

Accessibility in language production

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Speakers can choose between a variety of referential expressions differing in terms of explicitness ...

(1) *Der Journalist* fand im Café *einen versteckten Brief*.

the journalist found in the café a hidden letter

Er ...

Der ...

Dieser ...

Der Journalist ...

Dieser Journalist ...

Er ...

Der ...

Dieser ...

Der Brief ...

Dieser Brief ...

p-pronoun

d-pronoun

demonstrative pronoun

definite NP

demonstrative NP

Example: Referential Expressions & Word Order

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demonstrative pronoun

definite NP

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... and they can choose between different word orders.

(1) *Der Journalist fand im Café einen versteckten Brief.*

the journalist found in the café a hidden letter

Er hat den Brief direkt gelesen.

Den Brief hat er direkt gelesen.

Er hat ihn direkt gelesen.

(?) Ihn hat er direkt gelesen.

Er hat den direkt gelesen.

Den hat er direkt gelesen.

...

He read the letter immediately.

The letter, he read immediately.

He read him immediately.

Him he read immediately.

This one, he read immediately.

This one, he read immediately.

Accessibility has been claimed to underlie two major choices speakers are faced with:

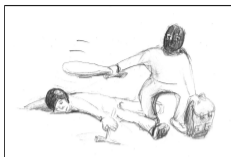
- **Accessibility:** *“the ease with which the mental representation of some potential referent can be activated in or retrieved from memory”* (Bock & Warren, 1985, p. 50)

Accessibility has been claimed to underlie two major choices speakers are faced with:

- **Accessibility:** *“the ease with which the mental representation of some potential referent can be activated in or retrieved from memory”* (Bock & Warren, 1985, p. 50)
- **Accessibility and word order:**
The first sentence position is preferentially filled by the most accessible referent.
- **Accessibility and referential expressions:**
Shorter expressions are chosen for more accessible referents.

Simplified version of the referential hierarchy (Kaiser & Fedele, 2019):

null forms > (unstressed) pronouns > demonstratives > full nouns ...

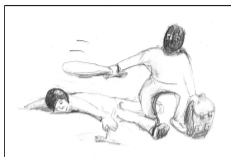


- 13% patient-first with animate agent:
The hiker is being struck dead by the criminal.



- 36% patient-first with inanimate agent (cause):
The hiker is being struck dead by the rock.

→ Animacy effects have been found in several languages using different methods: e.g., McDonald et al. (1993); Ferreira (1994); Prat-Sala & Branigan (2000); van Nice & Dietrich (2003); Verhoeven (2014).



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⇒ **Accessibility and word order:**

- Animate referents are assumed to be more accessible than inanimate referents.
- The first sentence position / subject position is preferentially filled by the most accessible referent.

- (2) a. **John** went to his favorite music store to buy a piano.
b. **He** had frequented the store for many years.
c. **He** was excited that **he** could finally buy a piano.
d. **He** arrived just as the store was closing for the day.

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- (2): coherent discourse; **John** = *center of attention* / **topic**
- (3): less coherent (although giving the same information); no clear *center of attention*

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⇒ **Accessibility and referential expressions:**

More reduced forms are used for more accessible referents (e.g., Gundel et al., 1993; Ariel, 2001).

Accessibility Hypothesis

At each point during an ongoing discourse, a referent mentioned in the discourse is associated with a certain accessibility value. This accessibility value governs both the linear position of the referential expression within the sentence and the choice of a referential expression for a referent.

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Predictions of the Accessibility Hypothesis

- Accessibility of a referent governs the linear position of the referential expression within the sentence: “more accessible \implies earlier sentence position”
- Accessibility of a referent governs the choice of a referential expression for this referent: “more accessible \implies more reduced form”

The Accessibility Hypothesis is tested in two experiments presented in this talk.

General aims:

- The experiments reported here are part of a larger research effort investigating choice of referential expressions, choice of word order, and the relationship between these two choices.
 - The first experiment reported here comes from an experimental series investigating verbs with animate agents and animate patients.
 - The second experiment reported here comes from a series of experiments investigating verbs with animate agents and inanimate patients.
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Specific research questions addressed in this talk

- Question 1: Can a single notion of accessibility account for both choice of word order and choice of referential expression?
- Question 2: How is accessibility determined when animacy and contextual salience are in conflict?

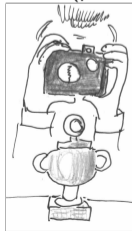
In the following, we present two picture description experiments testing the Accessibility Hypothesis using German materials:

- Participants had to describe pictures as shown on the right, using the verb printed above the picture.
- We focus on the following choices:
 - three competing referential expressions:
 - personal pronouns
 - demonstrative pronouns
 - definite NPs
 - two word orders:
 - canonical SO (subject-before-object) order
 - non-canonical OS (object-before-subject) order
- A preceding context manipulated two factors known to modulate accessibility:
 - topichood: topic more accessible than non-topic (e.g., Givón, 1992; Cowles & Ferreira, 2012)
 - linear position: initial NP more accessible than final NP (e.g., Gernsbacher & Hargreaves, 1988)

**Exp 1: Animate agent,
animate patient**
untersuchen (examine)



**Exp 2: Animate agent,
inanimate patient**
fotografieren (photograph)



(4) Topic = Agent

Der beste Arzt

In unserem Viertel gab es **einen sehr guten Arzt**.

Er/Dieser Arzt konnte fast immer helfen.

Einmal musste **er einen scheinbar schwerhörigen Klavierlehrer** behandeln.

The best doctor

'A very good doctor was practicing in our quarter.'

'**He/This doctor** could help almost always.'

'Once **he** had to treat a seemingly hearing-impaired piano teacher.'

untersuchen
(examine)



(5) Example descriptions

- Er untersuchte ihn.* (S:pro examined O:pro).
- Er untersuchte den Lehrer.* (S:pro examined O:def).
- Diesen hat der Arzt untersucht.* (O:dem examined S:def)

(6) **Topic = Patient**

Sorgen eines Klavierlehrers

In unserem Viertel gab es **einen guten Klavierlehrer**.

Er/dieser Klavierlehrer hatte eine Zeit lang Probleme beim Hören.

Einst suchte **er einen angesehenen Ohrenarzt** auf.

A piano teacher's worries

'A good piano teacher was living in our quarter.'

'He/This piano teacher was having hearing problems for quite a while.'

'Once he visited a respected ear specialist.'

untersuchen
(examine)



(7) Example descriptions

- Er untersuchte ihn.* (S:pro examined O:pro).
- Er untersuchte den Lehrer.* (S:pro examined O:def).
- Diesen hat der Arzt untersucht.* (O:dem examined S:def)

Task: Picture description in context

- Participants: 18 native German speakers
- Procedure:
 - Participants read a context consisting of three sentences.
 - Afterwards, they provided a spoken description of a picture "(transitive event; animate subject agent and animate object patient) using a given verb.
 - The experiment was run in our psycholinguistics lab.
- 24 experimental items in a 2x2 design:
 - **Context topic:** Which referent is the topic of the preceding context?¹ – agent vs. patient
 - **Referential form of topic:** How was the topic realized in the second context sentence – pronoun vs. demonstrative NP

¹The context topic is the topic according to standard definitions of *aboutness topic*, including Reinhart (1981) and Grosz et al. (1995), but also a topic in the broader sense of *discourse topic*.

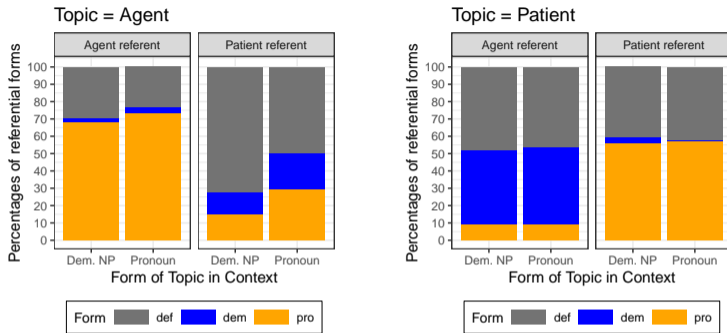


Figure 1: Referential forms used for referring to agent and patient in the picture descriptions.

Major pattern 1: Referential expressions

- Choice of pronoun: More pronouns for the agent when the agent was the topic, more pronouns for the patient when the patient was the topic.
- Choice of demonstrative: Mainly used for the non-topic.

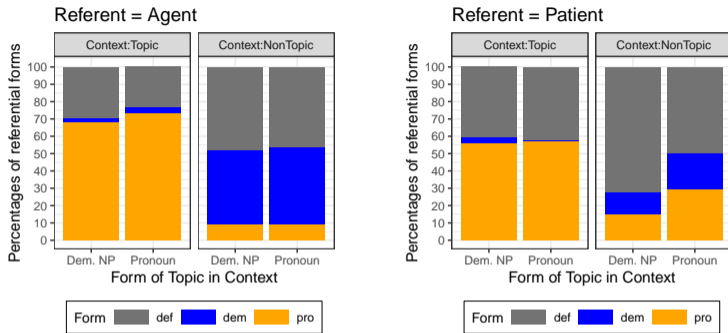


Figure 2: Referential forms used for referring to agent and patient.

Major pattern 2: Choice of pronoun

- Agent referent: Significant effect of Topic Status, no effect of referential form
 - Patient referent: Significant effect of Topic Status, no effect of referential form
- Pronoun use governed by topichood

Combinations of agent and patient expressions:

- **Agent more reduced than patient (A > P)**
e.g., *Er untersuchte den Lehrer.* 'He examined the teacher.'
- **Agent equals patient (A = P)**
e.g., *Er untersuchte ihn.* 'He examined him.'
- **Agent less reduced than patient (A < P)**
e.g., *Der Arzt untersuchte ihn.* 'The doctor examined him.'

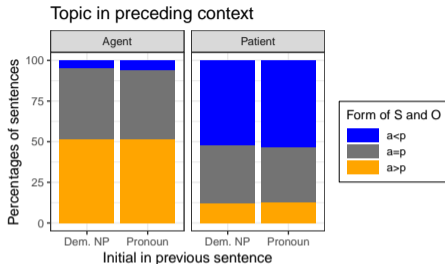


Figure 3: Combinations of referential forms used for referring to agent and patient.

Major pattern: Combination of agent and patient expressions

- With few exceptions, the referential expression for the topic was identical or more reduced than the referential expression for the non-topic. This holds equally for agent and patient as topic.
- This is in correspondence with Rule 1 of Centering Theory (When any non-topic is referred to by a pronoun, then the topic must be referred to by a pronoun, too).

How often were sentences produced with OS order?

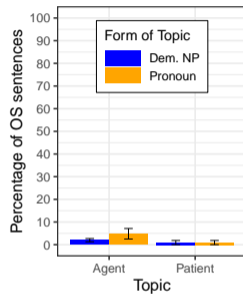


Figure 4: Percentages of OS sentences.

Major pattern: Word order

SO order was used in the large majority of descriptions, realizing the animate agent referent before the animate patient referent.

In Experiment 1,
accessibility was independent of animacy because agent and patient were both animate.

→ Accessibility was therefore predicted to be mainly a function of topichood.

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accessibility was independent of animacy because agent and patient were both animate.

→ Accessibility was therefore predicted to be mainly a function of topichood.

⇒ This prediction was confirmed with regard to the choice of referential expressions but not with regard to the choice of word order:

- **Choice of referential expressions:**

The topic, whether agent or patient, was referred to more often by a reduced expression than the non-topic.

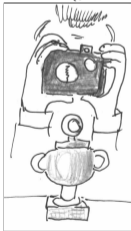
- **Choice of word order:**

Independently of which referent was the topic, SO order was strongly preferred.

Experiment 2 investigates pictures with an animate agent and an inanimate patient in order to disentangle effects of two main contributors to accessibility:

- animacy as a property of inherent accessibility
- topichood as a property of contextually derived accessibility

fotografieren (photograph)



(8) Context topic: Agent

Der Reporter

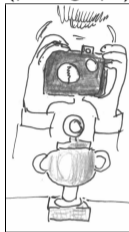
Bei unserer Zeitung arbeitet ein bekannter Reporter. Dieser Reporter hat schon die sonderbarsten Geschichten erlebt.

a. SO: Vor kurzem faszinierte ein wertvoller Pokal den Reporter_{top}.

b. OS: Vor kurzem faszinierte den Reporter_{top} ein wertvoller Pokal.

'The reporter. A well-known reporter works for our newspaper. This reporter has experienced all kind of strange stories. A short while ago a precious trophy fascinated he/the reporter_{top}.'

fotografieren
(photograph)



(9) Example descriptions

a. Er fotografierte ihn. (S:pro photographed O:pro).

b. Er fotografierte den Pokal. (S:pro photographed O:def).

c. Diesen hat der Reporter fotografiert. (O:dem photographed S:def)

(10) Context topic: Patient

Der Pokal

Unser Verein besitzt **einen wertvollen Pokal**.

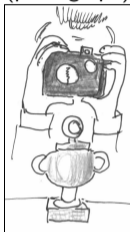
Dieser Pokal stand jahrelang vergessen in einer Rumpelkammer.

a. SO: Vor kurzem entdeckte zufällig **ein bekannter Reporter** **den Pokal_{top}**.

b. OS: Vor kurzem entdeckte **den Pokal_{top}** zufällig **ein bekannter Reporter**.

'*The trophy. Our club owns a precious trophy. This trophy had been standing forgotten in a boxroom for years. A short while ago a well-known reporter discovered **it/the trophy_{top}** by chance.*'

fotografieren
(photograph)



(11) Example descriptions

a. *Er fotografierte ihn.* (S:pro photographed O:pro).

b. *Er fotografierte den Pokal.* (S:pro photographed O:def).

c. *Diesen hat der Reporter fotografiert.* (O:dem photographed S:def)

Task: Picture description in context

- Participants: 26 native German speakers
- Procedure:
 - Participants read a context consisting of three sentences.
 - Afterwards, they provided a written description of a picture " (transitive event; animate subject agent and inanimate object patient) using a given verb.
 - The experiment was run on Ibx Farm (Drummond et al., 2016).
- 24 experimental items in a 2x2 design:
 - **Context topic:** Which referent is the topic of the preceding context? – agent vs. patient
 - **Initial Referent:** Which referent is mentioned first in the last context sentence? – agent vs. patient

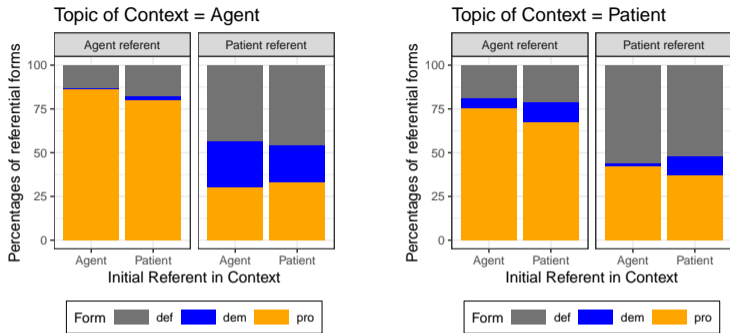


Figure 5: Referential forms used for referring to agent and patient in the picture descriptions.

Major pattern 1: Referential expressions

- Choice of pronoun: Across all contextual conditions, rate of pronoun choice higher for animate agent than for inanimate patient.
- Choice of demonstrative: Demonstrative rate jointly determined by topichood and animacy, with topichood having a somewhat stronger effect.

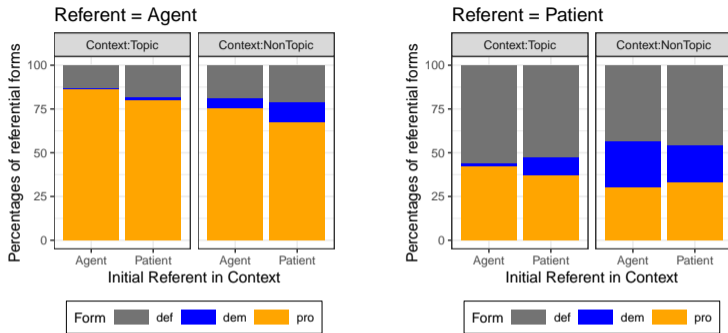


Figure 6: Referential forms used for referring to agent and patient.

Major pattern 2: Choice of pronoun

- Agent referent: Significant effects of Topic Status and Topic Position, no interaction
 - Patient referent: Only significant effect of Topic Status
- Contextual properties influence pronoun use, but effects small in comparison to effect of animacy.

Combinations of agent and patient expressions:

- **Agent more reduced than patient (A > P)**
e.g., *Er fotografierte den Pokal.* 'He photographed the trophy.'
- **Agent equals patient (A = P)**
e.g., *Er fotografierte ihn.* 'He photographed it.'
- **Agent less reduced than patient (A < P)**
e.g., *Der Reporter fotografierte ihn.* 'The reporter photographed it.'

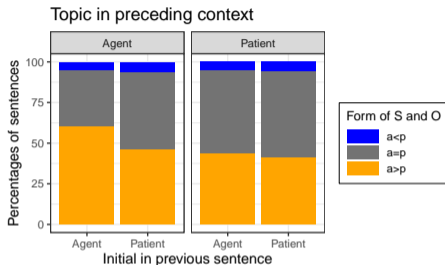


Figure 7: Combinations of referential forms used for referring to agent and patient.

Major pattern: Combination of agent and patient expressions

With few exceptions, the referential expressions for agent and patient were identical, or a more reduced form was used for the agent.

How often were sentences produced with OS order?

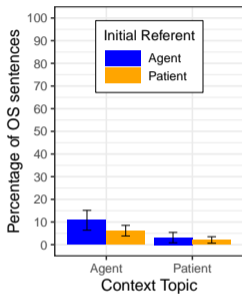


Figure 8: Percentages of OS sentences.

- The position of the context topic in the final context sentence had no significant effect.
 - The factor Context Topic had a significant effect:
 - 10% OS sentences with agent topic versus 2% OS sentences with patient topic.
- This is a side effect of a dependence of word order on referential form:
- OS sentences are mainly produced when the object (= patient) is a demonstrative.
 - Demonstrative patients were mainly produced when the agent was the context topic.

Major pattern: Word order

SO order was used in the large majority of descriptions, realizing the animate agent referent before the inanimate patient referent.

In Experiment 2, the agent was always more accessible than the patient in terms of animacy whereas accessibility due to topichood varied with context.

⇒ The results show that animacy outranks topichood in determining accessibility:

- **Choice of referential expressions:**

The animate agent referent, whether topic or non-topic, was referred to more often by a reduced expression than the inanimate patient referent.

- **Choice of word order:**

Independently of which referent was animate or the topic, SO order was strongly preferred.

Question 1: Can a single notion of accessibility account for both choice of word order and choice of referential expressions?

- Experiment 1: Higher pronoun rate for the topic than for the non-topic, suggesting that the topic referent is more accessible than the non-topic referent.
 - This is not reflected in the word-order results: Strong SO preference independent of which referent was the topic.
- Experiment 2: Higher pronoun rate for the animate referent than for the inanimate referent, suggesting that the animate referent is more accessible than the inanimate referent.
 - This is also reflected in the word-order results: Strong SO preference = Strong preference for animate argument before inanimate argument.

Despite initial appearance, these results are compatible with a single notion of accessibility!

- Accessibility plays a much larger role for the choice of referential expressions than for the choice of word order.
 - Choice of referential expressions: Rather direct reflection of accessibility status.
 - Choice of word order: Strongly influenced by “plan reuse” (MacDonald, 2013), that is, canonical word orders are used unless strong reasons cause a use of non-canonical word orders.

Question 2: How is accessibility determined when animacy and contextual salience are in conflict?

Answer: Experiment 2 shows that animacy outranks contextual salience, to judge both from pronoun choice and from choice of word order:

- Irrespective of the topic status of agent and patient, the animate agent was pronominalized much more often than the inanimate patient.
- In about 95% of all cases, sentences were produced with SO order, that is, with the animate argument preceding the inanimate argument.

Note: Animacy is confounded with thematic role and syntactic function in Experiment 2. Due to Experiment 1 with an animate agent and an animate patient, we can exclude that thematic role/syntactic function instead of animacy are responsible for the obtained results.

Question 2: How is accessibility determined when animacy and contextual salience are in conflict?

Due to the higher ranking of animacy, the agent expression in Experiment 2 was at least as high on the accessibility hierarchy as the patient expression, even when the patient was the topic and the agent was the non-topic.

→

This finding is in flagrant contradiction to Rule 1 of Centering Theory,

(12) Rule 1 of Centering Theory (adapted from Grosz et al., 1995, p. 214)

When any non-topical referent is realized by a pronoun, then the topic referent must be realized by a pronoun, too.

We propose to replace Rule 1 by a more general rule in terms of accessibility:

(13) *Accessibility corollary for the combined occurrence of referential expressions*

If referent α is more accessible than referent β , the referential expression used for α is at least as high on the referential hierarchy as the referential expression used for β .

- Animacy outranks topichood when choosing personal pronouns and word order.
- When animacy is held constant, topichood governs the choice of personal pronouns.
- SO order is preferred independently of which argument is the topic.
- The referential expression for the most accessible referent must be at least as reduced (= high on the referential hierarchy) as the expression for any less accessible referent.

Thank you!

Please contact us in case of feedback, questions, criticism, etc.

We are happy to get in touch:

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Experiment 1: Results – Combinations of referential expressions

Table 1: Percentages of combinations of referential expressions for subject (S) and object (O) in Experiment 1.

Forms for S and O		Description Topic = Agent		Description Topic = Patient	
		Form of context topic		Form of context topic	
		Pronoun	Definite NP	Pronoun	Definite NP
		n = 110	n = 109	n = 115	n = 121
subject = object	S:pro O:pro	12.5	23.2	3.3	3.4
	S:dem O:dem	0.0	0.0	0.0	0.0
	S:def O:def	24.6	19.5	31.9	30.7
subject more reduced	S:pro O:def	46.7	29.3	2.2	4.5
	S:pro O:dem	8.8	20.7	3.3	1.1
	S:dem O:def	1.3	1.2	6.6	6.8
object more reduced	S:def O:pro	1.3	3.7	16.5	15.9
	S:dem O:pro	0.8	2.4	36.3	37.5
	S:def O:dem	4.2	0.0	0.0	0.0

Note: def = definite NP; pro = personal pronoun; dem = demonstrative pronoun

Major pattern: Combination of agent and patient expressions

- With few exceptions, the referential expressions for the topic was identical or more reduced than the referential expression for the non-topic. This hold equally for agent and patient as topic.
- This is in correspondence with Rule 1 of Centering Theory (When any non-topic is referred to by a pronoun, then the topic must be referred to by a pronoun too).