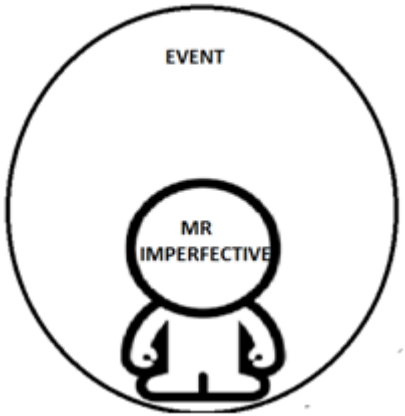
On the impact of context on the processing of IMPERFECTIVE aspect in Polish: evidence from reading time experiments

Dorota Klimek-Jankowska (University of Wrocław)

joint research with:

Anna Czypionka (Constance University)

Joanna Błaszczak (University of Wrocław)



MOTIVATION

In all sciences, scholars tend to draw a line between “theoretical” and”experimental” research

“THEORETICAL” LINGUISTICS

the category of aspect has recieved a lot of attention

“EXPERIMENTAL” LINGUISTICS

Germanic languages

More and more research on the processing of aspect in English and German

Slavic languages

Very few studies related to aspect processing in Slavic languages

If so much has been said about aspect in “theoretical” linguistics, can experimental research still contibute something new?

Why experimental research?

"We often encounter the hope that experiments will give us more precise data that will allow us to settle difficult theoretical questions, but such hopes are rarely realized. We believe that this is because we have unrealistic expectations about the ability of experiments to answer questions that theoreticians already had. Meanwhile, researchers have underappreciated the value of experiments for allowing us to address new questions that were not even on our radar previously."

Colin Phillips, Phoebe Gaston, Nick Huang, Hanna Muller

"Theories all the way down"

http://www.colinphillips.net/wp-content/uploads/2019/08/phillips_gaston_huang_muller_2019.pdf

One of the questions often asked by “experimental” linguists but not so often asked by “theoretical” linguists is *WHEN things happen in real time when we process language.*

And this is actually one of the key concerns in the research on the processing of aspect.

How incremental is the process of interpreting aspect?

What is the domain of aspectual interpretation?

Is the process of aspectual interpretation maximally incremental in all languages?

Highly incremental approaches (Marslen-Wilson and Tyler 1980, Frazier 1999) the parser uses verbal information immediately and starts the interpretation immediately.

Wait, but not always ...

Bott and Hamm (2014): **a cross-linguistic aspectual variation hypothesis**

Verb

The processor immediately commits to an aspectual interpretation only if a language has the grammatical means to express an aspectual distinction as in **Russian** for example.

Verb Phrase

In contrast, the parser does not immediately commit to an aspectual interpretation in a language which lacks grammatical means to express an aspectual distinction as is the case in **German** for example.

(in line with Filip and Rothstein's 2006 telicity parameter)

Evidence for this hypothesis was provided by Bott and Gattnar (2015)

achievement verbs (*win, spot, reach ...*)

For X time	**verb**	subject	object
GERMAN			
Ganze drei Stunden	**gewann**	die Boxerin	den Kampf und . . .
RUSSIAN			
Celyx tri casa	**vyigrala.pfv**	boxersa	turnir i . . .
For three hours	won	the boxer	the fight and . . .

Russian readers showed aspectual mismatch effects immediately at the verb while German readers reacted to this mismatch with a delay (they waited until the verbs received a direct object argument).

They focused on **PERFECTIVE ASPECT.**

Much less is known about the domain of interpretation **IMPERFECTIVE VERBS**?

In Polish, most verbs (even infinitives) are either **perfective** or **imperfective**:

So when we generalize about the domain of interpretation of grammatical aspect in Slavic, we need to consider both perfective and imperfective aspect.

(1) *Jan* ***jechał***.
Jan.NOM drove
'Jan drove.'

(2) *Jan* ***przejechał*** *dziesięć mil*.
Jan.NOM drove ten.ACC miles.GEN
'Jan drove ten miles.'

Most Polish perfective verbs are morphologically marked by means of a prefix or a suffix (cf. Bogusławski 1963; Nagórko 1998; Wróbel 1999; 2001; Willim 2006).

na*pisać*^{P} ‘to write’

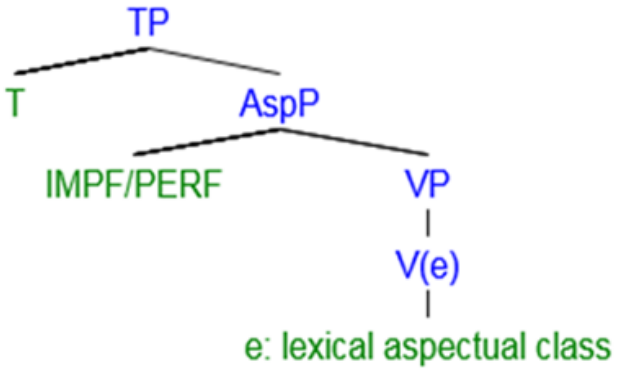
*błysn****ą****ć*^{P} ‘to flash’

Imperfective verbs form two classes: primary imperfectives (bare, i.e., ‘unprefixed’ Vs) and derived imperfectives.

(1) a. ***pisać***^{I} ‘to write’

b. *podpis**yw**ać*^{I} ‘to sign (imperfective)’

Standard representation of Tense and Aspect



[Tense [Aspect* [aspectual class]]]

De Swart's (1998)

PERFECTIVE

It is used to refer to episodic bounded events (it puts individuation boundaries on events)

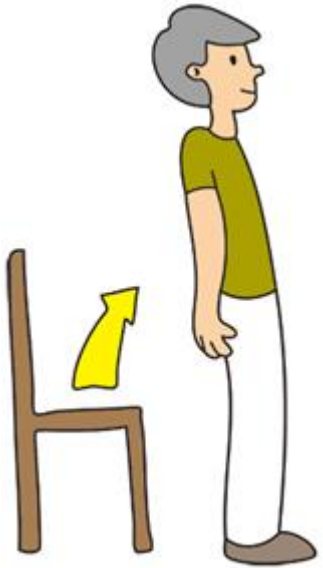
wstać

stand_up.**pfv**.infv

'to stand up'

Time-relational semantics: the temporal trace of an event is included in the perspective time

$[\![\text{pfv}]\!] = \lambda P.\ \lambda t.\ \exists e:\ \boldsymbol{\tau(e)} \subseteq \mathbf{t}$ and $P(e)$

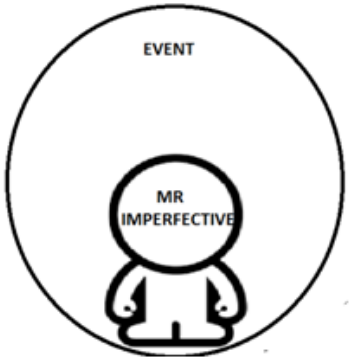


(see Reichenbach 1947; Comrie 1976; Smith 1991; Kamp and Reyle 1993; Klein 1994; Borik 2002; Kratzer 2004, Kazanina and Phillips 2006)

IMPERFECTIVE

It reflects the perspective of an ‘insider’, who sees a portion of an event from the inside and is oblivious to its endpoints.

(see Reichenbach 1947; Comrie 1976; Smith 1991; Kamp and Reyle 1993; Klein 1994; Borik 2002; Kratzer 2004, Kazanina and Phillips 2006)



$[\![\text{Impfv}]\!] = \lambda P.\ \lambda t.\ \exists e:\ \boldsymbol{\tau(e)} \supseteq \mathbf{t}$ and $P(e)$

Time-relational semantics: perspective time is included in the temporal trace of an event

But what still puzzles linguists is how to capture the fact that cross-linguistically **imperfective** verbs have so many different readings

(see de Swart 1998; Cipria and Roberts 2000; Ferreira 2004; Hacquard 2006; Arregui, Rivero and Slanova 2012; Deo 2009, 2015 and to appear)

Languages differ in the range of possible readings of imperfective but its two most **canonical meanings** are:

single ongoing and **plural event** readings

WSTAWAĆ

stand/get_up.**ipfv.**infv

‘to stand/get up’

Among the **“THEORETICAL”** approaches to imperfective aspect, there is an UNDERSPECIFICATION APPROACH:

Imperfective is semantically vacuous (underspecified) and its single ongoing and plural event readings are realized by contextually determined covert operators (see Hacquard 2006).

What do we know about the processing of semantically underspecified verbs?

According to Pickering and Frisson (2001), Pickering, McElree, Frisson, Chen, and Traxler (2006), Frisson (2009)

When we process semantically underspecified verbs, the processor does not commit to any of their possible senses but rather it initially activates an underspecified representation and subsequently homes in on the precise sense with a delay.

We decided to test this hypothesis by examining the time-course of processing of two classes of perfective and two classes of imperfective verbs in Polish in an eye-tracking experiment.

Experiment 1

COND1: simple imperfective verbs (48 verbs)

szlochać ‘cry’, jęczeć ‘moan’

COND 2: iterative imperfective verbs (48 verbs)

mrugać ‘wink’, tupać ‘stamp’

COND 3: semelfactive perfective verbs (48 verbs)

mrugnąć ‘wink once’, tupnąć ‘stamp once’

COND 4: simple perfective verbs (48 verbs)

zaszlochać ‘start crying’, zajęczeć ‘start moaning’

Comparison 1: simple imperfective verbs vs. iterative imperfective verbs

COND1: simple imperfective verbs

szlochać ‘cry’, jęczeć ‘moan’

COND 2: iterative imperfective verbs

mrugać ‘wink’, tupać ‘stamp’

We expected the effect of semantic complexity on the verbal region for iterative verbs and the effect of semantic underspecification on postverbal regions for basic imperfective verbs.

(iterative imperfective verbs are semantically more specific - the iterative reading is a subreading of imperfective)

Eye-tracking study (Comparison 1)

simple imperfective verbs

vs. iterative imperfective verbs

Significantly longer TOTAL READING TIMES on IA6 for simple imperfective verbs and significantly more regressions to the beginning of the sentence (re-readings)

IA 1	IA 2	IA 3	IA4	IA5	IA6
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***wył*** **screamed.ipfv**	głośno loudly	w piaskownicy in a sandpit
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***tupał*** **stamped.iter.ipfv**	głośno loudly	w piaskownicy in a sandpit

significantly more regressions to IA4 for iterative imperfective verbs

Interpretation, Comparison 1 simple imperfective verbs vs. iterative imperfective verbs

I. Significantly longer TOTAL READING TIMES on IA6 for simple imperfective verbs

THE EFFECT OF SEMANTIC UNDERSPECIFICATION

As expected

Interpretation: the underspecified semantics of simple imperfective verbs caused the delay in aspectual interpretation and re-readings

Unexpected

I. significantly more regressions to the verbal region for iterative imperfective verbs

WHY?

Iterativity

We think that the so called iterative verbs in Polish are lexically encoded as **activities**.

As such they can co-occur with an inceptive prefix e.g. ***za-***

zamrugać[1] ‘to start to wink repeatedly’

zabłyszczeć[1] ‘to start to flash repeatedly’

zastukać[1] ‘to start to knock repeatedly’

zadrgać[1] ‘to start to twitch/shudder repeatedly’

Without this prefix they are lexically ambiguous:

reading 1: a series of winking atomic events

reading 2: slow motion camera reading

Iterativity

Semelfactive and iterative imperfective verbs usually come in pairs:

mrugać^{I} ‘to wink repeatedly’ – ***mrugnąć***^{P} ‘to wink once’

błyszczeć^{I} ‘to flash repeatedly’ – ***błysnąć***^{P} ‘to flash once’

stukać^{I} ‘to knock repeatedly’– ***stuknąć***^{P} ‘to knock once’

drgać^{I} ‘to twitch/shudder repeatedly’ – ***drgnąć*** ^{P} ‘to twitch/shudder once’

Semelfactive morphemes in Polish attach only on those activities which are conceptually decomposable into discrete atomic units.

Semelfactive verbs are derived from their imperfective bases by means of a semelfactive suffix ***-nq***.

Iterativity

Why significantly more regressions to iterative verbs in our study?

Some of the iterative imperfective verbs in our experiment were decomposable into conceptually longer discrete units:

łykać[I] 'to swallow', ***dmuchać***[I] 'to blow', ***trąbić*** 'to trumpet', ***ryczeć*** 'to roar'

These instances may have created a clearer ambiguity between an iterative meaning (very dominant) and a "slow-motion" camera reading referring to a single protracted unit of swallowing, blowing or trumpeting understood as an activity.

Comparison 2: simple imperfective verbs vs. simple perfective verbs

COND1: simple imperfective verbs: szlochać ‘cry’
COND 4: simple perfective verbs: zaszlochać ‘start crying’

We expected the effect of semantic underspecification on postverbal regions for basic imperfective verbs.

For the perfective verbs, we expected the effects of morphological complexity based on relevant earlier research by for example Bozic & Marslen-Wilson (2010) and Schuster et al. (2018) who reported an increased processing cost as a factor of morphological complexity of words (possibly caused by the process of morphological decomposition).

Eye-tracking study (Comparison 2)
simple imperfective verbs vs.
simple perfective verbs

Significantly longer FIRST PASS AND TOTAL READING TIMES on IA6 for simple imperfective verbs and significantly more regression to the beginning of the sentence (re-reading)

IA 1	IA 2	IA 3	IA4	IA5	IA6
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***wył*** **screamed.ipfv**	głośno loudly	w piaskownicy in a sandpit
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***zawył*** **screamed.pfv (started to scream)**	głośno loudly	w piaskownicy in a sandpit

Significantly longer TOTAL READING TIMES on perfective verbs, significantly more regressions to perfective verbs and to the beginning of the sentence.

Interpretation, Comparison 2 simple imperfective verbs vs. simple perfective verbs

I. Significantly longer FIRTS PASS and TOTAL READING TIMES on IA6 for simple imperfective verbs and significantly more regression to the beginning of the sentence (re-reading)

THE EFFECT OF SEMANTIC UNDERSPECIFICATION

As expected

Interpretation: the underspecified semantics of simple imperfective verbs caused the delay in aspectual interpretation and re-readings

As expected

I. significantly longer TOTAL READING TIMES on IA4 for perfective verbs

THE EFFECT OF MORPHOLOGICAL COMPLEXITY

Interpretation, Comparison 2 simple imperfective verbs vs. simple perfective verbs

Unexpected

III. significantly more regressions to perfective verbs and to the beginning of a sentence

Some inceptive perfective verbs are ambiguous in that contextual information is necessary to determine where to place individuation boundaries.

(1) Orkiestra ***zagrała***^{P} *i goście się rozeszli* ‘After the band completed the action of playing and everyone left the dance floor’.

(2) Orkiestra ***zagrała***^{P} *i goście zaczęli tańczyć* ‘The band started playing and everyone started dancing’.

Comparison 3: iterative imperfective verbs vs. semelfactive perfective verbs

COND 2: iterative imperfective verbs

mrugać ‘wink’, tupać ‘stamp’

COND 3: semelfactive perfective verbs

mrugnąć ‘wink once’, tupnąć ‘stamp once’

We expected the effect of morphological complexity on perfective verbs

Eye-tracking study (Comparison 3)

iterative imperfective verbs vs.
semelfactive perfective verbs

IA 1	IA 2	IA 3	IA4	IA5	IA6
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***wył*** **screamed.ipfv**	głośno loudly	w piaskownicy in a sandpit
Marysia powiedziała, że Mary said that	nadąsany sulky	maluch kid	***tupnął*** **stamped once (semelfactive)**	głośno loudly	w piaskownicy in a sandpit

Significantly longer TOTAL READING TIMES on semelfactive verbs

Interpretation, Comparison 3 iterative imperfective verbs vs. semelfactive perfective verbs

I. significantly longer TOTAL READING TIMES on IA4 for semelfactive verbs

THE EFFECT OF MORPHOLOGICAL COMPLEXITY

As expected

The most relevant finding:

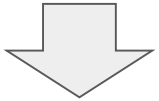
Significantly longer **TOTAL READING TIMES** on the **last region** **for semantically underspecified simple imperfective** verbs as compared to the semantically more specific iterative imperfective and simple perfective verbs.

Importantly, all the verbs used in our study were **intransitive** and they contained **no contextual cues** which could favour any of the readings of imperfective aspect.

Things may be a bit different when we study transitive imperfective verbs. WHY?

The grammatical number of objects seems to play a role in the interpretation of imperfective verbs.

What is the impact of the grammatical number of objects on the interpretation of imperfective verbs?



RELEVANT FACTS

single ongoing meaning (strongly dominant)

(1) Rubens malował **kobietę.**

Rubens paint.3sg.masc.impfv.past woman

‘Rubens was painting a woman.’

SG

e1

plural event meaning (dominant)

(2) Rubens malował **kobiety.**

Rubens paint.3sg.masc.impfv.past women

‘Rubens painted women.’

PL

e1

e2

e3

The selection of a **single ongoing** or a **plural event reading** based on the grammatical number of nominal objects of imperfective verbs is not **deterministic** but rather **probabilistic**.

plural event reading (very unlikely)

(1) Rubens malował **kobietę.**

Rubens paint.3sg.masc.impfv.past woman

‘Rubens was painting a woman.’

SG

e1

e2

e3

single ongoing reading (very unlikely)

(2) Rubens malował **kobiety.**

Rubens paint.3sg.masc.impfv.past women

‘Rubens painted women.’

PL

e1

PILOT STUDY 1: Meaning preferences for imperfective verbs – an online questionnaire

Impfv verb (10)	Impfv verb + NP_{sg} (10)	Impfv verb + NP_{pl}(10)
ratował 'rescued.3sg.masc.impfv.past'	naprawiał rower 'repair.3sg.masc.impfv.past bike'	malował obrazy 'paint.3sg.masc.impfv.past paintings'

Task: to decide whether a given verb or a verb phrase referred to:

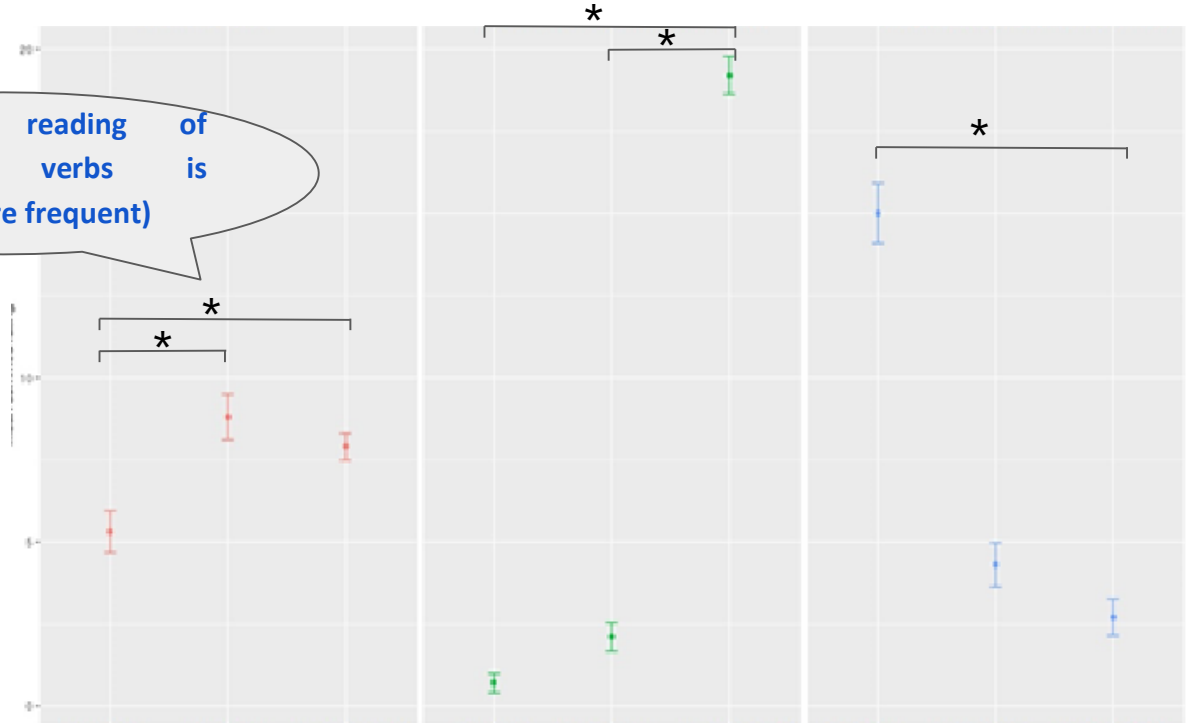
22 respondents

- one event in the past
- many events in the past
- there was an additional option 'It is hard to say as both meanings are possible'.

PILOT STUDY 1: Meaning preferences for imperfective verbs – an online questionnaire

impfv VERB | impfv + PL object | impfv + SG object

the plural reading of imperfective verbs is dominant (more frequent)



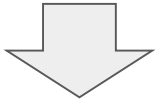
Conclusion:

The results of this pilot study indicate that the grammatical number of nominal objects of imperfective verbs can serve as a contextual cue pointing either to its single ongoing or plural event meaning.

Why is the single ongoing reading strongly preferred when the NP object is singular?

Why is the plural event reading strongly preferred when the NP object is plural?

What is the impact of the grammatical number of nominal objects on the interpretation of imperfective verbs?



FORMAL ACCOUNT

Ferreira's (2004, 2005) NUMBER APPROACH TO IMPERFECTIVE ASPECT

Ferreira's number approach to imperfective aspect combined with de Swart's (2005) bijection operation

Ferreira (2004, 2005) - the domain of events contains singular (e) and plural events (E)

Imperfective operator selects for either plural or singular VPs

IMPF [VPsg/VPpl]

Ferreira's (2004, 2005) NUMBER APPROACH TO IMPERFECTIVE ASPECT

Imperfective aspect selects for either plural or singular VPs

$[\![\text{Impfv}_{sg}]\!] = \lambda P_{sg}.\ \lambda t.\ \exists e: \tau(e) \supseteq t \text{ and } P(e) = 1$

$[_{TP}\ \text{Past}\ [_{AspP}\ \text{Impfv}\ [_{VP\text{-}sg}\ \textbf{sg}\ [_{VP}\ \text{John paint a house}]]]]$

The **single ongoing** interpretation of an imperfective verb is derived from the logical form with **Impfv selecting for VP_{sg}**.

$[\![\text{Impfv}_{pl}]\!] = \lambda P_{pl}.\ \lambda t.\ \exists e: \tau(e) \supseteq t \text{ and } P(e) = 1$

$[_{TP}\ \text{Past}_1\ [_{AspP}\ \text{Impfv}\ [_{VP\text{-}pl}\ \textbf{pl}\ [_{VP}\ \text{John paint a house}]]]]$

The **plural event** interpretation of an imperfective verb is derived from the logical form with **Impfv selecting for VP_{pl}**.

plural event meaning (dominant)

Rubens malował **kobiety.**

Rubens paint.3sg.masc.impfv.past women

‘Rubens painted women.’

PL

e1

e2

e3

∃E ∃X (women(**X**) and paint-by-Rubens (**E**, **X**) and **E x X is a bijection**)

E stands for a plural set of events; **X** stands for a plural set of individuals

There is a **bijection** (one-to-one) relation between events and individuals in the plural sets **E** and **X**. → **DEPENDENT READING**

→ THE PLURAL EVENT READING emerges as THE MOST LIKELY

plural event meaning (blocked)

Rubens	malował	**kobietę.**
Rubens	paint.3sg.masc.impfv.past	woman

‘Rubens painted women.’

SG

e1

e2

e3

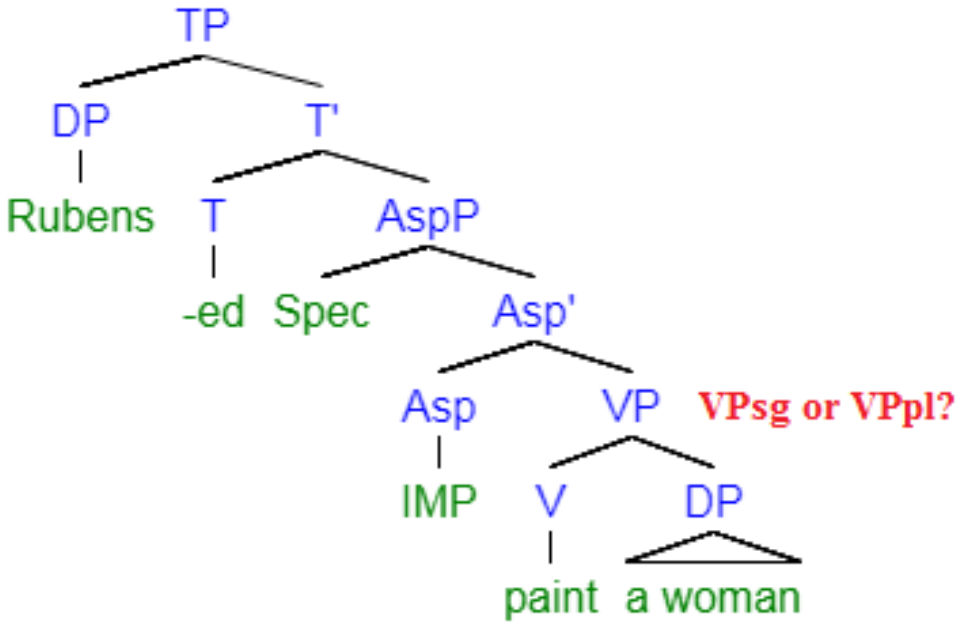
If the interpretation was like this:

∃E ∃x (woman(**x**) and paint-by-Rubens (**E**, **x**) (**bijection** is impossible between **E x x**)

Hence the plural event reading is dipreferred.

→ THE SINGLE ONGOING READING emerges as THE MOST LIKELY

Question: At which point during the interpretation of imperfective aspect does IMPFV decide whether to select for a VP_{sg} or VP_{pl}?



Question: Is the process of selection of VP_{sg} or VP_{pl} by IMPFV immediate (strictly incremental) or can it be delayed?

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Bott (2010) discusses three models of resolving aspectual underspecification

The ***Underspecification Model***

The processing of underspecified aspectual meanings is DELAYED

The ***Probabilistic Parsing Model***

The processing of underspecified aspectual meanings is IMMEDIATE (based on PROBABILISTIC information including discourse context, conceptual knowledge, lexical information and the frequency of a given meaning) → later reinterpretations are expected

The ***Lazy Parsing Model***

The processing of underspecified aspectual meanings is IMMEDIATE and a semantically less complex aspectual meaning is added first → later reinterpretations are expected

EXPERIMENT 2:

The GOAL of our study

To test the validity of these approaches by examining:

how early the parser commits to a single ongoing or plural event meaning of imperfective aspect depending on whether disambiguation cues are present in a preverbal context and depending on the grammatical number of NP objects of imperfective verbs

IA1	IA2	IA3	IA4	IA5	IA6	IA7	IA8
Sara Sara	powiedziała, że said that	Piotrek Peter	wczoraj yesterday	naprawiał repaired.impf	rower/y bike/s	i Bartek and Bartek	też tak powiedział said so too
Sara Sara	powiedziała, że said that	Piotrek Peter	często frequently	naprawiał repaired.impf	rower/y bike/s	i Bartek and Bartek	też tak powiedział said so too
Sara Sara	powiedziała, że said that	Piotrek Peter	powoli slowly	naprawiał repaired.impf	rower/y bike/s	i Bartek and Bartek	też tak powiedział said so too

only accomplishment verbs

for each of the selected verbs the most plausible objects were selected based on the corpus data

Method: eye-tracking during reading

Language material: 6 experimental conditions, 30 sentences per condition, sentences from each sextet distributed across 6 lists (Latin square design), 30 fillers, each sentence was followed by a comprehension question

Participants: 72 Polish native speakers

Condition1: yesterday_sg	Condition 4: yesterday_pl
Condition 2: frequently_sg	Condition 5: frequently_pl
Condition 3: neutral_sg	Condition 6: neutral_pl

We looked at the following reading measures:

- **First Pass Reading Time** sums all the fixations made in a region until the point of fixation leaves the region either to the left or to the right.
- **Regression Path Reading Time** sums of all the fixations from the first fixation in a region up to but excluding the first fixation to the right of this region.
- **Total Reading Time** sums all the fixations made within a region of text, including those fixations made when re-reading the region.
- **Regressions into and out of IAs** (the proportion of jump backs during the first inspection of the material from or into an Interest Area)

Prediction 1 (based on the Underspecification Model)

Under the *Underspecification Model*, we expect a delay in the specification process to later regions in neutral contexts.

We expect longer reading times on and more regressions from the postverbal regions in NEUTRAL contexts than in FREQUENTLY and YESTERDAY.

Prediction 2 (based on the Probabilistic Parsing Model)

In our meaning preference pilot study, the plural event meaning of bare imperfective verbs was preferred over the single ongoing reading.

The dominant plural event reading of imperfective verbs should lead to a mismatch with the earlier adverb ‘yesterday’ favoring an episodic reading.

We expect significantly longer reading times on (and potentially more regressions from) the verbal region in YESTERDAY than in NEUTRAL and FREQUENTLY.

Prediction 3 (based on the Lazy Parsing model)

The parser should immediately choose the semantically less complex single ongoing reading of imperfective verbs over the semantically more complex plural event reading. This should lead to a mismatch with the semantics of the preverbal adverb ‘frequently’. We expect significantly longer reading times on (and potentially more regressions from) the verbal region in FREQUENTLY contexts than in the remaining contexts.

Prediction 4 (based on the number approach to imperfective)

Based on Ferreira's (2004, 2005) number approach to imperfective aspect we expect a mismatch between the singular objects of imperfective verbs in contexts with the preverbal adverb FREQUENTLY. This should be manifested in longer reading times on (and potentially more regressions from) the object position in FREQUENTLY_SG as compared to FREQUENTLY_PL.

Results

VERB

first pass times: ***yesterday > neutral**

In line with Prediction 2 (based on the Probabilistic Parsing Model)

MISMATCH

***wczoraj* 'yesterday'**

(creates a preference

for an episodic reading)

imperfective verb

(its plural event reading is dominant)

Interpretation

This result may indicate that the resolution of the underspecification meaning of imperfective aspect is ineed based on **probabilistic information**.

Results

VERB

regression path times: ***neutral > yesterday** > frequently

(the sum of all fixations from the first fixation in a verb before moving on to the right including the time spent re-reading the preverbal context)

Neutral adverb IMPFV verb

OBJECT

regressions out of IA:

***neutral > frequently** > yesterday

Neutral adverb IMPFV verb NP object

In neutral contexts, there is significantly more interaction between the verbs, objects and the preceding neutral adverbs than in the other two contexts.

Interpretation

The specification process for imperfective verbs starts immediately on the verb and then it continues on the object.

No effects were obtained on later regions in neutral contexts.

But in Experiment 1 (where we used intransitive verbs) the interpretation of imperfective verbs was delayed to the end of the sentence.

It may suggest that the presence or absence of the object plays a role in the specification process.

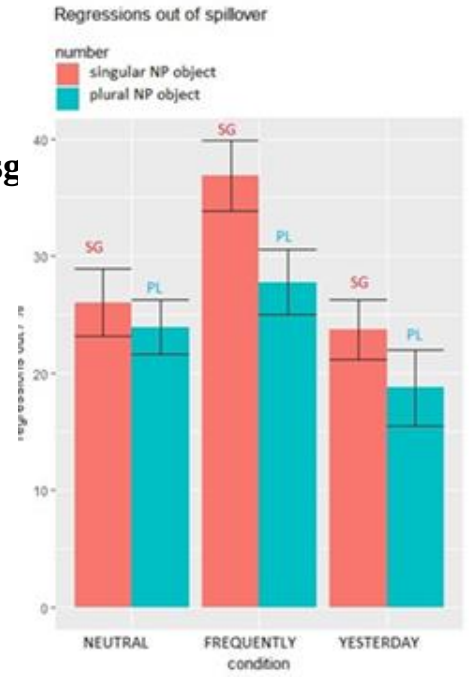
Results

SPILLOVER (one position after the object)

first pass times: ***frequently_sg < frequently_pl, neutral_sg and yesterday_sg**

regressions out of: ***frequently_sg > frequently_pl, neutral_sg and yesterday_sg**

frequently IMPFV verb NPsg object spillover



Interpretation

This scenario is compatible with the prediction based on the number approach to imperfective aspect.

We can conclude that the number of the object is part of the probabilistic information and it plays an important role in the specification of the meaning of imperfective verbs.

Interpretation

Step 1: The parser read a frequentative adverb followed by an imperfective verb and it opted for the plural event reading.

Step 2: It encountered a singular object and it could not create a pragmatically more plausible bijection relation between a plural set of events and a singular entity denoted by a singular object.

Step 3: The parser makes significantly more regressions from the spillover region to earlier regions.

Conclusion

Imperfective aspect is underspecified for number (it is underspecified for whether it selects for a plural or singular VP).

The specification process is based on probabilistic information (the number of the object being part of it).

The specification process starts on the verb and this process is gradual - it proceeds until the probabilistic information is strong enough for the parser to commit to one of the meanings.

Conclusion

Gradual Probabilistic Model of Parsing Imperfective Aspect

The imperfective operator is added to the representation with an empty slot (buffer) to be gradually specified for number (VPsg or VPpl) on the basis of probabilistic information (including preverbal context, the frequency of a given meaning, the grammatical number of the object).

IMPFV probabilistic information VP [number: sg/pl]

The concept of a BUFFER is inspired by Dölling's (2003, 2014) and Egg's (2005) theory of underspecification.

They suggest that during the first stage, an underspecified representation is computed in a strictly compositional way but all the semantically underspecified elements are left open (as buffers or holes in the representation).

During the second stage, the representation is specified on the basis of discourse context and conceptual knowledge.

We think that the specification process starts immediately but it proceeds gradually and it is based on probabilistic information.

THANK YOU

Contact: sigmadorota1979@gmail.com

It is not always so that the singular number of the object blocks the plural event reading of imperfective verbs: **AMBIGUITY**

(1) Audrey Hepburn paliła [illegible].

SG

Audrey Hepburn smoked.impfv pipe

‘Audrey Hepburn smoked a tobacco pipe.’

single ongoing meaning

e1

plural event meaning (on each occasion the same tobacco pipe) PLAUSIBLE
a different pipe (impossible)

e1 e2 e3

BUT …

(1) James Dean palił SG papierosa.

James Dean smoked.impfv cigarette.

‘James Dean smoked a cigarette.’

single ongoing meaning

e1

plural event meaning (on each occasion he smoked the same cigarette) VERY UNLIKELY
a different cigarette (impossible)

e1 e2 e3

PILOT STUDY 2: online acceptability rating questinnaire

yesterday + IMPFV +NP$_{sg}$	**yesterday + IMPFV +NP$_{pl}$**
Peter yesterday prepared.impfv report	Peter yesterday prepared.impfv reporty
frequently + IMPFV + NP$_{sg}$	**frequently + IMPFV + NP$_{pl}$**
Peter frequently prepared.impfv report	Peter frequently prepared.impfv reporty
neutral + IMPFV + NP$_{sg}$	**neutral + IMPFV + NP$_{pl}$**
Peter slowly prepared.impfv report	Peter slowly prepared.impfv reporty

20 respondents

Task: to evaluate the acceptability on a three-point scale (1 = bad, 2 = ok, but could be better, 3 = good).

PILOT STUDY 2: online acceptability rating questionnaire

	Bad (1)	OK but could be better (2)	Good (3)
frequently + IMPFV + NP_{sg}	17(*)	36	47
frequently + IMPFV + NP_{pl}	0	3	97
yesterday + IMPFV + NP_{sg}	0	16	84
yesterday + IMPFV + NP_{pl}	1	13	86
slowly + IMPFV + NP_{sg}	4	22	74
slowly + IMPFV + NP_{pl}	0	4	96

Contexts in which imperfective verbs are preceded by the adverb *często* 'frequently' and followed by a singular NP object are significantly less acceptable than all the remaining types of tested contexts

PILOT STUDY 2: online acceptability rating questionnaire

Why low acceptability?

frequently + IMPFV + NP_{sg}

Conclusion:

The adverb **frequently** creates a preference for the plural event reading of the imperfective verb whereas the VP with an imperfective verb and a **singular NP object** creates a preference for a single ongoing reading → **MISMATCH**.