

Pitch and Syntactic Disambiguation in English and German: An Eye-tracking study

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PROSODY AND SYNTACTIC DISAMBIGUATION

SYNTACTIC AMBIGUITIES

Sentence structure causes ambiguity

PREPOSITIONAL-PHRASE ATTACHMENT AMBIGUITIES

Noun-Phrase Attachment

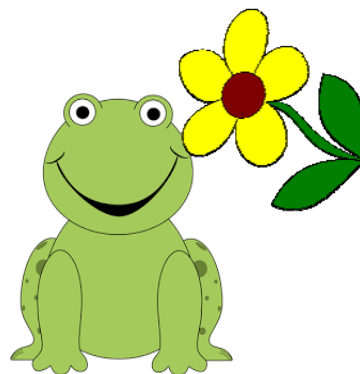
Tap the frog with the flower



PREPOSITIONAL-PHRASE ATTACHMENT AMBIGUITIES

Verb-Phrase Attachment

Tap the frog **with the flower**

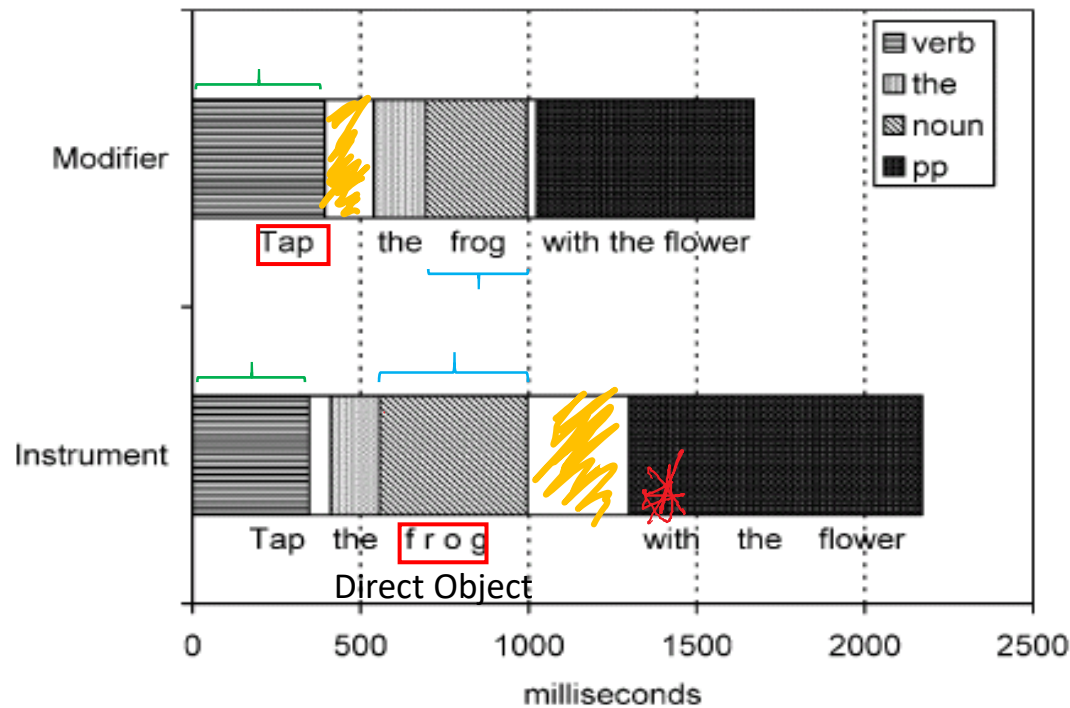


PROSODIC CUES CAN HELP DISAMBIGUATE BETWEEN INTERPRETATIONS

**(Lehiste, 1973; Price et al., 1991; Speer, Kjelgaard, &
Dobroth, 1996; Schafer, 1997; Snedeker & Trueswell, 2003;
Lingel et al., 2006).**

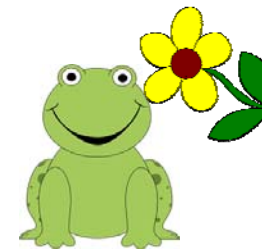
SNEDEKER AND TRUESWELL (2003) - RESULTS

Comparison of Interpretations:
Mean duration of words and pauses:



Noun-Phrase Attachment

Verb-Phrase Attachment



CUES USED IN ENGLISH AND GERMAN

Snedeker and Trueswell (2003) Lingel et al. (2006)

	ENGLISH		GERMAN	
Acoustic Cues	Noun Phrase Attachment	Verb Phrase Attachment	Noun Phrase Attachment	Verb Phrase Attachment
Subject length				
Verb length	■			
Direct Object length		■		
Prepositional Phrase length		■		
Verb pitch excursion				
Direct Obj. pitch excursion				
Verb-Direct Object pause	■			
Direct Obj-Prep Phrase pause		■		
Pitch accent on preposition (<i>with</i>)		■		

CUES USED IN ENGLISH AND GERMAN

Snedeker and Trueswell (2003) Lingel et al. (2006)

	ENGLISH		GERMAN	
Acoustic Cues	Noun Phrase Attachment	Verb Phrase Attachment	Noun Phrase Attachment	Verb Phrase Attachment
Subject length				
Verb length	Green	White	Green	White
Direct Object length	White	Green	White	Green
Prepositional Phrase length	White	Green	White	Green
Verb pitch excursion				
Direct Obj. pitch excursion				Red
Verb-Direct Object pause	Green	White	Green	White
Direct Obj-Prep Phrase pause	White	Green	White	Green
Pitch accent on preposition (<i>with</i>)	White	Green	White	Green

O'BRIEN ET AL. (2014) – PROSODY AND SYNTACTIC DISAMBIGUATION IN ENGLISH AND GERMAN

Production study on American English and German:

- English-German bilinguals
- German-English bilinguals
- Monolingual English speakers

O'BRIEN ET AL. (2014)

Temporarily ambiguous prepositional-phrase attachments:

English

The thief hit **the man** with no money. (NP Attachment)

The thief **hit** the man with a chair. (VP Attachment)

German

Der Dieb schlug **den Mann** mit einem Euro. (NP Attachment)

Der Dieb **schlug** den Mann mit einem Stuhl. (VP Attachment)

O'BRIEN ET AL. (2014) – STIMULI NOUN-PHRASE ATTACHMENT

CONTEXT:

During a hold-up, a thief wanted money from two men. One man gave the thief twenty dollars. The other man had no money.

The thief hit the man with no money.

O'BRIEN ET AL. (2014) - RESULTS

English

The thief hit the man with no money. (Noun Phrase Attachment)

The thief hit the man with a chair. (Verb Phrase Attachment)

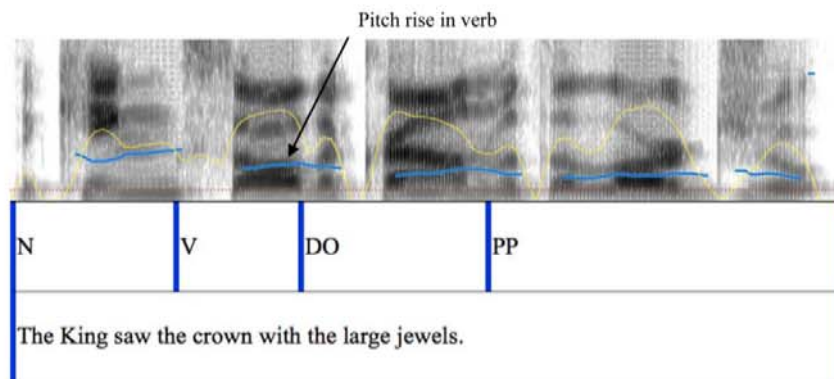
German

Der Dieb schlug den Mann mit einem Euro. (Noun Phrase Attachment)

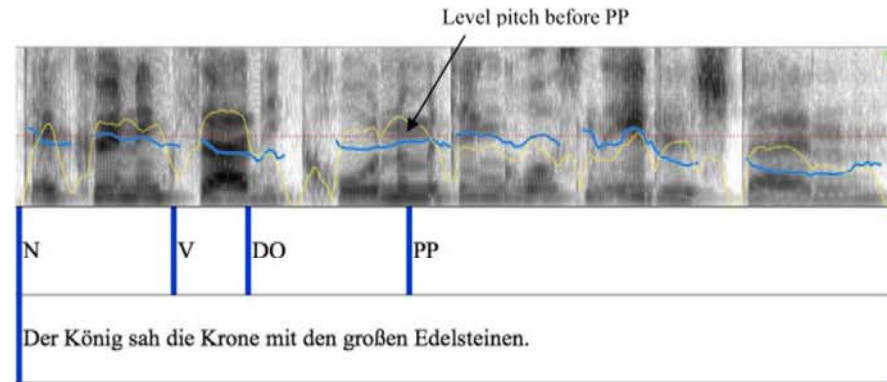
Der Dieb schlug den Mann mit einem Stuhl. (Verb Phrase Attachment)

O'Brien production results example

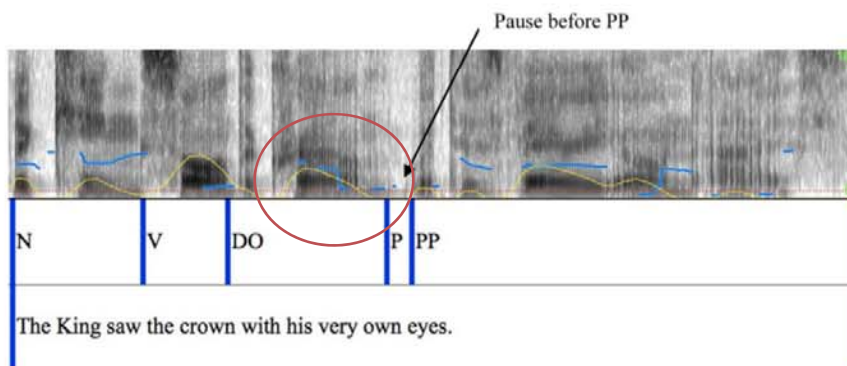
(A) English NP-attachment sentence



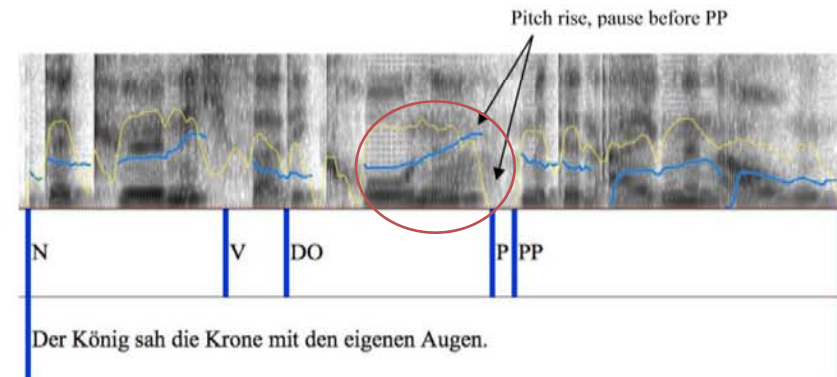
(C) German NP-attachment sentence



(B) English VP-attachment sentence



(D) German VP-attachment sentence





THE CURRENT EXPERIMENT

Are *listeners* using different prosodic cues to
resolve ambiguity?

Sentences

English:

The man visited the zoo *with the new tigers/lions.* (NP Attachment)

The man visited the zoo *with his young niece/nephew.* (VP Attachment)

German:

Der Mann besuchte den Zoo *mit den neuen Tigern/Löwen.* (NP Attachment)

Der Mann besuchte den Zoo *mit seiner Nichte/Neffe.* (VP Attachment)

Sentences

English:

The man visited the zoo *with the new tigers/lions*. (NP Attachment)

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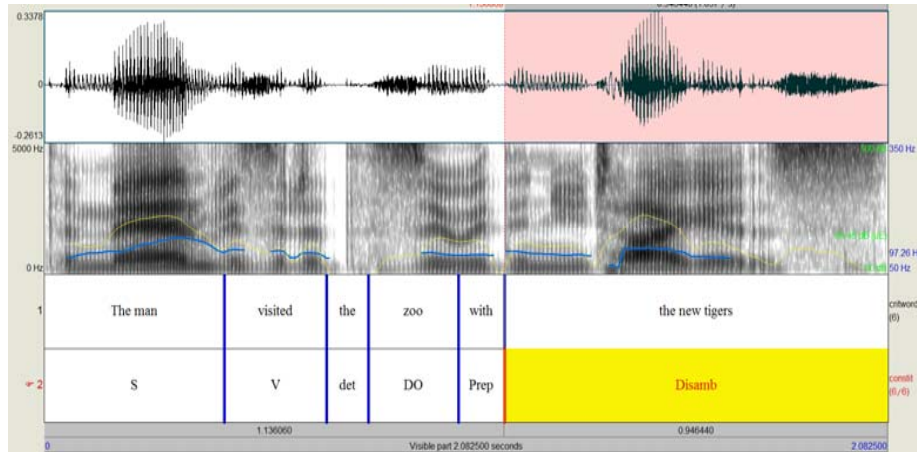
Der Mann besuchte den Zoo *mit seiner Nichte/Neffe.* (VP Attachment)



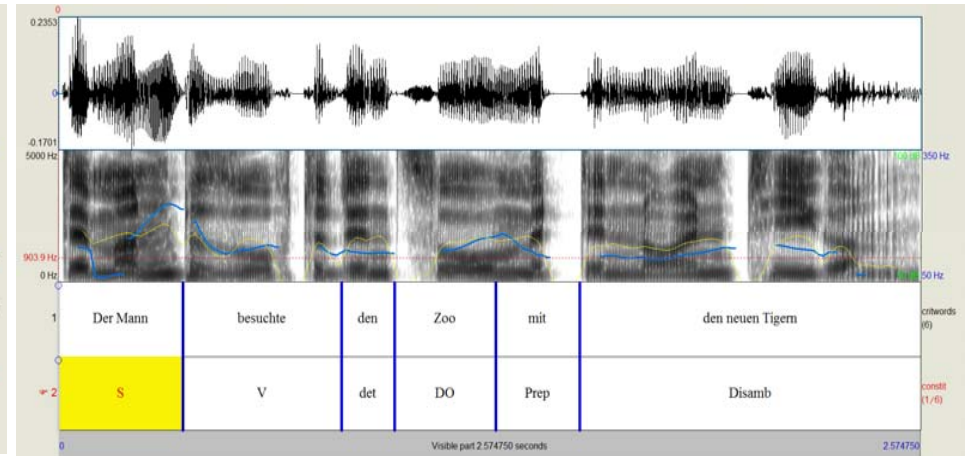
Equal number of syllables

Experiment Stimuli - Example

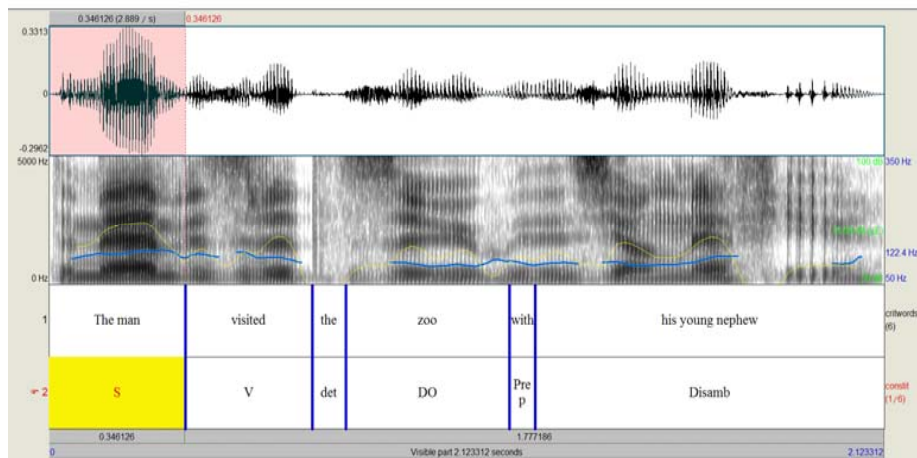
English NP 



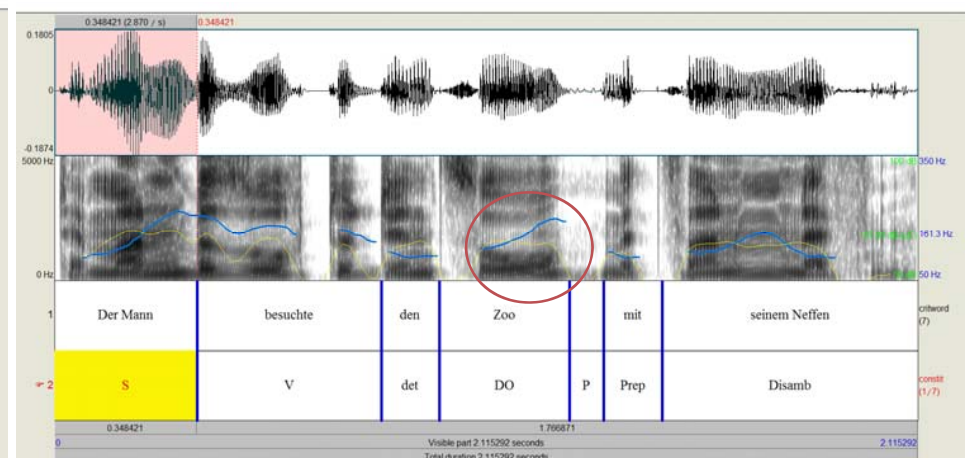
German NP 



English VP 



German VP 

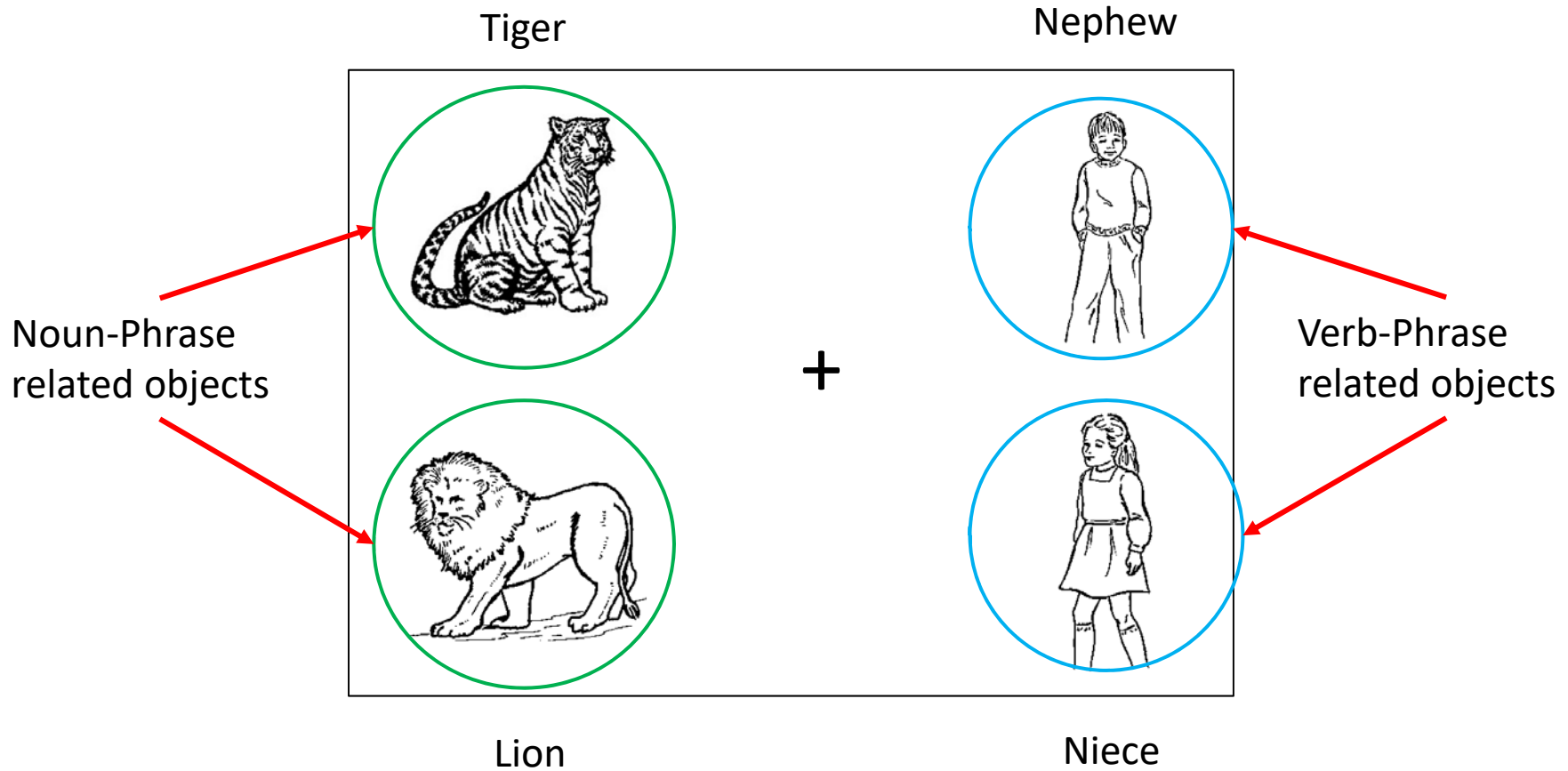


METHOD – VISUAL WORLD PARADIGM



The man visited the zoo *with the new tigers*. (Noun-Phrase Att)

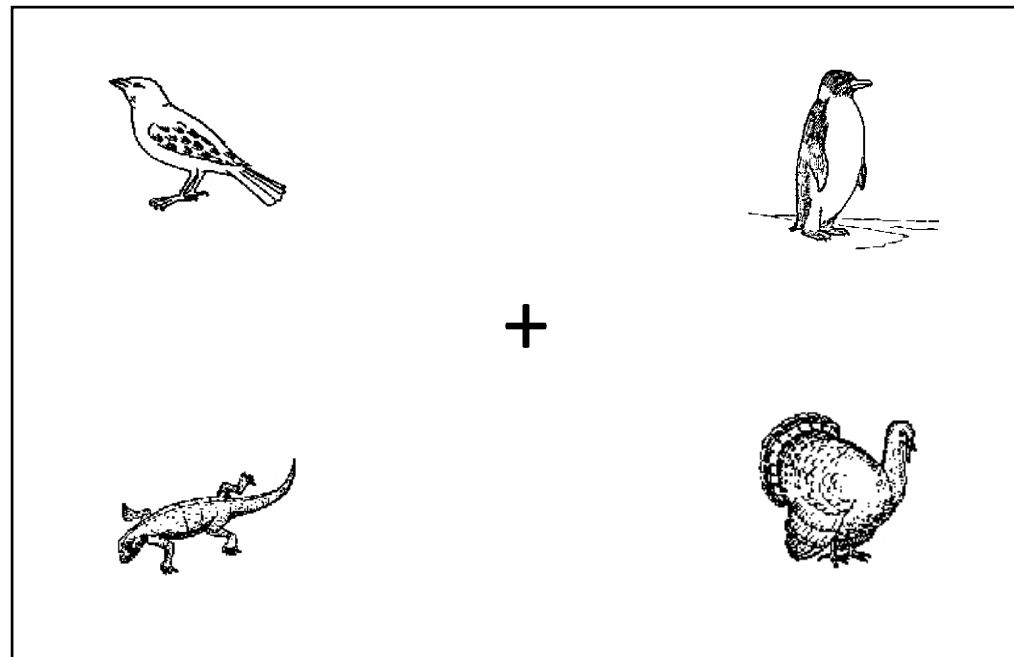
The man visited the zoo *with his young niece*. (Verb-Phrase Att)



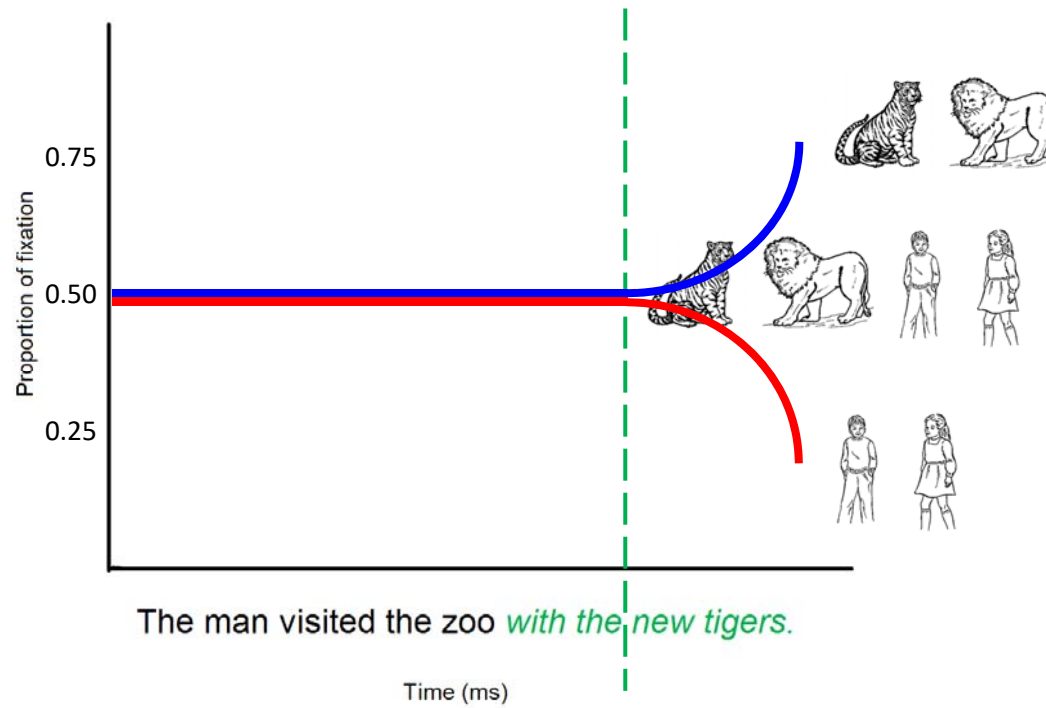
Fillers

- 32 sentences with different structures

The egg was laid by the lizard.



EXPERIMENT 1 – Eye movement predictions



PREDICTIONS

WITHIN LANGUAGES

If prosody helps to differentiate between syntactic structures
→ different patterns of fixation between NP and VP
sentences

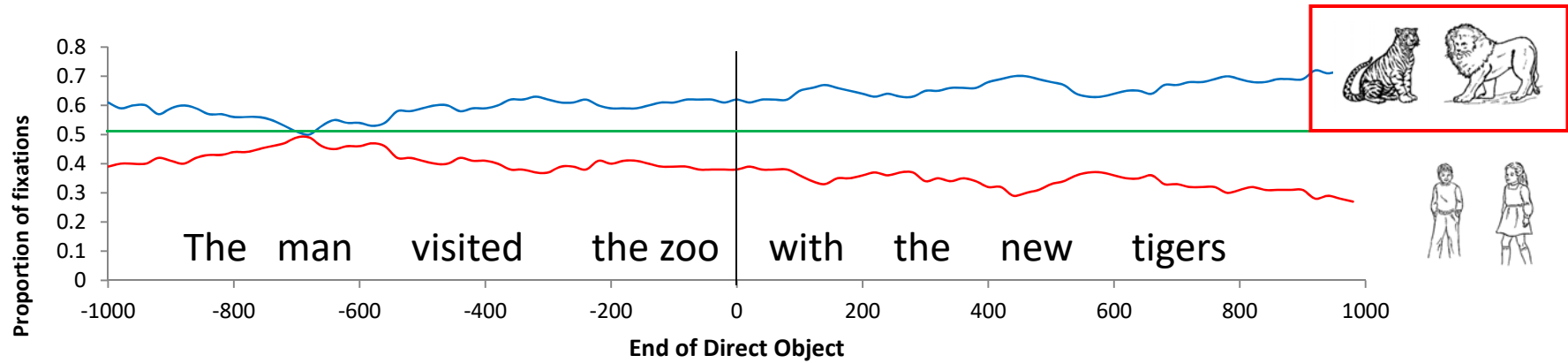
PREDICTIONS

BETWEEN LANGUAGES

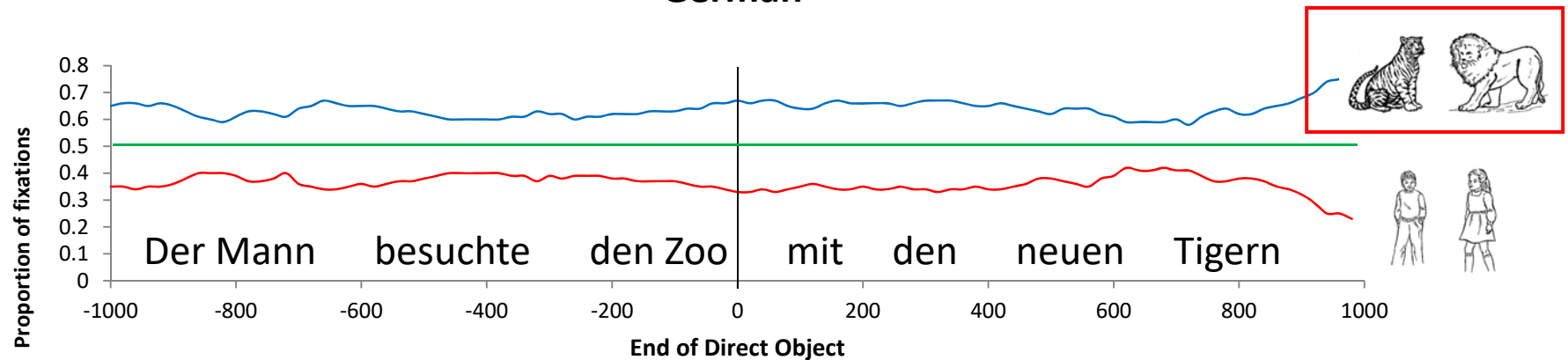
If English and German speakers are using different cues
→ Different pattern of eye movements between Eng NP
and Ger NP and Eng VP and Ger VP

RESULTS – NP vs VP WITHIN LANGUAGES

English

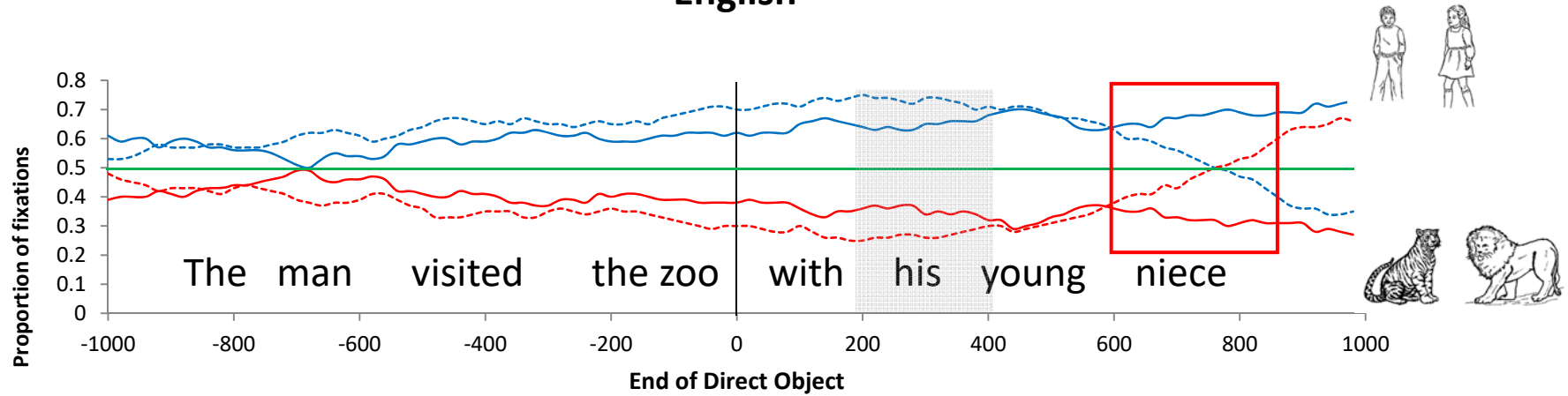


German

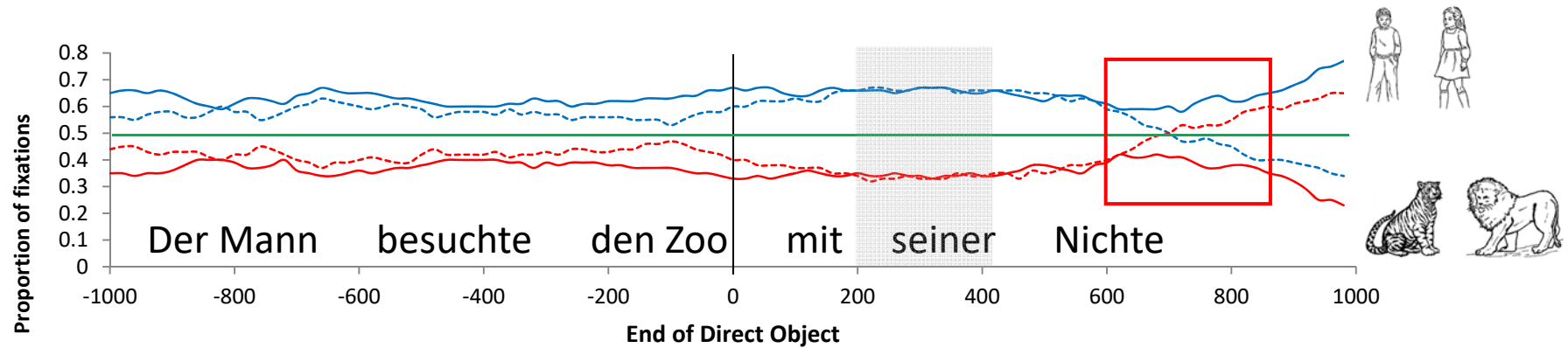


RESULTS – NP vs VP WITHIN LANGUAGES

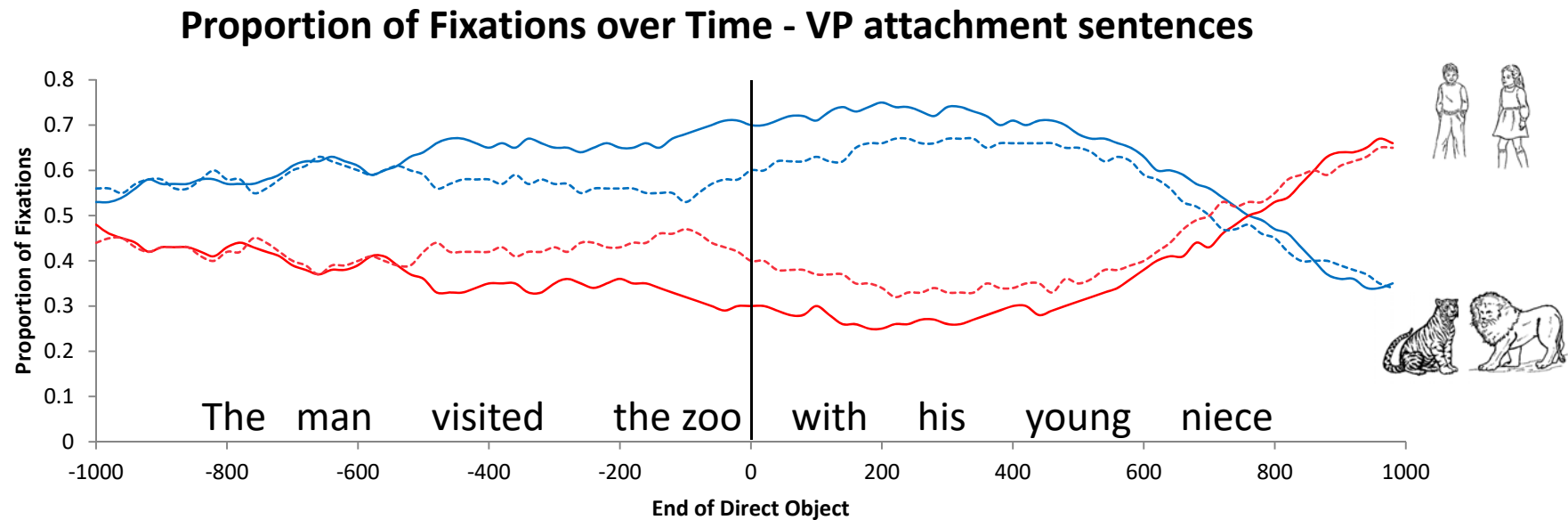
English



German



RESULTS – COMPARING VP FIXATIONS BETWEEN ENGLISH AND GERMAN

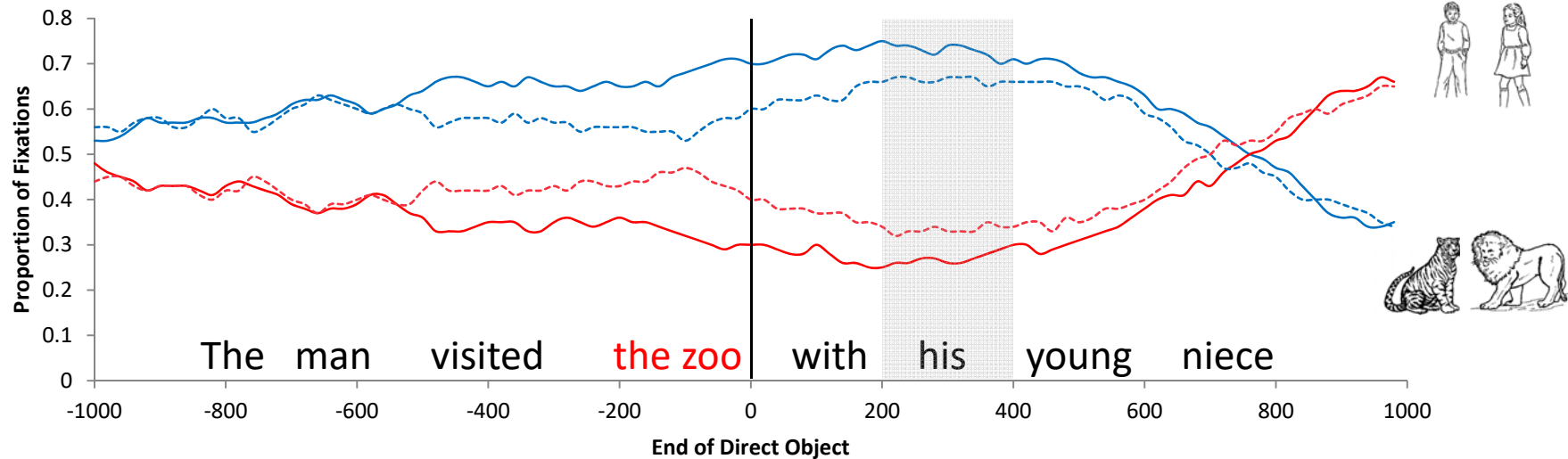


English – solid line
German – dotted line

NP objects - blue
VP objects - red

RESULTS – COMPARING VP FIXATIONS BETWEEN ENGLISH AND GERMAN

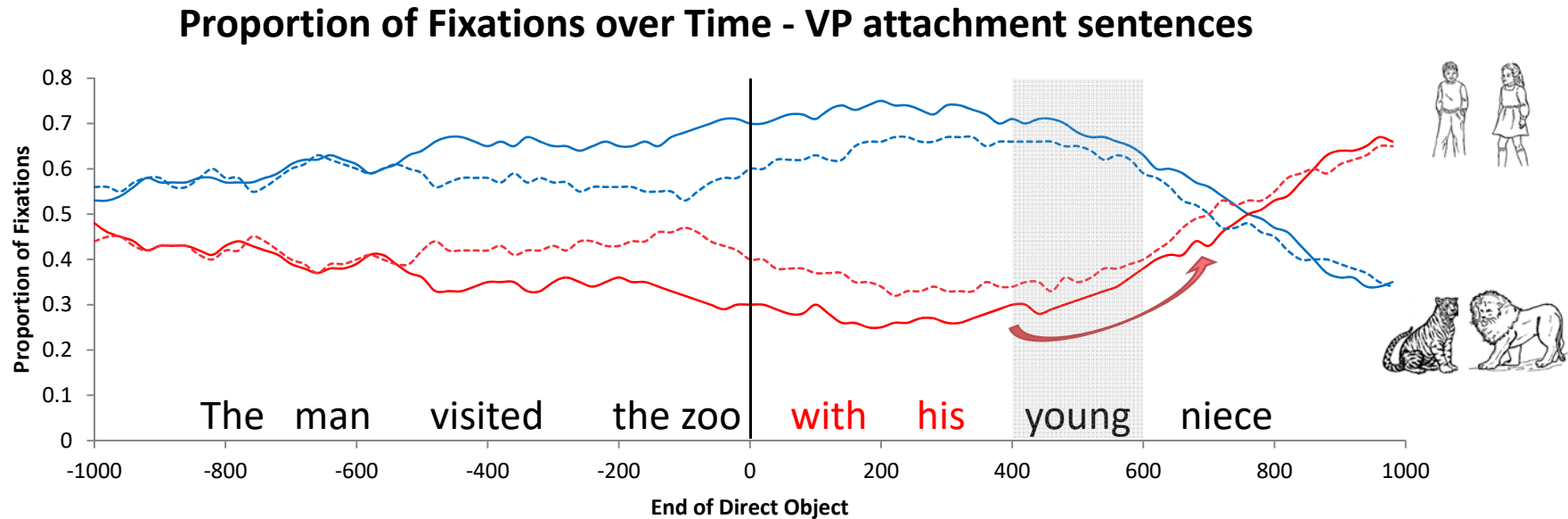
Proportion of Fixations over Time - VP attachment sentences



English – solid line
German – dotted line

NP objects - blue
VP objects - red

RESULTS – COMPARING VP FIXATIONS BETWEEN ENGLISH AND GERMAN



English – solid line
German – dotted line

NP objects - blue
VP objects - red

RESULTS SUMMARY

No evidence of anticipatory eye movements within and between these two types of attachments in English and German

DISCUSSION – WHY?

1. Variability within German group and between English and German group
 - German speakers from all different regions
 - Mean German age 34 vs mean English age 20

- Retest of German group in Tuebingen

DISCUSSION

2. Picture Stimuli

The journalist followed the gangster:

- with the scar.

- with the moustache.

- with his van.

- with the taxi.

-Switch to word stimuli?



DISCUSSION

3. Listeners may rely on other cues like context more than prosody when disambiguating (Snedeker & Trueswell, 2003)

-Review production results

DISCUSSION SUMMARY

1. Variability within German group and between English and German group

-Re-testing in Tuebingen

2. Picture Stimuli

-Switch from pictures to words

3. Listeners may rely on other cues like context more than prosody when disambiguating

-Review production results

English stimuli



Noun-Phrase attachments

Verb-Phrase attachments

1	The man visited the zoo with the new tigers. The man visited the zoo with the new lions.	The man visited the zoo with his young nephew The man visited the zoo with his young niece
2	Daniel is repairing the bike with the punctured tyre. Daniel is repairing the bike with the rusty, broken chain.	Daniel is repairing the bike with his screwdriver. Daniel is repairing the bike with his trusty spanner.
3	The director thanked the secretary with the blonde hair. The director thanked the secretary with the black hair.	The director thanked the secretary with some flowers. The director thanked the secretary with a nice gift.
4	Stephan hit the thief with the beard. Stephan hit the thief with the mask.	Stephan hit the thief with a stool. Stephan hit the thief with a bat.
5	Sophie ate the dessert with whipped cream. Sophie ate the dessert with caramel sauce.	Sophie ate the dessert with a spoon. Sophie ate the dessert with a fork.
6	The journalist followed the gangster with the scar. The journalist followed the gangster with the moustache.	The journalist followed the gangster with his van. The journalist followed the gangster with the taxi.
7	The doctor examines the man with the crutches. The doctor examines the man with the arm sling.	The doctor examines the man with the thermometer. The doctor examines the man with the stethoscope.
8	Peter inspected the ring with the diamond. Peter inspected the ring with the engraving.	Peter inspected the ring with a small torch. Peter inspected the ring with a glass lens.
9	Andrea opened the oven with the hot roast. Andrea opened the oven with the biscuits.	Andrea opened the oven with the oven mitts. Andrea opened the oven with a cloth.
10	Thomas caught the fish with many stripes. Thomas caught the fish with many spots.	Thomas caught the fish with his fishing rod. Thomas caught the fish with his fishing net.
11	Martin opened the package with the label. Martin opened the package with the bow.	Martin opened the package with his box cutter. Martin opened the package with the scissors.
12	The tourist found the museum with the famous paintings. The tourist found the museum with the ancient statues	The tourist found the museum with his guide book. The tourist found the museum with his city map.
13	Jonas ate the sushi with the prawns Jonas ate the sushi with the caviar	Jonas ate the sushi with his fingers. Jonas ate the sushi with his chopsticks.
14	The tutor is instructing the student with the cap. The tutor is instructing the student with the glasses.	The tutor is instructing the student with his textbook. The tutor is instructing the student with his study notes.
15	Frank delivered the pizza with extra olives. Frank delivered the pizza with extra mushrooms.	Frank delivered the pizza with his motorbike. Frank delivered the pizza with his motor scooter.
16	Sandra sewed the blouse with the long sleeves. Sandra sewed the blouse with the short sleeves.	Sandra sewed the blouse with the sewing machine. Sandra sewed the blouse with the needle and thread.

English stimuli



Noun-Phrase attachments

Verb-Phrase attachments

1	Der Mann besuchte den Zoo mit den neuen Tigern. Der Mann besuchte den Zoo mit den neuen Löwen.	Der Mann besuchte den Zoo mit seinem Neffen. Der Mann besuchte den Zoo mit seiner Nichte.
2	Daniel reparierte das Rad mit dem platten Reifen. Daniel reparierte das Rad mit der gerissenen Kette.	Daniel reparierte das Rad mit dem Schraubenzieher. Daniel reparierte das Rad mit dem Schraubenschlüssel.
3	Der Direktor dankte der Sekretärin mit den blonden Haaren. Der Direktor dankte der Sekretärin mit den schwarzen Haaren.	Der Direktor dankte dem Kollegen mit dem Blumenstrauß. Der Direktor dankte dem Kollegen mit dem Geschenk.
4	Stephan schlug den Dieb mit dem Bart. Stephan schlug den Dieb mit der Maske.	Stephan schlug den Dieb mit dem Hocker. Stephan schlug den Dieb mit dem Hammer.
5	Sophie aß den Nachtisch mit der Schlagsahne. Sophie aß den Nachtisch mit der Karamellsauce.	Sophie aß das Dessert mit dem Löffel. Sophie aß das Dessert mit der Gabel.
6	Der Journalist folgte dem Gangster mit der Narbe. Der Journalist folgte dem Gangster mit dem Schnurrbart.	Der Journalist folgte dem Gangster mit seinem Van. Der Journalist folgte dem Gangster mit dem Taxi.
7	Die Ärztin untersucht den Mann mit den Krücken. Die Ärztin untersucht den Mann mit der Schlinge.	Die Ärztin untersucht den Mann mit dem Thermometer. Die Ärztin untersucht den Mann mit dem Stethoskop.
8	Peter untersucht den Ring mit dem Diamanten. Peter untersucht den Ring mit der Gravur.	Peter untersucht den Ring mit der Taschenlampe. Peter untersucht den Ring mit der Lupe.
9	Andrea öffnet den Ofen mit dem Braten. Andrea öffnet den Ofen mit dem Gebäck.	Andrea öffnet den Ofen mit den Topflappen. Andrea öffnet den Ofen mit dem Tuch.
10	Thomas fing den Fisch mit den vielen Streifen. Thomas fing den Fisch mit den vielen Flecken.	Thomas fing den Fisch mit der Angel. Thomas fing den Fisch mit dem Netz.
11	Martin öffnet das Paket mit dem Aufkleber. Martin öffnet das Paket mit der Schleife.	Martin öffnet das Paket mit dem Teppichmesser. Martin öffnet das Paket mit der Schere.
12	Der Tourist fand das Museum mit den berühmten Gemälden. Der Tourist fand das Museum mit den alten Statuen.	Der Tourist findet das Museum mit seinem Reiseführer. Der Tourist findet das Museum mit seinem Stadtplan.
13	Jonas aß das Sushi mit den Garnelen. Jonas aß das Sushi mit dem Kaviar.	Jonas aß das Sushi mit den Fingern. Jonas aß das Sushi mit den Stäbchen.
14	Der Tutor unterrichtet den Schüler mit dem Rucksack. Der Tutor unterrichtet den Schüler mit der Brille.	Der Tutor unterrichtet den Schüler mit seinem Lehrbuch. Der Tutor unterrichtet den Schüler mit seinen Notizen.
15	Frank lieferte die Pizza mit extra Oliven. Frank lieferte die Pizza mit extra Pilzen.	Frank lieferte die Pizza mit seinem Motorrad. Frank lieferte die Pizza mit seinem Motorroller.
16	Sandra näht die Bluse mit den langen Ärmeln. Sandra näht die Bluse mit den kurzen Ärmeln.	Sandra näht die Bluse mit der Nähmaschine. Sandra näht die Bluse mit Nadel und Faden.