

## **Passives are not inherently more complex than actives: Insights from processing verbal passives in German**

Berit Gehrke (CNRS-LLF/Paris Diderot) & Nils Hirsch (HU Berlin)  
(joint work with Nino Grillo, Artemis Alexiadou, Caterina Paolazzi & Andrea Santi)

### **1 Introduction**

- Early psycholinguistic theory: the Derivational Theory of Complexity (DTC)
  - Transformations (e.g., passives, negation, *wh*-questions) increase a sentence's complexity.  
BUT: Not all cases bore out the predicted differences. → Abandonment of the DTC
- Still prevalent idea: Some transformations, including passives, are difficult.
  - Bever (1970): Heuristic strategies in parsing, e.g. agent first in (English) passives
  - Borer & Wexler's (1987) maturation account: Delay in the acquisition of A-movement
  - Grodzinsky (1990): Agrammatic aphasics' failure to understand passives as part of an overarching problem with the representation of movement-derived sentences.  
→ Passives involve movement (contra, e.g., LFG).

- **Previous work on the processing of passives: Fragmented picture**

Offline data: Passives are more difficult than actives.

- Adult processing (e.g. Ferreira 2003)
- (Early) research in language acquisition  
(e.g. Bever 1970; Horgan 1978; Maratsos et al. 1985; Borer & Wexler 1987, a.o.)
- Language impairment (Grodzinsky 2000; Grillo 2008, a.o.)

Online studies: Passives are read faster than actives (even if not significantly so in all cases).  
(Carrithers 1989; Rohde 2003; Traxler et al. 2014)

- E.g. Ferreira (2003):
  - Unimpaired adult speakers consistently fail to correctly assign thematic roles in passives.  
→ Algorithmic processing is replaced by processing heuristics: The first NP is attributed agenthood resulting in an incorrect interpretation of the English passive.  
(building on Bever 1970; Townsend & Bever 2001)<sup>1</sup>

⇒ **How to reconcile these different findings?**

- Paolazzi et al. (2015, 2016): Problems with previous studies
  1. Overlooked the role of morphological cues (passive auxiliary, *by*-phrase) in modulating reading times: Typical comparison of synthetic active vs. periphrastic passive (1)
    - (1) a. The boy attacked the girl.
    - b. The boy was attacked by the girl.
  2. Used a mixed bag of predicates as input (eventive and stative)
    - In particular passives derived from statives provide a temporary ambiguity between an adjectival and verbal reading, increasing offline difficulty with passivisation.

---

<sup>1</sup>See also Kamide et al. (2003) and Knoeferle & Crocker (2006) for evidence from the *visual world paradigm* that speakers are able to immediately revise an initial active-bias upon hearing semantic or morphosyntactic cues incompatible with an active structure.

- **Self-paced reading study on English passives I: Paolazzi et al. (2015)**

- Presence of the auxiliary might speed up reading times at the verb because it likely reduces its *surprisal* (Konieczny 2000; Hale 2001; Levy 2008, a.o.).
- Comparison of (eventive) periphrastic passive, progressive active, simple past active (2)

(2) The guitarist {was rejected by / was rejecting / rejected} the attractive and talented singer in the hall next to the pub.

Results:

- No effect of voice on accuracy: Passives were understood just as well as actives.
- RTs at the verb did not differ in the auxiliary conditions (passive and progressive) but were significantly longer for actives without auxiliaries.
- Faster RTs at multiple regions within the second DP (after *by*) in passives
  - *by* as a morphological cue; could also explain previous online results

- **Self-paced reading study on English passives II: (Paolazzi et al. 2016)**

- Lexical aspect (state vs. event) and voice interact in the processing of English passives.
- Replaced eventive with stative verbs (subject experiencer verbs, e.g. *love*, *admire*)

Results:

- Voice affected accuracy: Participants understood actives better than passives.
- Faster RTs in passives at the verb and immediately after *by*.
- At the head of the second DP RTs for actives became numerically faster.

Interpretation of the results:

- Participants initially assign an adjectival parse to the stative passive.
- Upon encounter of the *by*-phrase this analysis becomes untenable.
- Reanalysis leads to numerically longer RTs at the head of the *by*-phrase for passives and to offline comprehension difficulties.

- **Overall picture**

- Passives (in English) are not more complex than actives by default, but only when formed on stative predicates due to a temporary adjectival/verbal ambiguity.
- Faster RTs: Levels of surprisal are lower at specific points during the processing of passives due to their richer morphology.

- **This paper**

- Review and extend the theoretical motivation for there being a temporary ambiguity in English stative passives and the point of its resolution.
- Removing the ambiguity: German makes a formal distinction between verbal and adjectival passive (auxiliary *werden* ‘become’ vs. copula *sein* ‘be’).

Predictions:

- English and German should show similar effects of surprisal (morphological cues) on RTs.
- Unlike in English, the event/state distinction should not influence the relative complexity of unambiguously verbal passives in German.

→ Predictions are borne out.

## 2 Background: The disambiguation of adjectival/verbal passives in English

- Verbal passives involve movement (cross-linguistically):
  - Either of an internal argument DP to subject position, possibly over the external argument DP in the (silent or overt) *by*-phrase (traditional assumption)
  - Or of a lower VP shell, dragging along the internal argument (e.g. Collins 2005; Gehrke & Grillo 2007, 2008)
- Adjectival passives are less complex: no additional movement (cross-linguistically)
  - The DP in subject position of adjectival passives behaves like an external argument. (see McIntyre 2013, for recent discussion, and literature cited therein)
- English: no formal distinction between adjectival and verbal passives; (3) allows either parse  
(3) The boy was loved by everyone.  
→ An adjectival parse might be preferred in some cases, depending on two factors:
  - Presence vs. absence of a ('specific') *by*-phrase
  - Predicate semantics (eventive vs. stative input)

### 2.1 Passivisation and the *by*-phrase

- Claim until recently for English: The presence of a *by*-phrase is enough to disambiguate towards the verbal reading, as *by*-phrases are not available with adjectival passives.  
BUT: English *by*-phrases are also found with adjectival passives (cf. McIntyre 2013; Bruening 2014)  
Also in German (e.g. Rapp 1997; Kratzer 2000; Anagnostopoulou 2003; Maienborn 2007) and other languages (cf. Alexiadou et al. 2015, for a general overview)  
→ A sentence like (4) is still ambiguous (actual drawing event vs. childish drawing):  
(4) This picture is drawn by a child.
- Referentiality restrictions on the nominals in English and German adjectival *by*-phrases: (cf. Gehrke 2015) (see also Alexiadou et al. 2014, for extensive discussion and further reference)
  - Ok: Weakly non-referential (e.g. bare nouns, weak (in)definites, (4)), generic DPs (3)
  - No strongly referential DPs (5)  
(5) a. The door seemed broken/opened/painted (\*by Mary). (McIntyre 2013)  
b. Der Mülleimer ist (\*von meiner Nichte) geleert. (Rapp 1996)  
the rubbish-bin is by my niece emptied  
Intended: 'The rubbish bin is emptied by my niece.'  
→ In the presence of a specific *by*-phrase an English passive is unambiguously verbal.
- Problems with previous studies, e.g. (6) (Traxler et al. 2014, Experiment 2, items 23 & 24)  
(6) a. The neighbours were upset by the college students living next door.  
b. The child was upset by the nurse at the clinic this morning.
  - Until the (specific) *by*-phrase both sentences can be interpreted as an adjectival passive.
  - E.g. felicitous continuation with *about* in (7)

- (7) The neighbours were upset about the noise.
- Online studies typically seek to find complexity effects looking at RTs at the verb  
BUT: At this region it is not clear that a verbal passive structure should be postulated.
  - [Traxler et al. \(2014\)](#) also looked at RTs at the *by*-phrase  
BUT: Complexity effects are often found in spill-over regions in self-paced reading.  
→ Since the *by*-phrases used are typically short, effects could have been missed.  
(6) is rather exceptional in this respect
  - Probably not a problem for offline studies: By the end of, e.g., (6) the ambiguity is gone.

## 2.2 Passivisation and verb type

- An adjectival passive ascribes a temporal stative property to its subject.
  - Best input: Verbal predicates containing a stative subevent (cf. [Rapp 1997](#), for German)
  - (For German:) The state has to be interpretable as an inchoative state  
→ Some states, changes of state (i.e. accomplishments, achievements)
  - Activities/processes (e.g. *kick*) and more lasting states (e.g. *know*) are not good inputs

(see also [Alexiadou et al. 2015](#); [Gehrke 2015](#), and literature cited therein)

→ (8) (involving an activity) is parsed as a verbal passive, since an adjectival interpretation (out of context and without additional coercion) is unavailable.

(8) John was kicked.

- Input requirements for verbal passives (in English, Italian, but not German; see §2.4)
  - Eventive predicates (i.e. activities, accomplishments, achievements)
  - Passivised states like (9) will first and foremost be parsed as an adjectival passive, unless context (e.g. a specific *by*-phrase) requires a verbal passive interpretation.

(9) John was loved.

⇒ Elimination of the verbal/adjectival ambiguity with some predicates / Some inputs favour one parse over the other (if we assume that the other parse can be made available through coercion).

- English, Italian: Stative inputs are good adjectival passives, bad with verbal passives.
  - Such predicates undergo coercion into a consequent state subevent to receive an inchoative, i.e., eventive interpretation. (cf. [Gehrke & Grillo 2007](#); [Garraffa & Grillo 2008](#), for discussion)
  - This leads to reduced acceptability. (cf. [Belletti & Rizzi 1988](#), on object experiencers)
- Relevance of predicate semantics (& adjectival/verbal ambiguity) in **acquisition literature**:
  - Children’s comprehension and production of maintained *actional* vs. problematic *nonactional* passives (see e.g., [Maratsos et al. 1985](#); [Borer & Wexler 1987](#); [Fox & Grodzinsky 1998](#), a.o.)
  - Restated in terms of event structure ([Gehrke & Grillo 2009](#)):  
Verbal passivisation requires an event structure with at least two subevents, which is absent in states; states have to undergo inchoative coercion.<sup>2</sup>

<sup>2</sup>Data from aphasia show a similar distinction at play, in the sense that aphasics have more problems with stative than with eventive inputs (see [Grodzinsky 1995](#); [Grillo 2008](#), for discussion). For additional empirical support for the event-structure-based account in [Gehrke & Grillo \(2009\)](#) see [Crawford \(2012\)](#); [Estrela \(2014\)](#); [Snyder & Hyams \(2015\)](#) and especially [Volpato et al. \(2015\)](#).

### 2.3 Processing ambiguous verbal passives: English (Paolazzi et al. 2015, 2016)

- Problem with previous processing studies: Ignore adj./verb. ambiguity & state/event distinction
  - Possible adjectival parse until specific *by*-phrase, leading to costly reanalysis
  - Costs should be observable in lower accuracy scores and/or longer RTs online, but only at or after the *by*-phrase. → Use of longer *by*-phrases & spillover regions
- Predictions were borne out: Testing voice alternations in English always involves having to deal with the adjectival/verbal ambiguity, which acts as a powerful confound.

BUT: Unclear whether previous studies found passives to be more difficult than actives:

- A Due to this ambiguity and the use of a mixed bag of predicates?
- B Due to passivisation itself?

### 2.4 Processing unambiguous verbal passives: German

- German verbal vs. adjectival passives: auxiliary *werden* (10-a) vs. copula *sein* (10-b)

- (10)
- a. Der Gitarrist wurde zurückgewiesen.  
the guitarist became rejected  
'The guitarist was/has been rejected.'
  - b. Die Reifen waren aufgepumpt.  
the tires were up-pumped  
'The tires were inflated.'

→ Allows separating potential verbal/adjectival ambiguity effects from pure voice effects.

- If a complexity were to be detected, it would only be imputable to passivisation.

- German vs. English, Italian:

- Verbal passives with stative inputs do not force an eventive/inchoative reading.  
(see also Koo 1997; Rapp 1997)

E.g. Italian (examples from Belletti & Rizzi 1988, p. 311):

- Stative verbs are always good inputs to (ambiguous) *essere*-passives, with a preference for the adjectival reading (11-a).
- Stative inputs are coerced into an inchoative reading in (verbal) *venire*-passives (11-b).
- Coercion is not always possible (11-c).

- (11)
- a. Gianni è temuto/apprezzato dai suoi concittadini.  
Gianni is feared/appreciated by his fellow-citizens
  - b. Gianni viene temuto/apprezzato dai suoi concittadini.  
Gianni comes feared/appreciated by his fellow-citizens
  - c. \*Gianni viene preoccupato/appassionato dalla politica.  
Gianni comes worried/excited by the politics

German *werden*-passive does not force an inchoative interpretation of states (12).

- (12) Hans wird von seinen Mitbürgern gefürchtet/geschätzt.  
Hans becomes by his fellow-citizens feared/appreciated  
'Hans is feared/appreciated by his fellow-citizens.'

- The corresponding adjectival passive is usually ungrammatical, but becomes more acceptable with additional modification by *bei/von allen* ‘at/by all’ or *weltweit* ‘worldwide’.  
(see also Zifonun 1992; Zifonun et al. 1997, for earlier discussion of this point)

Speculation Italian vs. German:

- Italian *venire* is a marked form; the default passive auxiliary is *essere* ‘be’ (ambiguity).
- German *werden* is a fully grammaticalised verbal passive auxiliary. (cf. Eroms 1992)

⇒ **German as an ideal testing ground of the proposal in Paolazzi et al. (2015, 2016).**

- Expectations, based on their previous hypotheses:
  - Surprisal account of faster RTs
    - Online, German should behave like English (similar morphological cues)
  - Offline, German should not behave like English:
    - \* English: Processing difficulty due to stative input & adjectival/verbal ambiguity
    - \* German: No ambiguity; also: specific *by*-phrase appears before verbal predicate
      - neither stative nor eventive inputs should be difficult

### 3 Experiment 1

- Participants
    - 40 native German speakers from University of Stuttgart
    - All participants gave their informed consent and received either course credits or monetary compensation for their participation.
  - Materials, e.g. (13)
    - Original stimuli from Paolazzi et al. (2015): active vs. passive, eventive inputs
    - Translated into German verbal passive plus some changes; e.g. perfect vs. progressive: German lacks a progressive; perfect functions mostly like a simple past
- (13) a. Der Gitarrist wurde von der attraktiven und talentierten Sängerin in der  
the guitarist became by the attractive and talented singer in the  
Konzerthalle zurückgewiesen, während es zu regnen begann.  
concert.hall rejected while it to rain began  
‘The guitarist was rejected by the attractive and talented singer in the concert hall  
as it began to rain.’
- b. Der Gitarrist hat die attraktive und talentierte Sängerin in der Konzerthalle  
the guitarist had the attractive and talented singer in the concert.hall  
zurückgewiesen, während es zu regnen begann.  
rejected while it to rain began  
‘The guitarist had rejected the attractive and talented singer in the concert hall as  
it began to rain.’
- 30 items per condition, manipulating *Voice* [active vs. passive], additional 60 fillers
  - Each followed by (half yes / half no) comprehension question targeting thematic relations between different arguments of the verb that were used in the actual sentences.
  - Stimulus sentences were closely translated from the original stimuli in Paolazzi et al. (2015), which were normed for plausibility of thematic role assignment.

- Procedure

- Word-by-word self-paced reading with a moving window display (Just et al. 1982)
- Latin-square design
- PC, Linger software (<http://tedlab.mit.edu/dr/Linger/>)
- Soundproof booth, Linguistics lab, Universität Stuttgart
- Razer©(BlackWidow©2014) gaming keyboard (1000Hz polling rate) for accurate timing
- Instructions by the researcher and on computer screen concerning the functioning of the moving window display (dashes for each word, pressing of the space bar to advance, etc.)
- Each participant was first familiarised with the experimental method via a series of practise trials, which were excluded from data analysis.
- The time required to press the space bar for each word was recorded by the software.
- Upon the final key press a comprehension question appeared to which participants responded by key presses (“F” for YES, “J” for NO).
- The experiment took approximately 20 minutes to complete.
- Participants were instructed to take breaks only after answering the comprehension question; a mandatory break was planned in the middle of the experiment.

- **Comprehension Data Analysis & Results**

- All participants scored above 70% in comprehension questions.
- Comprehension question accuracy analysis with a mixed effects model in R with a binomial distribution
- *Voice*: Fixed Effect; *Item* and *Participant*: Random Effects
- Both random intercepts and slopes were included.
- The analysis did not show any significant difference in accuracy across condition.

Active	Passive
80.6	77.3

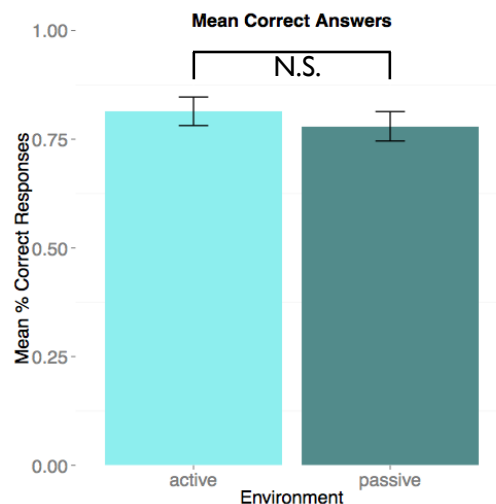


Figure 1: Mean % of correct responses per condition.

contrast	coefficient	SE	z-value	p
Voice	-0.3067	0.1973	-1.555	0.12

- Response Times

- Statistics were performed by using mixed effect regression models as implemented in the R-package lme4 (Bates et al. 2014).
- Response Times were analysed in a linear mixed effects model with *Voice* as Fixed Effect and *Item* and *Participant* as Random Effects.
- Both random intercepts and slopes were included.
- P-values were determined through treating the t-value as a z-statistic (Barr et al. 2013).
- There was a marginal effect of *Voice* on Response Time ( $t=-1.57$ ,  $p\text{-value}=.11$ ).

- Reading Time Analysis

- Regions with RTs longer than 2500ms and shorter than 100ms were eliminated from the analysis.
- Residual Reading Times (RRTs) were calculated for each subject from the difference between a word logRT and its predicted logRT, based on a model that included number of characters (considering both experimental and filler items) as a Fixed Effect and Participant as Random Effect (intercept only).<sup>3</sup>
- RRTs which deviated from the mean by more than 2.5 standard deviations (per participant and region) were automatically eliminated from the analysis at this point using Tang's (2014-2015) Linger Toolkit.
- RRTs were analysed with a linear mixed effects model in *R* with *Voice* as a Fixed Effect and *Item* and *Participant* as a Random Effects.
- Both random intercepts and slopes were included.<sup>4</sup>

There were three regions of interest:

- The second DP (embedded within the *by* phrase in the passive condition)
- The verb
- The postverbal region

## Results – RTs

- As in the English study reported in Paolazzi et al. (2015)
  - Passives were read faster than actives at multiple regions (see Figure 2).
  - RTs were significantly faster for passives two regions downstream from the beginning of the *by*-phrase (i.e. at the first prenominal adjective *attractive*,  $p\text{-value}=.027$ ), and approached significance at the Determiner ( $p\text{-value}=.17$ ) and the conjunction ( $p\text{-value}=.08$ ).
  - Taken together, these results support the idea that the higher amount of morphological cues in passives (i.e., presence of *von* 'by') reduces surprisal associated with the following DP and locally reduces syntactic processing complexity.

<sup>3</sup>This is a standard procedure for self-paced reading data and works to eliminate the confounding effects of individual reading speed and character length per word (Ferreira & Clifton 1986).

<sup>4</sup>For comparison, we also calculated and analyzed RRTs based on a more complex model including the restricted cubic spline of word position in the sentence, item position in the stimulus list as factors as in Jaeger et al. (2008) and Hofmeister (2011). As the results did not change across the two models we will report the results of the simplest model.



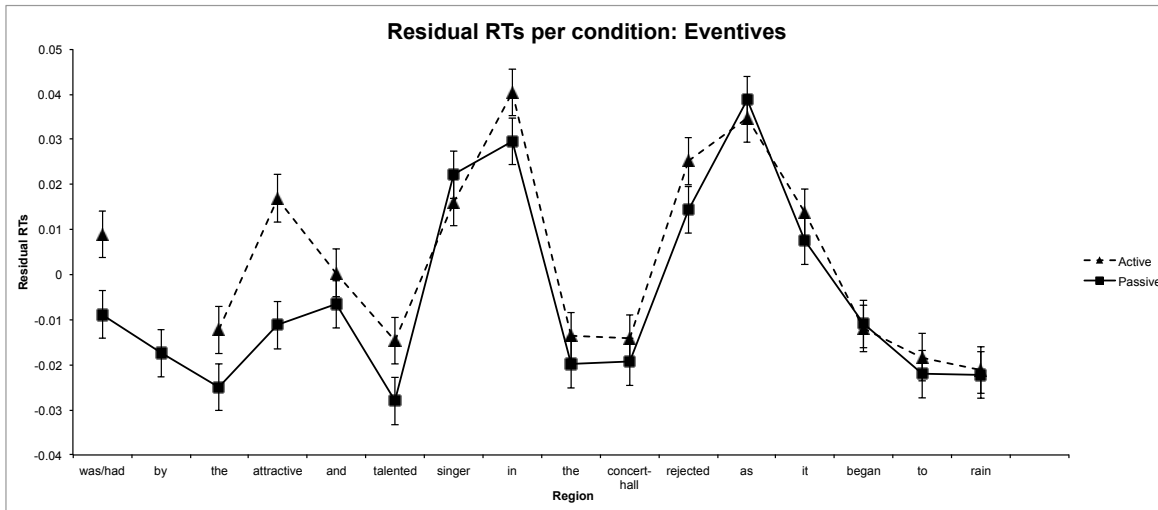


Figure 2: Mean residual RTs per region

- Contrary to what we observed in English:
  - No effect of *Voice* at the verb ( $p\text{-value}=.37$ ), as expected
  - *Voice* did not affect RTs at any other region.
- A possible alternative explanation in terms of a passive bias based on frequency of occurrence was ruled out by a corpus-based analysis of all the verb entries contained within the DeReKo 2015-II; cf. Table 1

Verb	Frequency passive %	Verb	Frequency passive %
zurückweisen	28.3	angreifen	62.67
verletzen	89.55	einstellen	68.86
bedrängen	67.83	anheuern	30.07
verklagen	21	erstechen	61.85
entführen	70.97	zurücklassen	35.73
bestechen	36.68	ausrauben	79.01
beleidigen	37.33	entführen	70.9
verführen	19.44	austricksen	32.86
bezahlen	26.05	ausrauben	79.01
verklagen	21	bergen	93.53
feuern	74.07	schlagen	45.51
stoßen	54.02	beleidigen	37.33

Table 1: List of verbs used in Experiment 1 with relative frequency of the passive form.

- Conservative frequency count: Only actives in the perfect form used in the experiment (significantly lower than the overall frequency of actives for these verbs), in comparison to the past form for the passive
- A Pearson’s product-moment correlation analysis performed in R between the frequency of the predicates surface structure and the residual logRT at the first prenominal adjective (the region that most robustly showed faster RTs for passives than actives), confirmed that frequency did not play a role in shaping our results ( $t=-0.17512$ ,  $p\text{-value}= 0.861$ ).
- Overall, the results add to the picture sketched in [Paolazzi et al. \(2015\)](#).

## 4 Experiment 2

- German counterpart to [Paolazzi et al. \(2016\)](#)
    - Unambiguous verbal passives of stative predicates
    - Another difference from English: *by*-phrase precedes the final verb → Any measure of complexity is expected to show up at the verb or as spillover in the regions following it.
    - We expect to replicate an RT advantage for passives over actives at the region of the second DP/*by*-phrase observed in Experiment 1 (also observed for English).
    - We should not observe any inversion of the effect at the verb or at the following regions (because of the lack of the adjectival/verbal ambiguity).
    - Contrary to English, we should also not expect an advantage for actives over passives in our offline measure (comprehension accuracy).
  - Participants
    - 34 German native speakers from the University of Stuttgart
    - All participants gave their informed consent and received either course credits or monetary compensation for their participation.
  - Materials and Design
    - 24 minimal pairs of active/passive sentences following the format in (14)<sup>5</sup>
    - Translation of [Paolazzi et al.’s \(2016\)](#) stimuli proved more difficult.  
→ New stimuli were constructed, obeying the same format of the original ones.
    - To create an additional region after the verb to test for spill-over effects, we added a subordinate (causal or concessive) clause.
    - All stimulus sentences were normed for plausibility of thematic role assignment.
    - The experimental procedure was kept identical to the one of Experiment 1.
- (14) a. Der eigenwillige Schriftsteller wurde von seinem seltsamen und wortkargen  
the headstrong writer became by his strange and taciturn  
Kollegen respektiert, obwohl er ihn nicht mochte.  
colleague respected although he him not liked  
‘The headstrong writer was respected by his strange and taciturn colleague, even  
though he did not like him.’
- b. Der eigenwillige Schriftsteller hat seinen seltsamen und wortkargen Kollegen  
the headstrong writer has his strange and taciturn colleague  
respektiert, obwohl er ihn nicht mochte.  
respected although he him not liked  
‘The headstrong writer had respected his strange and taciturn colleague, even  
though he did not like him.’
- Data Analysis and Results
    - Data analysis was conducted exactly as in the previous experiment.

---

<sup>5</sup>Note that this experiment differs from the previous one in that we avoided the long PP in between the *by*-phrase and the verb. This additional region was initially introduced to test for potential spill-over effects following the *by*-phrase and before the verb. No such effects were observed, however. Furthermore, as the two sets of stimuli do not differ up until the verb, i.e., after this region, we wanted to avoid making the experiment unnecessarily longer.

- Accuracy (Figure 3)

- Verbal passives of stative verbs are understood just as well as their active counterpart.
- Supports the idea that the main factor explaining lower performance with English stative passives relates to the adjectival/verbal ambiguity absent in German

Active	Passive
87.0	88.2

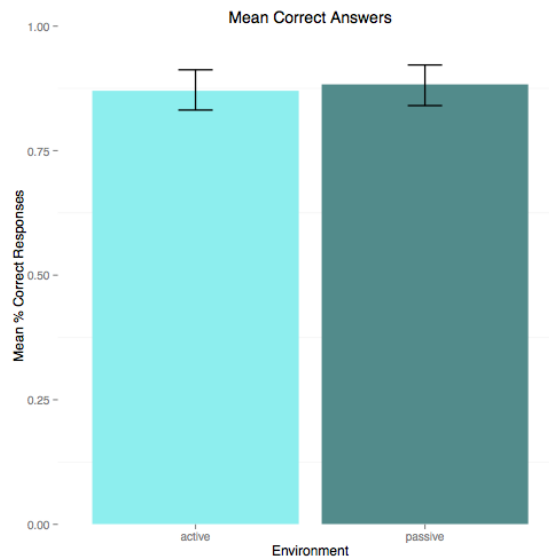


Figure 3: Mean % of correct responses per condition (temporary plot)

contrast	coefficient	SE	z-value	p
Voice	0.1814	0.2440	0.744	0.457

- Response Times: did not differ across condition ( $t = -1.50$ ,  $p\text{-value} = .132$ ) although the numerical trend was in the same direction as experiment 1 (slower for passives).

- **Results – RTs**

Effect of *Voice* at multiple regions (faster RTs for passives) (as in Exp. 1); cf. Figure 4.

- Significant at two regions within the *by*-phrase: at the Determiner ( $p\text{-value} = .002$ ) and Conjunction ( $p\text{-value} = .0107$ )
- Marginally significant at the Verb ( $p\text{-value} = .075$ )
- Numerically faster RTs at the Verb and at following regions show no effect of verb type on RTs.
- Together with offline results: RT effects show that German unambiguously verbal passives with stative inputs are not harder to process than actives (contrary to English ambiguous passives).

- As for the previous experiment, we conducted an analysis of the frequency of all the verbs entries contained within the DeReKo 2015-II (Deutsches Referenzkorpus des IDS) corpus; cf. Table 2. (same result: Frequency cannot be an alternative explanation)

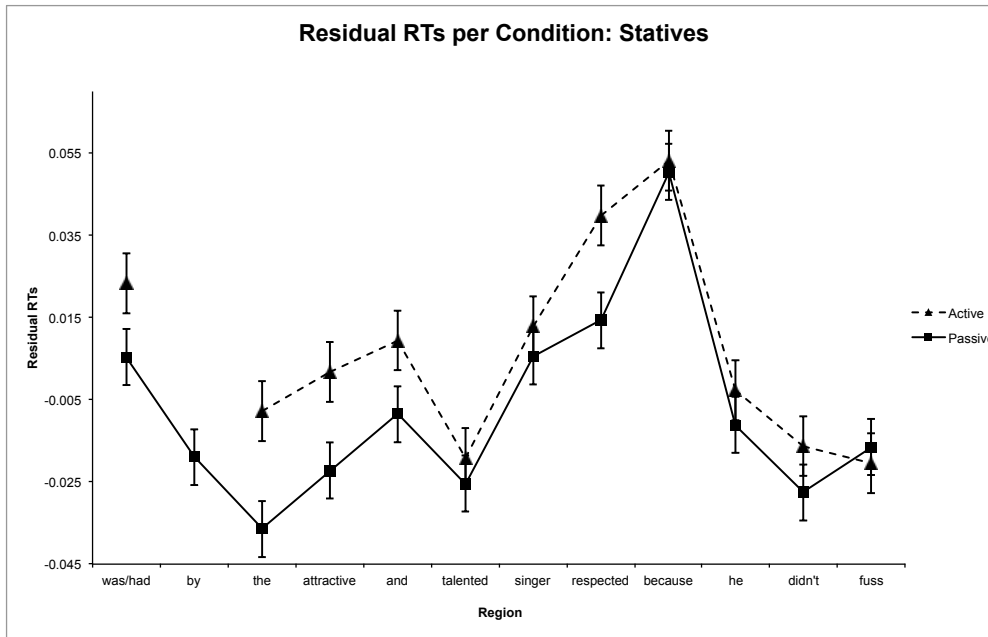


Figure 4: Mean residual RT per region Experiment 2

Verb	Frequency passive %	Verb	Frequency passive %
ablehnen	59.02	verschmähen	45.78
respektieren	43.76	gedenken	30.11
achten	61.66	misstrauen	17.01
schätzen	77.22	bemitleiden	57.89
bewundern	52.41	fürchten	28.93
beneiden	43.03	vergöttern	53.048
hassen	29.77	verehren	76.72
vertrauen	21.53	verachten	37.76
lieben	22.7	mögen	8.27
wertschätzen	44.68	begehren	35.61
brauchen	27.93	bedauern	32.08
achten	61.66		

Table 2: List of verbs used in Experiment 2 with relative frequency of the passive form (Mean = 41.26%).

## 5 Discussion and Conclusion

- Two self-paced reading studies on German:
  - Active vs. verbal passive with eventive input (Experiment 1)
  - Contrast with stative input (subject experiencer predicates) (Experiment 2)
- Main findings:
  - German unambiguously verbal passives are as easy to understand as actives.
  - This effect is independent of the type of predicate used as input (state vs. event).

- Fragmented picture from the few studies of the processing of passive sentences in unimpaired adults, as compared to actives:
  - Mostly on English; typically either offline or online, but not both
  - Worse performance in comprehension (Ferreira 2003)
  - Faster RTs in reading (Carrithers 1989; Rohde 2003; Traxler et al. 2014)
- Paolazzi et al. (2016): 3 potentially confounding factors in evaluating the role of Voice itself
  1. Variable degree of morphological richness across Voice, which likely influences RTs
  2. Adjectival/verbal passive ambiguity in English
  3. The use of a mixed bag of verbs, which is problematic in the light of 2) since predicate type (event vs. state) interacts with this ambiguity

→ A clearer picture emerges when these factors are controlled for.

- Passives of eventive verbs are not harder to understand than corresponding actives.
- Complexity effects emerge with statives (in English): Initial adjectival passive interpretation requires reanalysis (and coercion into an inchoative state).
- The present paper adds to this picture in the following ways:
  - We replicate the main finding: Passives are not necessarily harder to parse than actives.
  - Embedding stative verbs in unambiguously verbal passives in German
    - Indirect support for the claim that previously observed complexity effects with English passives are due to the interaction of the adj./verbal ambiguity with predicate type
  - Online: Faster RTs in passives than actives in the region of the second DP in both English and German: morphological cue (*von/by*) reduces surprisal
  - German, unlike English: no effect of voice or verb type → unambiguously verbal passive early on & exclusive use of periphrastic forms
  - (Marginally significant) numerically longer RTs at the head of the *by*-phrase in English but not in German → Lack of ambiguity in German
- From an acquisition perspective, these results might be expected as well.

Borer & Wexler (1987):

- Children's asymmetric ability to deal with passives of *actional* and *nonactional* passives stems from their inability to derive verbal passives through A-mvt of the internal argument.
- Being unable to derive passives via A-mvt, children resort to an adjectival parse when possible.
- Passives of actional verbs are easier because they can more easily receive an adjectival interpretation (as in e.g. *the girl is well combed*).

Gehrke & Grillo (2009):

- The relevant distinction is not based on *actionality*, but on *event structure*.
- States freely participate in adjectival passivisation across languages but resist verbal passivisation in many languages.
- Verbal passives of states (but not of complex events) are hard because they initially license an adjectival interpretation, which then turns out to be incompatible with specific *by*-phrases.
- In some languages, states need to be coerced into events to successfully participate in verbal passivisation, which further adds to their complexity.

- This predicts a potential domain of variation in acquisition:
  - Passives should be harder to acquire/understand in languages like English, where they are ambiguous (up until a specific *by*-phrase) than in languages like German, where they are disambiguated early.

Potential support from findings in [Armon-Lotem et al. \(2016\)](#):

- Tested children’s ability to comprehend passives in 11 typologically different languages
  - Passives are easier to acquire in languages such as German where they are uniquely marked, unlike what the literature on passive acquisition reports for English.
  - Caveat: The study only tested passives of *actional* verbs.
- Future work: Test the processing of unambiguous verbal passives in Italian
    - Like English: ambiguous BE-passives
    - Similar to German: verbal *venire*-passive
    - Unlike German: *venire*-passives force an inchoative interpretation of stative verbs.
- This partial overlap with German would allow assessing whether the main factor distinguishing English from German is the lack of ambiguity or lack of coercion.

## References

- Alexiadou, Artemis, Elena Anagnostopoulou & Florian Schäfer. 2015. *External arguments in transitivity alternations: a layering approach*, vol. 55. Oxford University Press, USA.
- Alexiadou, Artemis, Berit Gehrke & Florian Schäfer. 2014. The argument structure of adjectival participles revisited. *Lingua* 149. 118–138.
- Anagnostopoulou, Elena. 2003. Participle and voice. In Artemis Alexiadou, Monika Rathert & Armin von Stechow (eds.), *Perfect Explorations*, 1–36. Berlin: Mouton de Gruyter.
- Armon-Lotem, Sharon, Ewa Haman, Kristine Jensen de López, Magdalena Smoczynska, Kazuko Yatsushiro, Marcin Szczerbinski, Angeliek van Hout, Ineta Dabašinskienė, Anna Gavarró, Erin Hobbs, Laura Kamandulytė-Merfeldienė, Napoleon Katsos, Sari Kunnari, Chrisa Nitsiou, Lone Sundahl, Olsen Xavier Parramon, Uli Sauerland, Reeli Torn-Leesik & Heather van der Lely. 2016. A large-scale cross-linguistic investigation of the acquisition of passive. *Language Acquisition* 23(1). 27–56.
- Barr, D.J., R Levy, C. Scheepers & H.J. Tily. 2013. Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language* 68(3). 255–278.
- Bates, D., M. Mächler, B. Bolker & S. Walker. 2014. Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823*.
- Belletti, Adriana & Luigi Rizzi. 1988. Psych verbs and  $\theta$ -theory. *Natural Language & Linguistic Theory* 6. 291–352.
- Bever, Thomas G. 1970. The cognitive basis of linguistic structure. In J. R. Hayes (ed.), *Cognition and the development of language*, 279–362. New York: Wiley.
- Borer, Hagit & Kenneth Wexler. 1987. The maturation of syntax. In Tomas Roeper & Edwin Williams (eds.), *Parameter setting*, 123–172. Dordrecht: Reidel.
- Bruening, Benjamin. 2014. Word formation is syntactic: Adjectival passives in English. *Natural Language and Linguistic Theory* 32(2). 363–422.
- Carrithers, Caroline. 1989. Syntactic complexity does not necessarily make sentences harder to understand. *Journal of Psycholinguistic research* 18(1). 75–88.
- Collins, Chris. 2005. A Smuggling approach to the passive in English. *Linguistic Inquiry* 36(2). 289–297.

- Crawford, Jean. 2012. *Developmental perspectives on the acquisition of the passive*. Storrs, CT: University of Connecticut dissertation.
- Eroms, Hans-Werner. 1992. Das deutsche passiv in historischer sicht. *Deutsche Syntax, Ansichten und Aussichten, de Gruyter, Berlin* 225–249.
- Estrela, Antónia Pimentel. 2014. *A aquisição da estrutura passiva em português europeu*: Faculdade de Ciências Sociais e Humanas, Universidade Nova de Lisboa dissertation.
- Ferreira, Fernanda. 2003. The misinterpretation of noncanonical sentences. *Cognitive Psychology* 47. 164–203.
- Ferreira, Fernanda & Charles J. Clifton. 1986. The independence of syntactic processing. *Journal of Memory and Language* 25(3). 348 – 368.
- Fox, Danny & Yosef Grodzinsky. 1998. Children’s passive: A view from the *by*-phrase. *Linguistic Inquiry* 29(2). 311–332.
- Garraffa, Maria & Nino Grillo. 2008. Canonicity effects as grammatical phenomena. *Journal of Neurolinguistics* 21. 177–197.
- Gehrke, Berit. 2015. Adjectival participles, event kind modification and pseudo-incorporation. *Natural Language and Linguistic Theory* 33(3). 897–938.
- Gehrke, Berit & Nino Grillo. 2007. Aspects on passives. In Sylvia Blaho, Eric Schoorlemmer & Luis Vicente (eds.), *Proceedings of console xiv*, 121–141. Available at <http://www.sole.leidenuniv.nl/>.
- Gehrke, Berit & Nino Grillo. 2008. How to become passive. In Kleantes K. Grohmann (ed.), *Explorations of Phase Theory: Features, arguments, and interpretation at the Interfaces Interface Explorations*, Berlin: de Gruyter.
- Gehrke, Berit & Nino Grillo. 2009. Event structure and the acquisition of passives. VII GLOW in Asia, Hyderabad.
- Grillo, Nino. 2008. *Generalized Minimality: Syntactic Underspecification in Broca’s Aphasia*. Utrecht: LOT. LOT Dissertation Series 186.
- Grodzinsky, Yosef. 1990. *Theoretical perspectives on language deficit*. MIT Press.
- Grodzinsky, Yosef. 1995. Trace deletion  $\theta$ -roles and cognitive strategies. *Brain and Language* 51. 469–497.
- Grodzinsky, Yosef. 2000. The neurology of syntax: language use without Broca’s area. *Behavioral and Brain Sciences* 23. 1–71.
- Hale, J. 2001. A probabilistic earley parser as a psycholinguistic model. In *Proceedings of the 2nd North American Chapter of the Association for Computational Linguistics on Language Technologies*, .
- Hofmeister, Philip. 2011. Representational complexity and memory retrieval in language comprehension. *Language and Cognitive Processes* 26(3). 376–405.
- Horgan, Dianne D. 1978. The development of full passives. *Journal of Child Language* 5. 65–80.
- Jaeger, Florian T., Evelyn Fedorenko, Philip Hofmeister & Edward Gibson. 2008. Expectation-based syntactic processing: Anti-locality effects outside of head-final languages. Paper presented at the 21st Annual CUNY Sentence Processing Conference, University of North Carolina-Chapel Hill, NC.
- Just, Marcel A., Patricia A. Carpenter & Jaqueline D. Woolley. 1982. Paradigms and processes in reading comprehension. *Journal of Experimental Psychology* 111. 228–238.
- Kamide, Yuki, Gerry TM Altmann & Sarah L Haywood. 2003. The time-course of prediction in incremental sentence processing: Evidence from anticipatory eye movements. *Journal of Memory and language* 49(1). 133–156.
- Knoeferle, Pia & Matthew W Crocker. 2006. The coordinated interplay of scene, utterance, and world knowledge: Evidence from eye tracking. *Cognitive Science* 30(3). 481–529.
- Konieczny, L. 2000. Locality and parsing complexity. *Journal of Psycholinguistic Research* 29(6). 627–645.
- Koo, Myung-Chul. 1997. *Kausativ und Passiv im Deutschen*. Lang.

- Kratzer, Angelika. 2000. Building statives. In Lisa J. Conathan (ed.), *Proceedings of the 26th annual meeting of the Berkeley Linguistics Society*, 385–399. Berkeley: Berkeley Linguistics Society.
- Levy, R. 2008. Expectation-based syntactic comprehension. *Cognition* 106. 1126–1177.
- Maienborn, Claudia. 2007. Das Zustandspassiv. grammatische Einordnung–bildungsbeschränkung–interpretationsspielraum. *Zeitschrift für germanistische Linguistik* 35(1-2). 83–114.
- Maratsos, Michael P., Danny Fox, Judith E. Becker & Mary A. Chalkley. 1985. Semantic restrictions on children passives. *Cognition* 19. 167–191.
- McIntyre, Andrew. 2013. Adjectival passives and adjectival participles in English. In Artemis Alexiadou & Florian Schäfer (eds.), *Non-canonical passives*, 21–42. John Benjamins.
- Paolazzi, Caterina, Nino Grillo, Artemis Alexiadou & Andrea Santi. 2015. Evidence against heuristic processing of English passive sentences. In *AMLaP (Architectures and Mechanisms for Language Processing)*, University of Malta.
- Paolazzi, Caterina, Nino Grillo, Artemis Alexiadou & Andrea Santi. 2016. Processing English passives: Interaction with event structure, but no evidence for heuristics. In *CUNY Conference on Human Sentence Processing*, University of Florida.
- Rapp, Irene. 1996. Zustand? Passiv? – Überlegungen zum sogenannten “Zustandspassiv”. *Zeitschrift für Sprachwissenschaft* 15(2). 231–265.
- Rapp, Irene. 1997. Partizipien und semantische Struktur: Zu passivischen Konstruktionen mit dem 3. Status. Tech. rep. Tübingen: Stauffenberg.
- Rohde, Douglas. 2003. The on-line processing of active and passive structures in English. <http://tedlab.mit.edu/dr/Papers/Rohde-Gibson-CUNY2003.pdf>.
- Snyder, William & Nina Hyams. 2015. Minimality effects in children’s passives. In Elisa di Domenico, Cornelia Hamman & Simona Matteini (eds.), *Structures, strategies and beyond: Studies in honour of Adriana Belletti*, 343–368. (Linguistik Aktuell/Linguistics Today, 223). Amsterdam/Philadelphia: John Benjamins.
- Tang, Kevin. 2014-2015. Linger toolkit. <http://tang-kevin.github.io/Tools.html>.
- Townsend, David J & Thomas G Bever. 2001. *Sentence comprehension: The integration of habits and rules*, vol. 1950. MIT Press.
- Traxler, Matthew J., David P. Corina, Jill P. Morford, Sara Hafer & Liv J. Hoversten. 2014. Deaf readers’ response to syntactic complexity: Evidence from self-paced reading. *Memory and Cognition* 42. 97–111.
- Volpato, F., L. Verin & A. Cardinaletti. 2015. The comprehension and production of verbal passives by Italian preschool-age children. *Applied Psycholinguistics* 37(4). 901–931.
- Zifonun, Gisela. 1992. Das Passiv im Deutschen: Agenten, Blockaden und (De-)Gradierungen. In L. Hoffmann (ed.), *Deutsche Syntax: Ansichten und Aussichten*, 250–275. Berlin and New York: Walter de Gruyter.
- Zifonun, Gisela, Ludger Hoffmann & Bruno et al. Strecker. 1997. *Grammatik der deutschen Sprache*, vol. 3. Berlin and New York: Walter de Gruyter.