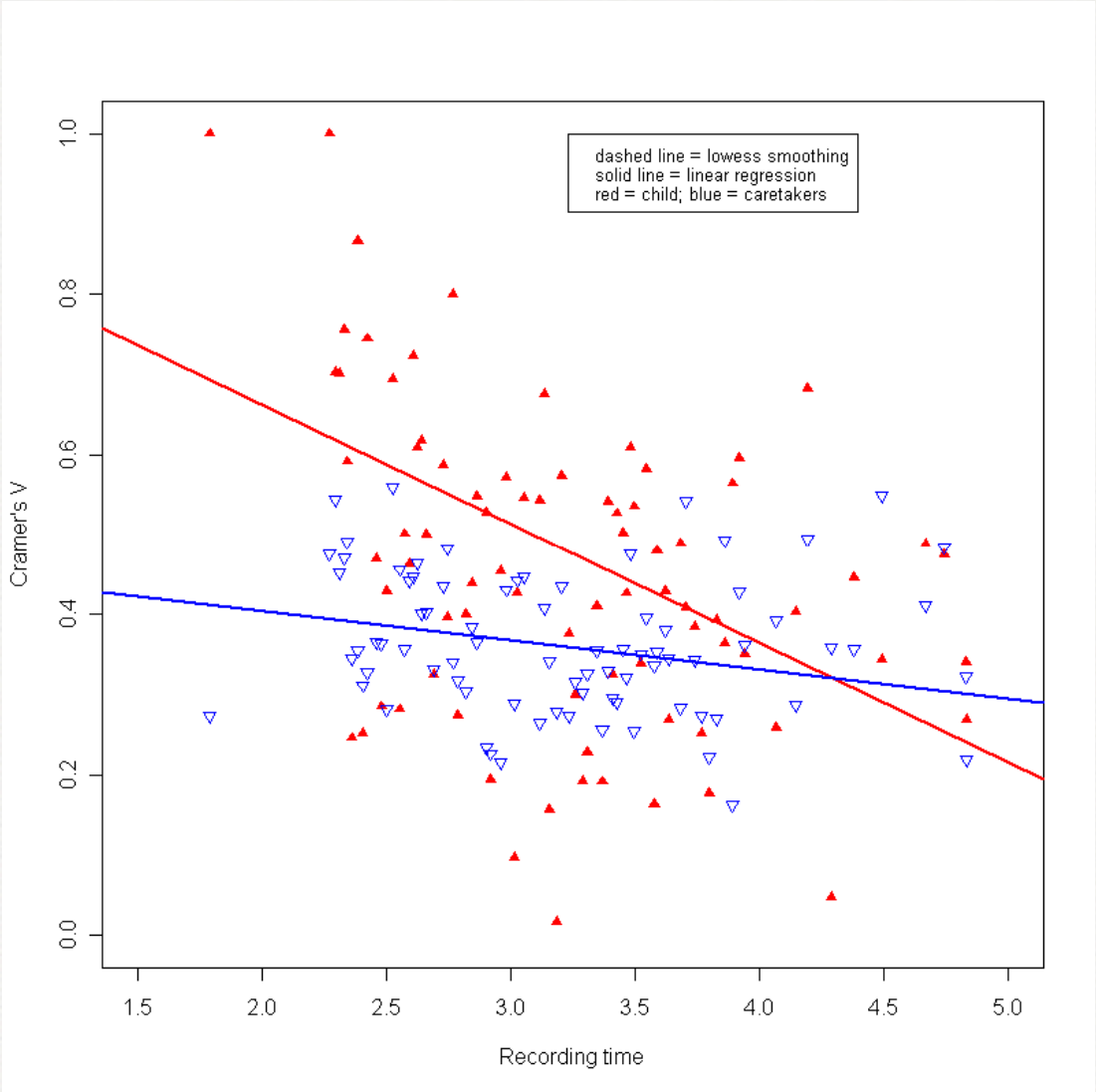
Data analysis

Plotting the data:

- for each recording (on the x-axis), we plotted:
  - the Cramer's V values of the child (on the y-axis)
  - the Cramer's V values of the caretakers (on the y-axis)
- to each of these scatterplots, we added a line resulting from a linear regression

(Stoll & Gries, 2009)

Results for Child 3



(Stoll & Gries, 2009)

Data Analysis

- The use of simple correlational techniques (Pearson's r or simple linear regression) is not useful
- linear regressions are particularly sensitive to outliers
- linear regressions are particularly insensitive to curvature
- Thus, as a simple summary statistic, such measures provide less information than they hide

(Stoll & Gries, 2009)

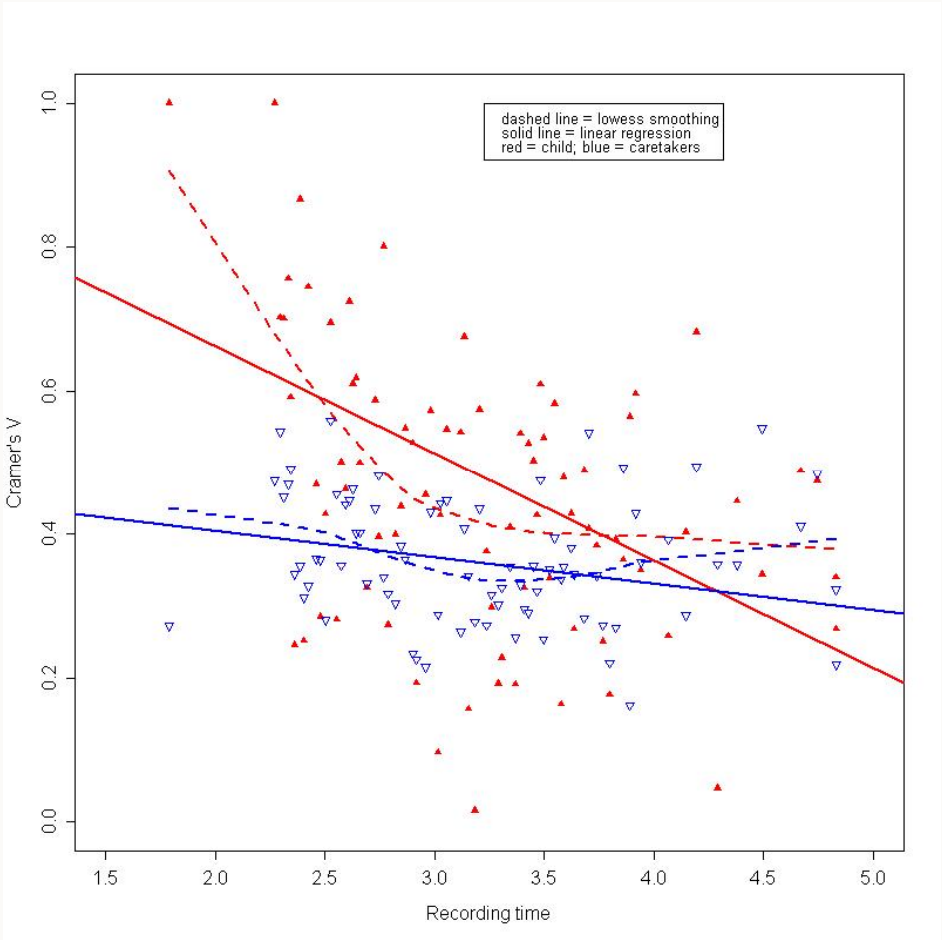
Data Analysis

Plotting the data

- for each recording (on the x-axis), we plotted
- the Cramer's V values of the child (on the y-axis)
- the Cramer's V values of the caretakers (on the y-axis)
- to each of these scatterplots, we added
- a line resulting from a linear regression
- a line resulting from a non-parametric smoothing technique (locally weighted robust regression; cf. Cleveland 1979)

(Stoll & Gries, 2009)

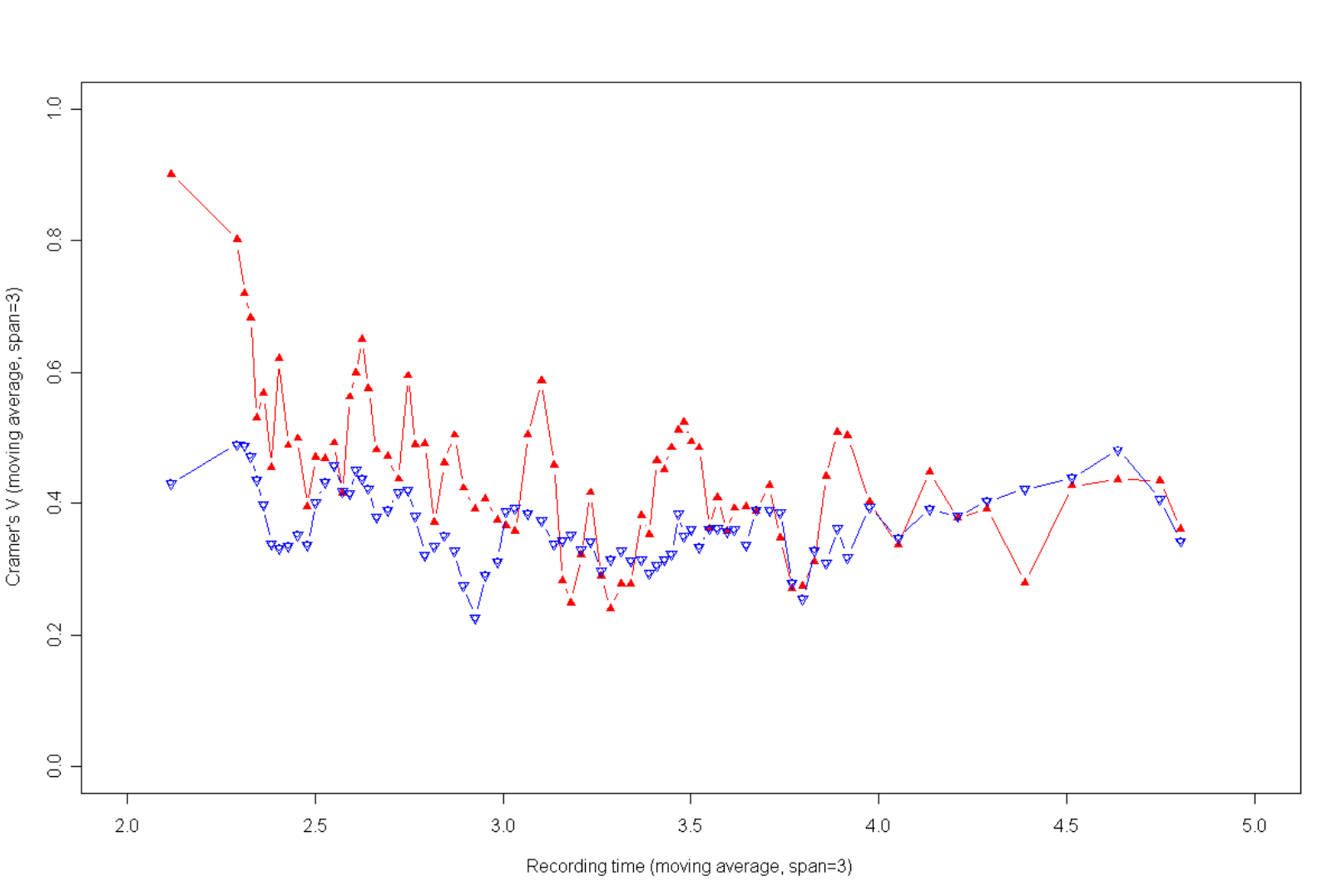
Results Child 3



- General findings
  - Aspect Hypothesis confirmed for both Child 3 and her caregiver.
  - Child 3 is much more conservative than her caregiver.
- Child 3
  - Developmental curve
  - Sharp decline until nearly age 3
  - Flattening out as of age 3 resulting in a nearly parallel line to that of the caregiver
- Caregivers
  - No consistent developmental curve or pattern of change (as expected)
  - Slight hump around age 3

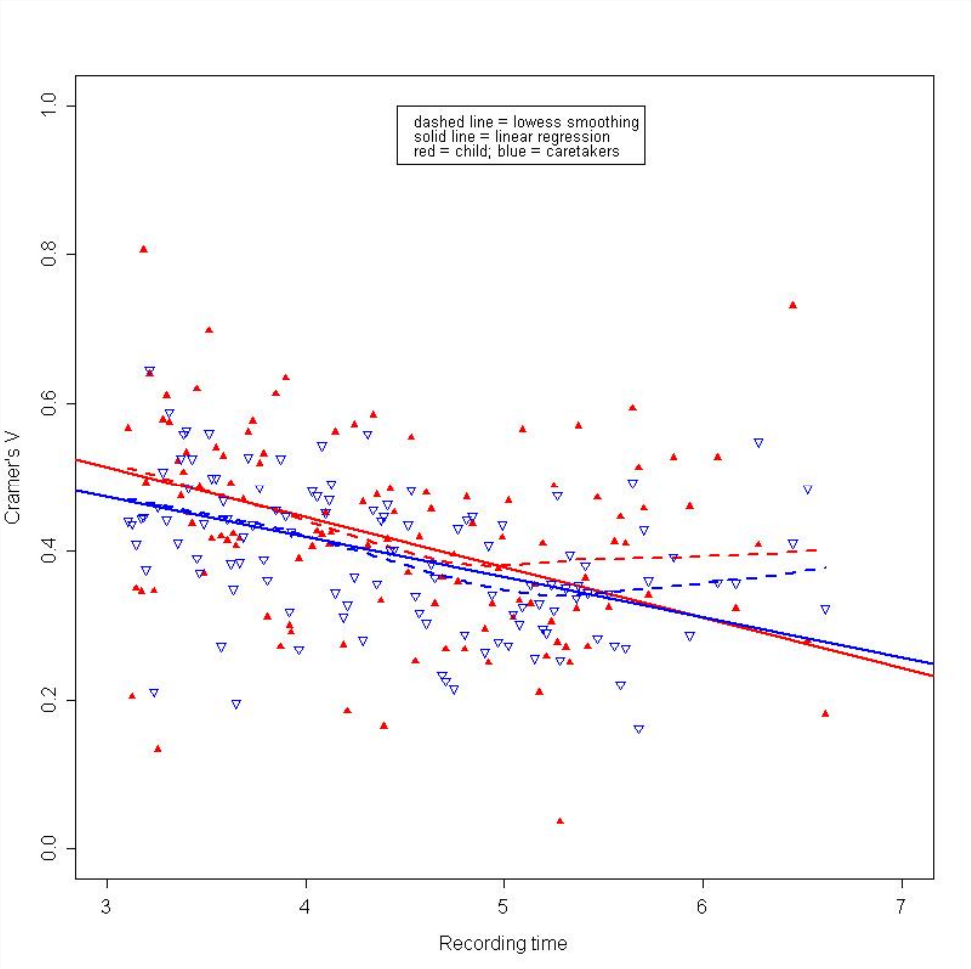
(Stoll & Gries, 2009)

Results for Child 3: a more fine-grained resolution



(Stoll & Gries, 2009)

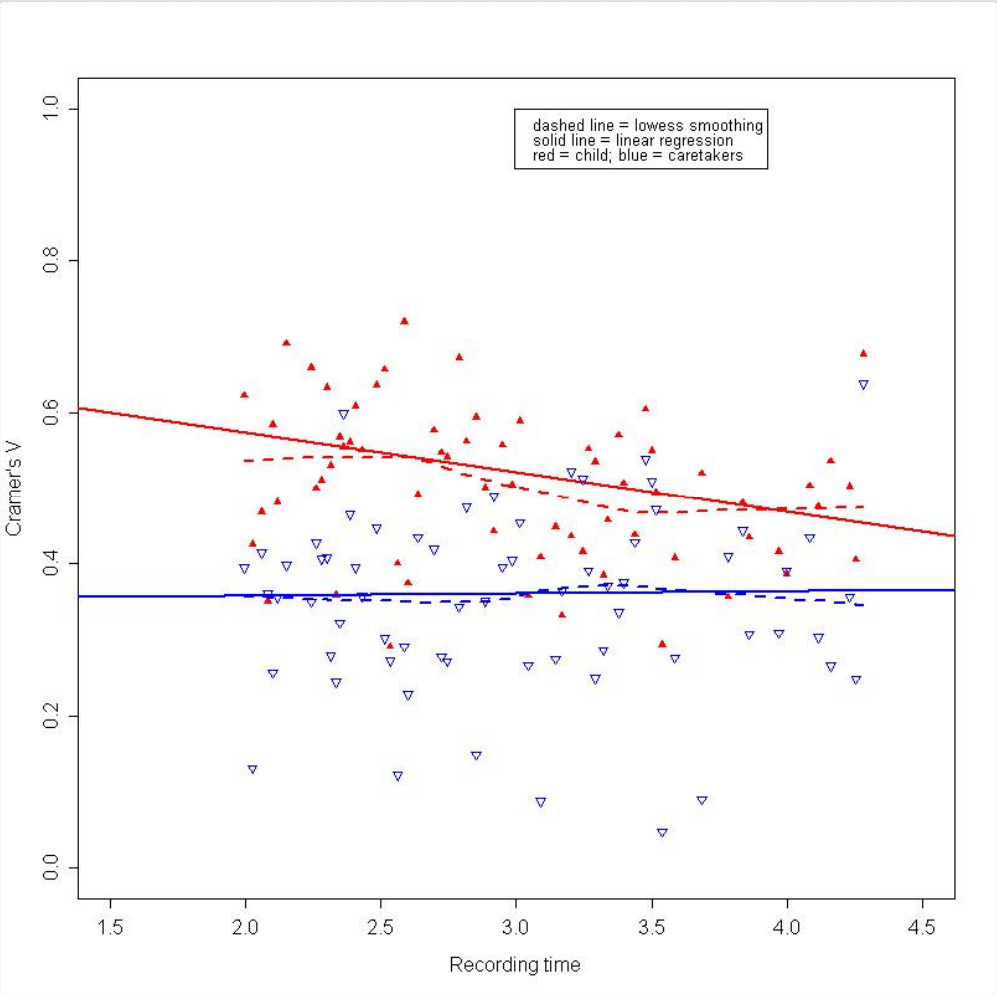
Results: Child 4



- General findings
  - Aspect Hypothesis confirmed for both Child 4 and her caregiver.
  - Child 4 is much more conservative than her caregivers.
- Child 4
  - Developmental curve
  - Decline until nearly age 5
  - Flattening out as of age 5
- Caretakers same as Child 3
  - No consistent developmental curve or pattern of change
  - Slight hump around age 5, after that, flattening as of then

(Stoll & Gries, 2009)

Results Child 5



General findings:

- Aspect hypothesis confirmed for both Child 5 and his caretakers
- Child 5 is much more conservative than his caretakers

Child 5:

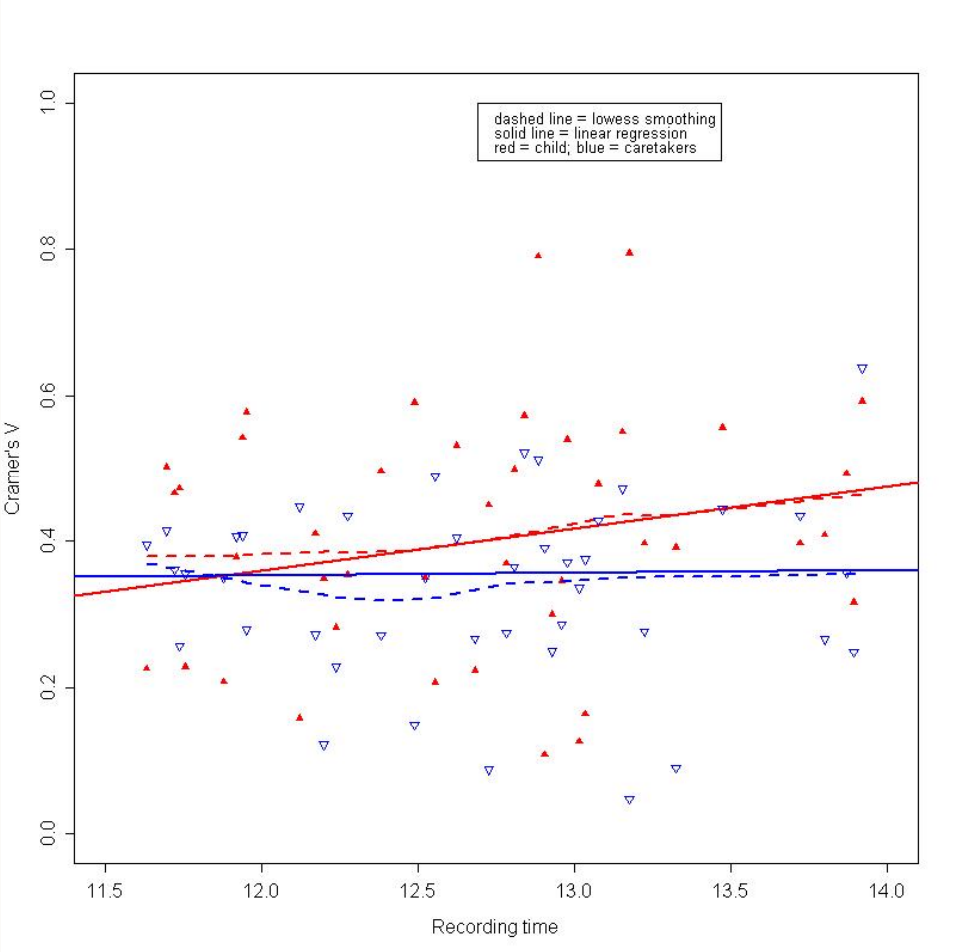
- Less pronounced developmental curve
- Slight decline as of age 2;6
- Flattening out as of age 3;6
- Possible confounding variable: MLU (Child 5's MLU at the beginnings of the recordings is 0.8 words larger than that of Child 3)

Caretakers:

- Absolutely no developmental curve or pattern of change (as expected)

(Stoll & Gries, 2009)

Results Child 6 (control)



General findings:

- Aspect hypothesis confirmed for both Child 6 and his caretakers
- Child 6 is slightly more conservative than his caretakers

Child 6:

- no consistent developmental curve (as expected)

Caretakers same as Child 5:

- no consistent development curve or pattern of change (as expected)

(Stoll & Gries, 2009)

Major Findings

- The Aspect Hypothesis is supported for child data. Russian children prefer:
  - Imperfective aspect with present tense
  - Perfective aspect with past tense
- The Distributional Bias Hypothesis is supported for the Russian data:
  - Adults talking to children also exhibit the above tense/aspect patterning
- New method to trace development with correlational data: Association Strength Approach

(Stoll & Gries, 2009)

Major Findings

- Developmental findings:
  - Decrease of the correlation over time.
  - Later in development the curve tends to flatten. Some children exhibit high degree of parallelism in their longitudinal patterning of the correlation of tense and aspect to that of their caretakers.
  - There is a lot of variation found across children and also in the adult data across sessions.
- One criterion for acquisition: Distributional equivalence between child and caretakers
  - The endpoint of acquisition corresponds to the mean Cramer's V of all caretakers in our data: 0.357±0.015 (95% C.I.)
    The three groups of caretakers do not differ from each other significantly (adj. R2=-0.007; F2, 188=0.295; p=0.7449)
  - but this awaits future results based on:
    - type-token ratios of caretakers and children
    - lexical preferences of caretakers and children
      (we're currently exploring these issues)

(Stoll & Gries, 2009)

How do children learn Russian aspect?

- H0: Russian aspect is learned as a unified category and there is no difference between individual verbs.
- H1: Russian aspect is learned in a piecemeal fashion and the semantics of verbs is an factor in the learning process.
- Prediction: Aktionsarten play a major role in the acquisition of Russian aspect

Aspect and context

- Question: How do children learn these distributions?
- Context plays a major role in the acquisition of aspectual forms. *Hypothesis of Context-Driven Learning* (Stoll 2001).
- Aspect usage varies with context. Thus, frequency is not the only relevant factor, but it is rather frequency within specific contexts that we need to look at.

Aspect Hypothesis

- Children learn aspect via lexical classes more specifically via Aktionsarten.

Experiment 1: Method

Comprehension experiment:

- Test the comprehension of the perfective aspect in 4 different Aktionsarten (telic, ingressive, delimitative and semelfactive) in isolated utterances.

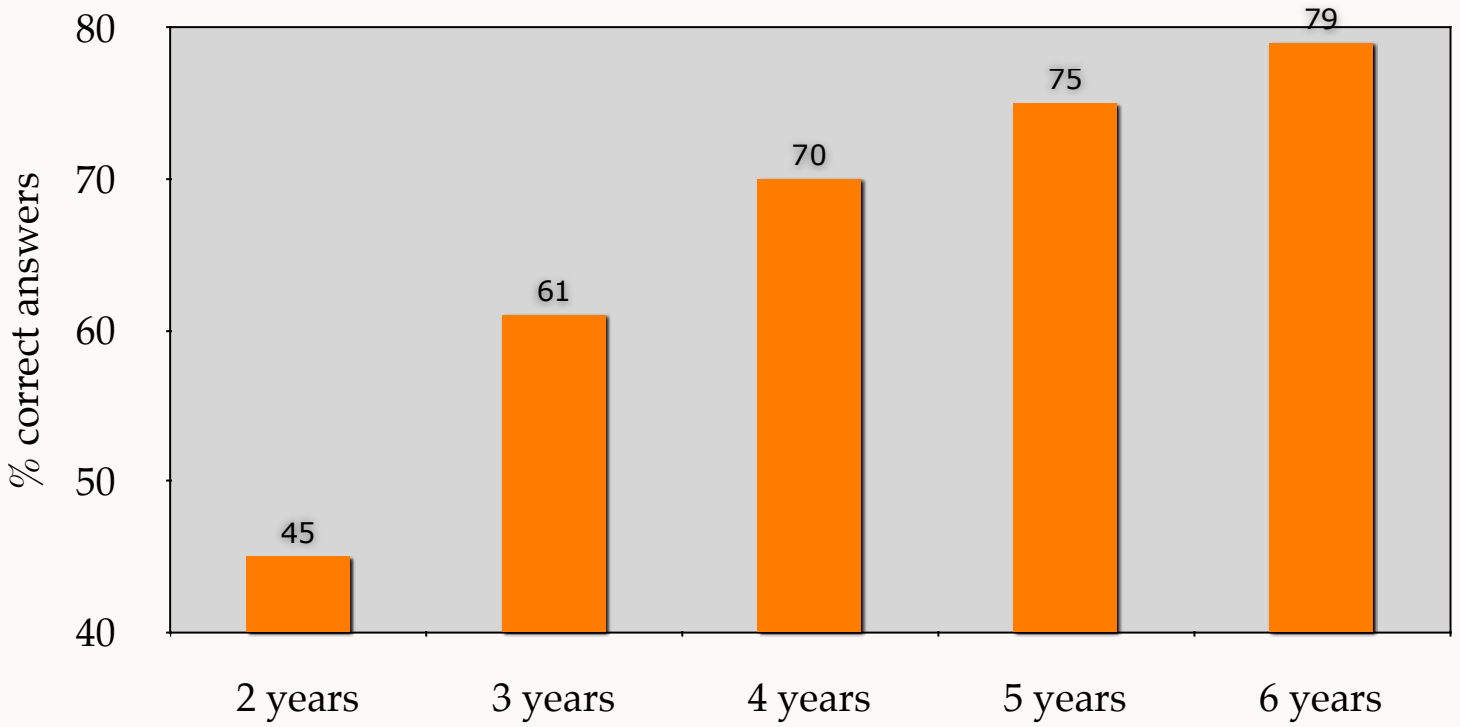
Experiment 1: Method

- Subjects: 100 preschool children (age 2 to 6) tested in several kindergarten of St. Petersburg.

- Material: 24 video clips, split-screen, actions acted out by 2 puppets representing aspectual pairs.

Experiment 1: Results

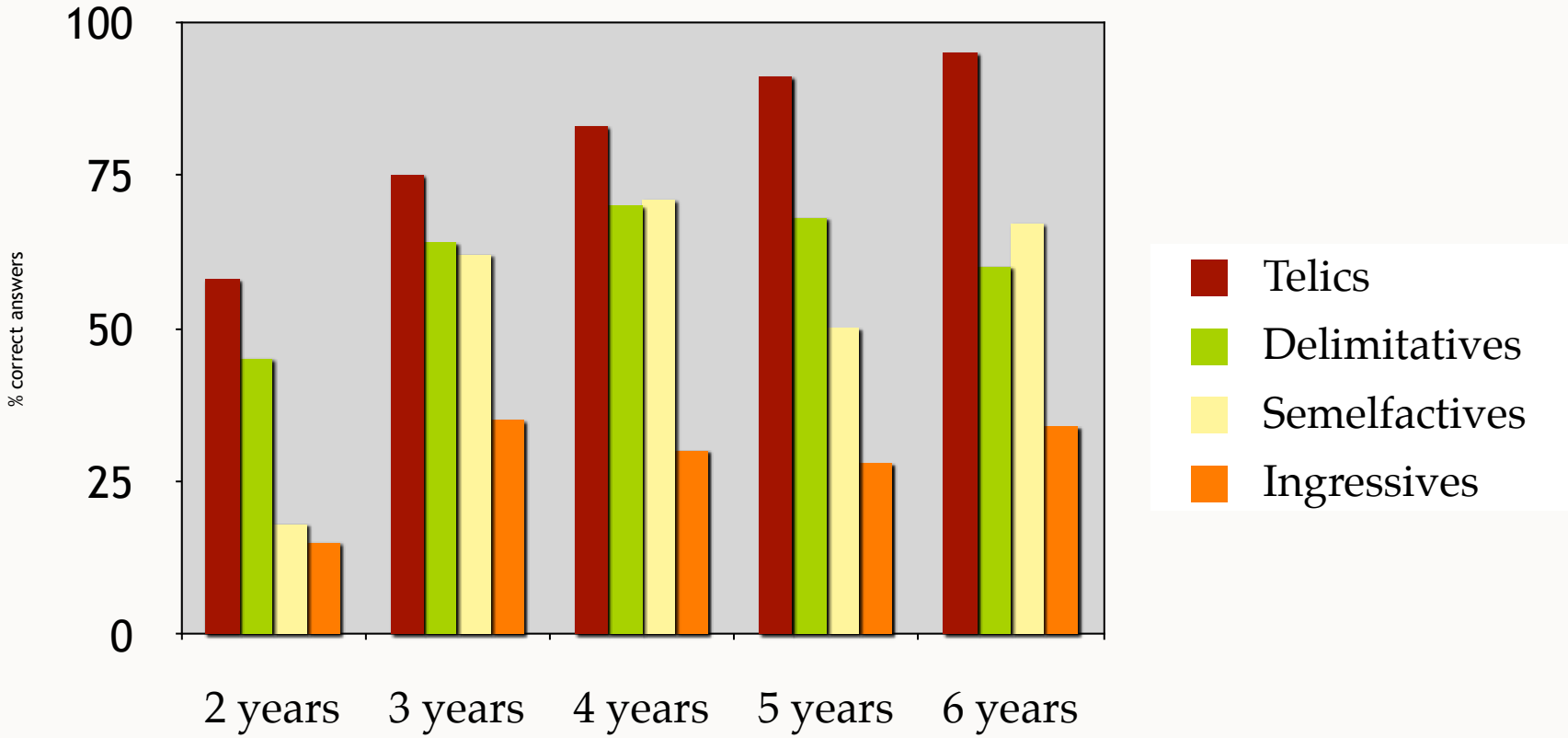
1. Clear development over age



Stoll (1998)

Experiment 1: Results

2. Not all Aktionsarten are understood equally well



Lieven & Stoll, DGfS Summer School, 2010

Stoll (2005)

Summary Experiment 1:

- The older age groups understand more (clear development).
- Aspect is not learned in a rule-based manner.
- Not all Aktionsarten are learned at the same time.
  - Telic verbs are understood best by children of all age groups
  - Ingressives are understood worst by all age groups.

Telics and ingressives

- Why do children understand telics so much more easily than ingressives?
- Pragmatic Reason:
  - Telics occur in all contexts (also more frequently). Human conversation is primarily about actions and results.
  - Ingressives are more context-specific and less frequent, they occur only in narratives, which is due to their semantics.

How do children learn these Aktionsarten?

Hypothesis of Context-Driven Learning:

- Children learn the these Aktionsarten in their prototypical contexts.

Prediction for ingressives:

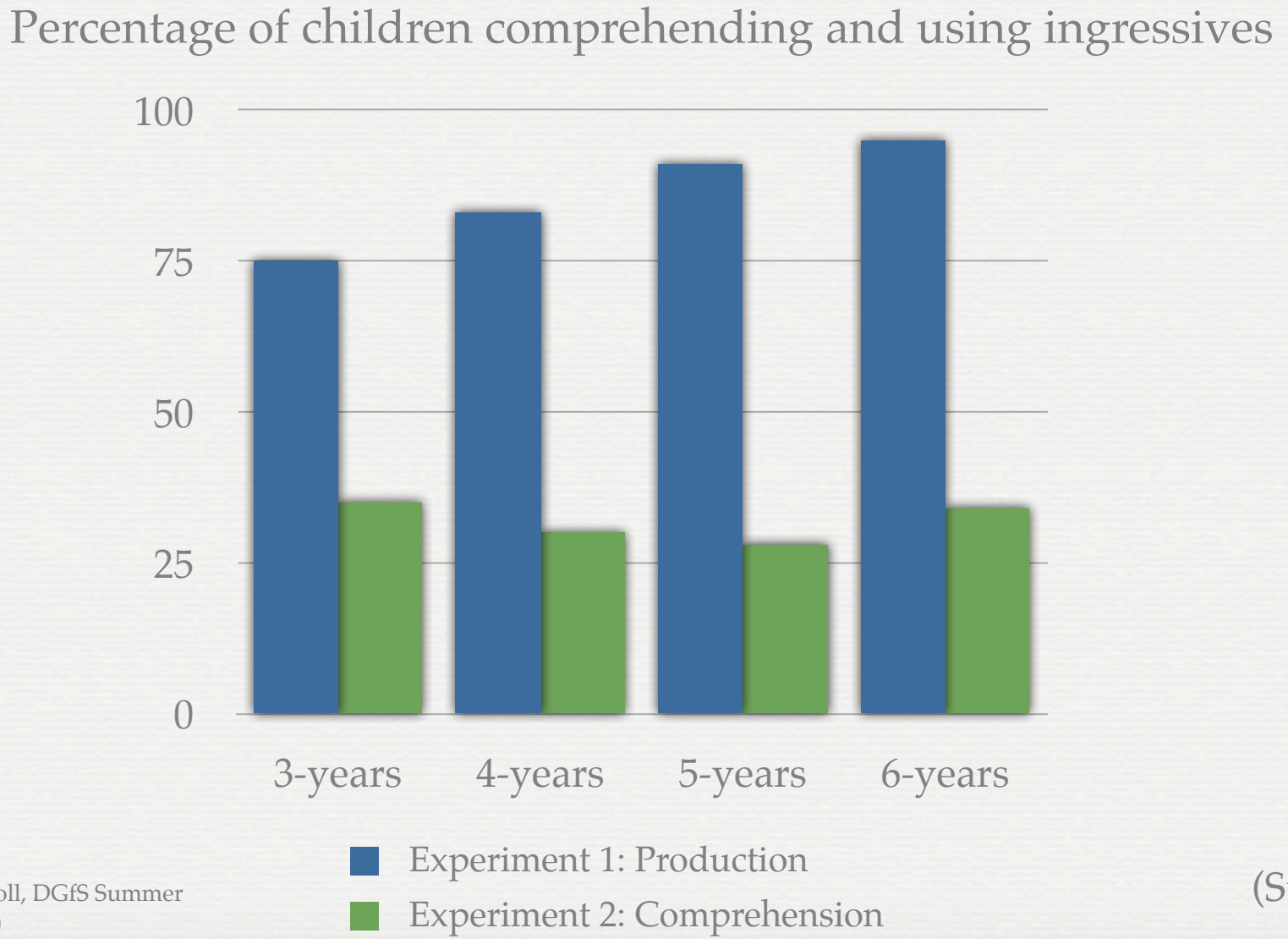
- Children will have less difficulties with ingressives if they occur in their prototypical context.

(Stoll, 2005)

Experiment 2: Method

- Subjects: 52 preschoolers (12 3-year-olds, 13 4-year-olds,14 5-year-olds, 13 6-year-olds)
- Material: picture book without words (Picnic by E. Arnold Mc Cully)
- Procedure: After going through the book once the child told the story to a hand-puppet online.

Experiment 2: Results



(Stoll 2005)

Experiment 2: Use of ingressives and narrative competence

- Narrative competence: Ability to order and report on events in temporal sequence, report on causation, recognize and report actions of protagonists etc.
- Prediction: if ingressives are used they are embedded in a sequence of a minimum of 2 utterances.
- Result: All children, who used ingressives used them in a sequence of events.

(Stoll 2005)

Summary Experiment 2:

- Children have difficulties to understand ingressives in non-prototypical contexts (see Experiment 1)
- Children use ingressives in a prototypical contexts even though they don't understand them in a non-prototypical context.
- All children used telics in Experiment 2.
- Experiment 1 and Experiment 2 support the *Hypothesis of Context-Driven Learning*.

(Stoll 2005)

Prediction

- Children will not use ingressives in the description of an isolated event, i.e. in describing an event with a single utterance.

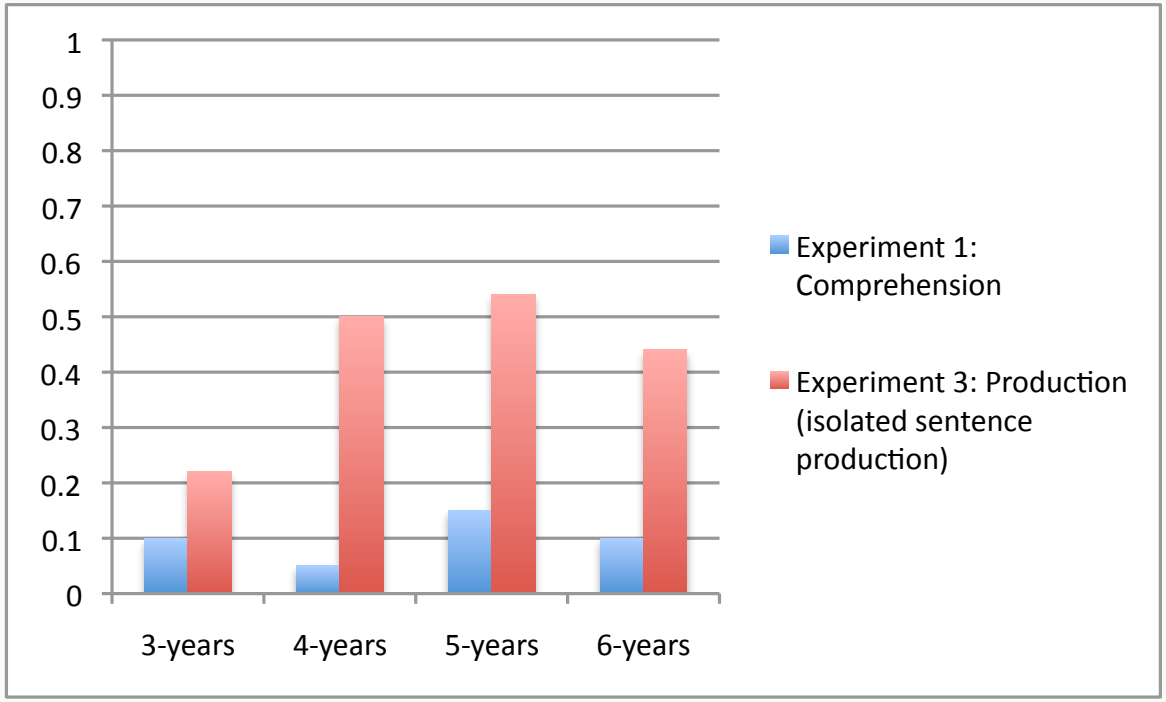
Experiment 3: Production (isolated events)

- Subjects: 39 preschoolers (nine 3-year-olds, ten 4-year-olds, eleven 5-year-olds, nine 6-year-olds)
- Material: same films as in Experiment 1, but shown individually not in split screen format (27-29 films)
- Procedure: after watching the film the child should tell a hand-puppet what had happened in the film.

(Stoll 2005)

Comparison comprehension and production

- Children score better in the isolated sentence production experiment than in the comprehension experiment



(Stoll 2005)

Experiment 3: Results

- Results seem to falsify the Hypothesis of Context-Driven Learning

  But:

  - Children have a choice how to describe the scene in the clip.

  (5) *Toša zaplakal* (M 6;0)

  'Tosha started to cry'.

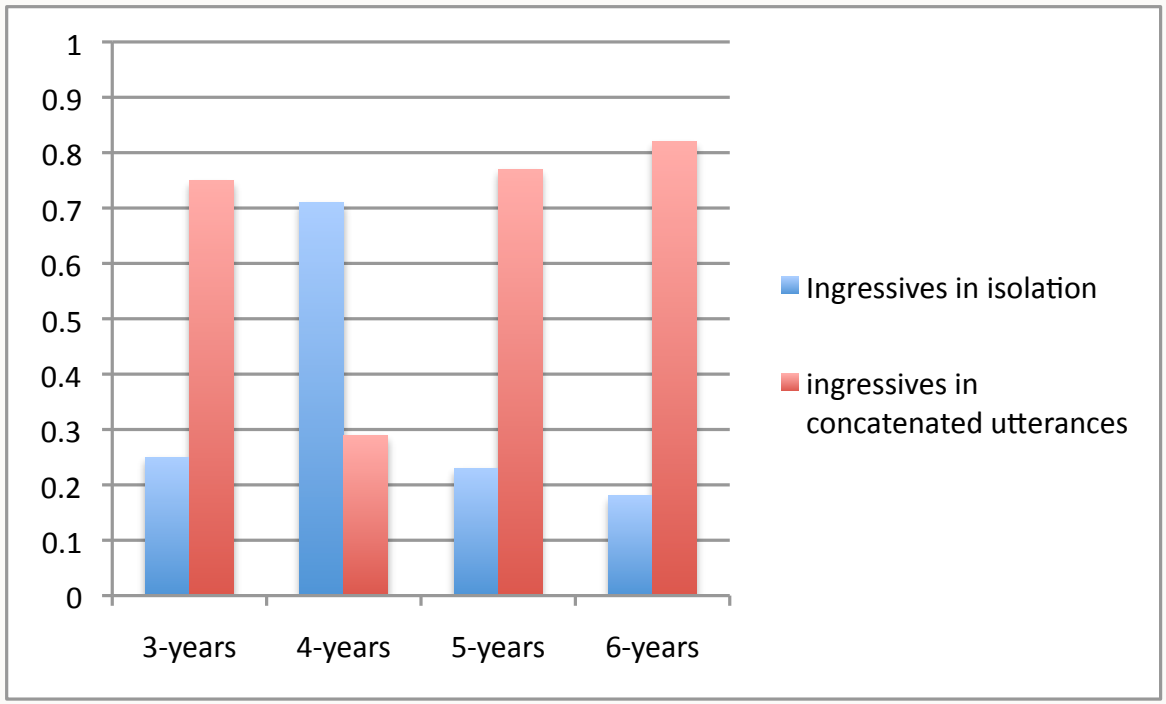
  - (6) *Maša podnjala golovu naverx, potom zasmejalas'* (F 4;11)

  'Masha raised her head and then started laugh.'

(Stoll 2005)

Results: Experiment 3

- Children embed their ingressives in concatenated utterances



(Stoll 2005)

Summary Experiment 3:

- Children use ingressives more often in Experiment 3 (isolated events) than they understand them in Experiment 1 (isolated events).
- If they use them, they prefer to embed them in a sequence of utterances.
  - supports the *Hypothesis of Context-Dependent-Learning* (at least for the older age groups for which the power of the experiment is strong enough).
  - Telics were used by all children.

(Stoll 2005)

Conclusions

Longitudinal Data:

- Also in Russian, there is a clear correlation between tense and aspect. (Aspect Hypothesis was supported.)
- There is clear development from a very strong correlation to a weaker, more adult-like correlation later on in development.
- Adults also show a correlation between tense and aspect. (Cramer's V ≈ .4) (Distributional Bias Hypothesis was supported).

Conclusions

Experiments:

- Aspect is learned in a piecemeal fashion and not in a rule-based manner.
  - Not all perfective verbs are learned at the same time.
    - Telics are learned before ingressives.
    - Ingressive are context-sensitive, telics are not.

Conclusions

- The acquisition of the perfective aspect in Russian supports the *Hypothesis of Context-Driven Learning*
  - Children up till at least age 6 don't understand ingressives in a non-prototypical context.
  - Children use these forms sign. more often in a prototypical context as soon as they have acquired specific narrative skills such as the ability to portray events in sequence.

Conclusions

- The acquisition of the grammatical category aspect interrelates with a number of factors
  - Aktionsarten
  - Narrative abilities (as one factor of cognitive development)
  - Communicative context
  - Age of the children
  - Input of caregivers