Derived accessibility
**in sentence production –
Experimental investigations of
Structural & Perceptual Priming in German**

Inauguraldissertation

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Long live the horror.

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List of Abbreviations

ms	**m**illi**s**econds
sec	**sec**onds
V2	verb-second
Vend	verb-final
NP	**n**oun **p**hrase
PP	**p**repositional **p**hrase
DO	**d**ouble **o**bject
PO	**p**repositional **o**bject
SO	**s**ubject-before-**o**bject
OS	**o**bject-before-**s**ubject
SVO	**s**ubject-**v**erb-**o**bject
OVS	**o**bject-**v**erb-**s**ubject
SOV	**s**ubject-**o**bject-**v**erb
OSV	**o**bject-**s**ubject-**v**erb
SpecCP	**spec**ifier of the **c**omplementizer **p**hrase

Chapter 1

Introduction

Diebe stehlen Murnaus Schädel aus Grabkammer
Thieves steal Murnau's skull out of burial chamber

Es war nicht das erste Mal, dass sich Eindringlinge Zugang zur Grabkammer von Friedrich Wilhelm Murnau verschafften: Jetzt haben Unbekannte den Schädel des Kinopioniers entwendet.

It was not the first time that intruders gained entrance to Friedrich Wilhelm Murnau's burial chamber: Now strangers have stolen the theatrical pioneer's skull.

<div align="right">spiegel.de (2015) – posted July 14, 2015</div>

Diebe stehlen Schädel von "Nosferatu"-Regisseur Murnau
Thieves steal skull of "Nosferatu" director Murnau

Der Leichnam des weltbekannten Regisseurs Friedrich Wilhelm Murnau ist geschändet worden: Unbekannte entwendeten aus der Gruft in Stahnsdorf seinen Kopf. Die Polizei ermittelt wegen Störung der Totenruhe.

The corpse of the world-famous director Friedrich Wilhelm Murnau was desecrated: Strangers stole his head out of the crypt in Stahnsdorf. The police is investigating due to desecration of graves.

<div align="right">tagesspiegel.de (2015) – posted July 14, 2015</div>

Schädel von Nosferatu-Regisseur F.W. Murnau gestohlen
Skull of Nosferatu director F.W. Murnau stolen

Das Grab von F.W. Murnau, dem Regisseur des Horrorklassikers Nosferatu, wurde von Unbekannten geöffnet. Was klingt wie ein echter Horrofilm, ist nun Realität, denn Murnaus Schädel wurde entwendet.

The grave of F.W. Murnau, director of the horror classic Nosferatu, was opened by strangers. What sounds like a true horror movie is reality now, because Murnau's skull was stolen.

<div align="right">moviepilot.de (2015) – posted July 15, 2015</div>

The three headlines above and the corresponding subheadings all convey the same incident: Some people (we do not know their names and we also do not know how many[1]) stole the skull of F.W. Murnau. The structures chosen by the authors to illustrate the incident, however, differ. Whereas the author of the *Spiegel* (Example 1) consistently uses subject-before-object (SO) active structures, the author of the *Tagesspiegel* (Example 2) primarily uses these structures, but also includes a (short) passive structure. The author of the *Moviepilot*, finally, consistently uses (short as well as full) passives, i.e., non-canonical structures. A closer look at just the headlines, treating them as isolated sentences, also reveals some differences:

(1)   Diebe   stehlen Murnaus Schädel aus   Grabkammer
         thieves steal   Murnau's skull   out of burial chamber

(2)   Diebe   stehlen Schädel von "Nosferatu"-Regisseur Murnau
         thieves steal   skull   of   "Nosferatu" director   Murnau

(3)   Schädel von Nosferatu-Regisseur F.W. Murnau gestohlen
         skull   of   Nosferatu director   F.W. Murnau stolen

In example (1), the animate agents of the stealing appear in the first position of the headline. This is also the subject position. The plural noun *thieves*, without any article, is chosen for them. After the finite verb (*steal*) in the second position, the object is mentioned. This is the theme of the action (*Murnau's skull*). Finally, a locative prepositional phrase (PP) description (*out of the burial chamber*) is included to localize the event by specifying where the skull was taken from.

In example (2), the headline also starts with *thieves* followed by the verb. The object, however, differs from the first example. Not only is a prepositional construction chosen to specify that it is the *skull of Murnau* that was stolen, but there is also some further information about Murnau himself by including his profession (*director*) and his most famous work (*Nosferatu*). On the other hand, there is no information about where his skull was stolen from.

The last example (3) departs from the observed pattern of starting with the agent of the action. It is the (hopefully) inanimate patient (*skull*) that we now find in the first, and subject, position of the headline. The noun is directly followed by the preposition providing the information that it is the skull of Murnau, this time again mentioning his most famous work, his profession, and furthermore his initials.[2] Followed by the longest subject

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[1]For those who wonder; the perpetrators still have not been identified, prosecution abandoned the investigations in 2017.

[2]Note that there is an ambiguity present in the German version of this headline. It can actually be read as *skull stolen by [. . .] Murnau* because the preposition *von*, among others, also introduces *by-agents* in German passives (see Section 2.2).

so far, the information about what happened to the skull follows with the participle in the last position of the headline. There is no mentioning of the (unknown) agents in this example.

How and why did the writers of these news choose their respective lexical items, the amount of information they convey, what kind of information they convey, and the linguistic structures to do so? This thesis experimentally investigates linguistic conditions that are cross-linguistically known to (sometimes) elicit non-canonical structures.

1.1 Scope and aims of this thesis

The concept of *conceptual accessibility* establishes the underlying basis of the experimental investigations. Conceptual accessibility has been defined by Bock and Warren (1985, p. 50) as *"the ease with which the mental representation of some potential referent can be activated in or retrieved from memory"*. The easier and earlier an element is retrieved, the more likely it is to occupy an early position within the sentence.

Inherent conceptual accessibility relates to different factors, such as *animacy* or *concreteness*, which are intrinsic features of the referents used in sentences. Linguistic research has shown that speakers place more accessible entities early in their sentences. Example (4) includes a sentence with an animate patient or theme, *the neighbor*. In the canonical SO active sentence, the inanimate agent or cause of the waking up, *the alarm*, precedes the animate element. When describing an image depicting the respective event, speakers sometimes produce descriptions such as (5). In the passive sentence, the more accessible entity, *the neighbor*, is promoted to the subject of the sentence and occupies the first position. The use of non-canonical sentences to promote animate referents compared to inanimate ones, has been found cross-linguistically.

(4)   Der Alarm hat die Nachbarin (auf)geweckt.
        the alarm has the neighbor   woken
        "The alarm woke the neighbor."

(5)   Die Nachbarin wurde von dem Alarm (auf)geweckt.
        the neighbor was   by the alarm woken
        "The neighbor was woken by the alarm."

Sticking with the event used in the last two examples, *the neighbor* could also be woken by an animate entity, such as *a mailman*. (6) includes an example of the active SO structure for this event. With two animate entities, there are no reasons in terms of animacy, or inherent conceptual accessibility in general, to produce a corresponding passive structure, such as (7).

(6)   Der Postbote hat die Nachbarin (auf)geweckt.
        the mailman has the neighbor   woken
        "The mailman woke the neighbor."

(7)   Die Nachbarin wurde von dem Postboten (auf)geweckt.
        the neighbor   was   by the mailman woken
        "The neighbor was woken by the mailman."

The *conceptual accessibility* of referents can also be *derived*. In language processing, speakers usually produce their sentences in discourse. Instead of producing isolated sentences, utterances have contexts. Choosing non-canonical structures is one way for speakers to adapt to *information structural* needs and to establish *perspective*. The term *derived accessibility* relates to the fact that some referents can be contextually more accessible than others. A (temporary) difference in derived accessibility has been found to license non-canonical structures, such as passives, cross-linguistically.

For the examples introduced above, one can imagine a communicative elderly person calling a friend and telling the friend what has happened in the last few days since they spoke to each other. The person tells her friend a short story, such as (8).

(8)   Der Postbote war heute früher als sonst bei uns im Haus und hat bei
        einer Nachbarin geklingelt. Sie hatte Nachtschicht und war deshalb
        noch am Schlafen.
        "The mailman came to our house earlier than usually today and rang
        my neighbor's bell. She had been on night shift and was therefore
        still asleep."

a.   Der Postbote hat die Nachbarin geweckt.
        "The mailman woke the woman."

b.   Die Nachbarin wurde von dem Postboten geweckt.
        "The woman was woken by the mailman."

Assuming the (sleeping) neighbor is the *topic* of the last context sentence, a continuation such as (8-b), which directly connects the first element of the utterance with the last context sentence, might be preferred over (8-a).

There are, however, reasons for speakers to nevertheless produce descriptions such as (7), without contexts. Psycholinguistic research has shown that the production of non-canonical structures can be *primed*. *Structural priming* refers to the "*phenomenon by which processing one utterance facilitates processing of another utterance on the basis of repeated syntactic structure*" (Branigan, 2007, p. 1). Experiment 1 investigates this phenomenon for the active/passive alternation in German. If speakers tend to repeat syntactic structures across subsequent utterances, the likelihood of producing a non-canonical passive structure should increase following the preceding

processing of a passive (compared to an active or different structure). Although structural priming has been found for many structures and many languages, there is an empirical gap in case of active and passive sentences in German. Experiment 1 aims at providing a first step in filling this gap.

The tendency to repeat syntactic structures has been found to increase in dialogue, compared to monologue, settings. To investigate the question whether the inclusion of a linguistic interlocutor, resulting in an interactive dialogue, increases the proportion of producing non-canonical structures, a dialogue study is presented in Experiment 2. The picture materials used in Experiment 2 are the same as those used in the first experiment, a monologue setting. Maintaining the experimental materials allows for a direct comparison of the produced descriptions.

The third experiment includes contexts and an information structural manipulation establishing one of two mentioned referents as *topic*, by asking a question about the respective referent. Using this manipulation, one of the two referents is derived to be more accessible than the second one.

A further phenomenon investigated in the third experiment is *perceptual priming*. In the perceptual priming experiment presented here, the position of one of two referents involved in a transitive action event is primed with an implicit visual cue. In this paradigm, participants usually describe pictures, in this case following several context sentences and a (topicalization) question. Before the picture is shown, a small black dot appeared for 60 ms at the position of either the agent or the patient of the subsequent picture. Although participants are not consciously aware of this dot, implicit visual cues are successful in attracting participants' eye movements. Studies using visual cueing in English have shown that participants are more likely to produce passive sentences following the presentation of a visual cue on the position of the subsequent patient, compared to cueing of the agent position. Cross-linguistic work, however, has questioned whether the perceptually more (or rather, perceptually earlier) accessible element will get assigned an early prominent position in the sentence, such as the subject position in English main clauses. Whereas factors of inherent and derived accessibility seem to show universal influences during grammatical encoding, a significant influence of implicit visual cueing on grammatical encoding has not been attested for more flexible languages.

This thesis provides important contributions to research in language production, more specifically to research on structural and perceptual priming. Reviews of psycholinguistic research will show that the investigation of influences on grammatical encoding in more flexible languages provides an important step in future research of possibly universal influences on language production. The inclusion of structural priming, in particular,

not only allows to advance models of language production, but also the extended domain of language processing in general. Structural priming has been claimed to be one of the most important mechanisms combining language production and comprehension. An expansion of the domain in terms of flexible languages and investigations about the interaction between language-specific characteristics and grammatical encoding is inevitable for future research.

In sum, this thesis reports three experiments conducted on structural choices during grammatical encoding in adult speakers of German. *Conceptual accessibility*, one of the most central notions in production research, as well as the phenomena of *structural* and *perceptual priming* are investigated. In the first two experiments, a manipulation in terms of inherent conceptual accessibility, which has shown universal influences on language production – animacy – is combined with a manipulation making the non-canonical passive structures itself *more accessible* via structural priming (in isolation and in dialogue). The third experiment combines contexts increasing the (derived) conceptual accessibility of one of two entities to be described with a visual cueing manipulation, thereby increasing the perceptual accessibility of one of the referents. Broadening the scope of languages for the listed phenomena with flexible word order languages, such as German, reveals important shortcomings and questions for future research which will help to evaluate and enhance models of language production as well as language processing in general.

1.2 Architecture of this thesis

Chapter 2 presents the necessary *Linguistic background on German*. A short introduction to theoretical accounts of German main clauses leads to the focus of this chapter, which is the flexibility of German. The notion of the *prefield* position, the first position in main clauses, is introduced to demonstrate its flexibility in hosting syntactic categories. Following examples of structural options speakers of German have when verbalizing transitive action events, the functions of two central structures, passive and object-before-subject active sentences, are discussed in more detail. Based on the importance of the information structural notion of *topic* in structural choices, the chapter is closed with a discussion about identifying topics in German main clauses.

Chapter 3, *Conceptual accessibility in language production*, establishes the psycholinguistic background of the experimental work presented in this thesis. The chapter reviews important aspects of the processing steps speakers have to pass through from message encoding to grammatical encoding, the processing level where structural choices are determined. The review

is based on Levelt's (1989) influential model of language production. The overarching concept of *conceptual accessibility* in language production will be reviewed and deepened for factors of both *inherent* as well as *derived* accessibility. The focus of inherent accessibility is on the influence of *animacy* on grammatical encoding. For derived accessibility, it is on general, *agent, and patient questions* as means of *topicalization*. A review and discussion of cross-linguistic work investigating influences on structural choices completes the chapter.

Chapter 4, *Structural priming in sentence production*, introduces the first central phenomenon investigated in this thesis, structural priming. After introducing the structural priming paradigm developed by Bock (1986b), a literature review focusing on priming of the active/passive alternation is undertaken before presenting the first experiment of this thesis. Experiment 1 investigates structural priming in German, including a manipulation of inherent accessibility. The procedure used follows Bock's (1986) classic demonstration of structural priming in English and uses picture descriptions to elicit the target responses in a monologue setting. The second part of this chapter expands the scope to *structural alignment*, the tendency of speakers to adopt syntactic structures, produced by their interlocutors, in dialogue settings. Following the introduction of Branigan, Pickering, and Cleland's (2000) *confederate scripting technique*, prior studies investigating structural alignment in dialogue are summarized before turning to the second experiment of this thesis. Experiment 2 investigates structural alignment in German dialogues, once again including a manipulation of inherent accessibility. The task employed in Experiment 2 is a modified confederate scripting technique based on dialogue studies conducted by Branigan and colleagues.

Chapter 5, *Perceptual priming in sentence production*, presents the second phenomenon investigated, perceptual priming using an implicit visual cue. After a general introduction of this topic, prior cross-linguistic work is reviewed. The distinct findings of research conducted in English compared to flexible word order languages lead the way to Experiment 3. Experiment 3 aims at finding distinguishing evidence for two opposite accounts of the cross-linguistic pattern found in visual attention and structural choices, accounts by Myachykov, Thompson, Scheepers, and Garrod (2011) and Hwang and Kaiser (2015). In Experiment 3, a manipulation of derived accessibility is employed in addition to the perceptual priming. Different from Experiment 1 and 2, which focused on isolated sentences, the third experiment includes contexts and a further *topicalization* manipulation.

In Chapter 6, the *General Discussion* of this thesis, a summary of the most important findings is given. Furthermore, outlooks of future questions within the domain of structural and perceptual priming as well as language production in general are included.

Chapter 2

Linguistic background on German

A person who has not studied German
can form no idea of what a perplexing language it is.

Mark Twain (1880) – The Awful German Language

The following chapter includes a short overview of the structural properties of German and of structural options German speakers have when producing non-canonical structures. The examples given here are far from complete, they are rather chosen due to relevance for the experimental investigations presented in this thesis. In particular, they are focused on word order variations related to placing subjects and direct objects. The structures are described in terms of their order of grammatical functions as well as order of thematic roles, the two factors pertinent to the experiments. Please note that corresponding experimental research will be discussed in the respective thematic chapters. Furthermore, the usage of the term *subject* is limited to referents marked for nominative case in agentive events.

TABLE 2.1: Topological fields of German.

clause type	prefield	left bracket	middlefield	right bracket	postfield
V2	one constituent	finite verb	several constituents (*scrambling*)	verb complex: infinite	several constituents
Vend	–	comple-mentizer	several constituents (*scrambling*)	verb complex: finite	several constituents

In German declarative main clauses, a phrase of almost any syntactic category can occupy the first position of the clause, the so called *prefield* (*Vorfeld*) position. In the words of Speyer (2007), the prefield is *syntactically*

underdetermined; there has to be one phrase, but there is no specification on the syntactic category of this phrase. Due to the verb-second (V2) property, this phrase is followed by the finite verb in the second position of the clause.

Table 2.1 contains a simplified version of the so-called *topological field model* of German (e.g., Engel, 1972; Grewendorf, 1988) for main (V2) and subordinate clauses (verb-final; Vend) to illustrate this.[1] Topological fields have been applied, among other uses, as a descriptive tool to capture linear regularities (for example of finite verbs as in German main clauses) in otherwise free word order languages. The topological fields are included here to enable a neutral description of German sentence positions and the amount of elements they may contain. The three-way partitioning into pre- (*Vor-*), middle- (*Mittel-*), and postfield (*Nachfeld*) is caused by the splitting of the (sentence) brackets, hosting the finite verb in case of the left bracket (*linke Satzklammer*) and the verb complex in case of the right bracket (*rechte Satzklammer*). Word order in German is very flexible, a property also described as *scrambling* (e.g., Uszkoreit, 1987; Grewendorf and Sternefeld, 1990b; Fanselow, 2001; Karimi, 2008). In the middlefield, phrases can be arranged freely, although some orderings may be information structurally infelicitous (Haider and Rosengren, 2003).[2]

Table 2.2 includes the sentence "Thieves stole Murnau's skull yesterday" (*Diebe haben gestern Murnau's Schädel gestohlen*), within the topological model, realized in different word order linearizations. In the prefield position, there can be the subject (*Diebe*), the temporal adverbial (*gestern*), the participle (*gestohlen*), the object (*Murnaus Schädel*), or the object and the participle (*Murnaus Schädel gestohlen*).

A look at the topological field model already indicates that the prefield position of German with its characteristics of being the first position, adjacent to the prior utterance/sentence, and the restriction to host just one constituent, make it an especially prominent position. In generative grammar, the prefield position corresponds to the specifier position of the complementizer phrase (SpecCP; Figure 2.1; the dots represent additional functional projections), the position located in the outer left periphery. Generative accounts of German assume that the structure below the CP level is generated before the finite verb moves to C° and before one phrase selected from the so-called *middlefield* (the layer(s) between the CP and the verb in VP) is moved to SpecCP.

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[1]For a comprehensive overview including German structures and including all further (optional) fields see for example Höhle (1983) and Pafel (2009). See also Telljohann, Hinrichs, Kübler, Zinsmeister, and Beck (2006) for an adaption of the topological fields in corpus annotation.

[2]Note that the term *scrambling* is not used consistently in the literature. It is, for example, sometimes used to refer to a special case of free word order, *move alpha* (see e.g., Grewendorf and Sternefeld, 1990a; Bayer and Kornfilt, 1994).

TABLE 2.2: Different linearizations for *"Thieves stole Murnau's skull yesterday"* and their respective positioning within the topological field model.

prefield	left bracket	middlefield	right bracket
Diebe	haben	gestern Murnaus Schädel	gestohlen
Diebe	haben	Murnaus Schädel gestern	gestohlen
Gestern	haben	Diebe Murnaus Schädel	gestohlen
Gestern	haben	Murnaus Schädel Diebe	gestohlen
Gestohlen	haben	Diebe gestern Murnaus Schädel	
Gestohlen	haben	Murnaus Schädel gestern Diebe	
Gestohlen	haben	Murnaus Schädel Diebe gestern	
Murnaus Schädel	haben	gestern Diebe	gestohlen
Murnaus Schädel	haben	Diebe gestern	gestohlen
Murnaus Schädel gestohlen	haben	gestern Diebe	
Murnaus Schädel gestohlen	haben	Diebe gestern	
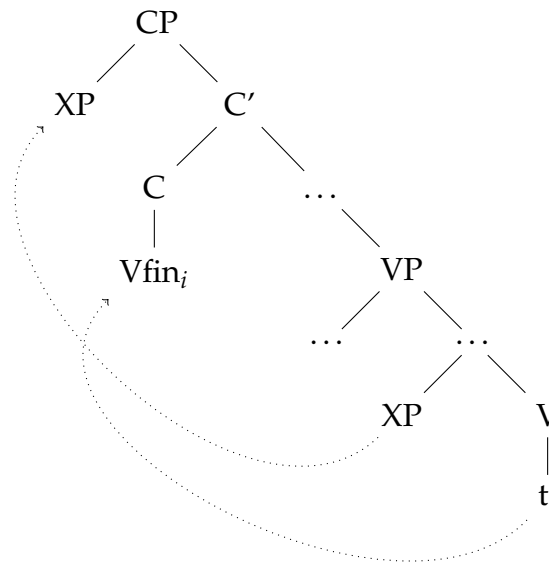
FIGURE 2.1: Generative structure of German main clauses.

Frey (2006) proposes three different means to fill the German prefield position. The first option is to move the phrase heading the middlefield to the prefield via *formal movement*. Frey assumes that the topic is hosted in the leftmost position of the middlefield (see also the next section on *topics*). Example (1) includes the subordinate clause structure for the first version of the sentence in Table 2.2, but without the temporal adverbial. The subject occupies the highest position in the middlefield and is therefore moved to the prefield, resulting in the unmarked order, *"preserving the semantic/pragmatic properties of the constituent and without endowing it with additional ones"* (Frey, 2006, p. 5).

(1)   Ich weiß, dass Diebe   Murnaus Schädel gestohlen haben.
       I   know that thieves Murnau's skull   stolen   have

(2)   Ich weiß, dass Murnaus Schädel   Diebe gestohlen haben.
       I   know that thieves   Murnau's skull stolen   have

Pragmatic reasons however, may favor another phrase. If another phrase is scrambled to the highest position of the middle field, as shown in (2) with the object preceding the subject, this phrase can also be moved to the prefield via formal movement. Pragmatic markedness resulting from the scrambling is preserved in this case.

According to Frey (2006), the second way to fill the prefield is via base generation of sentence adverbials. In example (3), *by the way* occupies the

prefield position. Frey argues that the adverbial is base generated there.[3]

(3)   Am Rande bemerkt haben Diebe Murnaus Schädel gestohlen.
         by the way   have   thieves Murnau's skull   stolen

The third option of filling the prefield is moving a phrase of the middlefield via *A'-movement*. In (4-b), the topic *skull* has undergone long movement. According to Frey, the long A'-movement (and A'-movement in general) induces a contrastive interpretation on the moved constituent[4] compared to (4-a) without A'-movement.

(4)   Ich erzähle dir was   über Murnaus Schädel.
         I   tell   you something about Murnau's skull

a.   Den   Schädel haben Diebe   gestohlen.
       the$_{ACC}$ skull   have   thieves stolen
b.   Den   Schädel meint mein Nachbar, dass Diebe   gestohlen haben.
       the$_{ACC}$ skull   thinks my   neighbor that thieves stolen   have

As argued in Bader, Ellsiepen, Koukoulioti, and Portele (2017), Frey's account assumes information structurally neutral main clauses (without sentence adverbials) to mirror the argument order of the middlefield, with the highest constituent of the middlefield having moved into the prefield. The question then shifts to factors influencing constituent ordering in the middlefield - the field allowing scrambling. Theoretical (e.g., Lenerz, 1977; Grewendorf, 1989; Haider, 1993; Müller, 1999) as well as corpus studies (e.g., Hoberg, 1981; Bader and Häussler, 2010; Verhoeven, 2015) suggest that at least two of the factors that are placed under the notion of *conceptual accessibility* in psycholinguistics (see Chapter 3) – thematic roles and animacy relations/properties – are relevant to capture argument orderings of the middlefield. There is also an extensive line of (cross-) linguistic research on the role of animacy and thematic relations in the assignment of syntactic functions and/or setting word order in different languages (e.g., Silverstein, 1976; Siewierska, 1988; Dahl and Fraurud, 1996; Aissen, 1999; Tomlin, 2014). Siewierska (1988), for example, includes the two (*dominance*) hierarchies shown in (5) and (6) as major hierarchies affecting the choice of subject and object and/or linearization in the world's languages (see also Chapter 3). Further hierarchies affecting grammatical function choice and linearization listed in Siewierska (1988; following Allan, 1987) are *formal*

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[3]*By the way* is classified as "discourse adverbial" in Frey (2004). Arguments for the assumption of the base generation of certain sentence adverbials in SpecCP can be found in the article.

[4]Note that Frey's (2006) judgment about the contrastive interpretation is evaluated as questionable.

(structural complexity, length) and *familiarity* (familiarity/topicality, given-ness, definiteness, and referentiality) hierarchies.

(5)   *semantic roles – subject and object selection*:
    a.   **subject**: agent > patient > recipient > benefactive > instrumental > spatial > temporal
    b.   **object**: patient > recipient > benefactive > instrumental > spatial > temporal

(6)   *personal hierarchy*:
    1st p. > 2nd p. > 3rd p. human > higher animals > other organisms > inorganic matter > abstracts

In his (corpus-)linguistic account of filling the prefield, Speyer (2010, p. 270) proposes the hierarchy in (7), ranking information structural properties of phrases based on their tendency to occupy the prefield position. This allows to predict, which one of several phrases present in the respective sentence should be put into the first position. For all the phrases, one has to check whether one of the properties incorporated into the hierarchy is met. If so, the phrases should be sorted according to the hierarchy and the phrase bearing the leftmost property should be the one to be put into the prefield. Note that in Speyer's hierarchy, the *topic* is preceded by *scene-setting* and *contrast* elements.

(7)   scene-setting » contrast » topic

In the sentence about the stealing of Murnau's Skull which was shown according to the topological field model, the relevant phrases one has to take into consideration are the temporal adverbial *yesterday*, the subject *thieves*, and the object *Murnau's skull*. Based on Speyer's proposal, the scene-setting element *yesterday* is the prefered element for the prefield position, resulting in the structure shown in example (8). When excluding the temporal, the topic of the sentence will occupy the prefield position (assuming that there is no contrastive element).

(8)   Gestern   haben Diebe   Murnaus Schädel gestohlen.
    yesterday have   thieves Murnau's skull   stolen

The notion of the *topic* plays a central role in the linguistic accounts reviewed so far. Before turning to structural options of German, this notion will be elaborated on to connect topics and structural choices in German.

2.1 A note on *topics*

In the linguistic literature, a deviation from the default structure is often connected to information structural demands. The German prefield position, with its left-peripheral location and the resulting proximity to the prior discourse, is associated with information structure in several accounts, as mentioned above.

The notion of information structure has been used in Halliday (1967) to characterize the structuring of spoken language into "information units". These information units are independent of the constituent structure: *"Rather could it be said that the distribution of information specifies a distinct constituent structure on a different plane; this 'information structure' is then mapped on to the constituent structure as specified in terms of sentences, clauses and so forth, neither determining the other"* (Halliday, 1967, p. 200).

Krifka (2008) distinguishes three central concepts within information structure; *focus*, *givenness*, and *topic*. The three concepts each form bipartite pairs with distinctions between *focus and background*, *given and new*, and *topic and comment*.[5]

In the remaining part of this section, the notion of *topic* is elaborated on due to its central role in accounts if filling the German prefield.

The topic (on a sentential level which should not be confounded with a *discourse topic*) has been defined by Reinhart (1981, p. 54) in terms of *aboutness*: *"So 'topic of' expresses the relation of being about"*. To detect the topic of a sentence, tests – such as the *as-for paraphrase* or the *about-paraphrase* – can be used. Example (9) is taken from Reinhart (1981, p. 62). To identify the topic of the second sentence, both the as-for paraphrase in (10-a) and the about-paraphrase in (10-b) suggest that *the book* (the NP following about in the paraphrase) is the topic of the sentence.

(9)   Kracauer's book is probably the most famous ever written on the subject of the cinema. Of course, many more people are familiar with the book's catchy title than are acquainted with its turgid text.
(The Village Voice, Oct. 1, 1979 : 49)

(10)   a.   **As for** this book, many more people are familiar with its catchy title than are acquainted with its turgid text.
        b.   He said **about** the book that many more people are familiar with its catchy title than are acquainted with its turgid text.
(Reinhart (1981, p. 64f.))

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[5]The dichotomies are not formulated consistently within the literature. An overview of different pairings can, for example, be found in von Heusinger (1999).

Reinhart noticed that there is a strong tendency to interpret the subject of a sentence as the aboutness topic, or to place the subject in topic position. She also observed that subjects may be the unmarked topic, but they are not obligatory topics, as can also be seen in example (9), in which the book is the topic, but not the subject of the sentence.

In German, there is a discussion about "the" topic position in the linguistic literature. Some researchers (e.g., Molnár, 1991; Lambrecht, 1994, Reis, 1999) assumed that the prefield is the default position of the topic. Frey (2006, p. 2) assumes a designated topic position above the base position of sentential adverbials in the middlefield, captured in the quote in (11).

(11)   Frey's (2006, p. 2) topic position:
        In the middle field of the German clause, directly above the base position of sentential adverbials, there is a designated position for topics: all topical phrases occurring in the middle field, and only these, occur in this position.

In line with Reinhart (1981), Frey (2006) uses the notion of "aboutness topic" in his account. The assumption of a designated topic position is underpinned by Frey using the contrast shown in example (12).

(12)   Ich erzähle dir etwas   über Hans$_1$.
        I   tell   you something about Hans.

a.   Ich habe gehört, dass den   Hans$_1$ erfreulicherweise nächstes
        I   have heard   that the$_{ACC}$ Hans happily   next
        Jahr eine polnische Gräfin   t$_1$ heiraten wird.
        year a   polish   countess   marry   will
b.   #Ich habe gehört, dass erfreulicherweise den   Hans$_1$ nächstes
        I   have heard   that happily   the$_{ACC}$ Hans next
        Jahr eine polnische Gräfin   t$_1$ heiraten wird.
        year a   polish   countess   marry   will

In example (12), the introductory sentence makes sure that Hans is the topic. In (12-a), the topic (*Hans*) occupies Frey's topic position, preceding the sentence adverbial *happily*. In (12-b), on the other hand, the topic is not in the designated topic position, because it follows the sentence adverbial, which is judged worse than the former counterpart by Frey.

The above review shows that the German prefield position does not have a sole function. There are at least two important observations that arise from the linguistic literature (Siewierska, 1988) and both Frey's (2006) and Speyer's (2010) syntactic accounts on German. On the one hand, factors such as animacy and thematic roles seem to play an important role

in capturing grammatical function assignment and word order preferences
(Siewierska, 1988). On the other hand, the information structural notion of
topic has to be considered (e.g., Frey, 2006; Speyer, 2010). In addition, the
above section shows that there are several proposals that may enable the
identification of aboutness topics. The following subsection presents some
of the non-canonical structures speakers of German might use to react to
information structural and/or accessibility needs. The last section of this
linguistic background includes an attempt to bring together non-canonical
structures and topic characteristics for specific structures of German.

2.2 Structural options in German

A speaker might be standing near the "Hauptwache" in Frankfurt, a famous
place in the city, waiting for a friend to arrive. She looks at all the people
walking the very crowded "Zeil" and the following scene catches her eye:
On a side street, in front of a store, there is a small group of people, and
the police has just arrived. Among the people, she can see a policeman
handcuffing a man who is wearing a black beanie and a small black mask.
She could think to herself or describe this situation with a sentence such as
(13).

(13)   Der   Polizist   verhaftet den   Dieb.
        the$_{NOM}$ policeman arrests   the$_{ACC}$ thief

(14)   Ich sehe, dass der   Polizist   den   Dieb verhaftet .
        I   see   that the$_{NOM}$ policeman the$_{ACC}$ thief arrests

   In canonical active SO structures with prototypical agentive verbs, such
as *verhaften* shown in (13), the prefield position is occupied by the animate
subject, which is also the agent of the action. The (in this example also ani-
mate) direct object, the patient of the action, follows the finite verb. This SO
sentence represents the canonical (or *unmarked*) word order of German (e.g.,
Engel, 1972; Lenerz, 1977; Hoberg, 1981; Primus, 1994; Müller, 1999; and
many more). Example (14) exemplifies the same proposition in a subordi-
nate clause. As can be seen in this example, the subject occupies the highest
position in the middlefield. In the main clause (13), this phrase is the one
moved to the prefield. These canonical active structures fulfill the seman-
tic hierarchy, shown in (5). The subject function is assigned to the highest
role in the hierarchy, the agent. With the subject occupying the prefield po-
sition, the agent also occupies the linear first position of the sentence. The
patient on the other hand is assigned to the thematically less prominent pa-
tient, following the subject. In terms of the personal hierarchy, there is no
mismatch between the two referents with both of them being human. In
German, there are however several further structures that can be chosen to

describe the event being watched. The following examples show some of the structures speakers might produce when describing the scene just witnessed:[6]

(15) Der   Dieb wird von dem   Polizist(en) verhaftet.
      the$_{NOM}$ thief is   by   the$_{DAT}$ policeman   arrested

(16) Von dem   Polizist(en) wird der   Dieb verhaftet.
      by   the$_{DAT}$ policeman   is   the$_{NOM}$ thief arrested

These non-canonical (or *marked*) counterparts to the active SO sentence all describe the same event, but as the term *non-canonical* suggests, the canonical order of grammatical functions and/or thematic roles is changed. Example (15) is a full passive structure. Whereas the canonicity in terms of grammatical functions is maintained (subject > object), the actual assignment of functions has changed. The patient now receives the subject function, whereas the agent is assigned the dative argument of the prepositional by-phrase. The thematic order is also changed; the patient now occupies the first position, whereas the agent follows the finite verb/auxiliary. In Example (16), again a full passive structure, the opposite pattern is found. The agent, structurally expressed in the dative by-phrase, is put into the prefield, whereas the patient follows the finite auxiliary. Looking at the grammatical functions, the object now precedes the subject.

Due to the word order flexibility of German and the freedom in filling the prefield, Example (13) also has a non-canonical active counterpart, maintaining voice:

(17) Den   Dieb verhaftet der   Polizist.
      the$_{ACC}$ thief arrests   the$_{NOM}$ policeman

Example (17) is the object-before-subject (OS) counterpart to the initial example (13). Different from the passive variants, the grammatical function assignment of the entities has not changed. It is still the patient of the action that is the (accusative) direct object and the agent is still the nominative subject. However, the prefield position is now occupied by the accusative object, whereas the subject follows the finite verb. Table 2.3 summarizes the four structures discussed so far and their different orderings in terms of grammatical functions and thematic relations.

To gain a first impression of frequency distributions of the mentioned structures, Bader, Ellsiepen, Koukoulioti, and Portele (2017) analyzed corpus data of written newspaper articles. The active sentences and their respective passive counterparts analyzed by Bader, Ellsiepen, Koukoulioti, and Portele (2017) showed that even though the different versions are found in corpora, their frequency varies remarkably. Table 2.4 shows the

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[6]The brackets indicate that in spoken German, the suffix *en* is sometimes omitted.

TABLE 2.3: Grammatical function and thematic orderings of some structural options to encode agentive transitive events in German.

Structure	Subject	Object	Order	
			Grammatical functions	*Thematic roles*
Active SO	agent	patient	subject > object	agent > patient
Active OS	agent	patient	object > subject	patient > agent
Passive SO	patient	agent	subject > object	patient > agent
Passive OS	patient	agent	object > subject	agent > patient

distribution of the four sentence types exemplified in (13), (15), (16), and (17) in the TIGER 2.1 treebank.[7] Active SO sentences are unequivocally the preferred structure chosen. Their OS active counterparts follow with the second highest frequency. SO passive structures are chosen considerably less than OS active sentences, and OS passives (with the by-phrase in the prefield position) occur with the smallest number.

TABLE 2.4: Frequency (50000 sentences) of active and passive clauses in the TIGER 2.1 treebank from Bader et al. (2017, p. 29).

	$NP_{NOM} > NP_{ACC}$/PP-by	NP_{ACC}/PP-by > NP_{NOM}
Active	4462	652
Passive	223	19

In addition to these four *classical* structures, the arresting scene might be perceived in a way causing the production of further structures. Maybe the primary interest is the thief himself, and maybe it can be taken for granted, that it is a policeman who puts the thieves in handcuffs. A structure such as (18) might be produced then, a short passive structure. The agent of the action is dropped and the patient subject is put into the prefield position. Maybe, on the other hand, it is surprising that the thief is so calm and a struggle between the two opponents would have been expected. A thought or utterance as (19) might result then. In Example (19), the thief once again occupies the prefield position as a nominative subject. The object, and agent of the action, may or may not be produced. On second thought, maybe an observer would have preferred another description like the one given in

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[7]The TIGER 2.1 treebank was created by the Universities of Stuttgart, Saarbrücken and Potsdam (`https://www.ims.uni-stuttgart.de/forschung/projekte/tiger.html`).

(20). As in the example before, the actual patient of the action becomes the subject in the prefield position and the agent can once again be mentioned or disregarded.

(18)   Der   Dieb wird verhaftet.
        the$_{NOM}$ thief is   arrested

(19)   Der   Dieb lässt sich   (von dem   Polizist(en)) verhaften.
        the$_{NOM}$ thief lets himself (by   the$_{DAT}$ policeman) arrest

(20)   Der   Dieb bekommt Handschellen (von dem   Polizist(en))
        the$_{NOM}$ thief receives   handcuffs   (from the$_{DAT}$ policeman)
        angelegt.
        put on

The last six examples all deviate from the canonical active SO version shown in (13), but they do so in different degrees. Speakers of German not only have to decide who becomes the subject and direct object (in transitive nominative-accusative agentive actions) of their sentence, but they also have to decide about the linearization of the arguments. The syntax of German licenses all of the mentioned structures. This however, does not help in answering the question how speakers decide on which entity gets which grammatical function and which position. Linguistic accounts within generative grammar assume that information structural needs (pragmatics) are the main determinant of filling the prefield (the prominent position at the left periphery). In the remaining part of the thesis, this reasoning is incorporated into a psycholinguistic perspective to investigate conditions causing speakers to produce non-canonical structures. Prior work on the functions of some of these non-canonical structures is discussed within the next section.

2.3   Functions of non-canonical structures

The following subsection of this chapter attends to linguistic work on the functions of two prominent non-canonical structures. An extensive amount of research has been dedicated to the relationship between active and passive sentences. This section gives a summary of what today is regarded as the most important functions of the passive voice. The focus is on German, thereby disregarding the typological analyses of the meaning, forms, and functions of the passive. It will become clear that there is an imbalance in the investigation of passives compared to further structural options, especially in comparison to object fronting in German.

To avoid some terminological confusion, at the same time contributing to the existing one, the term *function* is used to refer to linguistic work

dealing with the question of *why* passive structures may be chosen over their active counterpart. The term *meaning*, often mixed up with *function* and *usage*, is reserved for purely linguistic analyses of the relationship between active and passive voice and is therefore left out.

2.3.1 Passive structures

The suggestion to generally treat the passive as a *form of suffering* (*Leideform*) compared to the active being a *form of action* (*Handlungs- or Tatform*), that was discussed in the 20s of the last century, is rejected nowadays (see for example Song, 1986 for an overview).

More recent linguistic investigations of the passive distinguish at least two main functions of passive constructions – stylistic and linguistic functions. The first application area refers to what Brinker (1971) calls *stylistic factors in the narrow sense*; passive structures may be chosen over active structures to link sentences, to avoid ambiguity, and to create structural variety. Pertinent to this area, there is stylistic advice on when (not) to use passive constructions.[8] The text linguistic function of passive structures is not pursued in this subsection. Note, however, that functions of the second main category – linguistic matters – interact with stylistic functions of passive structures.

Following Givón (1981), Siewierska (1984) distinguishes three functional domains of passives: *topic identification*, *impersonalization*, and *detransitivization*. *Detransitivization*, after Siewierska (1984), indicates the potential of passive structures to demote the agent while at the same time promoting the patient. Hopper and Thompson (1980) assume transitivity to be scaled rather than binary or "all or nothing" (Siewierska (1984, p.15) and propose ten semantic (high) transitivity features. The shift between agent and patient in passive structures results in a general decrease of transitivity. The term *impersonalization* refers to the potential of passive structures to leave out the agent (*agent omission*). By choosing a short passive structure (see (18) for an example), speakers and writers omit the agent of the action. Reasons not to mention agents are diverse; they may be unknown, they may be inferable from the previous context (including extralinguistic context) or generally known, they may be irrelevant, or maybe the speaker/writer is just not sure about their identity. Corpus studies show that impersonalization in the sense described above is clearly the main function of passive

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[8]The prescriptive suggestions in case of passives are usually to avoid them (except for e.g., academic writing). Discussions can for example be found in Cornelis (1997) and Szatmári (2004).

structures. In the majority of cases, passives are used in their agentless version – without the optional agent (e.g., Stein, 1979 for English; Brinker, 1971 for written and Schoenthal, 1976 for spoken German). However, as Brinker (1971) notices, the function of the *avoidance of the agent* (*Agensabgewandtheit*) cannot be the determinant for passives including the agent.

The remaining functional domain of passives is *topic identification*. The information structural notion of *topic* is assumed to play a major role in the function of passive structures. However, it is widely acknowledged that the term is not defined unambiguously (see e.g., Siewierska (1984); Cornelis, 1997, and section 2.4 of this thesis). In canonical, unmarked structures, the topic is usually found in subject position and it is usually the first constituent in the clause. In the literature, several "topicality hierarchies" exist, with an animacy hierarchy (21) and a semantic hierarchy (22) among them (taken from Siewierska, 1984, p. 221):

(21)   *The Animacy Hierarchy*:
       human   >   nonhuman

       1st pers > 2nd pers > 3rd pers   animate > inanimate

(22)   *The Semantic Hierarchy*:
       agent > recipient   > patient > oblique
                 benefactive

Whereas in general, any NP of the clause may function as *topic*, cross-linguistic work has shown that NPs bearing properties ranked higher in the hierarchies show a higher likelihood of being the topic of the clause (Siewierska, 1984). Assuming passive structures to have a meaning equivalent to active counterparts or, in different words, to have the same truth conditions (Zifonun, 1992), the passive structure then shifts the topic relations of the clause by promoting the patient and demoting the agent. The patient object becomes the subject and may also be put into the first position, whereas the agent subject becomes an oblique object, usually accompanied by being put into a later position of the clause, or is completely omitted. At this point, one is back at some of the factors found to influence the assignment of the subject and object function and/or linearization – semantic or thematic roles and animacy properties. The function of the (full) passive then is to adapt to the different inherent as well as informational structural statuses of the referents and, more general, to adapt to discourse or communicative needs (Cornelis, 1997). As will be discussed in subsection 2.4, describing one of the main functions of the passive by referring to topics is problematic for several reasons (see also Cornelis, 1997 for a discussion).

A final factor to be mentioned in this subsection that can be found in the literature on functions of passive structures is *perspective* (e.g., Langacker, 1982). The notion of perspective is usually related to the relative

topicality approach (Cornelis, 1997), and remains a rather imprecise notion itself. Brinker (1971) argues that in passives, the agent does not bear the *sensible emphasis* (*den Sinnesschwerpunkt*), but rather the object becoming the subject of the utterance does. Helbig and Kempter (1997), in line with this reasoning, suggest that even though active structures and their full passive counterparts objectively describe the same situation, they reveal different (subjective) ways of seeing of the speaker or different perspectives, thereby not having the exact same meaning (Daneš, 1976; Helbig and Wiese, 1983). Finally, Zifonun (1992) argues in a similar vein that the function of the passive is, on a cognitive level, to promote a background element of the conceptualization to a foregrounded one. She further claims that passivization is useful when the respective arguments have distinctly different roles in their participation and when the most simple conceptualization of the respective event does not already include an argument re-ordering (Zifonun, 1992, p. 265).

The above review of the functions of passive structures shows that inherent properties of the included referents as well as information structural properties (including perspectival angles) both matter in the production of non-canonical structures, i.e., passives. However, as many researchers analyzing passives have noticed, a satisfactory description of the respective functions has to take into account further structural possibilities in the respective language: *"The fact that the passive may fulfill one, all or any combination of the above functions does not in itself explain why this construction is used as opposed to other topicalizing, impersonalizing and detransitivizing constructions"* (Siewierska, 1984, p. 217).

The final part of this Chapter is dedicated to another relevant structural option of German, the possibility to front the object.

2.3.2 Object fronting

As discussed above, the freedom in German word order allows for the (patient) object to appear in the prefield position, thereby preceding the (agent) subject. A respective construction is shown in Example (17) and repeated as (23). This movement of the object to the prefield is called *object fronting*.

(23)   Den   Dieb verhaftet der   Polizist.
       the$_{ACC}$ thief arrests   the$_{NOM}$ policeman

Siewierska (1984, p. 218) claims that *"[...] it is the lack of alternative topicalizing and impersonalizing strategies in English which results in the frequent use of the English passive and distinguishes it from its counterparts in other*

European languages". The following discussion is limited to German.[9] Object fronting is usually assumed to be a further topicalization strategy in German. Based on Siewierska's (1984) argument, one might expect fronted objects to compete with passive structures to promote topical referents. Different from their passive counterpart, the (in this case) patient is not promoted to the subject. However, it linearly precedes the subject by occupying the first position. Remembering the claim from the linguistic literature on German that the prefield position is subject to accessibility or information structural properties, this provides an useful way to satisfy information structural needs. Abraham and Leisiö (2006, p. 1) express this option in the following quote, elaborating on different languages and their possibilities to establish an appropriate information structure (*Themata* vs. *Rhemata*): *"The pragmatic-informational goals may be achieved by grammatically simpler means such as movement within the simple sentence, i.e., by CP-expansion (Rizzi, 1997; Van Gelderen, 2004 for diachronic accounts within one and the same language) of the base (merged) structure, thus maintaining active voice in the clause (as in Russian, Polish, and German) [...]".* This quote implies that beside passivization, object fronting in German is not only another option, but should be the preferred option to linguistically realize information structural characteristics.

Despite the significance of German object fronting in research on word order variation, research investigating the function of object fronting is rare. Corpus studies of German word order show that OS structures occur much less frequent than SO structures (Hoberg, 1981; Kempen and Harbusch, 2004; Kempen and Harbusch, 2005; Bader and Häussler, 2010; Verhoeven, 2015). Hoberg (1981) and Kempen and Harbusch (2005) investigated written word order variation in the German middle field, based on newspaper corpora, and found that for accusative verbs, OS order in the middlefield occurs in less than 1% of the cases. Two more recent corpus studies (Bader and Häussler, 2010; Verhoeven, 2015) also included the prefield position in their analysis. The following discussion focuses on these prefield analyses, since they allow for an evaluation of object fronting as a second topicalization strategy beside the passive. The summaries are also limited to accusative verbs with a subject and just one object. Please see the original references for discussions about the middlefield, dative verbs, sentences including two objects, and further factors possibly influencing word order options.

Bader and Häussler (2010) also investigated written newspaper texts. They analyzed the number of the NP arguments, the case of the object, the

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[9]Linguistic research on different cross-linguistic topicalization strategies can, for example, be found in Rivero (1980) for Spanish; Greenberg (1984) and Prince (1998) for English; Alexopoulou and Kolliakou (2002) for Greek; Boeckx and Grohmann (2005) for Germanic; Frascarelli and Hinterhölzl (2007) for Italian and German.

pronominality of the subject, the animacy of the respective NPs, the definiteness of the subject, the length of subject and object(s), and *"verb-related properties including voice"* (Bader and Häussler, 2010, p. 723). Their results show again a strong preference for SO structures. In accusative main clauses (without pronominal subjects), they occur in about 86% of cases. Bader and Häussler's (2010) data show that animacy has an effect on German word order. Animate subjects are mainly realized in SO structures. Regarding the middlefield, OS order can be found mainly with inanimate subjects and animate objects. In accusative main clauses however, this animacy mismatch is still resolved in SO structures. In their evaluating logistic regression analysis, the only factor that turned out to be fully significant regarding word order including the prefield was subject animacy. The factor length turned out marginally significant. Bader and Häussler (2010) conclude that whereas word order in the German middlefield is mainly influenced by lexical conceptual factors, word order involving the prefield is influenced by different factors.

In their subsequent discussion about what these factors are, Bader and Häussler (2010, p. 754) arrive at the conclusion that in sentences involving the prefield, *"discourse-based reasons mask effects of lexical-semantic factors to a substantial extent"*. Based on OS examples taken from their corpus, they suggest that in OS sentences, it is mostly the topic that occupies the prefield. Different from word order choices in the middlefield, where objects seem to precede subjects to enable focused subjects in preverbal positions, objects *"are put into the prefield for their own sake"* (Bader and Häussler, 2010, p. 757). Their conclusion results in the following generalization (24) for German main clauses hosting objects in the prefield (Bader and Häussler, 2010, p. 757):

(24)   *The OS Prefield Generalization*:
         For putting objects into the prefield, and thereby in front of the subject, lexical-semantic constraints and discourse-related constraints play both a significant role. The main discourse-related constraint is the constraint requiring topics to occur in clause-initial position.

Verhoeven (2015) focused on different verb classes in her corpus study and investigated *psych verbs*, verbs showing exceptional thematic properties (e.g., Belletti and Rizzi, 1988; Landau, 2010). Though these verbs are very informative about thematic influences on word order variation, they are not discussed further at this point, due to their deviating thematic structure. An overview of some important properties of these verb classes are given in section 3.2.1.

Verhoeven (2015) also included 10 canonical accusative verbs as "control verbs". She mentions that these verbs do not serve to establish word order patterns on their own, but to relate differences compared to psych verbs.

Nevertheless, a short summary of the findings is given. Verhoeven (2015) replicates the finding from Bader and Häussler (2010) that accusative verbs show a clear SO preference. In her study, no significant effect of animacy for OS sentences is visible. An effect of animacy however is visible in the choice of non active structures (i.e., passives) also for canonical verbs.

It is clear from the above review that animacy or thematic properties alone cannot account for the function of object fronting in German. The importance of including discourse factors is obvious and also apparent from the general inclusion of German object fronting in a subset of topicalization strategies. However, so far there seems to be only one quantitative investigation of discourse factors and this corpus study did not analyze the topic status of the different referents. Yet the study of Weber and Müller (2004) includes, among others, one of the important factors assumed to contribute to the topic status of referents, the *givenness* of the respective participants.[10] Weber and Müller (2004) analyzed the subject and ordering of German main clauses in written newspaper texts. They found that in SO sentences, given subjects precede new objects more often than the other way around. In OS sentences on the other hand, both given/new orderings occur equally often. As the authors notice, however, when looking at the results from a different perspective, by comparing the occurrence of the givenness mismatches, one finds that given subjects and new objects occur more often in SO than OS sentences, whereas the opposite pattern, a given object and a new subject is found more often in OS than SO sentences.

The current subsection shows that non-canonical structures may serve to adapt to animacy, thematic, as well as discourse properties. Passive as well as object fronting possibilities are used to put animate referents into the subject and/or first position of main clauses. Especially passive structures provide a way for speakers and writers to promote less prominent, salient, and/or accessible thematic roles into more prominent syntactic functions or linear positions, or put differently, to take their *perspective*. It is, however, difficult, to investigate animacy and thematic roles in isolation. The review has also shown that the most important role in the function of non-canonical structures seems to be the *topicalization* or *topic identification*. It is this point at the latest where the complex interplay (and confusion) of several factors influencing grammatical function assignment and linearization becomes unavoidable. Among the topicality hierarchies, there are again animacy and thematic properties influencing the choice of the topic. The claim

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[10]Note that the previously discussed corpus studies, Rambow (1993) as well as Weber and Müller (2004) include further factors that interact with the notion of *topic*, i.e., definiteness and pronominalization. These factors are neglected in this review, but relevant discussions can be found within the studies.

to be made here is that next to corpus studies, including small discourses rather than isolated sentences allowing to account for information structural characteristics, psycholinguistic experiments are needed. They provide an opportunity to carefully disentangle and investigate different factors and their interaction in the production of non-canonical structures. As will become clear, however, the urgent matter to include discourse when investigating information structural properties of utterances, is no less a hopeful step in the right direction for psycholinguistic work as it is for linguistic accounts of non-canonical structures. The following chapter is dedicated to the psycholinguistic work on some of the factors promoting the production of non-canonical structures.

2.4 Identifying topics?

The last section of this chapter attempts to identify topics in three of the presented structural choices speakers have when describing agentive action events. The respective structures — active SO sentences, passive SO sentences, and active OS sentences — are repeated in (25), (26), and (27).

(25) Der   Polizist   verhaftet den   Dieb.
      the$_{NOM}$ policeman arrests   the$_{ACC}$ thief

(26) Der   Dieb wird von dem   Polizist(en) verhaftet.
      the$_{NOM}$ thief is   by the$_{DAT}$ policeman arrested

(27) Den   Dieb verhaftet der   Polizist.
      the$_{ACC}$ thief arrests   the$_{NOM}$ policeman

   To answer the question whether one can easily identify the aboutness topics of the three structures, the topic tests proposed in Reinhart (1981) are used in the following examples. In (28), the element occupying the prefield position is used in the as for paraphrase for all three sentence structures. The about paraphrase for the prefield elements is included in (29).

(28) **as for paraphrase** (*was ... angeht/betrifft*) for the **prefield element**:
a.   Was den Polizist(en) angeht, er verhaftet den Dieb.
      as for the policeman, he arrests the thief
b.   Was den Dieb angeht, er wird von dem Polizist(en) verhaftet.
      as for the thief, he is arrested by the policeman
c.   Was den Dieb angeht, ihn verhaftet der Polizist.
      as for the thief, him arrests the policeman

(29) **about paraphrase** (*über*) for the **prefield element**:

a. Sie sagt über den Polizist(en), dass er den Dieb verhaftet.
    she says about the policeman that he arrests the thief
b. Sie sagt über den Dieb, dass er von dem Polizist(en) verhaftet wird.
    she says about the thief that he is arrested by the policeman
c. Sie sagt über den Dieb, dass ihn der Polizist verhaftet.
    she says about the thief that him the policeman arrests

Both paraphrasing tests suggests that the prefield element is a good candidate for being the sentence topic in all three structures. The crucial question is whether the tests also suggest that the second referent, which is located in the middlefield, is not a good candidate for being the topic. To evaluate this question, examples (30) include the element in the middlefield in the as for paraphrase and in the about paraphrase in (31).

(30) **as for paraphrase** (*was . . . angeht/betrifft*) for the **middlefield element**:

a. Was den Dieb angeht, der Polizist verhaftet ihn.
    as for the thief, the policeman arrests him
b. Was den Polizist(en) angeht, der Dieb wird von ihm verhaftet.
    as for the policeman, the thief is arrested by him
c. ?Was den Polizist(en) angeht, den Dieb verhaftet er.
    as for the policeman, the thief arrests he

(31) **about paraphrase** (*über*) for the **middlefield element**:

a. Sie sagt über den Dieb, dass der Polizist ihn verhaftet.
    she says about the thief that the policeman arrests him
b. Sie sagt über den Polizist(en), dass der Dieb von ihm verhaftet wird.
    she says about the policeman that the thief is arrested by him
c. ??Sie sagt über den Polizist(en), dass den Dieb er verhaftet.
    she says about the policeman that the thief he arrests

Intuitively, only the two object fronted structures are judged with question marks in the above examples testing the topic status of the element located in the middlefield. Whether this uncertainty is influenced merely by the (non-) topic status of the referent or further factors, such as the the inclusion of pronouns, which come with certain positioning preferences, or a missing pragmatic felicity conditions for object fronting, must be left as open question. More importantly, the inclusion of the middlefield element as topic in the two tests does not lead to a distinct reduction in acceptability

for the active and passive structures.[11] The testing shows that an unambiguous determination of the aboutness topic is far from straightforward. For sentences without context, which include two definite NPs (or more general: two NPs that do not differ in terms of givenness as demonstrated by the use of the same articles for both nouns) that do not differ in terms of inherent properties, such as animacy, the topic tests result in felicitous paraphrases for both referents. Often, the topic identification relies on associations between information structure and syntactic structure in the sense that elements occupying the prefield are classified as default topics.

The argument to be made here is that for isolated sentences, without contexts, topic identification is vague. By including contexts, however, the topic identification gets less suspicious. In the literature, the inclusion of short sentences or questions such as "I'll tell you something about X" or "What happened to X" is used to establish X as the topic. With this manipulation, the identification of the topic is less problematic.

In sum, the attempt to unambiguously identify the topic in isolated sentences is problematic. This finding was also generally obtained by many linguists working on information structure and exemplified in the following quote by Bergen and de Hoop (2009):

> "[...] the topic, which very generally means 'what is being talked about'. This meaning, although intuitively sound, is rather vague, but there is very little consensus among linguists on any more specific definition. Multiple properties contributing to topichood have been described, but none of these properties seems either necessary or sufficient to classify something as a topic: topics are often subjects, but they need not be; topics mostly occur sentence-initially, but they do not have to; topics are generally definite, but they can be indefinite too. The 'flexible' applicability of all these properties makes it hard to come up with a uniform definition of topics."
>
> (Bergen and de Hoop, 2009, p. 173)

This conclusion has empirically been supported by work conducted by, for example, Cook and Bildhauer (2013). The authors undertook two topic annotation experiments. They used corpus sentences (German newspaper texts) of four different verbs as materials and pre-selected several candidates of the sentence as possible topics (the subject, the object, and adverbial expressions). Based on Götze, Weskott, Endriss, Fiedler, Hinterwimmer, Petrova, Schwarz, Skopeteas, and Stoel (2007), the criteria in (32) were given for determining the aboutness topic.

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[11]Note that this judgment is not based on empirical validation, but based on introspection.

(32)   An NP X is the aboutness topic of a sentence S containing X if

a.   S would be a natural continuation to the announcement
       Let me tell you something about X
b.   S would be a good answer to the question
       What about X?
c.   S could be naturally transformed into the sentence
       Concerning X, S′
       where S′ differs from S only insofar as X has been replaced by a suitable pronoun.

In their first experiment, the two authors themselves (experienced linguists familiar with information structural notions) annotated the materials for the topic of each sentence based on the above criteria. In the second experiment, four students (with a linguistic background) rated the materials for the topic of the sentence based on the changed annotation guideline to include only (32-a). The results of both experiments in terms of inter-annotator agreement are described as *disappointing* by Cook and Bildhauer (2013), with a highly variable Fleiss' κ never exceeding .57 in the first experiment and .447 in the annotation of the aboutness topic in the second experiment.[12]

The difficulty in identifying aboutness topics (both in general and in the respective structures tested in this section) from a theoretical as well as empirical perspective is used as basis for the waiver of the topic notion in isolated sentences in this thesis. Experiments 1 and 2 involve isolated sentences including two referents (not differing in terms of givenness). Experiment 3, on the other hand, includes contexts and an experimental manipulation that is characterized as *topicalization*. In line with the linguistic literature, *"What happens to X?"* is used to establish X as the topic.

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[12]Fleiss' Kappa ranges from -1 to 1, with negative values indicating agreement poorer than chance, zero indicating agreement at chance level, and positive values indicating agreement better than chance (e.g., Fleiss and Cohen, 1973). In the classification of Landis and Koch (1977, p. 165), Kappa values between 0.41 and 0.60 are interpreted as showing "moderate" strength of agreement.

Chapter 3

Conceptual accessibility in language production

and we talk the talk
we communicate

IAM{X} – Spit It Out

Among the central goals in language production research lies the question how speakers (and writers) transform their abstract need to speak – an idea, a communicative intention, a description of an event, or whatever it is that motivates the speaker at the respective point in time given the respective situation and circumstances as well as possible, but not necessary, inter-locutors – into a concrete sequence of words. In transforming thoughts into language, speakers have to make a lot of choices. They have to choose the *right words*, they have to find their *perspective* on whatever it is they want to convey, they can decide between being excessively polite or exorbitantly vulgar, they have to choose one of several possible syntactic structures to realize their intention, they can choose to prosodically highlight elements of their productions, and this list goes on. Despite all these tasks, speakers are usually more or less successful in production, they are very fast, fluent, and most of the time produce utterances obeying the language specific rules of well-formedness. However, much of the psycholinguists' as well as psy-chologists' knowledge about language production stems from erroneous or disfluent productions. Speech errors (e.g., Garrett, 1980), hesitations and pauses (e.g., Maclay and Osgood, 1959; Clark and Tree, 2002) as well as agreement errors (e.g., Bock, Eberhard, Cutting, Meyer, and Schriefers, 2001 for *attraction* errors; Vigliocco and Franck, 2001 for gender agreement) have been central phenomena shaping assumptions about representations and processes involved in production and their subsequent incorporation into models of language production.

The previous chapter has shown that linguistic accounts dealing with functions of non-canonical structures include notions such as *perspective* and

topicalization. In the current chapter, these notions are resumed and embedded into psycholinguistic accounts of the production of non-canonical structures. In the first part of this chapter, a short overview of relevant components for the transition from messages to syntactic structures within Levelt's (1989) influential model of language production is given. This overview includes processes and representations of message encoding as well as grammatical encoding. The transition between these two layers leads to the starting point problem, which is discussed afterwards.

The first section is followed by a summary of relevant experimental work. This summary investigates the question which factors influence speakers in exploiting structural flexibility in their respective language and thereby refraining from canonical or unmarked structures (see Chapter 2). The experimental work discussed in this chapter centers on the umbrella term of *conceptual accessibility.* Within the experimental section, influences of inherent as well as derived accessibility on structural choices are summarized. In terms of inherent accessibility, the factors reviewed are *animacy* and *thematic structure.* The major factor of derived accessibility is *topic status.*

Given the fact that there are a lot of different languages and specific options in terms of structural flexibility, the aims of this chapter are to evaluate experimental data and their compatibility with theories of language production. Furthermore, this evaluation sheds light on the question whether the architecture of the production system and influences on this system can be assumed to be universal rather than language specific. Instead of using erroneous productions, the data to be discussed are sentence structures elicited using different experimental methods.

3.1   Language production

From the intention to speak all the way to a full-fledged utterance, speakers have to get through several different linguistic processes. They are often subsumed under three big building blocks of language production; *conceptualizing, formulating,* and *articulating* (Levelt, 1989). In the initial phase of language production, conceptualizing, speakers have to plan and organize their utterance. They, for example, have to realize what their communicative goals are, decide how to adapt the information to be given, and which expressions match their intentions while at the same time including their interlocutor(s), their knowledge and beliefs, and the prior discourse. Levelt (1989) distinguishes two steps on this level of language production, *macro-* and *microplanning.* In macroplanning, speakers transform/construct their communicative goal into subgoals and select the information to be expressed to reach these goals, *determining the content of the subsequent speech acts* (p. 107). In microplanning, these speech acts are (propositionally) *shaped*
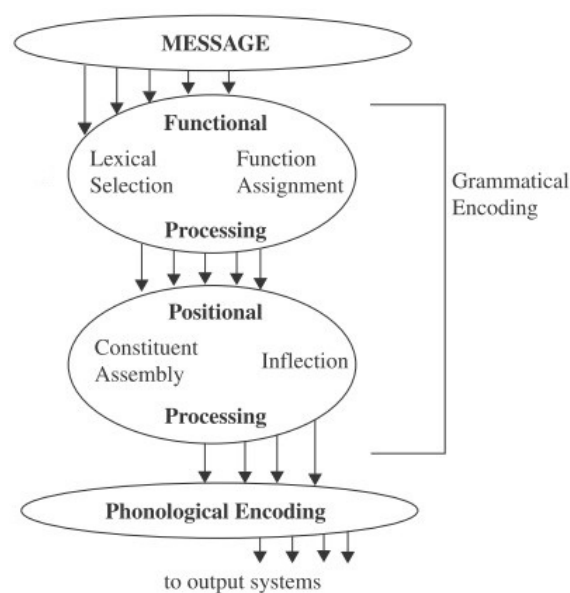
FIGURE 3.1: Processes of language production and their layers assumed by Bock and Levelt (1994), modified from Ferreira and Engelhardt (2006, p. 63).

and speakers set their informational *perspective*. This step serves the transformation into the final representation generated in conceptualizing, the *preverbal message*. The next big step of language production, formulating, encompasses several important linguistic sub-processes allowing to generate a linguistic representation based on the conceptual one. During *grammatical encoding*, speakers select the lexical items to be included in their utterance and they give rise to the syntactic structure. Furthermore, phonological and phonetic/articulatory plans for the individual items as well as for the whole utterance have to be accessed and assembled, processes often subsumed under the term *phonological encoding*. The resulting representation then reaches the final step of language production, articulating. In this final step, the phonological structures are transformed into motor activity and the final utterance can be produced.

In the following sections, research on the two encoding levels most relevant for the experiments presented in this thesis, message and grammatical encoding, is reviewed. For both aspects, the focus lies on the "classical" model of language production proposed by Levelt (1989) (see Figure 3.1) and carried on by many researchers.

3.1.1 Message Encoding

On the basis of features needed for later linguistic processing, Levelt (1989) represents the preverbal message as a nonlinear structure that is propositional and includes thematic structure as well as perspective. Levelt (1989, p. 71) clarifies that the term *propositional*, which might be misleading, *"stands for a mode of representation of which propositions are a special case"*. Furthermore, there are several modes to represent the *language of thought*, but the important point is that *"if a thought is to be expressed in natural language, the mediating code must be propositional"* (p. 71). As Bock and Ferreira (2014) notice, the term *proposition* causes another ambiguity, since propositional subjects and grammatical subjects might differ. In Levelt (1989), the propositional structures, the concepts and relations among them, form the *semantic structure* (the aboutness relations among concepts in the words of Bock and Ferreira, 2014, p. 23) of the preverbal message. The term semantic structure rather than propositional structure is used in this chapter. The semantic structure allows for various thematic roles to be included, forming the thematic structure. Furthermore, the message also comprises information about mood and temporal relations (*deixis* and *aspect*; depending on the respective language).

For an event description like the one given in Section 2.2 and repeated in (1), where *the policeman arrests the thief*, the message representation might be described as in example (2), based on Levelt (1989; p. 101). The representation includes the unmarked mood (DECL; declarative), a tense specification (PRESENT), and the thematic structure (the thematic roles are not expressed explicitly, but represented by the embedding in parentheses).

(1)   Der Polizist   verhaftet den Dieb.
         the policeman arrests   the thief

(2)   DECL(PRESENT(POLICEMAN(ARREST(THIEF))))

What is not easily apparent from the description in Example (2) is the *perspective* that is also part of the message. According to Levelt (1989), speakers encode relevant information structural properties in their message, thereby signaling for example which element is the topic (*the entity about which the message is intended to make a predication*; p. 71), the *givenness* of the respective elements, and what is to be focused.

Assuming messages include semantic and thematic structure as well as perspective, the question left with at this point is how speakers generate their message. As mentioned above, the processes on this level can be divided into those of macro- and those of microplanning according to Levelt (1989). In macroplanning, speakers have to take into account the communicative intention, they have to select the information to be expressed and

the ordering of this information. The result of these processes then is *"an ordered sequence of what we will call speech-act intentions. These are messages as far as specified for intended mood (declarative, interrogative, imperative) and content"*, according to Levelt (1989, p. 109). In microplanning, on the other hand, the message gets its informational perspective. In search for factors influencing the perspective of messages, Levelt (1989) discusses four important aspects of microplanning: the accessibility status of the referents, topicalization of one of the referents, propositionalization of information, and language-specific requirements. These four aspects are not discussed in detail in this section, a comprehensive discussion can be found in the original literature. In the following, the factors are shortly summarized. More importantly, some of these factors are embedded in their respective context established in Levelt (1989) to later differentiate them from similar (or equal) notions used in the literature, thereby hopefully reducing possible confusion.

The accessibility status of referents in the sense of Levelt (1989) is based on the (re-) introduction of referents in the particular discourse model. It is an *"estimated accessibility of the referent for the addressee"* (p. 145) in the sense that the speaker is the one who assigns this accessibility status - rather than the real accessibility experienced by the addressee. Levelt (1989) distinguishes between being *in focus*, *in the discourse model*, *accessible*, and *inaccessible* to the addressee, with these dichotomies being embedded (rather than orthogonal). A special notion discussed within this accessibility aspect is *conceptual prominence*. Levelt proposes to assign prominence (the feature "+ prominent") to an entity within the message when it is newly introduced to the discourse, when it is contrasting in a focused role, or when the speaker assigns prominence to a new predication, which, according to Levelt (1989, p. 151) is *"especially the case when the predication is an answer to a question about some referent"*. The second factor shaping the perspective of messages is topicalization, with the speaker assigning topic status to the referent the message is about. This allows the addressee to store the information under the respective referent. This process is formalized by Levelt (1989, p. 151) in the following procedure: *"IF the goal is that the listener store the information under address X, THEN assign topic status to X."* In the propositionalization (and in assigning perspective "proper"), speakers have to make several important choices, especially when encoding spatio-temporal images. Among these choices are choosing reference points and relations. The final aspect of microplanning are language-specific requirements that enter message generation. Among these are tense marking, categories of spatial deixis, or classificatory particles mentioned in Levelt (1989).

In sum, the "classical" verbal model of language production proposed by Levelt (1989) assumes a preverbal message containing semantic, thematic, and perspective structure. The semantic or propositional structure represents aboutness relations among concepts (Bock and Ferreira, 2014), the referents and their relations. The thematic structure allows the concepts to get assigned thematic roles. Finally, the message also provides a specific perspective of the utterance to be produced. This perspective is shaped by the prior discourse and allows the speaker to linguistically react to it and encode information structure within the message. Within these processes, the topic of the soon to be utterance is assigned and further *prominence* or *salience* features might influence the perspective of the message. Whereas the general processes of message encoding might be independent of the respective language, there are also language-specific requirements that must be met to guarantee the well-formedness of the message. The final representation of message encoding then serves as input to the next big step in language production – formulation, or more precise, grammatical encoding.

3.1.2   Grammatical Encoding

A message can be linguistically realized in different syntactic structures. It is within grammatical encoding that the structure gets assigned. The following section summarizes assumptions of the classical model of language production in the production of non-canonical structures.

The processes of grammatical encoding are divided into two separate stages within the classical model of language production, reflected in the term *two-stage architecture* (an architecture and corresponding term originating from Garrett, 1975 based on speech error data). On the first level, the *functional level* of grammatical encoding, *lemmas* are selected (*lexical selection*). Lemmas are assumed to contain information about the meaning and syntactic requirements of the items, but to not contain phonological properties (e.g., Levelt, 1989; Ferreira and Engelhardt, 2006). The chosen lemmas get assigned their grammatical functions or syntactic relations, e.g., the subject and direct object function ((*grammatical) function assignment*). For an utterance such as *The policeman arrests the thief*, the lemmas of POLICEMAN, THIEF, and ARREST have to be retrieved. POLICEMAN then gets assigned the grammatical role of the subject, whereas THIEF gets assigned the direct object function.

Following functional processing, positional processing operates on the representations formed during the preceding stage of language production to create the linear sequence of the utterance. The serial order of the elements is set and speakers retrieve syntactic frames (Bock and Levelt, 1994)
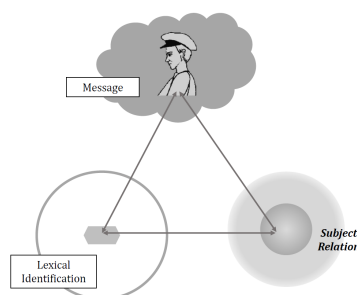
FIGURE 3.2: Binding of referential-relational-lexical components (adapted from
Bock and Ferreira, 2014, p. 30).

containing slots for the phrases (*constituent assembly*). Furthermore, inflection processes proceed during positional encoding, with inflection affixes being part of the frames (Ferreira and Engelhardt, 2006).

Note that after the grammatical function assignment, the production of a passive structure, such as *The thief is arrested by the policeman*, is ruled out, because the POLICEMAN received the subject role. During positional processing, however, the chosen grammatical function assignment still results in two options in German (and other flexible languages). The subject can precede the object in the utterance, but the object can also be fronted, resulting in its precedence over the subject.

In a more recent treatment of the classical architecture, Bock and Ferreira (2014) refrain from the notion of functional and positional processing and rather use the terms *structural scaffolding* and *structural assembly*. In their discussion on how the message gets transformed into structural frames, they use the term *structural scaffold* for the resulting product of mapping the message elements with words and syntactic relations. The aboutness relations brought about by the message get their grammatical role labels during the first step of grammatical encoding, then.

By binding the message concept, the respective syntactic relation of the scaffold, and the respective lexical item denoting the concept, as shown in Figure 3.2, the representation previously described as the result of functional processing is created.

The structural scaffold finally supports the construction of a *frame*, the classical result of positional processing or grammatical encoding in general. A syntactic frame is described as "*a mental representation of relationships that can, as they fill in and fill out, guide the ordering of elements. In essence, a frame is a short-lived mental ensemble that transiently symbolizes how a sentence's separate parts are related and ordered with respect to each other. In more technical terms, a frame is a virtual cognitive instantiation of hierarchical structure*" by Bock and Ferreira (2014, p. 22).

After grammatical encoding, it is this frame or the respective parts that

serve as input to the following processes of language production. If the construction so far was successful, *"the ensuing frame will convey what went together in a speaker's notion, encoding aboutness links among disparate and sometimes distant pieces of an utterance"* (Bock and Ferreira, 2014, p. 22). Having some ideas about the representations of message and grammatical encoding, the question remains how message representations are transformed into sentence structures. The following section is devoted to this question, thereby focusing on the question how the choice of a non-canonical surface structure might result from grammatical encoding.

3.1.3   From message to structure: The problem of the *starting point*

The functioning of the formulator in Levelt (1989)'s production model is based on Kempen and Hoenkamp's (1987) computational theory of grammatical encoding. Their algorithm within the *Incremental Production Grammar* works *lexically driven*, generates sentence structure *incrementally* from left to right, and allows for parallel processing. The parts (or fragments, as Levelt calls them) of the message are therefore processed in the order they become available for grammatical encoding. In turn, fragments of grammatical encoding are forwarded to following processing steps as soon as they are available in the right format or representation. The fragment arriving first in grammatical encoding then causes the retrieving of its lemma (including its grammatical specifications) and gets assigned its grammatical function before being available for positional encoding. Levelt (1989, p. 237) claims that the order in which the fragments become available *"can be a major determinant of the eventual syntactic form"*. In this case, the question is which element arrives in grammatical encoding first and why - or put differently, what is the *starting point* (MacWhinney, 1977; Gernsbacher and Hargreaves, 1988) in the bridging from a non-linguistic message to the beginning of a linear linguistic sequence. At this point, comprehensive reviews of both message and grammatical encoding within psycholinguistics (e.g., Konopka and Brown-Schmidt, 2014 and Bock and Ferreira, 2014) refer back to a lively debate in cognitive psychology dating back at least 100 years. The debate centers around the question of how much planning must be performed before the processes of speaking can begin their work. The two opposing sides are led by Paul on the one side and by Wundt on the other side (e.g., Paul, 1886/1970; Wundt, 1900). Paul assumes that message content is planned incrementally in small units, with these units successively becoming available for language production. Wundt on the other hand proposes that speakers need to have a holistic configuration of the elements and their relations within the message before speaking. Bock and

Ferreira (2014) "translate" these positions into the notions of *word-driven sentence production* (see Figure 3.3), focusing on the individual elements, and *structure-driven sentence production* (see Figure 3.4), focusing on the relationship among the elements. In word-driven production, the production of the utterance is driven by the particular words that give rise to their syntactic structure. In structure-driven production, the message relations are established in a first step, which in turn gives rise to the building of a syntactic structure that arranges the respective elements. Bock and Ferreira (2014, p. 27) indicate that *"word- and structure-driven sentence formulation are far from mutually exclusive"*, and that both possibilities of sentence formation play an important role in language production. Evidence for words or structures as the driving force of grammatical encoding is reconsidered and evaluated in the final discussion of this thesis.

The assumption of *incrementality* entails that the fragments arriving in grammatical encoding are successively processed and get assigned their respective grammatical function during this processing step. The question arising for the mapping between message and sentence structure is what determines the assignment of grammatical functions. Levelt (1989) assumes that the perspective of the conceptual structure plays an important role in grammatical encoding. Factors such as being the *topic* (p. 260), being a *highly accessible conceptual entity* (p. 266), and being *salient* (p. 266) – relative to other elements of the conceptual structure – are encoded in *"higher grammatical functions or earlier in the sentence"* (p. 267). The following sections deal with experimental investigations of different factors subsumed under the notions of (inherent and derived) *conceptual accessibility* that have been found to cause the occurrence of *more accessible* elements in syntactically prominent positions. In other words, the following review shows which properties make good candidates for the starting points of grammatical encoding. The description and evaluation of the term *syntactically prominent position* is left aside for the moment and postponed until it can be assessed based on cross-linguistic work in language production.

3.2 Conceptual accessibility

The term *conceptual accessibility* has been brought forward by Bock and Warren (1985, p. 50) as *"the ease with which the mental representation of some potential referent can be activated in or retrieved from memory"*. They suggest that the activation or retrieval is based on the predicability of the elements; the more conceptual relations an entity can enter, the more pathways to the lexical concept exist and the easier it is to retrieve the respective element. Coupled with the incrementality of the processor, a conceptually accessible element is retrieved early and can therefore enter grammatical encoding quickly. The more accessible element establishes syntactic relationships and
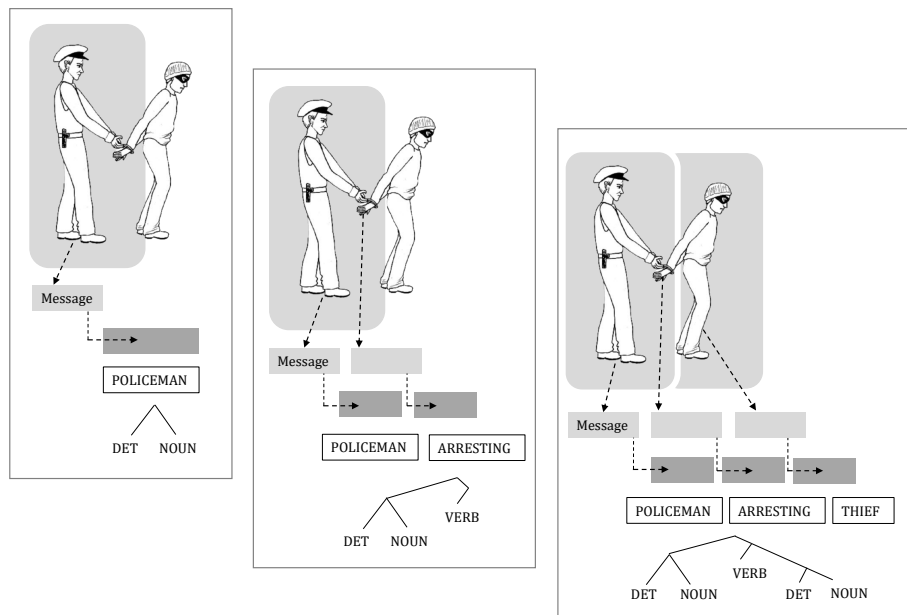
FIGURE 3.3: Word-driven development of an utterance, such as *The policeman arrests the thief*, from attentional focus through structural assembly (modified from Bock and Ferreira, 2014, p. 26).
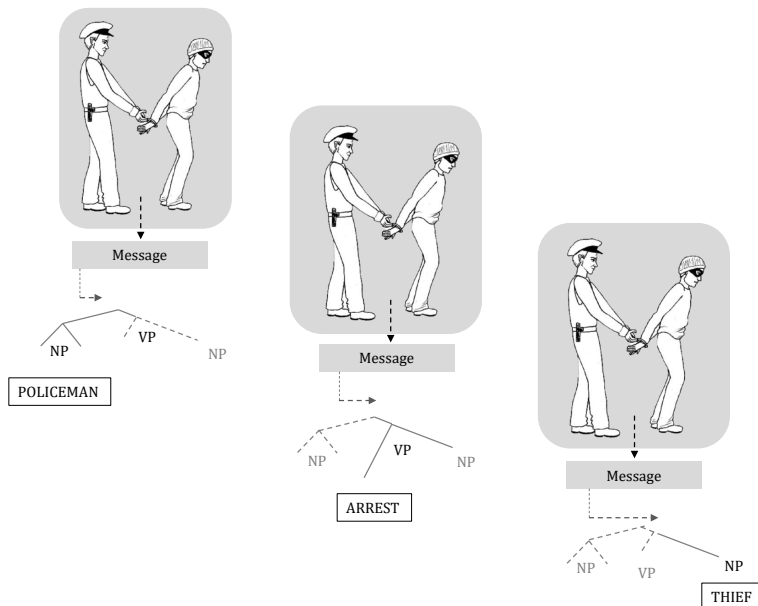
FIGURE 3.4: Structure-driven development of an utterance, such as *The policeman arrests the thief*, from apprehension through structural assembly (modified from Bock and Ferreira, 2014, p. 26).

causes potential deviations from the default syntactic structure. With recourse to the last section, a relatively more accessible element then occupies a *syntactically prominent position* (Levelt, 1989). Findings (discussed in the next section) that more accessible material is processed early has led Ferreira and Dell (2000, p. 299) to the Principle of Immediate Mention:

(3)   The Principle of Immediate Mention
        Production proceeds more efficiently if syntactic structures are used
        that permit quickly selected lemmas to be mentioned as soon as possible.

For a more accessible element to be used as soon as possible, there exist, however, different syntactic structures to implement the element early in different languages (see Chapter 2 for German). Bock and Warren (1985, p. 50) assume that conceptual accessibility only influences the assignment of grammatical functions (i.e., functional processing), but does not have an influence on word order options (i.e., positional processing). Grammatical functions, according to them, are assigned in line with Keenan and Comrie's (1977, p. 66) *NP accessibility hierarchy*[1] in the sense that the order of grammatical function assignment follows the accessibility hierarchy shown in (4):

(4)   Accessibility Hierarchy (AH)
        SU > DO > IO > OBL > GEN > OCOMP

   The subject function (SU) is therefore assigned first – to the more accessible element that first enters grammatical encoding – with direct object (DO), indirect object (IO), major oblique case NP (OBL), genitive NP (GEN), and object of comparison (OCOMP) following the subject. Word order, on the other hand, is not directly influenced by the relative conceptual accessibility of the entities. In English, a rather rigid language in terms of word order flexibility, the subject and first position of the sentence generally coincide.[2] More flexible languages, however, offer the possibility to empirically test the hypothesis that conceptual accessibility only influences grammatical function assignment directly. As discussed in the following sections, empirical evidence has indeed shown that conceptual accessibility also seems to influence word order choices in more flexible languages. The influence of accessibility on grammatical function assignment and/or word order has led to terminological distinctions between *grammatical function* and *word order models* of conceptual accessibility (e.g., Branigan, Pickering, and Tanaka, 2008) as well as the distinction between *direct* and *indirect influences*

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[1] The accessibility hierarchy was originally proposed by Keenan and Comrie (1977) to account for cross-linguistic regularities in the relativization of NP positions.

[2] Possible deviations from this overlap (e.g., left dislocations) in English are discussed in Prince (1998), for example.

of conceptual accessibility on word order (e.g., Jaeger and Norcliffe, 2009). In the remaining sections of this chapter, different factors contributing to the conceptual accessibility of entities are discussed. The review of cross-linguistic experimental evidence in the grammatical encoding of conceptual accessibility then serves as basis to evaluate *grammatical function* and *word order accounts* of conceptual accessibility in the subsequent discussion.

Prat-Sala and Branigan (2000) suggest that the notion of conceptual accessibility should be split into at least two overarching domains: *inherent* and *derived conceptual accessibility*. Factors of inherent accessibility are discussed in the following section. Cross-linguistic work on derived accessibility, properties of accessibility that are contextually licensed, is reviewed afterwards.

3.2.1   Inherent accessibility

Relative differences in the conceptual accessibility of entities might stem from properties or features *inherent* to the referents. Work in the realm of conceptual accessibility has investigated factors such as *imageability/concreteness* (Bock and Warren, 1985), *prototypicality* (Kelly, Bock, and Keil, 1986; Onishi, Murphy, and Bock, 2008), and most of all *animacy* (see Branigan, Pickering, and Tanaka, 2008 for a discussion). An impact of animacy on grammatical choices has been found for *main clause production* (e.g., Bock, Loebell, and Morey, 1992; McDonald, Bock, and Kelly, 1993; Dewart, 1979 for children; Garcia, Dery, Roeser, and Höhle, 2018 for Tagalog speaking children), in the production of *relative clauses* (e.g., Gennari, Mirković, and MacDonald, 2012), in *genitive variation* (e.g., Rosenbach, 2005), in *dative structures* (e.g., Bresnan, Cueni, Nikitina, and Baayen, 2007; Dennison, 2008 in Korean), and also in *childrens' productions* (e.g., Harris, 1978; Byrne and Davidson, 1985; Prat-Sala, Shillcock, and Sorace, 2000).

The following section reviews some of the work conducted in English for main clause structures of transitive verbs before turning to cross-linguistic research. As discussed before, isolated influences of accessibility are hard to investigate due to confounding factors. In the following sections, the most important confounding consists in the coincidence of animacy and thematic properties. The two important hierarchies are repeated in shortened versions in (5) and (6) (e.g., Comrie, 1989 and Yamamoto, 1999 for animacy; Belletti and Rizzi, 1988 and Grimshaw, 1990 for thematic roles). In the literature, different versions, especially of the thematic hierarchy and its respective ranking, exist. The short versions of the two hierarchies incorporate the properties relevant in the following sections and are chosen to illustrate that in all the different versions, human elements are ranked higher than other animate organisms or inanimate entities and agents are ranked higher

than experiencers which in turn are ranked higher than patients or themes or stimuli.

(5)   Shortened Animacy Hierarchy
        Human > Animate > Inanimate

(6)   Shortened Thematic Hierarchy
        Agent > Experiencer > Patient/Theme/Stimulus

Unless indicated otherwise, an influence of animacy is potentially correlated with the preference of animate entities to occupy the thematic role of the agent. Furthermore, the thematic properties do not constitute properties inherent to the referents, but are rather caused by the specification of the chosen verb. Despite this difference, thematic influences are subsumed under the term inherent accessibility here to facilitate the discussion of work combining aspects of animacy and thematic structure.

McDonald, Bock, and Kelly (1993) used a sentence recall task to investigate (among other factors) a possible influence of animacy mismatches. In a sentence recall task, participants are presented sentences they are asked to remember. Later during the experiment, participants are prompted to recall the sentences. The idea of this task rests on the assumption that people remember the meaning of the sentence, but not its exact (syntactic) form (e.g., Potter and Lombardi, 1990). In recalling the sentence, participants map the message content onto a linguistic form of their choice, the form that suits the mapping best, and that represents the bias of normal processes in language production (Tanaka, Branigan, and Pickering, 2011). Especially informative in this task are thus sentences where participants change the form of the sentence that was originally presented.

In the sentences presented in McDonald, Bock, and Kelly (1993), the authors varied the (in)animacy of agents as well as patients in active and passive sentences as shown in (7).

(7)   Example transitive sentences used in the sentence recall task
        by McDonald, Bock, and Kelly (1993, p. 198):
        a.   *A farmer purchased a refrigerator.*
        b.   *A refrigerator was purchased by a farmer.*
        c.   *The sound frightened the students.*
        d.   *The students were frightened by the sound.*

The sentences in the experiment served as answers to questions presented after short statements. In the recall phase, participants were presented with these prompts to elicit the respective sentence. The recall findings show that speakers of English are more likely to produce animate entities in the subject position. Sentences with inanimate agents (7-c) are recalled more often in structures with animate subjects (7-d) than sentences with animate subjects (7-a) in structures including inanimate subjects (7-b). The authors also included NP conjunctions differing in terms of animacy in their study, but this manipulation did not affect NP ordering. Note that the finding of conceptual accessibility influencing voice, but not NP ordering, in English was also replicated by Bock and Warren (1985) for *imageability/concreteness*. Further findings about ordering effects are taken up in the discussion of this section.

Ferreira (1994) used a *constrained production task* (a term coined later in Stallings, MacDonald, and O'Seaghdha, 1998), in which participants were given two referents and a verb (in this case past tense morphology) and had to produce a sentence based on these items. An abstract as well as a concrete example of this task for Experiment 3 of Ferreira (1994) is shown in (8) and (9).

(8)   Schematic example: Constrained Production task
          animate noun   animate noun
          animate noun   inanimate noun
          verb(-ed)   verb(-ed)

(9)   Concrete example taken from Ferreira (1994, p. 723):
          cowboy   *cowboy*
          sheriff   *frontier*
          avoided / challenged   *avoided / challenged*

Ferreira (1994) found no effect of animacy in her "normal verb" conditions (*avoided* in example (9) shown above). Note, however, that in this condition, no difference based on the animacy mismatch was expected since the active structure (as default) enables the more accessible element to be in first and subject position. By also including *theme-experiencer verbs* (*challenged* in example (9) shown above), Ferreira could isolate possible thematic and animacy effects. Theme-experiencer verbs (also called *object-experiencer verbs*) deviate from canonical agentive and agentive experiencer (*subject-experiencer*) verbs, subsumed as normal verbs in Ferreira (1994), in their thematic-syntactic properties (as outlined in (10) below). Whereas in normal verbs the syntactically more prominent subject function is occupied with the more prominent thematic role (agent or experiencer), theme-experiencer verbs show the opposite pattern. In sentences including these verbs, the more prominent thematic role is located in the less prominent syntactic

function of the object in active structures as shown in (10). By using a passive sentence, however, speakers can promote the more prominent thematic role into the more prominent subject position.

(10)   Verb classes and their thematic/function mapping:

Verb class	Thematic role default subject	Thematic role default object
agentive (action)	agent	patient
agent experiencer/ experiencer subject	experiencer	theme/stimulus
theme experiencer/ experiencer object	theme/stimulus	experiencer

Ferreira (1994) found an effect of thematic structure on the participants' productions in Experiment 3. With theme-experiencer verbs, speakers produced significantly more passive structures than in the normal verb condition to promote the more prominent/accessible thematic role into the more prominent subject position. This effect was independent of the animacy of the less prominent noun (the theme/stimulus). However, she also found an interaction of verb class and animacy; the rate of passive productions was even higher in the animacy mismatch condition – with an animate experiencer and an inanimate theme. The results of Ferreira (1994) are especially important in light of the question whether animacy and thematic role accessibility can influence grammatical encoding independently. By dissociating thematic and animacy effects, she showed that both factors are needed to account for conceptual influences on sentence production.

Altmann and Kemper (2006) had younger and older adults perform a constrained production task, but changed the presentation of the triplets compared to Ferreira (1994). In their task, the verb was presented between the two nouns and offset to the left. By changing the order of the nouns, the verb was preceded or followed by an (in)animate noun in the different conditions. Note that there was always a mismatch in terms of animacy present in this study. The patient or theme was always inanimate, whereas the agent or experiencer was the animate element. Productions in the transitive verb condition, included by the authors as control verbs, show that in general, the inanimate first order elicits less active responses (and consequently, more passives) than the animate first order. However, a significant difference between active and passive responses based on the NP ordering was found only for the elderly adults. Altmann and Kemper (2006) also included theme-experiencer verbs and replicated the thematic effect of Ferreira (1994). Participants produced less active (and correspondingly more passive) sentences in the experiencer-theme condition than in the control

verb condition. Note, however, that the overall production rate of passive structures varies considerably in the two studies. Whereas active structures were still favored in all of Ferreira's (1994) conditions (with a mean passive rate of 28% with theme-experiencer verbs), theme-experiencer verbs in Altmann and Kemper (2006) could overrule participants' preference for active structures (with a reduction of active productions to less than half of the responses in all but the inanimate first condition of the elderly participants). Different from Ferreira (1994), the authors did not include an animacy manipulation. Since there was always an animacy mismatch between the two thematic roles, the results are rather informative about the thematic structure, with the animacy contribution being confounded with the thematic accessibility. However, Altmann and Kemper's (2006) study adds a further important factor through the manipulation of the order of the (inanimate) elements.

Prat-Sala and Branigan (2000) also included animacy as a factor of interest in their study on English and Spanish (the Spanish data as well as further manipulations are discussed in subsequent sections), though between experiments. Participants had to describe pictures including two inanimate entities (an inanimate agent and an inanimate patient in Experiment 1) or an animate and an inanimate entity (an inanimate agent and an animate patient in Experiment 2) following contexts. The relevant finding at this point is that speakers of English produced more passive descriptions in Experiment 2 compared to Experiment 1.[3] Thus, speakers used non-canonical passive structures to promote the animate patient to the subject position. Further manipulations and findings of this study are discussed in section 3.2.4.

Summing up, experimental work conducted in English has shown that there is a systematic influence of animacy on language production. A relative difference in the animacy of the referents leads to a reduction of (default) active productions and a corresponding increase of passive sentences. The finding that conceptual accessibility affects grammatical choices, but not linear orderings, has led to the claim that conceptual accessibility does not influence word order (i.e., positional processing) directly, but only via the assignment of grammatical functions (i.e., functional processing). In English main clauses, the subject and first position of the sentence usually coincide. A possible influence of conceptual accessibility on word order may therefore be covered by the specific syntactic characteristics of the language. The inclusion of more flexible languages offers a possibility, then, to investigate influences of conceptual accessibility in grammatical

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[3]This effect was significant in only one of the conditions that are discussed in Section 3.2.4. In the second condition, the effect turned out only marginally significant.

encoding that may be concealed in English.

Cross-linguistic investigations of conceptual accessibility have indeed challenged the grammatical function account. Experimental investigations in other languages than English have shown effects of inherent conceptual accessibility not only on the grammatical function assignment, but also on word order, and on both processes of grammatical encoding.

The findings of Prat-Sala and Branigan (2000) for Spanish also show an influence of animacy in sentence production. Speakers produced more animate first structures in Experiment 2 compared to Experiment 1[4], just as speakers of English. Different from English, however, speakers of Spanish not only used passive structures, but also left-dislocation structures to promote animate patients to the subject and first position, thereby deviating from the default active structure (SVO). Note that in these dislocated structures, the grammatical function assignment remains unaltered. What is changed is the word order of the subject and the object, with the object preceding the subject in dislocated structures (OVS).

Prat-Sala (1997) furthermore investigated possible effects of animacy in Brazilian Portuguese and Catalan.[5] The picture materials included the same animacy manipulation as the ones used in Prat-Sala and Branigan (2000). Just as Spanish, Catalan offers the possibility of dislocated structures. The speakers of Brazilian Portuguese showed an influence of animacy in their productions, with passive structures occurring more frequently for animate patients compared to inanimate ones. The participants speaking Catalan used both passive as well as dislocated active structures more frequently for animate patients compared to inanimate patients.

Branigan and Feleki (1999) used a sentence recall task to investigate animacy in Greek. They manipulated the animacy of the subject noun and presented sentences in the preferred SVO as well as OVS order. In recalling the sentences, participants were more likely to change the original order if the change resulted in the animate entity preceding the inanimate one. Importantly, this effect showed up for both orderings. Participants changed the dispreferred order of OVS sentences to SVO order significantly more often when the subject was animate than when it was inanimate, but they also changed the preferred SVO order significantly more often to OVS order when the subject was animate compared to the inanimate subject condition.

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[4]Note, however, that this effect was only significant in one of the two further conditions employed in the experiments. These conditions are discussed in Section 3.2.4.

[5]Prat-Sala (1997) also investigated animacy effects in English and Spanish. These experiments are not summarized and discussed separately, because the effects have been replicated in the study of Prat-Sala and Branigan (2000). Note that Prat-Sala (1997) furthermore offers experimental evidence for the influence of animacy without further discourse manipulations in the first part of her PhD thesis.

However, the rate for word order changes was lower for changes resulting in the dispreferred OVS order compared to changes resulting in preferred SVO order.

Verhoeven (2014) also investigated word order variation in Greek. She included experiencer-subject and experiencer-object verbs (see example (10) above) as well as an animacy manipulation of the stimulus argument in a constrained production task. The verb stem was followed by the two respective nouns in a horizontal presentation on the screen. The order of the nouns was also controlled to account for possible effects of the noun ordering. Verhoeven (2014) found an effect of thematic structure as well as animacy on Greek sentence production. The results resemble the results of Ferreira (1994) for English. With experiencer-object verbs, speakers used structural options to promote the more accessible experiencer to the first position. This effect was enhanced by the animacy manipulation of the stimulus argument. With an inanimate stimulus, the deviation rate from the canonical active structure was even higher. However, different from the Greek data obtained by Branigan and Feleki (1999), speakers in the Verhoeven (2014) study made use of passive structures (i.e., changes in voice) instead of word order changes in active structures. Note that the tasks employed in the two studies on Greek differ considerably. A possible influence of methods eliciting sentence production is postponed to the discussion of this chapter.

Verhoeven (2014) also included Chinese, German, and Turkish in her cross-linguistic study. The summary of the results for German can be found in the following section. Some of the results for Chinese and Turkish, two further flexible languages in terms of structural options, are briefly summarized at this point. Speakers of Turkish also showed an animacy effect in the production of experiencer-object verbs. The inanimacy of the stimulus caused significantly more deviations from the default structure, SOV active structures in Turkish. The structures used by the participants to linguistically react to this asymmetry in animacy properties are intransitive SOV structures. A discussion of these structures is beyond the scope of this section, but the important finding for the question at hand is the influence of animacy on the grammatical function assignment (voice) instead of word order linearization. The participants speaking Turkish did not show effects of the thematic structure, i.e., no significant differences in the productions of experiencer-subject and experiencer-object verbs. However, Verhoeven (2014) indicates that different from German and Greek, Turkish and Chinese do not constitute "exceptional-experiencer" languages. She states that experiencer-object verbs in these two languages do not differ from canonical transitive verbs in their syntactic behavior. For Chinese, the data obtained by Verhoeven (2014) did not show any significant differences in the different conditions. An influence of animacy for the object-experiencer verbs is

only numerically visible in a 7.5% difference in earlier realizations of the animate entity in the inanimate stimuli compared to the animate stimuli condition. Structural options deviating from the default active SVO structures employed by Chinese speakers to front the animate element in these cases are passive structures.

A constrained production experiment including different verb classes and an animacy manipulation was also conducted by Lamers and de Hoop (2014) for Dutch. The authors included an animacy manipulation in terms of a difference between an animate experiencer or agent and an inanimate theme/stimulus or patient (an animacy *mismatch*) . They investigated agentive as well as two different types of experiencer verbs, causative and unaccusative psych verbs. The important property of the latter verb class is the fact that unaccusative psych verbs in Dutch do not allow for passivization (contrary to the causative ones). Their results showed an effect of thematic structure as well as animacy. For agentive verbs, participants mostly produced SO active structures (the default structure). Note that once again, no animacy effect was expected, since the default structure allows the animate agent to occupy the initial position, followed by the inanimate patient. For the causative theme-experiencer verbs (the verb class also investigated in the studies on English discussed above), participants used passive structures to promote the animate experiencer to the subject position. With the unaccusative psych verbs, which do not allow this option, participants used object-fronting to promote the animate experiencer to the first position of the sentence.

Christianson and Ferreira (2005) found an effect of animacy in Odawa. The findings summarized at this point are based on the general question condition that served as baseline in their study. Further conditions are discussed in section 3.2.4. They investigated relative differences in animacy by including pictures with human agents acting on animal patients and animal agents acting on human patients. The differing degree of animacy led speakers to produce more *inverse structures* (see section 3.2.4 for a more detailed description) when the agent was an animal and the patient was a human being compared to when there was a human agent and an animal patient. The chosen inverse structures (deviating from the default *direct structures*) serve to highlight the object as more *central* (Christianson and Ferreira, 2005, p. 112).[6]

Finally, Tanaka, Branigan, and Pickering (2011) investigated sentence production in Japanese using a sentence recall task. In their study, participants were presented with active SOV and OSV sentences, but also

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[6]A discussion of the "direction system" of Odawa, compared to Indo-European languages, as well as the direction system as a possible (functional) equivalent to voice systems (e.g., Aissen, 1997) is beyond the scope of this thesis. A summary of syntactic properties of Odawa and further references can be found in Christianson and Ferreira (2005).

with passive SOV and OSV sentences (Experiment 2). The recall data showed an effect of animacy on word order linearization. Participants recalled sentences presented in OSV order significantly more often as SOV sentences (the default structure) when this change led to the animate entity occupying the first position compared to inanimate entities. Participants in this study also showed an effect of grammatical function assignment. They changed the voice of their recall structure (but retained the original order) significantly more often when this change enabled animate entities to occupy the subject position compared to inanimate ones. This effect was obtained for both word order options originally presented for active as well as passive structures.

An interim summary of the experiments reviewed above can be found in Table 3.1. The table summarizes studies investigating animacy and the-matic structure in different languages and their main findings for the ques-tion of whether grammatical function assignment (gf) and/or word order (wo) is affected by factors of inherent conceptual accessibility.[7] The the-matic role manipulations presented in this section are based on the usage of experiencer-verbs. Before discussing the cross-linguistic findings, the fol-lowing section adds further experimental investigations of inherent concep-tual accessibility conducted in German, the language investigated in this thesis. German provides another promising test case for influences of con-ceptual accessibility on grammatical encoding. Language characteristics as well as structural options German provides are summarized in section 2.

3.2.2   Inherent accessibility in German

In their study on German, van Nice and Dietrich (2003) used a picture de-scription task to elicit main clauses. Their manipulation included all four logical possibilities of the (in)animacy of agent and patient. They therefore used drawings depicting transitive verbs such as *push* ("schieben") that al-low the action to be performed by animate and inanimate agents as well as the action to be carried out upon animate and inanimate patients. Within the study, the authors also changed the procedure of the task. In Experiment 1, participants gave written descriptions after inspecting the pictures. In Ex-periment 2, participants orally described the pictures while looking at them.

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[7]Sridhar (2012) investigated influences of conceptual acessibility in 10 different lan-guages (Cantonese, English, Finnish, Hebrew, Hungarian, Japanese, Kannada, Slovenian, Spanish, and Turkish). Among the experimental stimuli, there is also a manipulation infor-mative about animacy (i.e., pseudohumanness) effects on grammatical encoding. However, the way the data are reported in the study do not allow for a clear evaluation between ef-fects of grammatical function assignment and/or word order, which is why they are not included in this section.

TABLE 3.1: Prior cross-linguistic work (excluding German), including the tasks, investigating animacy and/or thematic roles as factors of inherent conceptual accessibility and the effects found on grammatical function assignment (gf) and/or word order (wo) in grammatical encoding.

Language	Factor	Effect	Study	Task
English	animacy	gf	McDonald et al.,1993	sr
	animacy	gf	Ferreira, 1994: Exp 3	cp
	animacy	gf	Prat-Sala, 1997	cp
	animacy	gf	Prat-Sala and Branigan, 2000	pd
	animacy & thematic	gf	Ferreira, 1994: Exp 3	cp
	thematic	gf	Ferreira, 1994: Exp 3	cp
	thematic (in animacy mismatch)	gf	Altmann and Kemper, 2006	cp
Brazilian Portuguese	animacy	gf	Prat-Sala, 1997	pd
Catalan	animacy	gf + wo	Prat-Sala, 1997	pd
Dutch	thematic (in animacy mismatch)	gf + wo	Lamers and de Hoop, 2014	cp
Greek	animacy	wo	Branigan and Feleki, 1999	sr
	animacy	gf	Verhoeven, 2014	cp
	thematic	gf	Verhoeven, 2014	cp
Japanese	animacy	gf + wo	Tanaka et al., 2011: Exp 2	sr
Odawa	humanness	gf	Christianson and Ferreira, 2005	pd
Spanish	animacy	gf + wo	Prat-Sala, 1997	pd
	animacy	gf + wo	Prat-Sala and Branigan, 2000	pd
Turkish	animacy	gf	Verhoeven, 2014	cp

sr = sentence recall, cp = constrained production, pd = picture description

TABLE 3.2: Mean passivization rates depending on the animacy of agent and patient found in van Nice and Dietrich (2003, p. 835) for all three experiments.

	Animate Agent		Inanimate Agent	
	Animate Patient	Inanimate Patient	Animate Patient	Inanimate Patient
Exp 1	12	8	24	15
Exp 2	16	5	26	16
Exp 3	8	8	34	17

In Experiment 3, participants once again orally described the pictures, but, as in the first experiment, after they had vanished from the screen.

The picture descriptions given by the participants showed clear effects of animacy. To promote an animate patient over the inanimate agent, speakers chose passivization as a structural option, thereby assigning the subject function as well as first position (the prefield position) to the animate patient. Mean percentages of passivization rates are shown in Table 3.2. Statistical analyses showed a main effect of animacy of the agent as well as animacy of the patient, but no interaction between them, in Experiments 1 and 2. In Experiment 3, the interaction of the two effects was significant. There was no effect of patient animacy when the agent was animate.

Verhoeven's (2014) cross-linguistic study on sentence production also included German. In the constrained production task, speakers of German showed an influence of animacy and thematic structure on grammatical function assignment rather than word order. With two animate entities, the effect of verb class caused a difference of about 22% in the production of structures allowing the more accessible experiencer to occupy the subject position (the *prefield*) in productions for experiencer-object verbs compared to experiencer-subject verbs. This rate is enhanced to a difference of 43% with an inanimate stimulus/theme and an animate experiencer.

(11)   Experiencer-object stimulus taken from Verhoeven (2014, p. 139):
         interessier…   Zuschauer   Aufführung
         concern   *spectator*   *performance*

An important finding of Verhoeven (2014) is that speakers of German did not only use the standard passive to adapt to conceptual influences. For an example such as (11), which is taken from Verhoeven (2014, p. 139), speakers also produced structures like the ones shown in (12) and (13). Example (12) includes an adjectival passive and example (13) contains an anticausative structure. The relevant characteristic of both structures at this point is the

fact that both structures allow the more accessible entity to occupy the subject position, i.e., a choice of one of these structures, just like the standard passive, shows an influence on the grammatical function assignment rather than on word order.

(12)　　*Der Zuschauer ist an der Aufführung　interessiert.*
　　　　the spectator　is　at　the performance interested

(13)　　*Der Zuschauer interessiert sich　　für die Aufführung.*
　　　　the spectator　interests　himself for the performance

A last study to be discussed for German is the one by Bader, Ellsiepen, Koukoulioti, and Portele (2017). The authors also investigated influences of animacy and thematic structure on sentence production. For a possible influence of thematic structure, once again experiencer-object verbs were included in addition to action verbs. The animacy manipulation for the agentive verbs manipulated the animacy of the agent. In the experiencer-object conditions, the animacy manipulation was exerted on the stimulus/theme argument, as in Ferreira (1994) for English and Verhoeven (2014) for German and further languages. The manipulation of the agent animacy offers an interesting test case for an isolated influence of animacy in agentive constructions (as done by van Nice and Dietrich (2003) before). Experiment 1 used a constrained production task. Noun-noun-verb triplets were vertically ordered on the screen, with the verb always positioned at the bottom and used in the infinitival form. The order of the nouns was systematically varied to capture possible effects of their ordering.

The results of the constrained production task, visualized in Figure 3.6, show an influence of animacy as well as thematic structure on participants' productions. With agentive verbs, the animacy manipulation of the inanimate agent causes a deviation from canonical active structures of 15% compared to animate agents (3%). The structures chosen by participants are passive as well as anticausative structures, showing an influence of inherent conceptual accessibility on grammatical function assignment. For the object-experiencer verbs, an influence of thematic structure was found. Participants used non-canonical structures to allow the more accessible thematic role of the experiencer to become the subject and to occupy the prefield position. The reduction of default SO active structures was even stronger when the stimulus was inanimate compared to an animate one. However, whereas the choice of non-canonical structures was about even between OS active, passive, and anticausative structures in the animate stimulus condition, this pattern changed in the inanimate stimulus condition. Of the 22% of productions that were non-canonical in this condition, the main proportion was formed by non-canonical OS active structures.

In Experiment 2 of Bader, Ellsiepen, Koukoulioti, and Portele (2017), the same experimental manipulations were employed, but a different task was
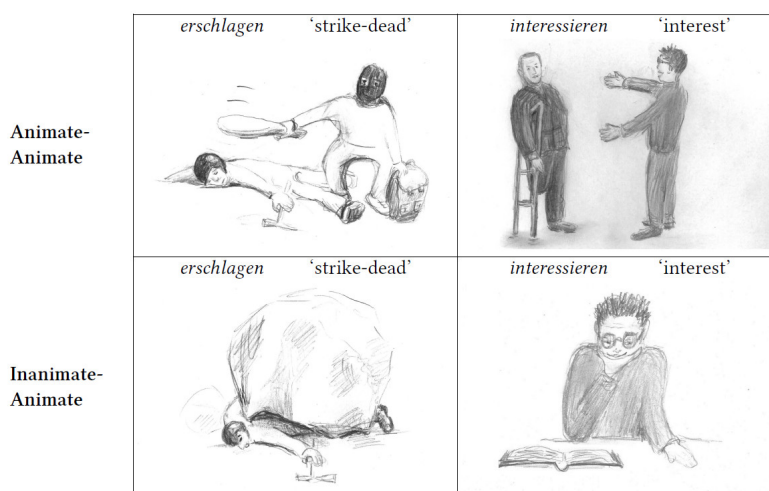
FIGURE 3.5: Example set of experimental stimuli used in Bader, Ellsiepen, Koukoulioti, and Portele (2017, p. 38) for Experiment 2 and 3 (picture description task).

used. The method chosen in the second experiment was a picture description task. The respective nouns were named in an introductory sentence before participants were asked *What can you see?* ("Was ist zu sehen?"). After the question participants described the pictures (see Figure 3.5 for an example set of experimental pictures).

The findings of Experiment 2 (Figure 3.7) show again an effect of animacy as well as thematic structure. Overall, the rate of non-canonical structures was higher than in the first experiment. In the inanimate agent condition of agentive verbs, the mean rate of non-canonical productions reached 36%, with a 23% difference compared to animate agents. In the object-experiencer verb conditions, the thematic accessibility resulted in 42% non-canonical structures for animate stimuli/themes and a further increase of 53% for inanimate stimuli.

A relevant difference for the influence of conceptual accessibility on structure choice emerged compared to Experiment 1. In Experiment 2, the object fronting sentences basically vanished and the deviation from the default structure was accomplished via passive sentences[8] and anticausative structures, i.e., via changing grammatical function assignment instead of word order.

Sauppe (2017) found an influence of animacy, or rather humanness, on the production of German main clauses. In his study, participants described pictures of transitive events that manipulated the humanness of the agent

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[8]Note that the category "passive sentences" in Bader, Ellsiepen, Koukoulioti, and Portele (2017) entails verbal as well as adjectival passive structures.
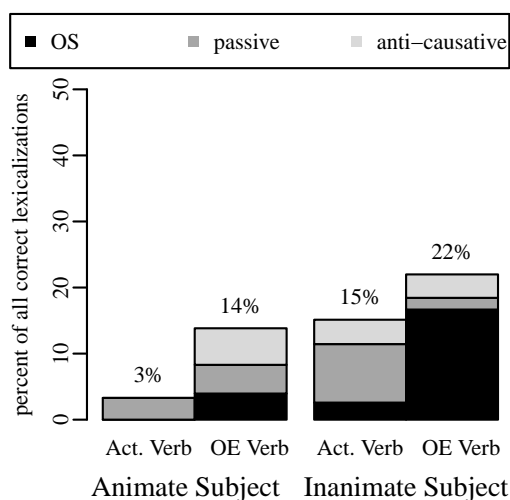
FIGURE 3.6: Results Experiment 1
(constrained prod.) from
Bader, Ellsiepen,
Koukoulioti, and Portele
(2017).
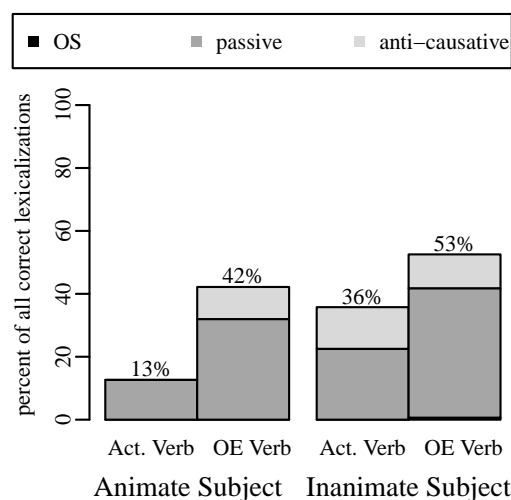
FIGURE 3.7: Results Experiment 2
(picture descript.) from
Bader, Ellsiepen,
Koukoulioti, and Portele
(2017).

and patient. By varying the humanness of both agent and patient, Sauppe (2017) could investigate all four logical possibilities in his materials, similar as van Nice and Dietrich (2003) did. His results show that speakers of German use passive structures to promote human patients. Furthermore, passives are even more likely to be used for descriptions involving non-human agents and human patients. Whereas the production of default active structures was at ceiling in the two conditions involving non-human patients, the proportion of active SO structures is reduced to about 0.9 for human agents and human patients, and decreased further to a proportion close to 0.5 for non-human agents and human patients.

The findings of influences of animacy and thematic structure as two factors of inherent conceptual accessibility in German are summarized in Table 3.3. The picture is similar to the cross-linguistic pattern summarized in Table 3.1. The two factors of relevance in this chapter show clear effects on main clause production. The major influence of inherent accessibility is exerted on the grammatical function assignment during grammatical encoding. However, there are first indications that word order options may be used by speakers of German to promote more accessible elements.

3.2.3 Discussion: Inherent accessibility

The assumption of the production processor working incrementally leads to a special role of the first element arriving in grammatical encoding in the

TABLE 3.3: Prior work, including the tasks, investigating animacy and/or thematic roles as factors of inherent conceptual accessibility and the influences found on grammatical function assignment (gf) and/or word order (wo) in grammatical encoding for German.

Factor	Effect	Study	Task
animacy	gf	van Nice and Dietrich, 2003	picture description
animacy	gf	Verhoeven, 2014	constrained production
thematic	gf		constrained production
animacy	gf + wo	Bader et al., 2017	constrained production
thematic	gf + wo		constrained production
animacy	gf		picture description
thematic	gf		picture description
animacy	gf	Sauppe, 2017	picture description

transition from the message level. Combined with the notion of conceptual accessibility proposed by Bock and Warren (1985), the most accessible element is retrieved from memory first and therefore enters functional processing before the remaining elements of the sentence. *Grammatical function models* of accessibility effects (e.g., Bock and Warren, 1985) propose that relative accessibility only influences the first stage of grammatical encoding, i.e., functional processing, within the *two-stage architecture*. The more accessible element arriving first gets assigned its grammatical function first. The assignment of grammatical functions is assumed to follow the NP accessibility hierarchy. Since the subject function precedes all other syntactic functions in this hierarchy, the most accessible element gets the subject function. Under this account, conceptual accessibility can only influence function assignment, but does not have a direct effect on word order (i.e., the positional level of grammatical encoding within the *two-stage architecture*). Due to this assumption, these accounts are also labeled models of *indirect* influences of accessibility on word order. The sole influence of accessibility effects on functional processing is a consequence of functional processing preceding positional processing within the *two-stage architecture* of grammatical encoding.

Empirical evidence for the grammatical function model mainly stems from experimental studies on English. A short look at the upper part of Table 3.1, which summarizes prior studies of main clauses investigating animacy and thematic structure as factors of conceptual accessibility, indeed

supports this account. Speakers of English show influences of accessibility in the grammatical function assignment during grammatical encoding, resulting in non-canonical passive productions. The passive allows the relatively more accessible element to occupy the subject function.

A main concern in the evaluation of grammatical function accounts in English, however, arises due to the overlap of the subject and first position in English main clauses. To reduce this concern, experimental work on English has also investigated different ordering options, allowing to isolate grammatical function assignment from word order, that speakers of English have (e.g., Bock and Warren, 1985; McDonald, Bock, and Kelly, 1993). Studies investigating conceptual accessibility in, for example, NP-conjunctions have yielded supporting evidence for grammatical function accounts. In these studies, the relative difference in animacy (or concreteness) did not cause speakers to linearly mention the more accessible element prior to the less accessible one. In other words, speakers of English did not show accessibility effects on word order, in accordance with grammatical function models.

The support for grammatical function accounts based on NP conjunctions must be treated cautiously for at least two reasons. It has been noted that within syntactic theory, coordinations sometimes receive a special status (e.g., Chomsky, 1957; Gazdar, Klein, Pullum, and Sag, 1985). As Branigan, Pickering, and Tanaka (2008) argue, coordinations might therefore be processed in *unusual ways* (p. 186) or at least different from the main clause structures elicited in the experiments. A more convincing argument to not rely on NP conjunctions when dismissing word order effects in English comes from studies that found influences of conceptual accessibility in conjunctions (e.g., Byrne and Davidson, 1985; Kelly, Bock, and Keil, 1986; Onishi, Murphy, and Bock, 2008).

The most convincing evaluation of grammatical function accounts can be accomplished by broadening the scope of languages that are taken into account. Languages with more flexible word order allow for more accessible elements not only to get assigned the subject function, but also to receive the object function and nevertheless precede the subject. The research reviewed in this section challenges the grammatical function account. There are studies that found an influence of conceptual accessibility on word order alone (e.g., Branigan and Feleki, 1999). The relative difference in terms of animacy caused speakers of Greek to deviate from the canonical SVO active structure. However, instead of assigning the subject function to the more accessible element, participants produced active OVS structures. To promote an animate over an inanimate entity, speakers showed word order effects. These effects cannot be captured by the grammatical function account, that predicts speakers to change the grammatical function assignment.

The word order effect found in Branigan and Feleki (1999) (and Tanaka, Branigan, and Pickering, 2011 in Experiment 1 for Japanese) can be captured by *word order models* of accessibility effects (e.g., De Smedt, 1994). These accounts propose that accessibility influences word order options, because word order positions may be set before the assignment of grammatical functions.

A third option, and the one that has to be preferred based on the cross-linguistic pattern, is a model allowing influences of conceptual accessibility on *both grammatical function assignment and word order*. The data expanding work on English that are summarized in the lower part of Table 3.1 unambiguously show that in flexible word order languages, speakers not only make use of non-canonical passive structures, but also use non-canonical object-before-subject active structures to adjust to conceptual accessibility. The same holds for the production pattern found for German (Table 3.3).

To adapt these findings into the classical two-stage architecture of grammatical encoding (see section 3.1.2), an influence of conceptual accessibility must be assumed on both the functional and positional processing stage. Animacy as one factor of conceptual accessibility in language production would then in a first step influence the grammatical function assignment and in a later stage once again influence the establishing of the respective word order (Branigan, Pickering, and Tanaka, 2008). Kempen and Harbusch (2004) indicate that this model adaption seems *unparsimonious*.

An alternative proposal has been given by Branigan, Pickering, and Tanaka (2008) and was pursued by further researchers (e.g., Cai, Pickering, and Branigan, 2012). The alternative model proposes that during grammatical encoding, grammatical function assignment and word order settings are determined in *one stage* of grammatical processing. Influences of conceptual accessibility can therefore allow the relatively more accessible entity to both get assigned the syntactic function of the subject and an early word order position in the sentence (Branigan, Pickering, and Tanaka, 2008, p. 184). The discussion of one-stage vs. two-stage accounts of language production is resumed in the general discussion (chapter 6) of this thesis.

A further lesson from the literature review concerns the different tasks used to elicit sentence production. A direct comparison of results elicited in different tasks may be inappropriate in some cases. The Greek data summarized in Table 3.1, for example, show an obvious difference in the structures chosen in the sentence recall task of Branigan and Feleki (1999) compared to the constrained production task used in Verhoeven (2014). Though both studies found an influence of animacy in the productions, this influence showed up exclusively via grammatical function assignment in the study of Verhoeven (2014) and via word order in Branigan and Feleki (1999). In the sentence recall task, participants were presented with SO

as well as OS active structures before the recall phase. In the constrained production task, participants saw the specific elements (two nouns and the verb) of the sentences to be produced. Since the studies also included different verb classes, a conclusive argument for possible influences of sentence production based on the different tasks is difficult to pursue. However, in the study of Bader, Ellsiepen, Koukoulioti, and Portele (2017), the same materials were used in the constrained production (Experiment 1) and picture description (Experiment 2) task. The results of the two experiments show striking differences in the usage of grammatical function or word order adaption to conceptual accessibility. Whereas word order options in form of OS active sentences occurred in Experiment 1, they "vanished" in Experiment 2 that included the same experimental manipulations and materials, but employed picture descriptions. Furthermore, experiments using constrained production tasks usually report effects of the presentation order of the respective elements (e.g., Ferreira, 1994; Altmann and Kemper, 2006; Bader, Ellsiepen, Koukoulioti, and Portele, 2017).

In sum, cross-linguistic investigations on sentence production have provided mixed results for possible accessibility influences on grammatical encoding. Studies on English have shown an influence of animacy and/or thematic structure (as two instantiations of inherent conceptual accessibility) on grammatical function assignment across the board. Given the rigid word order in English, resulting in the coincidence of the subject position with the first position in main clauses, this finding does not come as a surprise. More helpful for investigating influences of conceptual accessibility on sentence production are studies on languages with more flexible word order. The overview given above shows that some studies found an influence of animacy and/or thematic roles on grammatical function assignment. Other studies show an influence on word order linearization only. A third option that has empirically been found is an influence of inherent conceptual accessibility on both grammatical function assignment and word order.

A further important finding emerging from the overview of experimental work on inherent conceptual accessibility is the fact that both factors can have an independent (and additive) effect on grammatical encoding. As mentioned before, the thematic structure – investigated in the studies discussed so far by using experiencer-theme (object-experiencer) verbs – does not form an inherent property of the referents, but rather emerges from the verb's meaning. It is included under the notion of inherent accessibility at this point to summarize studies dealing with isolated sentences without contexts. Thus, the discussion of the linguistic literature (chapter 2) as well

as psycholinguistic theory on the production of non-canonical structures in this chapter shows that a central function of non-canonical structures may be the potential to take or change a certain *perspective* or to enable *topicalization*. This function(s) of, e.g., information structural adaption can, however, not be investigated adequately in isolated sentences because their characteristics usually depend on the discourse or context.

To enable a thorough discussion about conceptual accessibility and the use of non-canonical structures on the one hand and implications for models of language production on the other hand, the second domain of conceptual accessibility – derived accessibility – and its effects on grammatical encoding are reviewed in the next section.

3.2.4   Derived accessibility

The term derived accessibility is generally used to subsume different factors arising from contextual situations of language production. Prat-Sala and Branigan (2000) argue that conceptual accessibility not only entails fixed properties of referents, but can also vary depending on the communicative context. They furthermore propose that the temporary derived accessibility adds to the intrinsic properties of referents, i.e., to their inherent accessibility. Among the diverse factors (and terms) of derived accessibility found to influence grammatical encoding are *centrality in given vs. new information* (e.g., Needham, 1990), *contrastive focus* (e.g., Dennison and Schafer, 2011 in Korean dative structures), *focus of attention* in perceptual contexts (Turner and Rommetveit, 1968 investigating children of different ages; d'Arcais, 1987 for perceptual factors), *givenness/salience* (e.g., Bock, 1977; Bock and Irwin, 1980 for referential and lexical availability in 10 different syntactic types; Prat-Sala and Branigan, 2000 for relative salience), *given- vs. newness* (e.g., MacWhinney and Bates, 1978 for a developmental study in English, Hungarian, and Italian; Arnold, Ginstrom, Losongco, and Wasow, 2000 for dative alternations; Ferreira and Yoshita, 2003 for dative structures in Japanese; Féry, Skopeteas, and Hörnig, 2010 for spatial descriptions in English, Finnish, French, Georgian, German, and Mandarin Chinese), *perceptual priming/visual salience* (see chapter 5), *previous mention* (e.g., Bresnan, Cueni, Nikitina, and Baayen, 2007 for dative structures), *semantic priming* (e.g., Bock, 1986a; Hwang and Kaiser, 2015 for English and Korean), *structural priming* (see chapter 4), *subject vs. object focus* (Tannenbaum and Williams, 1968), and *topic status* (e.g., Cowles and Ferreira, 2012).

The following review is limited to experimental investigations involving *questions* to elicit sentence production of main clauses. The experimental manipulation is labeled differently in different studies, but is subsumed under the notion of "topicalization" here. Some exceptions are made by

including studies on *givenness* or *salience*, serving as a baseline finding of derived accessibility, to evaluate the stronger question manipulations against.

Prat-Sala and Branigan (2000) investigated influences of relative discourse salience in a picture description task. Prior to the picture onset, participants heard short recorded stories that introduced both entities included in the subsequent picture. The stories differed depending on the condition. In the *agent-salient* condition (14-a), the agent was made more salient, whereas the patient was more salient in the *patient-salient* condition (14-b). The increased salience of one of the entities was realized through introducing the referent first in an existential structure with a demonstrative, by adding an adjective to the referent, and by the predication of multiple properties (Prat-Sala and Branigan, 2000, p. 173). The less salient entity on the other hand was always introduced second and no additional properties were included.

(14)   Example set of contexts from Prat-Sala and Branigan (2000, p. 172):
   a.   agent-salient condition
         There was this old rusty swing standing in a playground near a scooter, swaying and creaking in the wind.
   b.   patient-salient condition
         There was this old red scooter standing in a playground near a swing, with rusty wheels and scratched paint.

The respective context was always followed by a general question (*What happened?*). After the question, participants saw the picture. They were asked to answer the question in describing the picture and to refrain from using pronouns for the depicted referents. In Experiment 2, the pictures were changed to not include two inanimate entities (as done in Experiment 1), but an inanimate agent and an animate patient. The results of Experiment 1 by Prat-Sala and Branigan (2000) for English show that speakers are systematically influenced by the relative salience of the referents. To promote the more salient element, speakers use passive structures, assigning the subject function to the more salient element. The rate of passive structures was increased from about 10% in the agent-salient condition to a rate of about 27% in the patient-salient condition, with a corresponding decrease of active structures. In Experiment 2, that is already discussed in comparison to Experiment 1 in the previous section, the rate of deviations from the default active structure increased further. By changing the animacy of the patient, the interplay of inherent and derived accessibility could be evaluated by Prat-Sala and Branigan (2000). There was once again an effect of derived accessibility. The patient-salient condition elicited more non-canonical structures than the agent-salient condition. This difference in

terms of salience showed a strong influence on the chosen structures. In the agent salient condition of Experiment 2, the majority of productions was still active structures, in this condition working against the preference of inherent accessibility to front an animate referent. Comparative analyses between the two experiments showed that there was also an interaction between the factors Experiment and Salience; Experiment 2 elicited more non-canonical responses when the patient was salient compared to Experiment 1.

The results of Prat-Sala and Branigan's (2000) study show the same overall pattern for speakers of Spanish. The patient-salient condition elicited more non-canonical responses than the agent-salient condition in Experiment 1. However, speakers of Spanish not only used passive sentences to promote the more accessible entity, but also made use of left dislocations. Both structures were produced more frequently in the patient-salient compared to the agent-salient condition. The same effect was found in Experiment 2. Furthermore, comparisons of both experiments showed that for Spanish, the patient-salient condition elicited more non-canonical structures in Experiment 2 than Experiment 1. In the agent-salient condition on the other hand, there was no difference. Prat-Sala (1997) reported the experimental manipulations employed in Prat-Sala and Branigan (2000) for speakers of Catalan. The findings closely match the findings for Spanish, with one difference being that the dislocated structures only turned out to be marginally significant.

Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) investigated the influence of information status and patient status in a paraphrasing task. Participants were shown contexts consisting of two sentences. In the first sentence, a referent was introduced in a preamble to the event. The second sentence contained a transitive event (in active voice) with two referents, the agent and the patient of the event. One of the two referents in this sentence was the one introduced in the preamble, i.e., it was *given*. The second protagonist was *new*. After reading aloud the two sentences (with one sentence per screen), participants were asked to paraphrase the event.

(15)   Contexts used by Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013, p. 4) in Experiment 1:

    a.   agent-given condition
           The thief made her way through the sandstorm to a small town.
           When she arrived she attacked a cowboy.

    b.   patient-given condition
           The cowboy rode across the desert into the small dusty town.
           When he arrived a thief attacked him.

In Experiment 1, Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) included an experimental manipulation of the givenness of the agent

or the patient. When the agent was given, participants produce default active structures to paraphrase the event represented in the context. In the patient given condition, the use of passive structures was significantly increased. Participants employed the structural option of a passive to promote the given patient to the subject function. The effect of the information status of the referents found in Experiment 1 served as a baseline to investigate further influences of derived accessibility in the subsequent experiments.

In Experiment 2, Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) added a further manipulation and varied the *focus* or *emphasis* of the agent or patient of the event. They used a syntactic cleft construction to linguistically realize this manipulation. An example of this manipulation is shown in (16) for the patient-given conditions. Note that the authors still included the agent-given conditions.

(16)   Example contexts used by Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013, p. 5)
in Experiment 2 in patient-given conditions:
   a.   agent-focussed condition
The cowboy rode across the desert into the small dusty town.
It was a thief who attacked him upon arriving*.*
   b.   patient-focussed condition
The cowboy rode across the desert into the small dusty town.
It was him who a thief attacked upon arriving*.*

The paraphrases produced by the participants of Experiment 2 showed main effects of information status as well as focus. Passive paraphrases were more likely to occur for a given patient compared to a given agent as well as for focused patients compared to focused agents.

In the third experiment of Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013), patient related questions for the paraphrasing task were included after the agent- or patient-given contexts. Example (15) includes the different questions for the patient-given conditions. These patient questions differed in their *agent- or patient-likeliness*.

(17)   Example contexts used by Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013, p. 7)
in Experiment 3 in patient-given conditions:
   a.   agent-like patient question
The cowboy rode across the desert into the small dusty town.
When he arrived a thief attacked him.
What did the cowboy do?
   b.   patient-like patient question
The cowboy rode across the desert into the small dusty town.

When he arrived a thief attacked him.
What happened to the cowboy?

The results of Experiment 3 showed main effects of information status as well as patient framing (i.e., *likeliness* of the patient question). Passive paraphrases were more likely to occur in the agent given conditions compared to the patient given conditions. Note that this finding is opposite to the findings of Experiment 1 and Experiment 2, where passive paraphrases occurred more often in patient- compared to agent-given conditions. Passive structures were furthermore more likely to be chosen for patient-like patient questions compared to agent-like patient questions.

In sum, the experiments conducted by Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) show that speakers of English make use of passive constructions[9] when influenced by the relative derived accessibility of referents.

Montag, Matsuki, Kim, and MacDonald (2017) investigated sentence production following patient questions in English, Japanese, and Korean. In Experiment 1 of the study, participants saw pictures that included either an animate agent and animate patient or an animate agent and inanimate patient/theme in an event action. After the presentation of the pictures, a written question (*Tell me about the patient/theme*) appeared under the picture and participants had to type written responses. In English, participants once again used passive descriptions to adjust the derived accessibility of the patient. Furthermore, the rate of passive structures was higher for animate patients than inanimate themes, exhibiting a further influence of inherent conceptual accessibility (i.e., animacy).

In Japanese, participants used passive, benefactive, as well as scrambled structures in reaction to the manipulation. The benefactive construction that might be used in conditions including animate patients (but not in conditions with inanimate themes) is similar to the passive in the sense that in both structures, the subject and object are marked with the same respective case markers. There are, however, differences between the structures, for example in terms of (passive) morphology (Montag, Matsuki, Kim, and MacDonald, 2017). Independent of the status of benefactive structures, the use of passive as well as scrambling options shows an influence of accessibility on both grammatical function assignment as well as word order linearization. Speakers of Japanese furthermore produced more non-canonical structures in the animate patient compared to the inanimate theme condition, showing an influence of relative inherent conceptual accessibility of the referents on structure choice.

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[9]The study of Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) in fact investigated differences in the production of by- and get-passives that are neglected here. The results summarized in this section are based on their combined analyses of passive voice responses.

In Korean, a very similar pattern to the one found for speakers of Japanese emerged in the study of Montag, Matsuki, Kim, and MacDonald (2017). The manipulation of derived accessibility elicited non-canonical sentences in the form of passive, benefactive, and scrambled structures. In addition, the rate of non-canonical structures was higher in the animate patient condition compared to the inanimate theme condition.

Christianson and Ferreira (2005) used different topicalizing questions before picture descriptions to investigate sentence production in the Algonquian language Odawa. Odawa shows a strong word order flexibility, with the important point being the fact that the subject as well as object can occur sentence-initially. Furthermore, Odawa allows for several verb forms. The three options relevant for the current discussion are summarized by Christianson and Ferreira (2005, p. 111) as follows: *"The most frequent transitive verb form (the direct) is used when the subject (and thematic agent) is designated as the topic. A less frequent verb form (the inverse) is used when the object (and thematic patient) serves as topic. Yet another verb form (the passive) is used when the patient serves as both topic and subject"*. The experimental manipulation was realized in form of different questions preceding the pictures to be described by the participants. Christianson and Ferreira (2005) included general questions (English equivalent: *What is happening here?*), agent-topicalizing questions (*What is the "agent" doing?*), and patient-topicalizing questions (*What is happening to the "patient"?*). The general question condition served as baseline condition for the two topicalizing questions. The results of the descriptions showed that direct verb forms were mainly used after general and agent-topicalizing questions. The patient-topicalizing question, however, reduced the production of direct structures and increased the use of inverse as well as passive verb forms, showing an influence of grammatical function assignment. As mentioned in section 3.2.1, Christianson and Ferreira (2005) also included an animacy manipulation in their materials. When excluding productions elicited in conditions showing an animacy asymmetry, the inverse effect vanished, but the effects for direct and passive forms remained unaltered. In terms of word order, the picture descriptions did not differ in the different question conditions. In all three manipulations, the overt subject (agent) was more likely to precede the overt object (patient) in the data of Christianson and Ferreira (2005, p. 123).

Skopeteas and Fanselow (2009) investigated effects of derived accessibility in terms of givenness in twelve different languages: Czech, Dutch, American English, Canadian French, Georgian, German, Greek, Hungarian, Konkani, Yucatec Maya, Prinmi, and Teribe. In a picture description task, they manipulated the givenness of the agent or patient of a transitive action. Before seeing the target picture with two animate individuals,

participants had been shown an introductory picture involving either the agent or the patient of the target. Note that this way, givenness in this study was manipulated non-verbally, different from the picture description studies discussed so far. The results of Skopeteas and Fanselow (2009) showed that the different languages use different strategies to front a given patient. Speakers of Czech, Georgian, Hungarian, Konkani, Prinmi, and Teribe used object fronting to promote the patient to the first position, thereby showing an influence on word order. Speakers of Dutch, American English, Canadian French, German, and Yucatec Maya used passivization in the patient given conditions, showing an influence in the assignment of grammatical functions. In Greek, no deviation from the active default structure could be observed. These data, however, have to be treated with caution, since they are purely descriptive. Skopeteas and Fanselow (2009) did not include any statistic analyses, and the numbers of non-canonical structures vary considerably, with some cases showing only very small numbers. Nevertheless, they suggest that both grammatical function assignment and word order can be influenced by relative differences in derived accessibility.

Schröter (2017) extended the investigation of givenness in sentence production to Russian, Turkish, and Urum. She also used a non-verbal introduction of either the agent or patient of a transitive action in a picture description task. The first picture introduced the upcoming agent or patient in a group of three individuals/objects. These were animate entities in the agent given condition and inanimate entities in the patient given condition. The results of all three languages did not show any significant differences in the structures produced in this condition. Note that different from the materials of Skopeteas and Fanselow (2009), the target pictures always included an animate agent and an inanimate patient. To structurally react to the givenness manipulation, not only do speakers have to front the patient over the agent, but they also have to front an inanimate patient over an animate agent. The canonical structures chosen by the participants therefore always allowed the animate entity to precede the inanimate one. The production of a non-canonical structure allows the more accessible element in terms of derived accessibility (the patient) to be promoted, but at the same time works against preferences in terms of inherent accessibility to have the animate entity in the first position.

Table 3.4 summarizes the results of the cross-linguistic studies discussed for influences of derived accessibility on grammatical encoding. The factor *salience* is chosen based on Prat-Sala and Branigan (2000) to represent studies that used contextual manipulations that promote the agent or the patient in terms of accessibility. The term *topicalization* represents studies that used questions to change the relative derived accessibility of the referents. Table 3.5 furthermore includes cross-linguistic work on givenness. Studies on givenness in English are excluded from this table, the studies reviewed in

TABLE 3.4: Prior cross-linguistic work (excluding German), including the tasks, investigating derived conceptual accessibility by using contexts as well as questions (*topicalization*) and effects found on grammatical function assignment (gf) and/or word order (wo) during grammatical encoding.

Language	Factor	Effect	Study	Task
English	salience	gf	Prat-Sala and Branigan, 2000	pd
	patient focussing	gf	Thompson et al., 2013: Exp 3	par
	topicalization	gf	Montag et al., 2017: Exp 1	pd
Catalan	salience	gf (+ wo)	Prat-Sala, 1997	pd
Japanese	topicalization	gf + wo	Montag et al., 2017: Exp 1	pd
Korean	topicalization	gf + wo	Montag et al., 2017: Exp 1	pd
Spanish	salience	gf + wo	Prat-Sala and Branigan, 2000	pd
Odawa	topicalization	gf	Christianson and Ferreira, 2005	pd

Brackets symbolize non-significant or marginally significant results.
par = paraphrasing, pd = picture description

TABLE 3.5: Prior cross-linguistic work (excluding German) using picture description tasks to investigate *givenness* as factor of derived conceptual accessibility and their effects found on grammatical function assignment (gf) and/or word order (wo) during grammatical encoding.

Language	Effect	Study	Task
Czech, Georgian, Hungarian, Konkani, Yucatec Maya, Prinmi, Teribe	(wo)	Skopeteas and Fanselow, 2009	pd
American English, Canadian French, Dutch	(gf)	Skopeteas and Fanselow, 2009	pd
Greek	(–)	Skopeteas and Fanselow, 2009	pd
Russian	–	Schröter, 2017	pd
Turkish	–	Schröter, 2017	pd
Urum	–	Schröter, 2017	pd

Brackets symbolize pending statistical analyses.

the summary are rather chosen to extend the range of languages. Before turning to a discussion of the studies summarized in this section, results for influences of derived accessibility in German are added in the following review.

3.2.5   Derived accessibility in German

Experimental work on syntactic choices in main clauses influenced by factors of derived accessibility is very rare for German. Skopeteas and Fanselow (2009) included German in their cross-linguistic study of givenness in sentence production that is discussed above. They found that speakers of German use passivization to front a given patient over an agent that was not introduced before (i.e., an agent that is new). In the agent given condition, all descriptions were given using default active SO structures (45 descriptions). When the patient was introduced first, there were 11 cases deviating from the default structure. In 10 of these 11 cases, participants used a passive structure, enabling the patient to become the subject and to occupy the first position, the prefield. In one case, a participant used object fronting, i.e., an OS active structure, to promote the patient to the prefield position, with the patient keeping the syntactic function of the (direct) object.

Bader, Ellsiepen, Koukoulioti, and Portele (2017) used patient questions to investigate effects of derived accessibility on German main clause production. The materials were the same as used in Experiment 1 and 2 of their study (see section 3.2.2). In their picture description task, they included experiencer-object as well as agentive verbs and also manipulated the animacy of the patient and theme/stimulus. An example set of the pictures in the different conditions is shown in Figure 3.5. In Experiment 3, the two referents were introduced by using the respective nouns, just as in the second experiment. Different from Experiment 2, the question now always asked about the patient/stimulus. An example is shown in (18).

(18)   Example used by Bader, Ellsiepen, Koukoulioti, and Portele (2017)
        in Experiment 3:
        Hier geht es um einen Räuber/Fels und einen Bergsteiger.
        Was lässt sich über den Bergsteiger sagen?
        "In this picture a burglar/rock and an alpinist are involved.
        What can one say about the alpinist?"

The results of Experiment 3 are shown in Figure 3.8. For reasons of comparison, the results of Experiment 2 with the general question (*What can you see?* "Was ist zu sehen?") instead of the patient question are repeated in Figure 3.9. The results show that with the patient question, over 90% of the
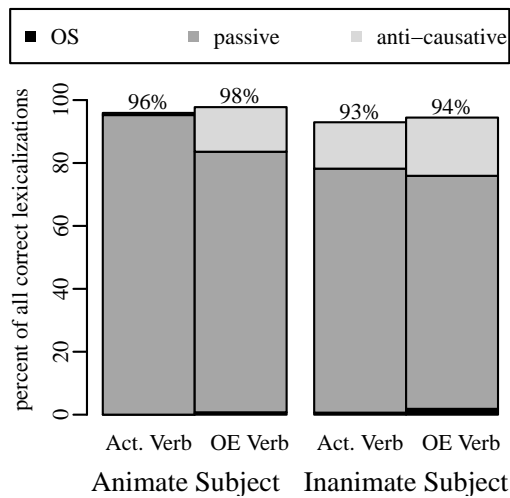
FIGURE 3.8: Results of Experiment 3 (patient question) from Bader, Ellsiepen, Koukoulioti, and Portele (2017).
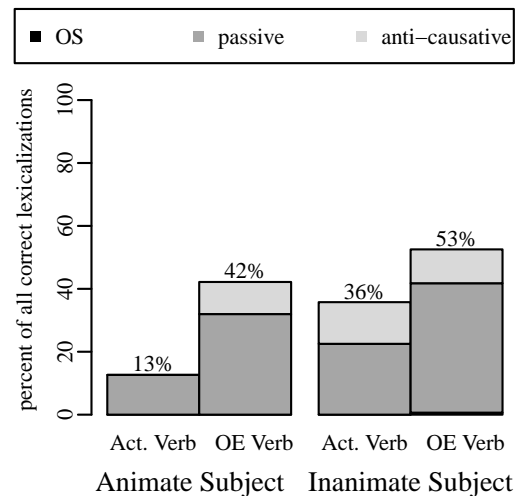
FIGURE 3.9: Results of Experiment 2 (general question) from Bader, Ellsiepen, Koukoulioti, and Portele (2017).

TABLE 3.6: Prior work using picture description tasks in German to investigate derived conceptual accessibility and effects found on grammatical function assignment and/or word order in grammatical encoding.

Factor	Effect	Study
givenness	grammatical function assignment	Skopeteas and Fanselow, 2009
topicality	grammatical function assignment	Bader et al., 2017

structures chosen in all conditions deviate from the canonical active structure. To promote the patient, speakers of German used passive structures in the majority of cases, independent of animacy and thematic roles. Another structural option to promote the patient into the subject position is used in form of anticausative structures. Both structures change the grammatical function assignment by making the patient the subject of the sentence. The data show that the relative difference in terms of derived accessibility that was manipulated in Experiment 3, but not in Experiment 2, had an enormous effect on the structural choices of speakers. The manipulation could totally override the default preference of active SO structures.

3.2.6 Discussion: Derived accessibility

The second part of the review conducted on cross-linguistic experimental work within the area of conceptual accessibility shows that in addition to inherent accessibility, derived accessibility influences structural choices in language production.

By changing the relative accessibility in terms of, for example, givenness, salience, or topic status, participants deviate from the canonical default structure and use non-canonical structures to promote more accessible entities. Similar to work on inherent properties of referents and thematic effects, prior work of derived accessibility has shown that speakers of English use passive structures that allow the more accessible element to become the subject (see: upper part of Table 3.4). By once again expanding the research area to different languages, it has become clear that speakers exploit both grammatical function assignment as well as word order to adapt to differences in terms of accessibility (see: lower part of Table 3.4). The discussion given in section 3.2.3 therefore also holds for findings of derived accessibility. Whereas *grammatical function models* may cover the data found for English, they cannot cover the whole pattern found cross-linguistically.

The review has also shown that different factors, subsumed under the term derived accessibility, differ in their strength on causing deviations from default structures. Whereas pure givenness compared to being new may cause a noticeable rate of non-canonical structures, strong manipulations that may be exercised with, for example, questions temporarily promoting an entity can totally override the preference for SO active structures. The data provided in Thompson, Ling, Myachykov, Ferreira, and Scheepers (2013) even allow for the suggestion that the different possibilities to derive accessibility add to the overall derived accessibility of the elements. A decrease in the production of canonical active structures was visible from one experiment to the other, with each experiment increasing the manipulations in terms of derived accessibility.

The studies using questions are subsumed under the notion of *topicalization* in the summary. In general, the notion of *topic* (see also chapter 2) has been extensively discussed in the literature and does not come without problems and confoundings. The term topicalization is chosen in this chapter, in line with Levelt (1989, p. 262) and further researchers who assume that *"a very natural way to induce a topic is by asking a question"*.

The term *salience* is used in this chapter for studies manipulating relative differences in the strength or amount of information that is given for one entity over another one. However, salience as well as prominence are closely related with the notion of topic, as expressed by Levelt (1989, p. 159) in the following quote: *"A salient entity will have a better chance of getting an address in the discourse model than a nonsalient one. As a consequence, salient entities are more easily topicalized than nonsalient ones. Items in the message will*

also vary in prominence. A speaker will make an item prominent if the listener has to store it as something new–a new referent, a new entity in a focused role, or a new predication".

Independent of the concrete terms chosen to describe the manipulations, they all belong to information structural notions or factors of derived accessibility that are established in the respective discourse context. The psycholinguistic research has therefore provided evidence for what is assumed to be among the most important functions of non-canonical structures in linguistic work (see chapter 2) – to adapt to information structural conditions. Furthermore, in terms of givenness, a pure binary distinction between given and new elements might not be sufficient to capture structural choices due to derived accessibility as the influences of salience in the different experiments show.

Another important finding from the studies discussed within this section is the observation that factors of both inherent as well as derived accessibility shape the syntactic structures. Prat-Sala and Branigan (2000) propose derived accessibility to be additive to the inherent accessibility of an entity. This proposal, which is based on their studies conducted in English and Spanish, has gained further support from cross-linguistic studies investigating derived as well as inherent accessibility influences (e.g., Christianson and Ferreira, 2005; Bader, Ellsiepen, Koukoulioti, and Portele, 2017). Note that Christianson and Ferreira (2005, p. 128) even argue for a qualitative interaction between inherent and derived accessibility, rather than an additive one, based on their data on Odawa. The argument rests on the finding that patient questions increased both passive and inverse verb productions. Without the inclusion of the mixed animacy conditions, the increase in using inverse verbs disappeared. In a separate analysis of only the mixed animacy conditions, there was, however, a significant use of inverse verb structures and a significant decrease in passive use for animal agents and human patients. In general, though, passive structures were preferred over inverse structures. Whereas the inverse verb form therefore seems to be the preferred mean to promote inherently more accessible elements, the passive may be chosen to react to differences in the derived accessibility.

An evaluation of this proposal is left for future work. The desired aim to include more languages in experimental investigations of conceptual accessibility, that has already proven to be fruitful for the evaluation of language production models, will hopefully allow for investigations of possible qualitative interactions of inherent as well as derived accessibility.

As a final remark, the tasks are once again considered. The studies discussed in this section all employed picture descriptions with *"the communication of perceptual experience being among the most important functions of language"* (Clark, Carpenter, and Just, 1973, p. 311). Even though the studies used the same task, differing results might emerge from the way the discourse was established. Whereas most studies used verbal contexts to introduce the referents and induce accessibility differences, the studies discussed for the factor givenness used non-verbal introductions via pictures.

3.2.7 Summary

The goal of this chapter was to investigate factors that influence speakers to exploit structural flexibility in terms of non-canonical structures in their respective language. A review of Levelt's (1989) model of language production shows that this question mirrors the way from message encoding to grammatical encoding. During message encoding, speakers have to build a preverbal message representation that entails semantic, thematic, and perspective structure. The semantic structure ensures that the relevant concepts and their relations among each other find their way to grammatical encoding. The thematic structure makes sure that the respective thematic roles, agent and patient in transitive action events, are incorporated. Finally, the perspective shapes the preverbal message to contain relevant information about the status of the different referents based on the prior discourse, and also highlights the topic of the utterance to be produced. In the transition from message to grammatical encoding, speakers (and the grammatical processor) then have to find a starting point, the element that enters grammatical encoding first. Under the assumption that the processor works incrementally, the first element to depart message encoding has the advantage to arrive first in grammatical encoding and therefore enter the processes of grammatical encoding prior to all remaining elements of the message. In the "classic" two-stage architecture of language production, grammatical encoding encompasses two levels of processing, the functional and the positional one. Whereas the tasks of functional processing are lexical selection and the assignment of grammatical functions, processes of positional processing operate on the representations formed during functional processing and specify hierarchical structure and linear order as well as inflectional requirements.

The review of the psycholinguistic literature has shown that conceptually accessible elements make good starting points. The conceptual accessibility of an element has been defined by Bock and Warren (1985, p. 50) as *"the ease with which the mental representation of some potential referent can be*

activated in or retrieved from memory". Thus, a relatively more accessible element can be activated and retrieved easily and enters grammatical encoding faster than the remaining elements.

The research conducted within psycholinguistics has shown that both inherent as well as derived accessibility influence structural choices in language production. Whereas the former domain covers properties inherently brought about by individual referents, the latter includes factors temporarily changing the accessibility of referents due to the respective context (i.e., information structure). The current chapter focuses on animacy, thematic structure, givenness, and topicalization as factors of conceptual accessibility. Whereas animacy clearly is a feature of inherent accessibility, givenness and topicalization belong to the second domain of accessibility, the derived one. The thematic structure, strictly speaking, belongs to an intermediate stage. Different from inherent accessibility, its properties are not specified by the respective referents. The thematic accessibility status is rather determined by the respective verb and its thematic specifications. Different from the derived accessibility, no contextual properties are involved, which is the reason why the thematic structure (of theme-experiencer/object-experiencer verbs) is subsumed under the notion of inherent accessibility.

Under the *grammatical function model* of accessibility effects (e.g., Bock and Warren, 1985), the accessibility status of the elements can only influence functional processing, i.e., the assignment of grammatical functions. There is no direct way for conceptual accessibility to influence word order at the positional level. The systematic review of experimental work investigating accessibility in English main clause production shows that this claim is supported by empirical evidence. In reaction to relative differences in terms of accessibility, speakers of English produce non-canonical passives. The limited structural flexibility of English poses a possible problem for a comprehensive evaluation. The subject in English main clauses also occupies the first position, thereby possibly disguising word order effects. Cross-linguistic work was incorporated to more satisfyingly evaluate grammatical function models of accessibility. More flexible languages not only allow speakers to change the grammatical function assignment, resulting in a passive structure, but also offer the possibility to keep the default assignment and change the word order of the subject and object. The review indeed shows that speakers of less rigid word order languages use both options when influenced by inherent as well as derived accessibility. This finding poses a challenge to the *grammatical function model* of accessibility, given the assumption that the architecture of the production system is universal. The empirical pattern has led to proposals of grammatical function assignment and word order to be determined during one stage of grammatical encoding (e.g., Branigan, Pickering, and Tanaka, 2008; Cai, Pickering, and Branigan, 2012).

Finally, the review shows that there seem to be universal influences on the production system. Animacy, as a factor of inherent accessibility, as well as topicalization (via questions), as a factor of derived accessibility, influence structural choices in all the languages investigated so far. Unfortunately, the sample size is rather low given the amount of languages in the world. Future work will hopefully change this situation by incorporating further languages. The cross-linguistic investigations so far have opened several doors for further important questions within the domain of conceptual accessibility. Two of these are given at this point as an outlook: The study of Verhoeven (2014) conducted on Chinese, German, Greek, and Turkish, showed that whereas animacy might constitute an universal influence on language production, other factors (thematic effects due to experiencers in her study) depend on or interact with language-specific characteristics, in this case the exceptional-experiencer-property of languages. The study of Christianson and Ferreira (2005) highlights a further direction in production research by including the Algonquian language of Odawa. The investigation of languages other than Indo-European ones and their respective characteristics in terms of word order, verb system, and/or morphology not only provide important test cases for architectural assumptions in language production, but they also allow for a more fine-grained analysis of different effect of conceptual accessibility, exemplified in the qualitative distinction proposed by Christianson and Ferreira (2005).

The remainder of this thesis is dedicated to another two factors within the extended domain of (derived) accessibility: *structural* and *perceptual priming*. The cross-linguistic work of accessibility in language production is broadened with data from German, a flexible word order language that offers speakers several structural choices (see chapter 2).

Chapter 4

Structural priming in sentence production

I am a patient boy
I wait
I wait
I wait
I wait
My time is like water down a drain

Everybody's moving
Everybody's moving
Everybody's moving
Moving
Moving
Moving
Please don't leave me to remain

The Cryptkeeper Five – Waiting Room (Fugazi Cover)

Repetition is good. Repetition helps to learn and to remember (and encourages *earworms* (e.g., Margulis, 2013), as might happen in case of the "waiting room"). On the other hand, repetition limits creativity by resuming something, some words or structures, that was processed (comprehended and/or produced) in the same way as done before.

Chapter 3 shows that during grammatical encoding, speakers are influenced by the content, or features of the elements being parts of this content, and the perspective they take in structurally conveying this content. These two aspects have been discussed under the terms of *inherent* and *derived conceptual accessibility*. There is, however, a second aspect influencing speakers' grammatical encoding, termed *cohesion* in Levelt (1989, p. 271), following Halliday and Hasan (1976): "*In cohesive discourse the speaker makes, where necessary, the form of the current utterance dependent on what was previously said by himself or the interlocutor*". Not only are speakers cohesive in referencing (e.g., the use of (in)definite articles or

pronouns given the current discourse model), but they are also cohesive on
the level of wording and syntax. Syntactic variation, in these cases, is not
only influenced by means of the message level during language production.

Priming is one of the most well established phenomena in the psycho-
logical and psycholinguistic literature. Numerous studies have shown that
the processing of a stimulus may facilitate (or inhibit[1]) the subsequent pro-
cessing of another stimulus. The logic underlying priming methodologies
is that for priming to occur, the respective stimuli need to share some as-
pect of their representation. One subcategory of priming that has proven
very fruitful for research on linguistic processing is *structural priming*: The
syntactic processing of a *prime* utterance facilitates the subsequent process-
ing of another *target* utterance that is related to the prime in terms of lin-
guistic structure. For sentence production, the most often replicated find-
ing of structural priming experiments is that speakers are primed in their
syntactic choices. They repeat (aspects of) a previously processed syntactic
structure in their subsequent target utterance. As has been noticed in the
literature (e.g., Pickering and Ferreira, 2008), repetition as a general psy-
chological phenomenon as well as repeating linguistic structure may reflect
different underlying psychological mechanisms. By repeating a process that
has (partly) been performed or observed before, the processing system may
reveal learning and/or development, adding something to the system. On
the other hand, this repetition limits the processing system by not exploiting
other given options, e.g., in terms of alternative syntactic structures. Other
terms that have been used to refer to the phenomenon at hand are *syntactic
priming* (e.g., Branigan, 2007), and *syntactic persistence* (e.g., Hartsuiker and
Kolk, 1998b). In the present thesis, the term structural priming is used to
clarify that the representations are not purely syntactic in most of the cases
and especially in the conducted experiments.

The present chapter reviews some of the (psycho-)linguistic literature
on structural priming, with a focus on the active/passive alternation. This
review reveals a certain gap in the literature in case of structural priming
in German. The experiments presented in this chapter aim at starting to
fill this gap by testing monolingual speakers of German for the structural
priming of active and passive structures. In the experiments, the structures
themselves are made more accessible by using structural priming. Inherent
conceptual accessibility (in this case: animacy) – a factor known to influ-
ence grammatical encoding (see chapter 3) – is included in the experimental
investigations.

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[1]The current chapter only deals with facilitating effects of priming, which is why in-
hibitory effects will be excluded.

4.1 Structural priming in psycholinguistics

Structural priming has been thoroughly investigated for more than 30 years now. Early observations of speakers repeating their own as well as their interlocutors' structures in everyday conversations and sociolinguistic interviews (Schenkein, 1980; Weiner and Labov, 1983; Estival, 1985) formed the early basis for a line of research that nowadays encompasses more than hundred of psycholinguistic experiments as well as computational studies. Whereas early studies suffered from potentially ambiguous results based on additional influences of e.g., stylistic preferences, register, or communicative intentions, experimental studies of structural priming allowed for a systematic investigation of linguistic factors causing structural repetition.

Starting with the fundamental work of Bock (1986b), it has been shown that not only in natural contextually rich conversations, but also in laboratory settings with participants producing isolated sentences, speakers are structurally primed. She presented participants with a (cover) memory recognition task that involved repeating and formulating sentences. After familiarizing participants with pictures and sentences in the study session, they had to recognize these in the experimental session. In each experimental trial, participants had to repeat a sentence and then decide whether they had heard this sentence before. Subsequently, participants described a seemingly unrelated line drawing and again were asked whether they had seen the picture before. With the sentence repetitions and picture descriptions disguised as memory aid, the repeated sentences actually served as prime structures and the elicited picture descriptions constitute the subsequent target structures (see section 4.2.2 for a more detailed description of the paradigm, including examples). Structurally, Bock (1986b) included the active/passive as well as dative alternation in the prime structures. Her results showed that speakers systematically repeated the primed structures in their target descriptions for both the dative as well as active/passive alternation. Following prepositional datives (e.g., *A rock star sold some cocaine to an undercover agent*), participants were more likely to produce a prepositional datives than after double-object primes. After having repeated a double-object prime (e.g., *A rock star sold an undercover agent some cocaine*), the production of double-object structures increased compared to prepositional primes in the target description. The same priming pattern showed up for active and passive sentences (e.g., *One of the fans punched the referee* vs. *The referee was punched by one of the fans*). The frequency of active and passive productions increased after the corresponding prime structure (see also section 4.2.2). For the active/passive alternation, structural priming changed the likelihood of producing the respective structure by 8%. For the dative alternation, priming changed the likelihood by about 23%. Note that structural priming does not determine the structure choice

by participants, but alters the relative likelihood of producing one structure or another (Branigan, 2007). As Branigan (2007, p. 2) noticed, *"syntactic priming is one of many factors that conspire to determine structure choice, and may in some circumstances exert a relatively weak (although consistent) influence".*

Thirty-three years after this classic demonstration of structural priming of the active/passive alternation as well as prepositional- and double object structures in English, structural priming research has been extended on many different levels.[2]

Levelt and Kelter (1982) had already investigated priming of (optional) prepositions in question-answer sequences. The finding of structural repetition of the dative and active/passive alternations by Bock (1986b) has been accumulated and expanded to different linguistic constructions or phenomena, such as *complex noun phrases* (Cleland and Pickering, 2003), the *order of main verbs and auxiliaries* (Hartsuiker and Westenberg, 2000), the *order of subjects and locatives* (Hartsuiker, Kolk, and Huiskamp, 1999), *genitives* (Bernolet, Hartsuiker, and Pickering, 2013), *main vs. subordinate clauses* (Branigan, Pickering, McLean, and Stewart, 2006), *relative clause attachment* (Scheepers, 2003), finite *complements of object-raising verbs* (Griffin and Weinstein-Tull, 2003), *coerced and full-form sentences* (Raffray, Pickering, Cai, and Branigan, 2014), *modifier order* (Goudbeek and Krahmer, 2012), *optional complementizers* (Ferreira, 2003), and *psych verbs* (Pappert, Baumann, and Bader, 2017).

Structural priming has been found in different languages, such as *American Sign Language* (Hall, Ferreira, and Mayberry, 2015), *Basque* (Santesteban, Pickering, Laka, and Branigan, 2015), *Mandarin Chinese* (Cai, Pickering, and Branigan, 2012; Huang, Pickering, Yang, Wang, and Branigan, 2016), *Dutch* (Hartsuiker and Kolk, 1998b; Bernolet, Collina, and Hartsuiker, 2016; Segaert, Wheeldon, and Hagoort, 2016), *German* (Köhne, Pickering, and Branigan, 2014; Pappert and Pechmann, 2014), *Japanese* (Tanaka, 2008), *Korean* Sung, 2015; see also Arai, 2012 for a review on structural priming in head-final languages) and also in *pantomime* (Prunier, 2015).

It has also been established using several different tasks, among them *sentence recall* (Potter and Lombardi, 1998), and *sentence completion* (written: Pickering and Branigan, 1998, spoken: Branigan, Pickering, Stewart, and McLean, 2000; Hartsuiker and Westenberg, 2000, spoken vs. written: Cleland and Pickering, 2006, and internet based: Corley and Scheepers, 2002).

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[2]The following enumeration of references is far from complete, simply due to the immense literature on priming. If possible, reviews of the respective subtopics are given. In cases without reviews, current articles (which are more recent than the general reviews) or studies broadening the scope of investigated languages or populations are cited to give recommendations as entry points for further references.

Structural priming has been investigated in different populations, for example *aging participants* (Hardy, Wheeldon, and Segaert, 2018), *amnesiacs* (Ferreira, Bock, Wilson, and Cohen, 2008; Heyselaar, Segaert, Walvoort, Kessels, and Hagoort, 2017), *aphasics* (Saffran and Martin, 1997; Hartsuiker and Kolk, 1998a; Cho-Reyes, Mack, and Thompson, 2016; Yan, Martin, and Slevc, 2018), *bilingual aphasia patients* (Verreyt, Bogaerts, Cop, Bernolet, De Letter, Hemelsoet, Santens, and Duyck, 2013), *bilinguals* (Salamoura and Williams, 2007;Bernolet, Hartsuiker, and Pickering, 2009; Shin and Christianson, 2009; Cai, Pickering, Yan, and Branigan, 2011; Chen, Jia, Wang, Dunlap, and Shin, 2013, see also van Gompel and Arai, 2018 for a review and Maier, Pickering, and Hartsuiker, 2017 for a bilingual translation study), *children* (Savage, Lieven, Theakston, and Tomasello, 2003; Savage, Lieven, Theakston, and Tomasello, 2006; Messenger, Branigan, and McLean, 2011; Branigan and McLean, 2016; Rowland, Chang, Ambridge, Pine, and Lieven, 2012; Gamez and Shimpi, 2016 for Spanish; Buckle, Lieven, and Theakston, 2017), *children with autism* (Allen, Haywood, Rajendran, and Branigan, 2011), *children with Developmental Language Disorder* (Garraffa, Coco, and Branigan, 2018), *children with Specific Language Impairment* (Garraffa, Coco, and Branigan, 2015), *multilinguals* (Hartsuiker, Beerts, Loncke, Desmet, and Bernolet, 2016), and *participants with Attention-Deficit/Hyper-Activity Disorder* (Engelhardt, Ferreira, and Nigg, 2009).

Experimental work of structural priming has also been enriched with corpus studies (Gries, 2005; Szmrecsanyi, 2005; Abbot-Smith and Behrens, 2006 for a child corpus; Gries and Kootstra, 2017 for within and across languages).

In addition to structural choices, there is experimental research about *speech onset latencies* (Wheeldon and Smith, 2003; Segaert, Wheeldon, and Hagoort, 2016), *lasting* effects, and *cumulativity* of structural priming (Bock and Griffin, 2000; Kaschak, Kutta, and Schatschneider, 2011; Kaschak, Kutta, and Jones, 2011; Fine and Jaeger, 2016; Bernolet, Collina, and Hartsuiker, 2016).

Structural priming is not limited to language production, but has also been studied *across modalities* (language production and language comprehension: Branigan, Pickering, and McLean, 2005; van Gompel, Pickering, Pearson, and Jacob, 2006; Bock, Dell, Chang, and Onishi, 2007; Tooley and Bock, 2014), and in *language comprehension* (Scheepers and Crocker, 2004; Branigan, Pickering, and McLean, 2005; Traxler and Tooley, 2008; Thothathiri and Snedeker, 2008; Tooley and Traxler, 2010 for a review; Ivanova, Pickering, Branigan, McLean, and Costa, 2012; Brandt, Nitschke, and Kidd, 2017 for children; Tooley and Traxler, 2018; Lee, Hosokawa, Meehan, Martin, and Branigan, 2019 for aphasia patients; Ziegler and Snedeker, 2019).

Structural priming has also been investigated in neurolinguistics (fMRI:

Noppeney and Price, 2004; Devauchelle, Oppenheim, Rizzi, Dehaene, and Pallier, 2009; Weber and Indefrey, 2009; Segaert, Kempen, Petersson, and Hagoort, 2013, and EEG: Litcofsky and Van Hell, 2019).

The syntactic domain of structural priming has been extended with further linguistic levels, such as event conceptualization and *event structure* (Bunger, Papafragou, and Trueswell, 2013; Konopka and Meyer, 2014; Ziegler, Snedeker, and Wittenberg, 2018; Ziegler, Morato, and Snedeker, 2018 for Brasilian Portuguese), *phonology* (Cleland and Pickering, 2003; Santesteban, Pickering, and McLean, 2010), and *pragmatics* (Bott and Chemla, 2016; Maldonado, Chemla, and Spector, 2017).

Finally, structural priming has been found to occur across cognitive domains (Scheepers, Sturt, Martin, Myachykov, Teevan, and Viskupova, 2011; Scheepers and Sturt, 2014 for language and arithmetic, and Van de Cavey and Hartsuiker, 2016 for language, music, and mathematics).

4.2   The active/passive alternation in structural priming

Weiner and Labov (1983) analyzed the use of passive structures by conducting sociolinguistic interviews with adolescent and adult speakers from/of different social classes. Due to the rare occurrence of *full passives* (including the optional agent by-phrase), they only investigated agentless passive structures. The authors found that the use of passive over active structures is strongly influenced by the occurrence of a passive structure in the previous five utterances. Though different *external* constraints, such as age and social class, as well as *internal* constraints like information structural influences (in their case the ordering of given vs. new elements) might significantly influence the production of passive structures, these predictors are clearly not as strong as the one induced by the parallel structure. In the 126 instances of passive productions, they found a 72% rate of preceding passives (anywhere in the preceding five clauses). Note that Weiner and Labov (1983) additionally indicate that there is a further stylistic factor promoting the production of passives which might be visible in more formal speech and written materials.

Estival (1985) continued an analysis of the corpus data investigated by Weiner and Labov (1983) and reconfirmed the effect of syntactic priming while making sure it is isolated from further discourse factors interfering with the choice of an active or passive structure. Since the passive voice is rarely used to express a 1st or 2nd person logical subject (in the optional by-phrase), all active utterances with 1st or 2nd person subjects were excluded. Secondly, to make sure that the effect to be investigated is really one of syntactic instead of lexical priming, verb repetitions were also excluded. This

not only entails purely lexical repetitions, but also holds for pragmatic repetitions, such as question/answer structures or corrections. She furthermore excluded structures in which the grammatical subject of the passive has a co-referent being the subject of a preceding passive to make sure that the repetition is not caused by a tendency to repeat the same referent within the same argument position.

Estival (1985) found in her multivariate analysis that the occurrence of a passive in the preceding five clauses remains a significant influence on the choice of a passive over an active structure even when accounting for lexical and discourse repetitions and the (co-)referentiality of the grammatical subject, with tokens with 1st or 2nd person logical subjects being excluded from the analysis. A 10% rate of passive structures was found in case of no preceding passive, but this rate increased to 38% passives if there was a preceding one in the immediate discourse.

Although Estival (1985) tried to show that the repetition is based on the linguistic structure rather than non-linguistic factors, it was noticed that the structural repetition found in sociolinguistic interviews may have alternative explanations, such as rhetorical devices or formal register (e.g., Branigan, 2007).

To exclude alternative possibilities as locus of the repetition, experimental studies in psycholinguistics took over to investigate the repetition of syntactic structures. In the following section, cross-linguistic studies investigating structural choices regarding the active/passive alternation in picture description tasks are reviewed.

4.2.1 Experimental investigations of English

Bock (1986b) established the syntactic priming paradigm disguised as a memory (recognition) task. In this task, the experiment is divided into two different phases; a study phase and a test phase. During the first phase, participants listen to sentences and look at pictures. They are told they should be able to recognize these items later. In the second phase, participants are told to identify for the pictures and sentences they are going to hear or see, whether they had encountered them during the study phase. After each sentence and picture during the test phase, participants have to say "yes" or "no", indicating whether the specific item was shown in the study phase. Additionally, two secondary tasks have to be performed during the test phase (two *memory aids*). Participants have to repeat the sentences which are read by the experimenter, and they have to describe the pictures shown in the study phase. The different tasks of the participant during the test phase are summarized in (1).

(1)   Different steps during the test phase of a structural priming
        paradigm disguised as memory task (based on Bock, 1986b):
a.   hear a sentence read by the experimenter
        [hear prime sentence]
b.   repeat the sentence
        [repeat prime sentence]
c.   indicate whether the sentence was presented during the study phase
d.   look at a picture and describe what is happening in it
        [target description]
e.   indicate whether the picture was presented during the study phase

In the active and passive priming conditions, participants of Bock
(1986b) were presented with structures such as the ones shown in (2).

(2)   Example priming structures used by Bock (1986b, p. 361):
        a.   *One of the fans punched the referee.*
        b.   *The referee was punched by one of the fans.*

FIGURE 4.1: Example target picture used in Bock (1986).

The crucial question in priming studies is whether the production of a
prime sentence causes the repetition of the respective sentence structure for
the target description. The target picture can be described using one of the
two priming structures. In structural priming experiments, the respective
prime structures are embedded in many filler trials, including many differ-
ent syntactic structures. For the given examples, the question is whether the
presentation and repetition of a passive structure, such as (2-b), causes more
passive descriptions of a transitive event, such as the one shown in Figure
4.1, compared to descriptions of the target following an active prime, such
as (2-a). Half of the target pictures showed a human agent, whereas the
other half contained nonhuman agents.

The results of Bock (1986b) for the first experiment in Table 4.1 showed significant effects of the prime structure on the target descriptions. Both active and passive structures increased in frequency by 8% after the corresponding prime sentences.

Although there was an overall effect of structural priming, an inspection of the target descriptions based on the animacy relations of the target pictures showed that the use of passive structures was correlated with the non-humanness of agents. There was no structural priming effect for pictured events including human agents.

> *"Such findings are consistent with evidence that the choice between active and passive sentences is sensitive to the conceptual characteristics of messages, with the occurrence of passives strongly associated with inanimate or nonhuman agents (Clark, 1965; Clark and Begun, 1971; Dewart, 1979; Harris, 1978). Such a pattern suggests that the priming manipulation may be ineffective when activated syntactic procedures are blocked from application by the conceptual features of a message."*
>
> (Bock, 1986b, p. 367)

TABLE 4.1: Percentages of utterances following active and passive primes found in Experiment 1 of Bock (1986b, p. 364).

	Structure of the target description	
Prime condition	Active	Passive
Active	73	12
Passive	65	20

To investigate the question whether the choice of active or passive structures is caused by the conceptual characteristics between primes and targets, instead of an isolable syntactic representation, Bock conducted a second experiment. In her second experiment, the priming sentences included human agents in half of the cases and nonhuman agents in the second half, as shown in (3). As for the target pictures, half of them depicted human agents and human patients. The second half had nonhuman agents, with two-thirds of the pictures including nonhuman patients and one third including human patients. With this experimental manipulations, Bock (1986) tested whether human agency, as a message level feature, *"plays a critical role in determining a particular linguistic form"* (p. 369).

(3)   Examples used in Experiment 2 of Bock (1986b, p. 370):

a.   A janitor cleans the floors daily.   active, human agent
b.   The floors are cleaned by a janitor daily.   passive, human agent

c.   A blizzard ruined spring vacation.   active, nonhuman agent
d.   Spring vacation was ruined by a blizzard.   passive, nonhuman agent

With nonhuman agents in the target pictures, the results of the passive responses showed the same pattern as the first experiment. Passive descriptions were given significantly more often after passive than after active primes (Table 4.2). For the descriptions of events including human agents, passive responses were equally probable after the two priming structures. The results for this animacy configuration showed a significant interaction (for subjects, marginal significant for items) between the structure of the prime sentence and the agent factor of the pictures.

For active sentences, there were no significant effect based on the active primes (but a numerical trend for more actives after active primes). The effect of human agents was reliable for both active and passive structures, with the rate of active structures increasing for descriptions of human agent pictures compared to nonhuman agent pictures. Conversely, the number of passive sentences decreased.

TABLE 4.2: Percentages of passive utterances following active and passive primes found in Experiment 2 of Bock (1986b, p. 371).

	Type of agent in prime sentence	
Prime condition	Nonhuman agent prime	Human agent prime
Descriptions of nonhuman agent events		
Active	23.6	26.4
Passive	32.6	31.2
Descriptions of human agent events		
Active	4.2	2.1
Passive	2.1	2.1

The inspection of the human agent pictures used in Bock's second experiment revealed a difference between the human agent and nonhuman agent events. In the former case, the agent was depicted on the left in eight of twelve cases. In the latter case, six of the twelve agents were depicted on the left. To ensure that the missing priming effect was not due to the left-to-right bias in the descriptions of the target pictures, this difference was balanced out in the third experiment. Moreover, to make sure that that the procedure did not cause participants to process the materials during the study phase in a shallow way, the study and test phase distinction was replaced with a *running recognition task* (Bock, 1986b, p. 374).

The results of the third experiment conducted by Bock (1986b) showed an increase of passive responses for both nonhuman agent and human agent

TABLE 4.3: Percentages of passive utterances following active and passive primes found in Experiment 3 of Bock (1986b, p. 375).

Prime condition	Type of agent in prime sentence	
	Nonhuman agent prime	Human agent prime
Descriptions of nonhuman agent events		
Active	30.6	31.2
Passive	38.9	35.4
Descriptions of human agent events		
Active	3.5	1.4
Passive	3.5	4.7

events. There was a main effect of the human agency of the target pictures, with 34% vs. 3% passives occurring for nonhuman vs. human agent events.

For active descriptions, Bock again found a trend for more active responses after active primes, that was not significant. Furthermore, more active structures were used to describe human agent pictures compared to nonhuman agent pictures.

In sum, Bock (1986b) conducted three experiments of structural priming of the active/passive alternation in English. The first experiment revealed a certain *immunity* of human agent events to structural priming in terms of passive structures. To further investigate the question whether structural priming of passive sentences can be isolated from message-level factors, such as human agency, Bock conducted a second experiment addressing this question by including prime sentences which were controlled for (non)human agency in the events. The findings of the second experiment once again showed that whereas in general, structural priming is identifiable under conceptual and lexical changes between primes and targets, human agency seems to be a critical factor for the production of passive sentences. A structural repetition effect was found only for conditions including nonhuman agents. To make sure this finding is not influenced by general production biases in picture descriptions, in a last experiment, the left-to-right orientation of agents in the picture materials was balanced. With this change, this experiment was the first of the three experiments to find an effect of structural priming for events with human agents.

Following the classic demonstration of structural priming in Bock (1986b), Bock and colleagues conducted further studies of the active/passive alternation in English. To investigate the question whether

the syntactic structure itself, instead of the ordering of thematic roles, is repeated, Bock and Loebell (1990) included active, passive, and locative structures, as shown in example (4), in their second experiment.

(4)   Example priming structures used in Experiment 2 by Bock and Loebell (1990, p. 18):

      a.   *The construction worker was hit by the bulldozer.*
      b.   *The construction worker was digging by the bulldozer.*
      c.   *The construction worker drove the bulldozer.*

If the structural priming of passive sentences is caused by a repetition of thematic roles, rather than the passive form, passive target descriptions should occur more frequently after passive primes (4-a). Crucially, a priming sentence such as (4-b), containing a locative prepositional phrase, should not increase the production of passive descriptions. The results of Bock and Loebell (1990) showed that locative by-phrase structures primed passive descriptions, including a by-phrase, just as passive primes primed passive descriptions. The overall proportion of passive structures amounted to .79 after passive primes and .80 after locative primes. Thus, the locative and passive priming conditions did not differ significantly from each other. On the other hand, there was a significant difference between active and passive primes as well as between active and locative primes, with passive responses amounting to 0.74 after active primes.

In sum, the results of the second experiment conducted in Bock and Loebell (1990) suggest that the conceptual features of the prime sentences (in terms of thematic roles) did not cause the structural repetition effects. The authors conclude that the syntactic structure of prime and target are the main force driving the priming pattern found in this experiment.

Note that Bock (1989) investigated an influence of lexical repetition (in form of prepositions) in dative structures and found that prepositional dative primes including *for* or *to* did not have a significant influence on the prepositional target productions including *to*. This finding argues against a purely lexical repetition, which may also influence speakers in the second experiment of Bock and Loebell (1990).

Bock, Loebell, and Morey (1992) again investigated the question whether semantic features, such as being animate, and their specific position in the sentence are primed. In the priming materials, two different versions of active and passive structures were included (5).

(5)   Example priming structures used by Bock et al. (1992, p. 160):

      a.   *Five people carried the boat.*
      b.   *The boat carried five people.*
      c.   *Five people were carried by the boat.*
      d.   *The boat was carried by five people.*

All prime versions included the same verb and the same referents. In one active version, there was an animate subject and an inanimate object (5-a). In the second version, the inanimate element was the subject and the animate element was the object (5-a). The same manipulation was used in the passive variants, each of the two elements were used as subject or in a by-phrase (5-c), (5-d). The target pictures always included an inanimate agent and an animate patient (for example *an alarm clock awakening a boy*).

The results of Bock, Loebell, and Morey (1992), presented in Figure **??**, showed significant effects of animacy and structural priming. Participants produced more inanimate subject structures compared to animate subject structures after inanimate subject primes. This effect was independent of the prime structure. The structural priming effect is established in the finding that active structures were more likely to occur after active primes than after passive primes (and conversely for passive targets). This repetition effect was not affected by the animacy of the subject.

In sum, Bock, Loebell, and Morey (1992) found structural priming effects despite differences in the animacy of the arguments of primes and targets. This finding supports the assumption of structural priming based on the syntactic structure shared by prime and target sentences. Secondly, the study also shows that bindings of conceptual features, such as (in)animacy, are repeatedly bound to the subject function in successive sentences that are unrelated otherwise.

Before discussing the findings obtained on English, cross-linguistic studies investigating active and passive primes are reviewed in the following section.

4.2.2 Cross-linguistic experimental investigations

Hartsuiker and Kolk (1998b) conducted three experiments including active and passive primes (as well as dative structures) on Dutch.

The transitive target pictures all had inanimate agents. Half of the pictures included animate patients and the second half included inanimate patients. In their first experiment, the authors included active and two different passive structures as prime sentences. In the first passive version (P1), there is a clause-final by-phrase, following the participle. In the second passive version (P2), the passive participle is the clause-final element, following the by-phrase. According to Hartsuiker and Kolk (1998b), the verb-final passive version P2 can be described as word order variation to the standard passive P1.

There was an animacy match in half of the prime sentences, shown in (6-a) for actives, (6-c) for P1, and in (6-e) for P2. In the second half, there

was an animacy mismatch, as shown in (6-b), (6-d), and (6-f). The authors also included a *baseline* prime, a prime structure which cannot structurally prime the target structure due to a difference in valency.

(6)   Example priming structures used by Hartsuiker and Kolk (1998b) in Experiment 1 with a target picture such as *A tank runs over a soldier*:

     a.   *De modder bevuilt de wandelaar.*   active: A
         "The mud dirties the walker"

     b.   *Du boer vervuilt de sloot.*
         "The farmer pollutes the drain"

     c.   *De wandelaar wordt bevuild door de modder.*   passive: P1
         "The walker is dirtied by the mud"

     d.   *De sloot wordt vervuild door de boer.*
         "The drain is polluted by the farmer"

     e.   *De wandelaar wordt door de modder bevuild.*   passive: P2
         "The walker is by the mud dirtied"

     f.   *De sloot wordt door de boer vervuild.*
         "The drain is by the farmer polluted"

     g.   *De man rijdt naar zijn werk.*   baseline
         "The man drives to his work"

"Animacy mismatch" in the study of Hartsuiker and Kolk (1998b) refers to the animacy relations between prime and target. For target pictures with inanimate agents and inanimate patients, the animacy mismatch was established in pairings with sentences including animate agents and animate patients. For pictures including inanimate agents and animate patients, sentences establishing an animacy mismatch had animate agents and inanimate patients.

Similar to Bock (1986), participants were told they would take part in a recognition memory test. In the procedure of the first experiment, participants read aloud each sentence and then had to indicate whether they had seen the sentence before. Afterwards, participants had to describe pictures and indicate once again whether they had seen it before.

The results of their first experiment showed effects of passive priming on the passive target descriptions. P1 responses were more likely after P1 primes than other primes, and P2 responses were more likely after P2 primes than other primes. There was no effect of prime type on the active responses chosen by participants. This finding was different from results obtained on English (discussed above). To make sure that this findings was not based on differences in the number of passive vs. active primes, resulting in cumulative passive priming with twice as many passive primes compared to active primes in their study, Hartsuiker and Kolk (1998b) conducted two further experiments. In the second experiment, the same materials were used, but the P2 passive prime sentences were removed, resulting

in four (instead of six) prime sentence types.

The results of Experiment 2 indicated a different pattern than the one found in the first experiment. Both the active and passive responses showed an opposite direction to the hypothesized effects. After active primes, the rate of active responses was lower than after passive primes. In addition, the rate of passive responses was lower following passive compared to active primes. Statistical analyses showed no significant effects for passive responses and a *negative priming effect* in the item, but not in the subject, analysis for active responses.

To eliminate possible differences in comparison to Bock (1986b), Hartsuiker and Kolk conducted a final experiment. In their third experiment, Hartsuiker and Kolk (1998b) modified the procedure to more closely match the one used in Bock (1986). Instead of visually presenting the prime sentences on the screen, an auditory presentation mode was used in their Experiment 3.

The structures chosen for the target descriptions by participants in the third experiment showed nearly identical rates in both prime conditions. Statistical analyses of both the active and passive responses showed no significant effect of the prime structure on the target descriptions.

In sum, the findings obtained by Hartsuiker and Kolk (1998b) are inconclusive. Whereas an effect of the passive primes was found on the passive productions in the first experiment, which included two passive prime structures in addition to actives, there was no effect on the passive responses due to the prime structure in the second and third experiment, which only included one passive and active as prime structures. Regarding the active responses, there was no effect due to the structural priming of actives in the first and last experiment. In the second experiment, a marginal significant effect of the active prime structure was found on the active target descriptions. This effect, however, was a negative one.

Segaert, Wheeldon, and Hagoort (2016) investigated structural choices (and cumulative priming as well as onset latencies) in a more recent priming study on Dutch. They used active and passive prime sentences and included intransitive or locative primes as baseline primes. Their task was different from the one used in prior work on structural priming. Before the first picture of each trial, participants saw a verb (infinitive form, shown for 500 ms) on the screen. This was the verb participants had to use for the description of the following picture. The first picture instantiated the prime trial. Instead of presenting the prime sentences on a screen or auditorily (as done in the classic structural priming paradigm), participants were shown photographs to elicit the prime structure. In baseline trials, participants saw a grayscale or colored picture. In prime trials, participants saw a picture in which the two referents were color-coded. The colors indicated precedence,

with green referents being the referents that had to precede the red-colored referents in the sentence. The color-coding therefore induced the respective active or passive prime sentences, which were produced by the participants themselves. After the prime trial, participants were again shown a verb on the next screen. This verb had to be used for the following picture description, the target description. The target pictures were shown as grayscale pictures.

In their first experiment, Segaert, Wheeldon, and Hagoort (2016) included a prime structure manipulation (active vs. passive) and a further manipulation of the number of prime sentences (one prime vs. three primes). The latter manipulation was exerted by using trials with just one prime sentence before the target description and using trials with three prime sentences (all of them in the same structure) before the target description. The verbs used in prime trials were always different from the verbs used for target trials.

Segaert, Wheeldon, and Hagoort (2016) found a significant effect of priming for the passive responses. Participants were more likely to produce a passive structure after a passive prime compared to a baseline prime. There was no significant effect of active primes compared to baseline primes. There was also an effect of the number of primes on the structural choices. There were more passive target descriptions following three primes than following one prime. For the active productions, there was no effect of the number of prime. The number of active responses did not increase after three primes compared to one prime.

In their second experiment, Segaert, Wheeldon, and Hagoort (2016) exchanged one of the experimental manipulations. The number of primes manipulation was replaced with an experimental manipulation of verb repetition. There was always one prime sentence before the target description. The verb that was used in the prime trials was either the same verb as used in the target trial or a different one.

The target descriptions replicated the effects found in the first experiment. Passives primes significantly increased the number of passive responses compared to baseline primes. There was again no effect on the structural choices based on active primes compared to baseline primes. There was also an effect of verb repetition. More passive structures were produced following the same verb than following a different verb. For active structures, the verb repetition manipulation did not have a significant effect.

Tanaka (2008) conducted a structural priming experiment in Japanese. Using a similar version to the classic priming paradigm, he primed active and passive sentences in his fourth experiment. Examples of the active and passive structures and their different animacy orderings are shown in (7).

(7)   Exemplary priming structures by Tanaka (2008) in Experiment 4:

    a.   *Gonin no hito-ga booto-o hakonda.*   S(ani)O(inani)V active
        Five people$_{nom}$ boat$_{acc}$ carry$_{past}$

    b.   *Booto-ga gonin no hito-o hakonda.*   S(inani)O(ani)V active
        Boat$_{nom}$ five people$_{acc}$ carry$_{past}$

    c.   *Gonin no hito-ga booto-niyotte hakobareta.*   S(ani)O(inani)V passive
        Five people$_{nom}$ boat$_{obl}$ carry$_{pas-past}$

    d.   *Booto-ga gonin no hito-niyotte hakobareta.*   S(inani)0(ani)V passive
        Boat$_{nom}$ five people$_{obl}$ carry$_{pas-past}$

In a prime trial, participants first saw a prime picture, including a verb printed below it. This picture was followed by the prime sentence (presented on the screen) and participants had to decide whether the prime sentence matches the prime picture. The verbs shown on the prime pictures sometimes matched and sometimes did not match the verb used in the prime sentence. After this decision, participants were shown the target picture they had to describe. All target pictures in Tanaka (2008) included inanimate agents and animate patients. The verb that had to be used for the target description was printed at the bottom of the picture. Analysis of the SOV active target descriptions showed a significant influence of the primed structure. Participants produced more active descriptions following active primes (81.5%) compared to passive primes (71%). The SOV passive descriptions were also significantly influenced by the prime sentences. Participants produced more passive responses after passive primes (26%) than after active primes (12.5%). In addition, there was a marginal significant interaction of Prime and Animacy of the subject.

In German, research on structural priming of the active/passive alternation is scarce. There is one study investigating structural priming of active and passive sentences in English-German bilinguals, which also reports data of monolingual speakers of German. Loebell and Bock (2003) used the structural priming paradigm established in Bock (1986). Participants heard and repeated the prime sentences. Afterwards, they indicated whether they had heard the sentence before. After this decision, they saw a picture that had to be described. After the picture, participants were once again asked whether they had seen the picture before. The pictures were black and line drawings and for the transitive pictures, all of them included animate agents and half of the patients were animate and the second half of the patients were inanimate.

TABLE 4.4: Number of utterances produced in the transitive priming conditions in the within-language experiment of Loebell and Bock (2003, p. 808).

	Numbers of utterances produced	
Prime	**Active**	**Passive**
Active prime	115	86
Passive prime	106	93

(8)   Example priming structures used by Loebell and Bock (2003):
   a.   *The janitor cleans the floors daily.*
   b.   *Der Hausmeister reinigt die Böden täglich.*
   c.   *The floors are cleaned daily by the janitor.*
   d.   *Die Böden werden täglich von dem Hausmeister gereinigt.*

The results showed that German-English bilinguals were structurally primed in dative structures (prepositional vs. double object dative structures). The priming of the respective dative structure in German caused participants to more likely produce the respective dative version in English. The findings also held vice versa, the production of dative structures in English primed the German dative productions. The German and English transitive structures, as shown in (8), on the other hand, did not prime each other. The results only showed numeric trends. However, notice that the trends in both languages conditions were actually reversed for passives, with numerically more passive productions after active priming than passive priming.

Loebell and Bock (2003) predicted structural priming for dative structures, since the structural configurations of the two dative versions are the same in both languages. The same holds for active sentences. Passive sentences, however, differ in their structures in the two languages, according to Loebell and Bock (2003). Therefore, the authors hypothesized that there would be no priming for passives. This findings was borne out in their data, but note that the hypothesized active priming across languages was not found (at least not statistically significant).

Loebell and Bock (2003) argue that their claim of structural differences between passive structures in the two languages allows for the prediction that within the language (i.e., German, since significant priming effects of English passives had already been found), there should be passive priming. This prediction was tested by them in another experiment, using the same materials as in the first experiment. The data of the monolingual speakers of German in the transitive conditions are shown in Table 4.4.

None of the effects in the within-language experiment on German reached significance. As Loebell and Bock (2003) noticed, the numerical

trends in this experiment, however, are in the predicted direction. This pattern was expected given within-language priming of passives, for example in English, and is different from the trends in the between-language experiment conducted by Loebell and Bock (2003).

The literature review shows that there is a gap in case of structural priming of active and passive structures in German. Taken together with the mixed results on Dutch, a language similar to German, the main motivation for the two experiments presented in this chapter is to fill this empirical gap. Trying to extend the space for hypotheses, the literature review was expanded in search for further structural priming studies of the active/passive alternation in German. Two studies using different tasks than the classic priming paradigm including picture descriptions are summarized in the following paragraphs.

Hanke (2007) used a sentence recall task (also used in e.g., Potter and Lombardi, 1998; Chang, Bock, and Goldberg, 2003), including written primes and targets, to investigate the question whether speakers of German are structurally primed. The scheme of each trial is shown in Figure 4.2. After a fixation screen, a sentence was presented using *rapid serial visual presentation* (RSVP). Each word of the sentence was shown for 100 ms in the center of the screen. After reading the sentence, participants had to perform a *distractor* task. They were shown five digits on the screen, followed by a written word denoting a number (between zero and nine). With the next screen, participants had to decide whether the written number had been among the five digits presented. After a feedback screen, showing a happy smiley for right choices and a sad smiley for wrong answers, participants were prompted to repeat the sentence they had read prior to the distractor task.

Hanke (2007) included active and passive sentences, shown in (9), as prime structures. The active sentences (9-a) were OS active structures, chosen to mirror the linear order of the entities in the two prime sentences. In his experiment, the events always included an inanimate agent (or cause) and an animate patient or two inanimate entities.

(9) Prime structures used in Hanke (2007, p. 45):

    a. *Den   Feuerwehrmann hat der   Hydrant nassgespritzt.*
        the$_{ACC}$ fireman   has the$_{NOM}$ hydrant drenched

    b. *Der   FWmann wurde von dem   Hydranten nassgespritzt.*
        the$_{NOM}$ fireman was   by the$_{DAT}$ hydrant   drenched

Thus, in prime trials participants read (and repeated) active and passive sentences. After the prime trials, active and passive sentences were once again used in the target trials. For a prime and target trial pairing, this
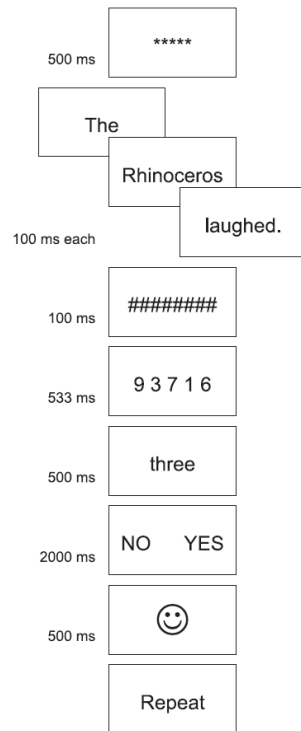
FIGURE 4.2: Trial scheme of the task used in Hanke (2007, p. 38).

leaves four possible combinations of prime and target structure, as shown in Table 4.5.

The hypothesis for the target productions rests on the identity status between primes and targets. In case of structural priming, the number of correctly repeated target sentences should be smaller for different prime and target structures compared to identical prime and target structures.

In the identical conditions, participants always correctly produced the target sentence for both active and passive structures. The proportions of the correctly produced structures in the non-identical conditions are shown in Table 4.6.

TABLE 4.5: Combinations of primes and targets in the study of Hanke (2007, p. 45).

prime produced	target presented	prime & target structure are
active	active	identical
passive	passive	
active	passive	not identical
passive	active	

TABLE 4.6: Proportion of correctly produced structures (absolute frequencies) in the non-identical conditions of Hanke (2007, p. 47).

prime	target	correctly produced target
active	passive	0.96 (78)
passive	active	0.93 (75)

Due to the missing variance in the identical conditions, no variance-analytical methods could be applied. Non-parametrical testing showed a significant difference between the two identity conditions, *"but the result of the sign test was based on an effective sample size of N = 5 for the subject-specific analysis. Consequently the results suffer from a lack in statistical power"* (Hanke, 2007, p. 48).

Pappert and Baumann (2019) investigated structural priming of active and passive structures using a constrained production task. In a trial, participants first heard one of the prime sentences, shown in (10). Afterwards, they repeated the prime sentence. On the next screen, the nouns and the verb of the target sentence were shown in a horizontal alignment. The order of the nouns was counterbalanced in both experiments.

(10)   Prime structures used by Pappert and Baumann (2019)
        for a target trial including the verb *töten* (*to kill*; see example (11)):
        a. *Die   Kugel durchbohrt das   Opfer*
           the$_{NOM}$ bullet perforates the$_{ACC}$ victim
        b. *Das   Opfer wird von der   Kugel durchbohrt.*
           the$_{NOM}$ victim is   by the$_{DAT}$ bullet perforated
        c. *Die   Kugel tötet das   Opfer*
           the$_{NOM}$ bullet kills the$_{ACC}$ victim
        d. *Das   Opfer wird von der   Kugel getötet.*
           the$_{NOM}$ victim is   by the$_{DAT}$ bullet killed

In the first experiment, the verb was shown as the last of the three elements (11-a). This order was changed, with the verb preceding the two nouns, in the second experiment (11-b). The two different orderings are shown in (11). In addition to the prime structure, the verb of prime and target was manipulated, with the verb being either the same or different in primes and targets (verb repetition).

(11)   a. Pfeil ("arrow")   Taube ("pigeon")   töten ("to kill")
        b. töten ("to kill")   Pfeil ("arrow")   Taube ("pigeon")

The results of both experiments, presented in Figure 4.3 and Figure 4.4,

showed significant main effects of prime structure and no main effects of verb repetition. However, there was a significant interaction of prime structure and verb repetition in both experiments (an effect of the *lexical boost*, see the following discussion in section 4.2.3).
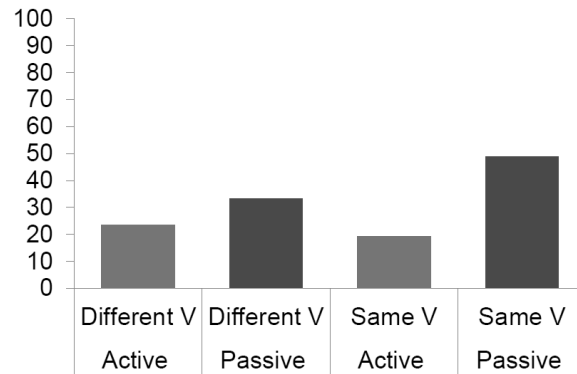
FIGURE 4.3: Percentages of passive responses found in Experiment 1 of Pappert and Baumann (2019).
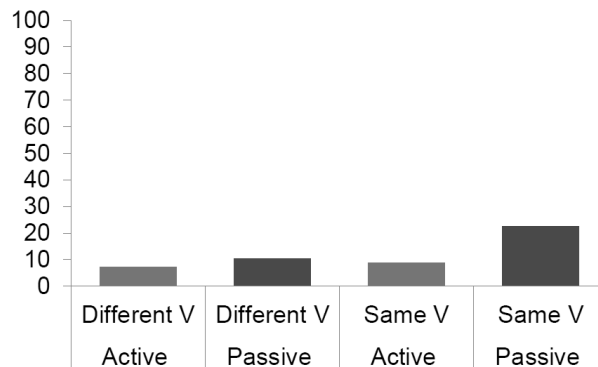
FIGURE 4.4: Percentages of passive responses found in Experiment 2 of Pappert and Baumann (2019).

4.2.3   Interim discussion: Priming the active/passive alternation

In their meta-analysis of structural priming in language production, Mahowald, James, Futrell, and Gibson (2016) included 69 articles (138 experiments) about structural priming. Most of these studies investigated dative structures. About 27% of the experiments included active and passive structures. In their analysis, the variables *language, construction type, temporal lag between prime and target, bilingualism, lexical overlap between prime and target, year of publication, target task, modality of prime, repetition of the prime*

by participants, and *confederate* were included as *"moderators"* of the priming effect. The results show robust effects of structural priming. Lexical overlap between prime and target is the most consistent moderator of structural priming. Many studies have shown that although structural priming is independent of lexical repetitions between primes and targets, lexical overlap enhances priming effects. Especially verb repetition between prime and target has been shown to increase priming effects (e.g, Pickering and Branigan, 1998; Bernolet, Hartsuiker, and Pickering, 2009; Segaert, Wheeldon, and Hagoort, 2016). In the literature, the supporting effects through lexical repetition have been termed the *lexical boost* to structural priming.

In the meta-analysis conducted by Mahowald, James, Futrell, and Gibson (2016), there were also effects of lag and bilingualism as well as "meaningful differences" (p. 18) based on the task, with written sentence completion eliciting smaller effects.

In the remainder of this discussion, the studies including active and passive primes summarized above are discussed regarding their implications about which representational structure is primed and in connection with the results of the meta-analysis on structural priming.

The literature review shows that significant effects of structural priming for active and passive structures have repeatedly been found for English. The studies of Bock and colleagues (Bock, 1986b; Bock and Loebell, 1990; Bock, Loebell, and Morey, 1992) showed that participants were more likely to produce passive picture descriptions following passive prime sentences compared to active prime sentences. Structural repetition has been found despite differences in message level features, such as animacy, of the elements in primes and targets. This finding suggests that the representation that is primed can be a purely syntactic representation of the sentence. This hypothesis is supported by findings of structural priming for passive structures despite differences in the thematic structure of primes and targets (e.g., Bock and Loebell, 1990). As Pickering and Ferreira (2008) notice, this independence of structural priming has been used as argument for *autonomous* syntactic representations (in contrast to *functionalist* views on syntactic structure).

Studies on English, however, have also shown that message level features are repeatedly bound to certain grammatical functions during grammatical encoding in subsequent utterances. Participants in Bock, Loebell, and Morey (1992) produced more passive responses following animate subjects in the prime structure compared to inanimate subjects in the primed structure when describing pictures involving inanimate agents and animate patients.

In the studies of Bock and colleagues, the materials between prime and

target structures did not overlap and most importantly, there was no verb repetition between prime and target. The findings therefore support the assumption that structural priming occurs independently of word (or verb) repetition. In case of the passive structure, one might argue that the repetition of the closed-class words between prime and target, instantiated for example in the agent by-phrase, might have caused the repetition effects. There are at least two arguments against this concern. On the one hand, no such closed-class repetition occurs for active primes, which were shown in Bock (1986b) to increase active target productions. On the other hand, structural priming research has shown that structural priming occurs independently of closed-class words and morphemes (e.g., Bock, 1989 and Fox Tree and Meijer, 1999 for dative structures; Ferreira, 2003 for complementizers; and Pickering and Branigan, 1998 for tense, aspect, or number morphemes).

In conclusion, experimental investigations of structural priming suggest that the structure which is primed, can be independent of word repetition(s) and conceptual (semantic) features, such as animacy and thematic roles. The resulting consequence of structural priming as a tool for the investigation of (abstract) syntactic representations has more recently been discussed in Branigan and Pickering (2017).

Leaving English and looking at cross-linguistic investigations of structural priming of active and passive sentences, effects have been summarized in the preceding section for Dutch, Japanese, and German.

The results obtained in Hartsuiker and Kolk (1998b) for Dutch are less clear than the results in English. Different from Bock (1986b) in English, Hartsuiker and Kolk (1998b) did not find priming effects based on active structures. Furthermore, they only found significant (positive) priming effects for passives in one of three experiments. Segaert, Wheeldon, and Hagoort (2016), on the other hand, found clear passive priming in both experiments on Dutch. They also replicated the finding that active structures are not significantly influenced by the prime. The mixed results of Hartsuiker and Kolk (1998b) and Segaert, Wheeldon, and Hagoort (2016) in terms of passive structures might stem from several differences between the studies. Whereas the former group used the classic priming paradigm established by Bock (1986), Segaert, Wheeldon, and Hagoort (2016) used a task in which participants themselves produced the prime structures (instead of repeating them). In addition, the verb that should be used by participants for the target description, was presented before the target picture in Segaert, Wheeldon, and Hagoort (2016). There are also differences regarding the materials used. Whereas Hartsuiker and Kolk (1998b) used black and white line drawings including many different nouns, Segaert, Wheeldon, and Hagoort (2016) used photographs showing humans, which were described by using "neutral nouns", such as *man* and *woman*. Note that the

usage of both human agents as well as patients allows for a more distinct evaluation of structural priming effects than the inclusion of materials differing in animacy (as discussed above).

Segaert, Wheeldon, and Hagoort's (2016) second experiment also replicated the effect of the *lexical boost* for active and passive primes in Dutch, the variable that has been found to be the most consistent moderator of structural priming in the meta-analysis by Mahowald, James, Futrell, and Gibson (2016).

In German, the results for active and passive priming are once again mixed. Using the classic paradigm including picture descriptions, Loebell and Bock (2003) did not find significant effects in their within-language experiment. Pappert and Baumann (2019), on the other hand, found significant effects of the prime structure in a constrained production task. The lexical boost effect in their experiments occurred as significant interaction between prime structure and verb repetition. The results obtained in Hanke (2007) did not allow for a statistically representative analysis. Note that the task used by Hanke was different from the remaining studies summarized. The limitation in the statistical analysis was caused by the fact that participants in general were at ceiling in repeating the presented structures.

Taken together, cross-linguistic work, which is limited for active and passive structures (especially in comparison to dative structures), has replicated effects of structural priming and effects of the lexical boost. The mixed pattern of results for Dutch and German leaves many open questions. Given the robust findings of structural priming in within-language experiments, taken together with findings of passive priming in Dutch, a language very similar to German, the hypothesis is that speakers of German should be structurally primed. The absence of an effect in Loebell and Bock (2003) has been ascribed to low statistical power by the authors, with numerical trends pointing towards the expected direction. The current chapter presents a structural priming experiment using picture descriptions to empirically investigate the expected effect in German.

4.3 Experiment I: Structural priming

The current experiment aims to investigate structural priming of active and passive structures in German. Given the effects found in prior work, it was expected that the structures chosen to describe target pictures are significantly influenced by the prime structure. This hypothesis holds especially for passive descriptions. For active descriptions, the expectations are vague.

Whereas work on English (e.g., Bock, 1986b) has found significant influences on the proportion of active descriptions following active primes, work on Dutch (e.g., Segaert, Wheeldon, and Hagoort, 2016) has not replicated this effect. Note that there are differences in the design and analysis between the two mentioned experiments. Whereas Bock compared the proportions of active and passive responses following active and passive primes in the statistical analysis, subsequent priming studies have included baseline conditions. The proportion of target responses following active and passive primes is analyzed in comparison to target responses following baseline primes. Baseline primes (e.g., intransitives or locatives) generally use structures that do not prime either active or passive responses, since they do not share the syntactic structure with the target response.

Due to the mixed and ambiguous results for German, a further manipulation has been included in the current experiment. Half of the pictures used in this experiment showed inanimate agents and human patients. This difference in the animacy of the respective referents has shown to cross-linguistically elicit passive responses (see chapter 3). To make sure the results would not suffer from a general unavailability of passive structures, this difference in the inherent conceptual accessibility was included to license deviations from the default active structure.

4.3.1 Method

4.3.1.1 Participants

Thirty students (21 female, 9 male) of the Goethe University Frankfurt participated in this experiment for course credit. All of them were native speakers of German.

4.3.1.2 Materials

Twenty-four experimental item sets were created for the current experiment. Each set consisted of a prime sentence and a target picture showing a transitive action event. The complete experimental materials can be found in Appendix A. The three prime versions of an exemplary sentence are shown in Table 4.7. Half of the prime sentences involved animate agents and animate patients. The other half included inanimate agents and animate patients. Different nouns (e.g., *student, girl, grandchild, uncle*) were used in the prime sentences. Except for one occurrence, the use of "man" and "woman" was avoided in the prime sentences. In the baseline prime sentences, intransitive verbs were used. The verbs used in the experimental materials were *treten, begrüßen, umarmen, boxen, küssen, jagen, trösten, beißen, schubsen, tragen, schlagen,* and *verarzten* ("to kick, to welcome/greet, to hug,

to box, to kiss, to chase, to soothe, to bite, to shove, to carry, to hit, to doctor") for targets including animate agents and animate patients. For inanimate agents and animate patients, the verbs were *stärken, blenden, filmen, verdecken, erfrischen, behindern, wecken, betäuben, wärmen, treffen, unterstützen,* and *beruhigen* ("to strengthen, to blind, to film, to cover, to refresh, to hamper, to wake, to numb, to warm, to hit, to support, to soothe").

TABLE 4.7: Example of prime sentences used in Experiment 1 and Experiment 2.

prime	sentence
	animate agent, animate patient
active	Die Rentnerin umarmt den Sohn. *"The retiree huggs the son."*
passive	Der Sohn wird von der Rentnerin umarmt. *"The son is hugged by the retiree."*
baseline	Die Schülerin liest vor. *"The pupil reads aloud."*
	inanimate agent, animate patient
active	Die Schleuder trifft den Spaziergänger. *"The slingshot hits the walker."*
passive	Der Spaziergänger wird von der Schleuder getroffen. *"The walker is hit by the slingshot."*
baseline	Das Segelflugzeug stürzt ab. *"The glider crashes."*

The 24 experimental target pictures were realistic photographs of transitive action events. In half of the pictures, an animate agent and animate patient (Figure 4.5) were involved in the action. In the second half, an inanimate agent and an animate patient were shown on the photo (Figure 4.6). The infinitive of the verb that should be used by the participants for the target description, was always printed on top of the picture. Each experimental target picture included one male and one female referent who could easily be described as "man" and "woman". Note that the faces of the persons shown on the pictures were not blurred in the experiment.

umarmen (*to hug*)   treffen (*to hit*)

FIGURE 4.5: Exemplary target picture including an animate agent and animate patient used in Experiment 1 and Experiment 2.

FIGURE 4.6: Exemplary target picture including an inanimate agent and animate patient used in Experiment 1 and Experiment 2.

Prime sentences and target pictures were combined in a way that always mirrored the animacy features. Prime sentences involving two animate entities were only paired with target pictures involving two animate referents. Conversely, prime sentences including animate agents and animate patients were paired with pictures including inanimate agents and animate patients. In the active and passive prime conditions, the verb of the prime sentence was always repeated in the target picture. Furthermore, the gender distribution of the agent and patient in the prime sentence mirrored the gender distribution of the target picture (except for two cases in which two male referents were included in the prime sentence).

Eighty-four additional filler sets were created. The filler structures used in the prime sentences encompassed dative structures (both prepositional and double object sentences), transitive structures including instrumental PPs (both in marked and unmarked word order; the prepositional phrases always included a lexically different preposition than the ones of the passive primes), and further diverse structures, such as intransitives, reflexive structures, fronted locative structures, left-dislocated structures, structures including relative clauses and structures involving epistemic verbs and subordinate clauses. The 84 filler photographs included ditransitive actions, transitive actions including (possible) instrumental NPs, intransitive actions and several different referents (children, adults – including those shown on the experimental items, furniture, and animals).

The 24 experimental materials were distributed across three lists according to a Latin square design. Each list contained exactly one version of each experimental set. The 84 filler sets were included for each list, with at least one filler separating experimental trials. The resulting number of 108 trials was individually randomized for each participant.

4.3.1.3 Procedure

A variant of the classic structural priming paradigm by Bock (1986b) was used in this experiment. Participants were seated in front of a computer and told they would participate in a study putting to test their memory for sentences and pictures. The instruction included a photograph of a man taking a photo of a woman in a park. The exemplary description for this picture was given in active voice. A practice session of five trials was given before the main experiment.

The procedure of Experiment 1 is shown in Figure 4.7. In each trial, participants first heard an auditory presentation of a (prime) sentence. They had to repeat this sentence and indicate afterwards whether this sentence had occurred within the experiment before. After their decision, the (target) picture appeared on the screen and participants were asked to describe this picture using the verb printed on top of it. Following the description, participants once again decided whether they had seen the picture before. For the recognition tasks, participants were told to respond quickly. In case they did not make a decision after 5 seconds, the next screen was shown automatically. Participants had 10 sec to give their picture description. Their speech was recorded with a recording device.
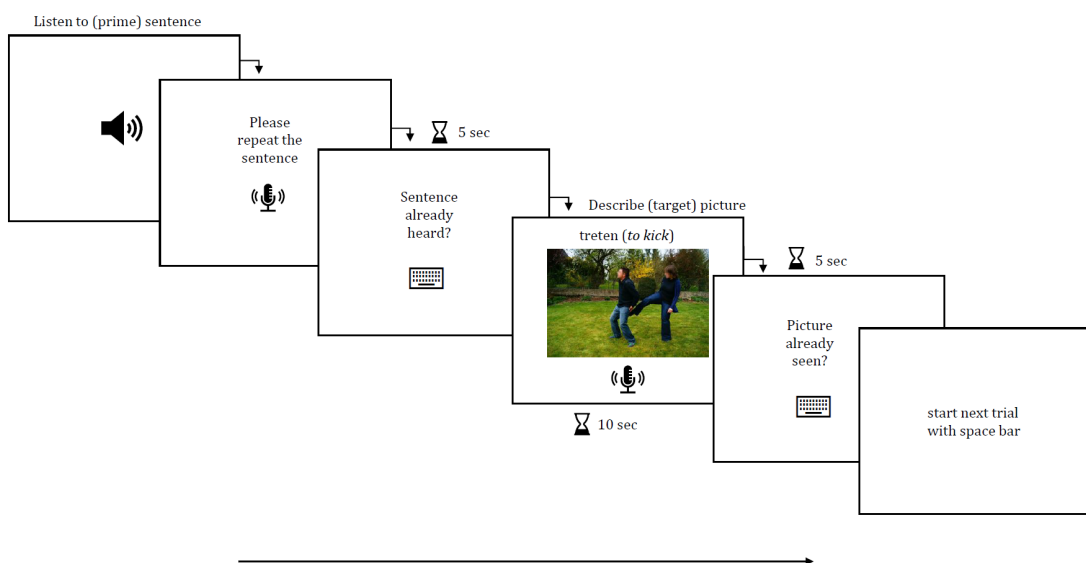
FIGURE 4.7: Trial scheme of the procedure used in Experiment 1.

4.3.1.4 Scoring

Participants' target picture descriptions were transcribed and analyzed. Analysis included the choice of the structure chosen (active, passive, and

anticausative) as well as word order (SO and OS). Of the overall 720 target descriptions, adjectival passive structures (n = 3), short passives (n = 20), and errors (n = 9) were excluded in a first step. In a second step, anticausative structures (n = 102; see next section) were excluded from further analyses. 586 target descriptions were left for the final analysis of effects due to the structural priming.

4.3.2   Results

For all results reported in this chapter, the statistical analysis was conducted using the statistics software R (R Core Team, 2016).
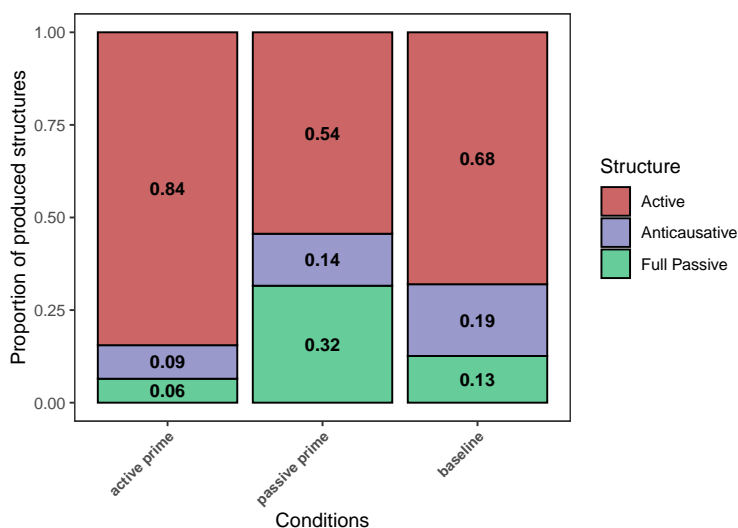
FIGURE 4.8: Proportions of produced target structures in the different prime conditions of Experiment 1.

Figure 4.8 shows the proportions of the produced structures in the target descriptions in the different prime conditions. Pictures involving inanimate agents and animate patients caused a noticeable number of anticausative structures (e.g. *Der Mann betäubt sich mit den Drogen*, lit. "The man numbs himself with the drugs"). Although this is an interesting finding in terms of animacy and/or thematic properties (taken up again in the discussion of this experiment), these structures were excluded from further analyses.

Figure 4.9 shows the overall proportions of active and passive structures in the different prime conditions. Visual inspection of the active structures (left side of Figure 4.9) shows that the highest proportion of active structures was produced following active primes (0.93). The proportion of active structures is lower following baseline primes (0.84). The lowest proportion of active responses was produced after passive primes (0.63). Consequently, the converse pattern holds for the produced passive structures (right side of

Figure 4.9). Their highest proportion is observed following passive primes (0.37). The proportion of passives is lower following baseline primes (0.16) and lowest following active primes (0.07).
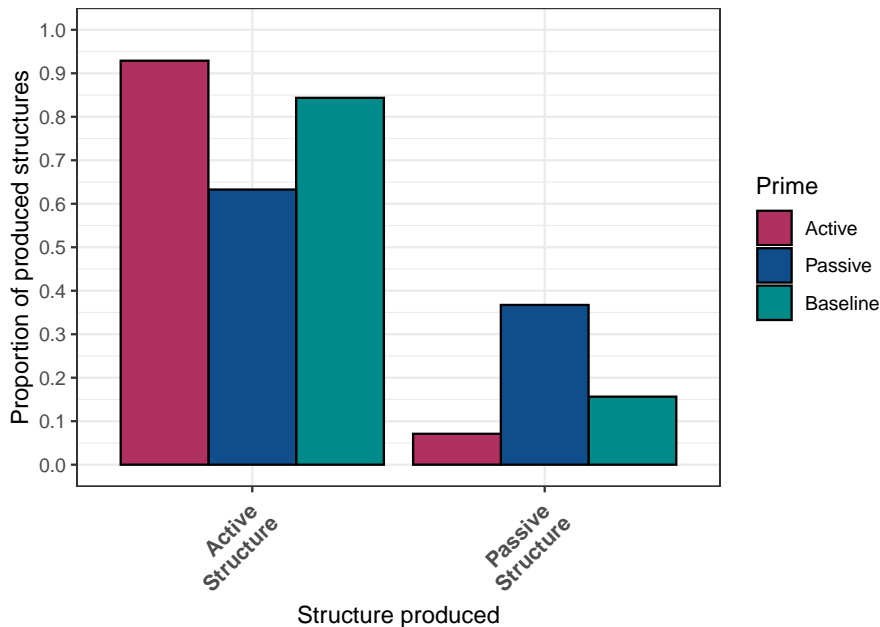
FIGURE 4.9: Proportions of produced active (left) and passive (right) structures in the different prime conditions of Experiment 1.

Figure 4.10 and Figure 4.11 present the mean proportions of the produced passive structures in the target picture descriptions depending on the animacy of the agent (animate on the left, inanimate on the right). For animate agents and animate patients (left), there was a passive proportion of 0.2 following passive primes. The proportions of passives following active and baseline primes were very low – 0.01 and 0.03. This pattern changed for the pairings of inanimate agents and animate patients (right). Following active primes, there was a proportion of passive descriptions of 0.15. A higher passive proportion of 0.41 was observed following baseline primes and an again higher proportion of 0.62 following passive primes.

For the inferential statistics, generalized linear mixed models using the R package lme4 (Bates, Mächler, Bolker, and Walker, 2015) were computed. A generalized linear mixed model with both factors and the interaction term as fixed effects, using effect coding, was run for the passive descriptions. Random effects for items and subjects with maximal random slopes supported by the data were included, following Bates, Mächler, Bolker, and Walker (2015). The response variable was defined as passive response. Table 4.8 summarizes the results of the statistical analysis and reports which random slopes were included.
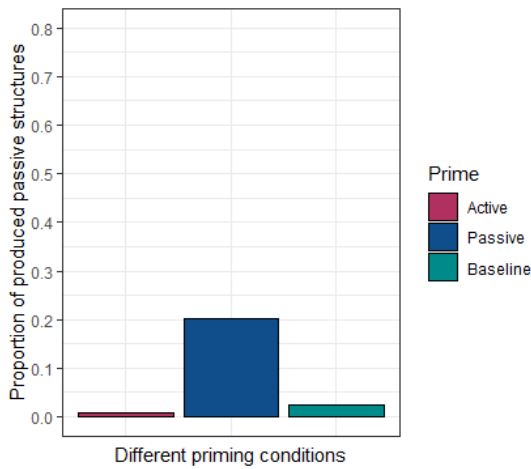
FIGURE 4.10: Proportions of passives in the different prime conditions of Exp 1 for animate agents (*to hug*, *woman*, *man*).
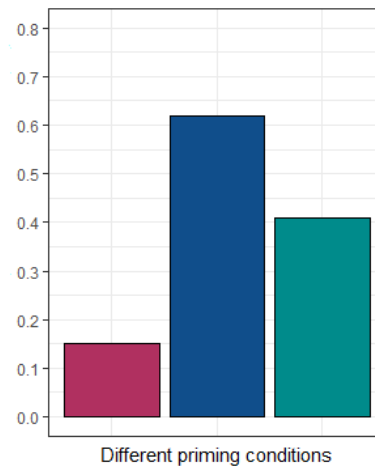
FIGURE 4.11: Proportions of passives in the different prime conditions of Exp 1 for inanimate agents (*to hit*, *pencil case*, *man*).

The results show a significant main effect of Prime. Participants were significantly more likely to produce a passive structure after a baseline prime than after an active prime and following a passive prime compared to a baseline prime. There was also a main effect of Agent, i.e., the animacy of the agent. Participants were more likely to produce a passive description for animate patients paired with inanimate agents compared to animate agents. There was no significant effect of the interactions of Prime and Agent.

4.3.3   Discussion

The results of the current experiment show that speakers of German can be structurally primed. When participants have repeated a passive sentence before a picture description, they are more likely to produce a passive structure in this description compared to active or baseline primes. In addition, the results show that speakers are also influenced by the animacy of the referents, replicating findings of effects of inherent conceptual accessibility on sentence production (see chapter 3). Participants were more likely to produce passive target descriptions for events involving an animate patient and an inanimate agent compared to both an animate patient and animate agent.

In the remainder of this section, limitations of this experiment, secondary findings, comparisons with other studies, and future perspectives based on this experiment are discussed.

TABLE 4.8: Summary of the mixed-effect model with full passive sentences as dependent variable for Experiment 1.

	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	-2.573	0.399	-6.45	1.1e-10 ***
Prime1 (active:baseline)	1.376	0.650	2.12	0.034 *
Prime2 (passive:baseline)	2.155	0.542	3.98	7.0e-05 ***
Agent	3.484	0.700	4.98	6.5e-07 ***
Prime1:Agent	0.392	1.297	0.30	0.763
Prime2:Agent	-1.026	0.859	-1.19	0.232

Formula: Passive ~ Prime * Agent + (Prime2 + agent || participant) + (1 | sentence),
Signif. codes: *** 0.001 | ** 0.01 | * 0.05 | . 0.1

A first point for discussion concerns the occurrence of anticausative structures. The proportion of produced structures including anticausative structures (Figure 4.8) showed that following baseline primes, about 19% of the produced structures are anticausative ones. This rate decreased to 14% following passive primes and 9% following active primes. Note that anticausative structures could only be produced for inanimate agent and animate patient pictures. The use of anticausative structures by participants supports the finding of an animacy effect of the agent. In producing an anticausative structure, the animate patient is promoted to the subject of the sentence and occupies the prefield position.

With regard to the structural priming, there are at least two implications for future research, depending on the respective interest. First, when one is interested in the strength of structural priming to override general preferences, an experimental manipulation should be based on the potential of the included verbs to result in (pragmatically felicitous) anticausative structures. Note that anticausative structures have also been found in other production studies on German (e.g., Verhoeven, 2014; Bader, Ellsiepen, Koukoulioti, and Portele, 2017, see chapter 3). In the current experiment, there was a numerical difference for anticausative productions following baseline primes compared to passive and active primes. These differences have not been statistically analyzed, because the main interest of this experiment were the active and passive structures. However, by matching the included verbs for their potential with regard to anticausative structures, one can investigate the question whether structural priming has the strength to override the anticausative preference of verbs. A second implication, the one to pursue when interested in structural priming of active and passive sentences, is to exclude verbs allowing anticausative structures. No matter which of the two questions one is interested in, the

TABLE 4.9: Proportion of passive sentences in the two animacy pairings of Experiment 1.

	Prime		
animacy	active	passive	baseline
animate-animate	0.01 (1)	0.20 (24)	0.03 (3)
inanimate-animate	0.15 (14)	0.62 (48)	0.41 (25)

finding of the anticausative structures suggests that the verbs used within structural priming studies should be matched for their frequency of the structural option chosen (e.g., in language corpora). In this experiment, verbs were chosen based on the possibility to depict the respective events. Given the amount of anticausative structures, the conclusion is that the choice of some of these verbs was an inadequate one. Note that despite the exclusion of anticausative productions, there was a significant effect of the prime structure. The hypothesis when only including verbs without the anticausative option is that these effects will be even stronger.

A second point for discussion concerns comparisons of the current effects with prior studies on structural priming. The two studies to compare findings in a more detailed way are chosen due to the manipulations and languages investigated. In the current experiment, the verb between prime and target sentence was always repeated. The experiments of both Segaert, Wheeldon, and Hagoort (2016) and Pappert and Baumann (2019) also included conditions with a verb repetition. Furthermore, the study of Segaert, Wheeldon, and Hagoort (2016) used descriptions of photographs showing animate agents and patient (as half of the items used in the current experiment) to elicit target sentences and was conducted in Dutch, a language very similar to German. The latter one even was conducted in German and included materials involving inanimate agents and animate patients (as the second half of items used in this experiment), but a different task.

For reasons of comparison to these studies, the proportion of passive responses are presented again based on the animacy pairing in Table 4.9. In this table, the proportions in each row add up to 1 (when adding the converse active proportions in each prime condition).

In their second experiment, Segaert, Wheeldon, and Hagoort (2016) included a verb repetition manipulation. Their findings in the repeated verb condition show a proportion of passive structures of about 0.07 in the baseline condition.[3] This proportion increased to about 0.22 following

---

[3]Note that the passive proportions of Segaert, Wheeldon, and Hagoort (2016) and Pappert and Baumann (2019) summarized in this paragraph are estimated based on a visual inspection of their graphs, which is why the actual numbers might differ.

passive primes, resulting in a baseline vs. passive prime difference of 0.15. When only looking at the animate agents and animate patients items in the current experiment (see Table 4.9, upper row), there is a passive proportion of 0.03 following baseline primes and 0.20 following passive primes, leaving a difference of 0.17. The differences in the passive proportions following passive compared to baseline primes are very similar in the two studies. Both studies used photographs of two animate entities to elicit target descriptions, both studies repeated the verb between prime and target in the cases mentioned, and both studies were conducted in languages structurally very similar, especially regarding their structural options.

Pappert and Baumann (2019) used materials including inanimate agents and animate patients, as was done for half of the items in the current experiment (see Table 4.9, bottom row). In their first experiment, in the verb identical conditions, Pappert and Baumann (2019) found a passive proportion of 0.19 following active primes. This proportion increased to 0.50 following passive primes, resulting in a 0.31 difference between active and passive primes. In their second experiment, a passive proportion of 0.08 following active primes increased to 0.24 following passive primes, leaving a difference of 0.16. In the current experiment, in the inanimate agent and animate patient conditions, the proportion of passive sentences was 0.15 following active primes. This proportion increased to 0.62 following passive primes, resulting in a difference of 0.47. The difference in the proportion of passive sentences produced was therefore higher in the current experiment than in Pappert and Baumann (2019). Possible reasons for this difference might stem from the different tasks used (picture description vs. constrained production) or from differences in the materials. Whereas in the current experiment, human patients were used, Pappert and Baumann (2019), for example, also included animal referents.

In sum, a comparison of the current findings with two further studies, a study conducted in Dutch and another study in German, shows a similar pattern of passive responses. Future work might investigate differences due to the tasks as well as materials used.

Comparisons to the experiments conducted on English by Bock and colleagues and on Dutch by Hartsuiker and Kolk (1998b) are dispensed with at this point, since the materials used complicate a sensible comparison. These differences in the prime as well as target materials, however, allow for a general consideration when comparing different experiments investigating structural priming. In the current experiment, the strongest manipulations possible were included to avoid possible floor effects in case of passive structures. First of all, an animacy manipulation was included. Second, the animacy relations in the prime sentences always matched the

animacy relations in the target pictures. Furthermore, the gender marking of the respective referents in the grammatical function of agent and patient in the prime structures matched the gender marking in the target pictures. Finally, the verb between primes and targets was always repeated, a decision made to tap into the *lexical boost*, found to be the strongest moderator of structural priming in the meta-analysis conducted by Mahowald, James, Futrell, and Gibson (2016). It is especially the last factor mentioned which may cause the diverging results of this experiment compared to, for example, Loebell and Bock (2003), who did not find significant effects in their within-language experiment on German. Further influences due to the conceptual or morphological overlap present in this study, however, cannot be ruled out.

The strong manipulations and overlaps between primes and targets in this experiment make aware of another consequence worth discussing. Based on the current experiment, it is not possible to evaluate structural priming of abstract syntactic representations. To do this, the overlaps of this experiment have to be eliminated or manipulated successively, allowing to see how the production patterns change and to investigate *what remains* given a purely syntactic relationship between prime and target. The respective experiments are left for future work at this point.

In the final section of this discussion, questions about the mechanism(s) and nature of representations of structural priming are briefly summarized, building the embedding framework of prior, current, and future research of structural priming. Although the current experiment does not allow for concrete evaluations of the different accounts, future work of structural priming has the potential to do this.

Pickering and Branigan (1998) proposed an account of structural priming which links syntactic representations and lexical information. In their model, syntactic structures are represented in combinatorial nodes (e.g., NP_NP for double object datives) at the lemma level of the lexicon. These combinatorial nodes are linked to the specific lemma nodes of verbs (e.g., *give*). A ditransitive verb such as give therefore has a connection to the combinatorial node of the double object structure (NP_NP) as well as to the prepositional object structure (NP_PP). The combinatorial nodes are shared by verbs with the possibility to make use of the respective structure.

Structural priming, in their account, occurs due to the residual activation of the combinatorial nodes. A syntactic structure, which was recently processed or "activated", increases the re-usage of this structure rather than an alternative one. Importantly, the model proposed by Pickering and Branigan (1998) straightforwardly accounts for effects due to the lexical boost, the strongest moderator of syntactic priming. In their model, the effect of the

syntactic priming is enhanced when the residual activation of the combinatorial node is accumulated with residual activation between the respective lemma node and combinatorial node, resulting in an increased re-usage of the syntactic structure in case of, for example, verb overlap between prime and target. In the words of Bernolet, Colleman, and Hartsuiker (2014), the account of Pickering and Branigan (1998) provides an *one-locus account* of structural priming and the lexical boost.

In contrast to this approach, accounts of structural priming via implicit learning assume that the structural priming effect and the enhancement due to lexical overlap are caused by different cognitive mechanisms (Bernolet, Colleman, and Hartsuiker, 2014). The account put forward by Chang and colleagues (e.g., Chang, Dell, Bock, and Griffin, 2000; Chang, Dell, and Bock, 2006; Chang, Janciauskas, and Fitz, 2012) assumes that structural priming is caused by implicit learning of the language processor. The learning process is assumed to take place via error-based learning, during which structural representations are strengthened by adjusting weights. Encountering syntactic structures leads to error signals and the less expected the encountered structure, the bigger the error signal and the resulting adjustment of the system (Jacobs, Cho, and Watson, 2019). In a computational implementation of their model, Chang, Dell, and Bock (2006) did not replicate findings of the lexical boost to structural priming, which is why the authors concluded that the locus of lexically strengthened priming effects is different from structural priming in general. Whereas the former one may be related to explicit (short-term) memory, the latter one changes long-term associations. In line with this proposal, Hartsuiker, Bernolet, Schoonbaert, Speybroeck, and Vanderelst (2008) have shown that the lexical boost effect decays rapidly, whereas general effects of structural priming persist over time.

Chang, Dell, and Bock (2006) did, however, replicate several findings of the priming literature, such as the persistence of structural priming (e.g., Bock and Griffin, 2000), the similar magnitude of priming effects when comprehending vs. producing the prime (e.g., Bock, Dell, Chang, and Onishi, 2007), or the inverse frequency effect of syntactic priming, with less expected structures exhibiting bigger priming effects than expected structures (e.g., Hartsuiker and Westenberg, 2000; Jaeger and Snider, 2013). Discussion of the model as well as comparisons to experimental work can be found in Chang, Dell, and Bock (2006) and, more recently, in Chang and Fitz (2014). Note that in recent experimental work, Scheepers, Raffray, and Myachykov (2017) support a separation of general structural priming from lexical boost effects of structural priming. The authors found that repeating the verb does not offer a special advantage compared to the repetition of arguments.

Finally, in a recent approach to distinguish spreading activation models (e.g., Pickering and Branigan, 1998; Reitter, Keller, and Moore, 2011) from error-based models (e.g., Chang, Dell, and Bock, 2006; Jaeger and Snider,

2013), Jacobs, Cho, and Watson (2019) investigated the question whether speakers prime themselves during language production, a hypothesis derived from activation-based, but not error-based models of structural priming. In their experiments, the authors found support for both activation-based as well as error-based models, arguing for a hybrid model of structural priming integrating both mechanisms (see also Reitter, Keller, and Moore, 2011 and Jaeger and Snider, 2013 for similar conclusions).

Taken together, the digression to models of structural priming shows that there is no uniform pattern given the current literature. The combination of experimental, corpus, and computational work in the future should be able to settle some of the vague findings. Both the lexical boost effect to structural priming as well as structural priming within and across modalities provide fruitful starting points for the refinement of models of structural priming (see also the general discussion of this thesis in chapter 6).

To the author's knowledge, this experiment is the first one to find structural priming of the active/passive alternation in German, using a classic structural priming paradigm. In sum, the experiment has replicated effects of inherent conceptual accessibility on grammatical encoding during language production. Furthermore, speakers are also *cohesive* (Levelt, 1989) in the sense that they adapt their syntactic variation to what was processed previously. In line with cross-linguistic work on English, Dutch, and Japanese, speakers showed significant repetition effects in their picture descriptions, following an auditory presentation and a subsequent repetition of the prime sentence. Though this is an important finding, especially given the mixed results of prior work on German and Dutch, many open questions are left for future research. One of these questions is taken up in the next section, which presents an experimental investigation of structural priming in dialogue.

4.4   Experiment II: Structural alignment in dialogue

Most research on sentence production (and language processing in general) takes place in monologue settings. A speaker or listener sits in front of a computer and processes linguistic materials. In everyday situations, on the other hand, language is usually processed in an interactive setting, with (at least) one interlocutor being present. This circumstance is also evident when looking at elaborations of models of language production. As an example, three quotes given in this dissertation are repeated in the following

examples. The respective passages in bold are highlighted for reasons of demonstration.

(12)   Accessibility status of referents in the sense of Levelt (1989, p. 145):
         *"estimated accessibility of the referent **for the addressee**"* in the sense that the speaker is the one who assigns this accessibility status - rather than the real accessibility experienced by the addressee.

(13)   Topic assignment formalized by Levelt (1989, p. 151):
         *"IF the goal is that **the listener** store the information under address X, THEN assign topic status to X."*

(14)   *Cohesion* in Levelt (1989, p. 271):
         *"In cohesive discourse the speaker makes, where necessary, the form of the current utterance dependent on what was previously said by himself **or the interlocutor**".*

In the experimental work discussed so far, as well as in Experiment 1, the role of the listener or addressee was neglected. In the following part of this chapter, experimental work, as well as an experimental investigation, including one (or several) interlocutors is presented.

In most of the experiments summarized in the prior section, participants produced both the prime and the target sentence. The production of the prime sentence can be induced by having participants repeat the prime sentence or giving them the instruction to start their sentence with a particularly denoted (e.g., color-coded) entity. In dialogue, speakers usually comprehend the utterance of their interlocutor and afterwards produce their own contribution to the conversation, resulting in a constant alternation between comprehending and producing.

In their *interactive alignment model*, Pickering and Garrod (2004) ascribe a central role to the mechanism of priming in interactive communication:

> *"The model assumes that as dialogue proceeds, interlocutors come to align their linguistic representations at many levels ranging from the phonological to the syntactic and semantic. This interactive alignment process is automatic and only depends on simple priming mechanisms that operate at the different levels, together with an assumption of parity of representation for production and comprehension."*
>
> (Pickering and Garrod, 2004, p. 188)

One of the central roles of structural priming in dialogue might therefore be the alignment between the interlocutors. In the following, some of the evidence about structural priming in dialogue is summarized. Henceforth, the term *structural alignment* is used to distinguish structural priming in

monologue settings from interactive dialogue situations.

Levelt and Kelter (1982) showed that there is alignment between speakers in question-answer sequences. The authors used a telephone technique in their third experiment. They called shops and asked how long they were open. In their question, they manipulated the occurrence of the preposition "om", as shown in (15).

(15)   Prime structures used in Levelt and Kelter (1982, p. 89):

         a.   Hoe laat gaat uw winkel dicht?
               "What time does your shop close?"
         b.   **Om** hoe laat gaat uw winkel dicht?
               "At what time does your shop close?"

The results showed that merchants aligned their answer to the question asked by the speaker (a *correspondence effect* in the words of Levelt and Kelter, 1982). Following questions including the preposition *om*, speakers are more likely to include the preposition in their answer compared to questions asked without the preposition (and conversely).

Note that in more recent work, Chia, Axelrod, Johnson, Bressler, Cooperman, Chu, Dash, Di Bella, Engelhardt, Farruggio, Folsom, Gomariz, Greiner, Hager, Hansen, Kenefick, King, King, Lavaud, Leone, McGuire, Montanez, Morpeth, Neumann, Rivera, Sotolongo, Sparacio, Stokes, Tarro, Treacy, Wagler, Weitzel, Woller, and Kaschak (2019) tried to replicate this finding in English. The authors conducted three experiments, varying several factors such as asking via phone, in person, or using text messages. In the individual experiments (including 590, 166, and 767 participants), there was no statistically significant effect of participants using prepositions following questions including prepositions compared to questions without prepositions. There was, however, a significant effect in the combined analysis of the three experiments, suggesting a weaker repetition effect than the one found in Levelt and Kelter (1982).

Levelt and Kelter's (1982) early demonstration of structural priming between speakers and hearers has been extended to dialogue situations, without such strong pragmatic conditions as question-answer sequences.

Branigan, Pickering, and Cleland (2000) employed a *confederate scripting technique*, shown in Figure 4.12, to investigate whether speakers show *syntactic co-ordination* ("alignment") in a controlled dialogue setting. In their study, participants and confederates played a game, in which the two players take turns in describing and selecting pictures, based on their interlocutor's description.

The confederate first gave a (scripted) description of a prime card. The participant ("subject" in Figure 4.12), then looked for the picture matching
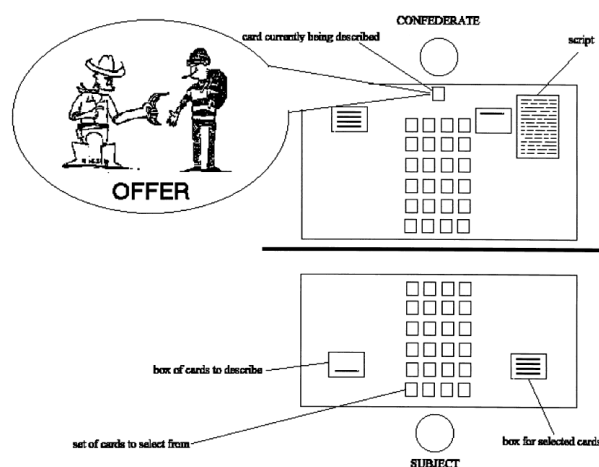
FIGURE 4.12: Experimental set-up of the confederate scripting technique by
Branigan, Pickering, and Cleland (2000, p. B19).

this description in her set of cards to select from and put it in the box for
selected cards on her right. Afterwards, it was the participant's turn to take
a card out of the box of cards to describe (on her left), and to describe this
picture to the confederate. The confederate then looked for the matching
picture in her set of cards to select from. Note that the confederate and par-
ticipant could not see each other during the experiment. Participants were
told that the experiment investigates the question of *"how well people com-
municate when they cannot see each other"* (Branigan, Pickering, and Cleland,
2000, p. B19). The experimenter and the confederate *"acted as if the confeder-
ate was a genuine participant"* of the experiment.

In prime trials, the confederate either produced a PO or DO description
of a ditransitive event (such as *offer* in Figure 4.12). The following picture de-
scription of the participant (the *target card*) also showed a ditransitive event
which could be described in a PO or DO structure. If participants syntacti-
cally align with the confederate, the target descriptions of the participants
should show significant influences of the prime description given by the
confederate. A PO or DO target description should occur more likely fol-
lowing the respective prime structure.

In addition to the two different prime structures (PO and DO), Branigan,
Pickering, and Cleland (2000) manipulated whether the verb of prime and
target were identical or not. Following a description of the confederate in-
cluding, for example the verb *offer*, the target card of the participant could
therefore include the same verb (*offer*) or a different ditransitive verb, for
example *sell*.

The results of Branigan, Pickering, and Cleland (2000) are shown in Table
4.10. Statistical analyses of the PO target descriptions showed a main effect
of Prime Type and an interaction between Verb Identity and Prime Type.

TABLE 4.10: Proportions of target responses found in the different conditions of Branigan, Pickering, and Cleland (2000, p. B20).

Verb type	Prime Type	Target description	
		PO	DO
Same	PO	0.86	0.14
	DO	0.31	0.69
Different	PO	0.65	0.35
	DO	0.39	0.61

Analyses for each of the two Verb type conditions showed effects of Prime Type. Participants were more likely to produce PO structures following PO primes compared to DO primes.

In conclusion, the findings of Branigan, Pickering, and Cleland (2000) show that participants were structurally primed by the structure given by the confederate, both in the same and different verb condition. The effect was stronger when the verb was repeated between prime and target, replicating the effect of the *lexical boost* in structural priming.

Structural alignment has been replicated in further languages, such as Dutch. Hartsuiker, Bernolet, Schoonbaert, Speybroeck, and Vanderelst (2008), for example, found syntactic alignment for dative structures and the effect of the lexical boost in form of verb repetitions between prime and targets using a computer-mediated chatting task in Dutch.

Structural alignment has also been investigated in different populations, such as *children* (e.g., Branigan and Messenger, 2016; Branigan and McLean, 2016), *aphasia patients* (e.g., Lee, Man, Ferreira, and Gruberg, 2019; Man, Meehan, Martin, Branigan, and Lee, 2019), *elderly participants* (Hardy, Messenger, and Maylor, 2017), and *adults with Asperger's Syndrome* (Slocombe, Alvarez, Branigan, Jellema, Burnett, Fischer, Li, Garrod, and Levita, 2013).

Not only is there alignment on a structural level, but, for example, also on the *lexical* (e.g., Brennan and Clark, 1996; Garrod and Anderson, 1987; Branigan, Pickering, Pearson, McLean, and Brown, 2011), *gestural* (e.g., Kimbara, 2008; Holler and Wilkin, 2011; Bergmann, Branigan, and Kopp, 2015; Christensen, Fusaroli, and Tylén, 2016), and *phonetic* (e.g., Pardo, 2006) level. Linguistically, alignment is not limited to structural choices during grammatical encoding, but has been investigated on the level of *message planning* (e.g., Brown-Schmidt and Konopka, 2015), for structures of *referential forms* (Cleland and Pickering, 2003; Carbary, Frohning, and Tanenhaus, 2010; Viethen, Dale, and Guhe, 2014), for *optional elements* (e.g., Ferreira and

Hudson, 2011), and for the question of *ambiguity avoidance* (Haywood, Pickering, and Branigan, 2005).

Structural and lexical alignment has also been investigated within the domain of *bilingualism* and *second language learning*, e.g., Schoonbaert, Hartsuiker, and Pickering (2007); Costa, Pickering, and Sorace (2008); Kootstra, Hell, and Dijkstra (2010); Fleischer, Pickering, and McLean (2012); Fricke and Kootstra (2016); Peng, Wang, and Lu (2018); Sinclair, Ferreira, Gašević, Lucas, and Lopez (2019), and for native speakers of English in a *foreign-accented speech* setting by Chun, Barrow, and Kaan (2016).

Alignment in dialogue settings has been investigated using language *corpora* (e.g., Healey, Purver, and Howes, 2014; Reitter and Moore, 2014; Gries and Kootstra, 2017) and in *neurolinguistics* (Menenti, Garrod, and Pickering, 2012, Schoot, Menenti, Hagoort, and Segaert, 2014).

It has also been investigated in participants interacting with *computers* instead of humans (see Branigan, Pickering, Pearson, and McLean, 2010 for a review).

Finally, many studies have shown that the likelihood of aligning in dialogue settings is influenced by more than linguistic factors (e.g., Balcetis and Dale, 2005; Weatherholtz, Campbell-Kibler, and Jaeger, 2014; Heyselaar, Hagoort, and Segaert, 2017; Hwang and Chun, 2018 for *social influences*, such as opinion about the interlocutor; Branigan, Pickering, McLean, and Cleland, 2007 for the *participant role* within the interaction; Branigan, Pickering, Pearson, McLean, and Brown, 2011 for the role about *beliefs*; Ferreira, Kleinman, Kraljic, and Siu, 2012 for partner- vs. task-based expectations; Yoon, Koh, and Brown-Schmidt, 2012 for *influences of perspective and goals*; Ostrand and Ferreira, 2019 for *partner-specific vs. partner-independent* alignment).

Although there are many studies investigating structural alignment in dialogue, there are only few studies which include active and passive structures. In the following section, three studies are briefly summarized. Note that the English data are extracted from studies investigating children and elderly adults. The results reported are the results of the student control groups included in the two studies.

In the study conducted by Branigan and McLean (2016), participants played a *Snap* game with the experimenter. In this game, both the experimenter and the participant each have a set of cards (face down) which they have to describe. The experimenter starts by turning the top card of her staple and describes her picture. This description serves as prime sentence. The participant then also turns her top card and describes the event shown on it, establishing the target response. Note that some of the pictures used in the two sets were identical. If the picture appearing on the participants' and experimenters' card was the same, the person who first shouted *"snap"* won

the cards. In addition to the manipulation of the prime structure (active vs. passive), Branigan and McLean (2016) also manipulated the verb identity between prime and target. The results summarized here are taken from the *Lag 0* condition, the condition in which the target description of the participant immediately followed the prime description by the experimenter.

The results (under the strict scoring scheme) of the adult group in Branigan and McLean (2016) showed significant effects of Prime Structure in both the verb identical and verb different conditions. Participants produced a proportion of passive responses around 0.64 following a passive prime (compared to about 0.09 following active primes) in the same verb condition. In the different verb condition, the proportion of passive responses in the passive prime condition amounted to about 0.39 (compared to about 0.22 following active primes). There was also a significant interaction between Prime and Verb Identity (the *lexical boost*).

Hardy, Messenger, and Maylor (2017) also included active and passive structures as well as conditions including verb repetition and conditions including different verbs in their study. The authors used the confederate scripting technique developed by Branigan, Pickering, and Cleland (2000), which is shown in Figure 4.12, with the verbs also printed below each picture.

Statistical analysis showed significant main effects of both the Prime structure and the Verb identity. Participants produced more passive responses following passives primes, compared to active primes, and they produced more passive responses when the verb was repeated between prime and target, compared to differing verbs. There was also a significant interaction between Prime and Verb (the *lexical boost*).

Deng, Ono, and Sakai (2012) investigated structural alignment of active (16-a) and passive (16-b) sentences in Japanese. The picture materials consisted of black and white line drawings and target pictures always included human entities. The verbs between prime and targets were never identical in this study.

The authors used a modified version of Branigan, Pickering, and Cleland's (2000) confederate scripting technique. The experiment conducted by Deng, Ono, and Sakai (2012) consisted of three blocks. The confederate always started and gave a picture description (the prime sentence). This description was repeated by the participants. Participants were told to memorize the sentence and to create a mental image of it. After the repetition, participants described their (target) picture. After each block, participants (and the confederate) completed a picture recognition task for which they were asked to decide whether the pictures match the descriptions given by the dialogue partner.

(16)   Prime structures in Experiment 1 of Deng, Ono, and Sakai (2012, p. 1489):

    a.   sapootaa-ga sakkaa sensyu-o ooensi-teiru.
        fans$_{nom}$ soccer player$_{acc}$ cheer
        "The fans are cheering the soccer player."

    b.   sakkaa sensyu-ga sapootaa-ni ooen-sare-teiru.
        soccer player$_{nom}$ fans$_{obl}$ cheer$_{passive}$
        "The soccer player is being cheered by the fans."

The results of Deng, Ono, and Sakai (2012) showed a significant effect of the prime structure. Participants were more likely to produce a passive structure following passive primes compared to active primes.

In sum, there is evidence for structural alignment in terms of active passive sentences from dialogue studies conducted in English and Japanese. Speakers of both languages are more likely to produce passive target descriptions following passive primes compared to active primes. The experiments conducted by Branigan and McLean (2016) and Hardy, Messenger, and Maylor (2017) furthermore replicate the finding that repeating the verb between prime and target enhances the effect of structural priming, demonstrating a *lexical boost* effect.

The following section reports an experiment investigating structural alignment for active and passive primes in German. The target materials used in Experiment 2 were the same as the ones included in Experiment 1. Based on the previous experiment of this dissertation, it was hypothesized that speakers show an effect of structural priming. It was also hypothesized that speakers show effects of inherent conceptual accessibility. Some of the work conducted in form of dialogue studies suggests that structural alignment may be stronger in dialogue than in monologue settings (Carbary, Frohning, and Tanenhaus, 2010; Branigan, Pickering, and Cleland, 2000, Branigan, Pickering, McLean, and Cleland, 2007). This question was investigated in the following experiment.

4.4.1   Method

4.4.1.1   Participants

Twenty-six participants (21 female, 5 male) took part in this experiment. They were mostly students of the Goethe University Frankfurt. All of them were native speakers of German. Participants provided written consent before taking part in the experiment and received 10 Euros for their participation.

4.4.1.2   Materials

The 24 experimental item sets included the same target pictures of transitive action events which were used in Experiment 1. The only changes made in the experimental materials compared to the first experiment concern some of the nouns used in the prime sentences. Some of the relational nouns used in Experiment 1 were exchanged with more plausible nouns given the pictures to be chosen from. The prime sentence *Die Studentin tröstet den Rentner "The student soothes the retiree"*, for example, was exchanged with the sentence *Die Mutter tröstet den Jungen "The mother soothes the boy"*. No changes were made regarding the baseline sentences. The complete experimental sentences (in direct comparison to the ones used in Experiment 1) can be found in Appendix A.

In addition to these "core priming materials", location materials as well as picture choice materials were included (see the next section 4.4.1.3 describing the procedure).

For the location materials, 72 location sentences describing a field of the *game board* were created for the confederate. Each location marker (the symbols on the game board) was used 18 times in the location descriptions. The resulting 36 locations including the blue or green star varied the structure used for the description of the symbol (color adjective + noun vs. relative clause including the color information).

Seventy-two pictures of location markings on the game board were created for the participant folder.

Forty-nine pictures of transitive, intransitive, and ditransitive actions including humans, animals, and objects were included in Experiment 2 for the picture choice task.

The number of filler materials in Experiment 2 was reduced to 48, but materials from all the different filler categories were included. The resulting number of 72 trials was randomized across three different lists.

4.4.1.3   Procedure

The procedure used in this experiment is a modification of the confederate scripting technique of Branigan, Pickering, and Cleland (2000).

Participants were seated at a table. They were told they would participate in a game (*with no name*), a combination of *Schiffe versenken ("Battleship")* and *verkorkstem Memory ("messed up Pelmanism/Pairs")*.

The overall set-up of the game is shown in Figure 4.13. The construction of the game from the participant's view is shown in Figure 4.14. On the participant's table, there were three different components. On the left side of the table, there was a staple including pictures to be chosen from. In the middle of the table, the game board was taped onto the table. On the right
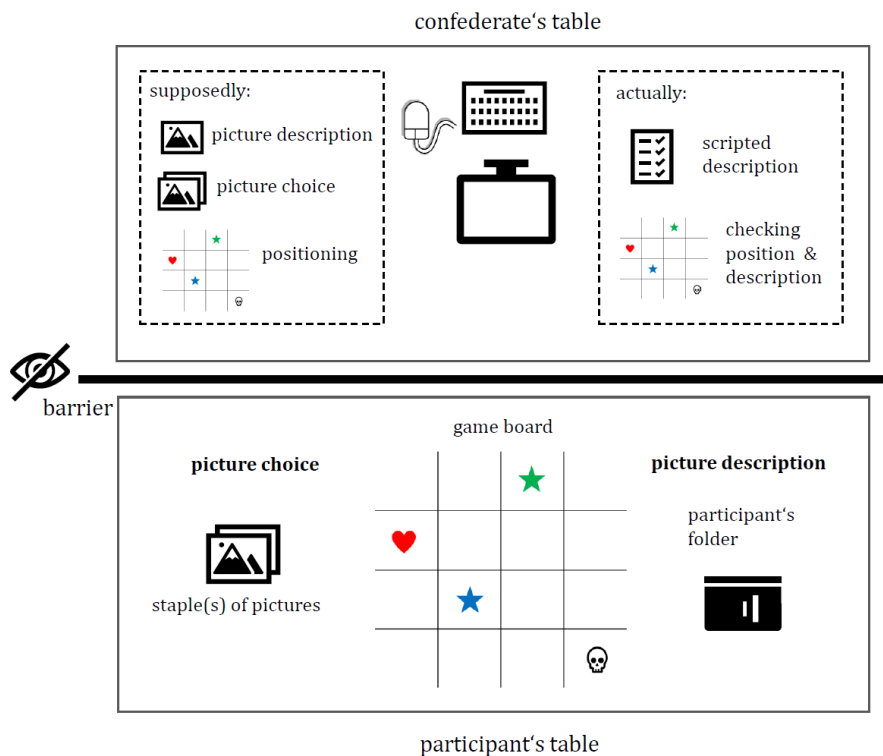
FIGURE 4.13: General set-up of Experiment 2.

side of the table, there was a folder including materials that should be used by the participant when it's her turn.

In the picture choice stage (the *confederate's turn*), participants heard a description of one of the fields of the game board given by the confederate first. Afterwards, the confederate gave a picture description and participants were asked to search their picture materials (on the left of the table). In case there was a picture the participant regarded as matching the description, the picture should be located on the respective position of the game board described by the confederate. After positioning the picture, participants started their turn. In case participants thought that none of the pictures matched the description given by the confederate, they were asked to directly start their turn.

In the picture description stage (the *participant's turn*), participants were asked to give a location of the game board first. The location was always shown on the top page of the participants folder and the respective position they should describe was marked with a black **x**. After the position, participants should describe the picture included on the bottom page of their folder in one sentence, using the verb printed below the picture. Afterwards, it was the confederate's turn again.
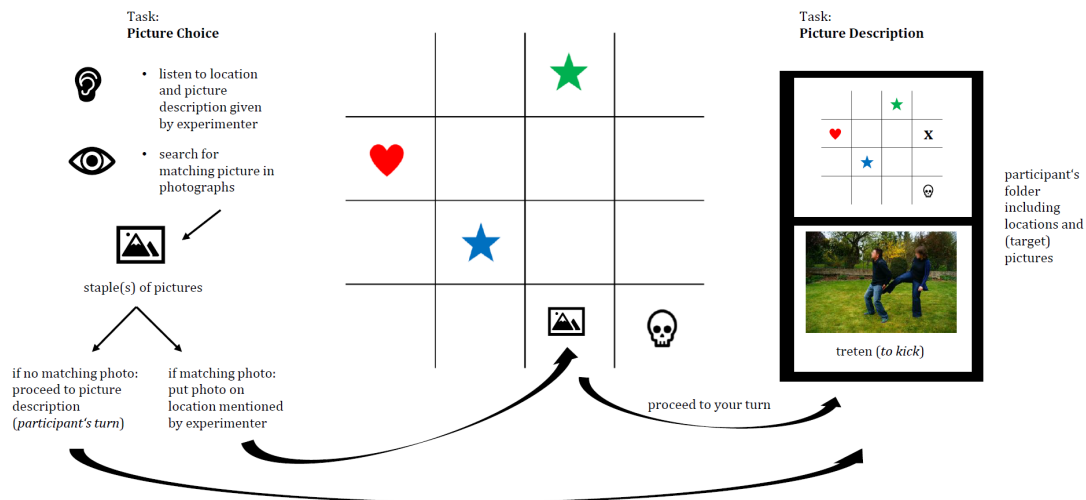
FIGURE 4.14: Procedure of Experiment 2.

Participants were told that it was their decision whether the picture description given by the confederate matched one of the pictures to select from. They were told there would be clearly non-matching descriptions, clearly matching descriptions and ambiguous ones. Furthermore, participants were told that the confederate (playing the *tech-version* of the experiment by using a computer) always had to choose between two possible pictures shown on her screen based on the participant's picture description and that the chosen picture would be located at the game board position described by the participant. Participants were informed that the game board of the confederate was the same as the ones they saw in front of them, with the same symbols being positioned on the same fields. Both the confederate as well as participant were not allowed to repeat the game board position or picture description in case the interlocutor forgot the respective description (unless for acoustic reasons directly following the description). Participants were told they could guess the position in case they forgot or simply put aside the picture. Before the practice trials, participants were given time to familiarize themselves with the picture selection pool. Participants could also arrange several picture staples instead of a single one.

Three practice trials in which the confederate checked whether the participant always described the position first, used the position marked in the respective practice trial, and included the intended verb in her description were completed prior to the experiment. Participants' productions were recorded using an audio device placed on their table.

After the experiment, participants were asked whether they would like to know four pictures from their picture selection pool which should most certainly be left and they were asked about their thoughts related to the game.

4.4.1.4 Scoring

Target picture descriptions given by the participants were transcribed and analyzed. Analysis included the choice of the structure (active, passive, and anticausative) as well as word order (SO and OS). Of the overall 624 target descriptions, short passives (n = 9) errors (n = 22; participants did not use the given verb or produced descriptions such as *Ein Pärchen spielt Fangen* "*A couple plays catch/tag*"), productions including modal verbs (n = 9), reflexive descriptions (n = 6; *Der Mann und die Frau begrüßen sich* "*The man and the woman greet each other*"), OS active sentences (n = 2; *Den Mann trifft ein Mäppchen* "*The$_{ACC}$ man hits a$_{NOM}$ pencil case*"), and descriptions in which the intended agent was produced as instrumental PP (n = 13; *Die Frau verdeckt ihren Kopf mit der Zeitung* "*The woman covers her head with the newspaper*") were excluded in a first step. In a second step, anticausative structures (n = 97) were excluded. 466 target descriptions were left for the final analysis of effects due to the structural priming.

4.4.2 Results

The proportions of the produced target structures in the different prime conditions are shown in Figure 4.15. Again, there was a noticeable number of anticausative structures. The proportion of anticausatives following active primes of 0.09 found in Experiment 1 changed to 0.15 in the current experiment. The proportion of anticausatives following passive primes was the same as the one found in Experiment 1. Following baseline primes, the proportion of anticausatives found in Experiment 1 numerically changed to a proportion of 0.22 in the current experiment. The produced anticausative structures were once again excluded from further analyses.

The overall proportions of active and passive structures in the different prime conditions are shown in Figure 4.16. The general pattern is similar to the one found in the prior experiment. For active structures (presented on the left in Figure 4.16), the highest proportion (0.82) was produced following active primes. This proportion was reduced following baseline primes (0.76). The lowest proportion of actives was produced following passive primes (0.50). The converse pattern was consequentially found for passive responses (presented on the right in Figure 4.16), with their highest proportion following passive primes (0.50, compared to 0.37 in Experiment 1). The proportion of passives was lower following baseline primes (0.24, compared to 0.16 in Experiment 1) and lowest following active primes (0.18, compared to 0.07 in Experiment 1).
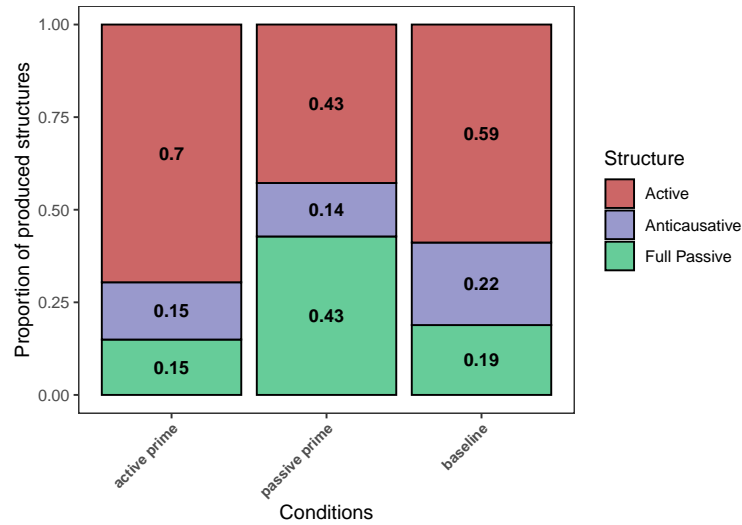
FIGURE 4.15: Proportions of produced target structures in the different prime conditions of Experiment 2.
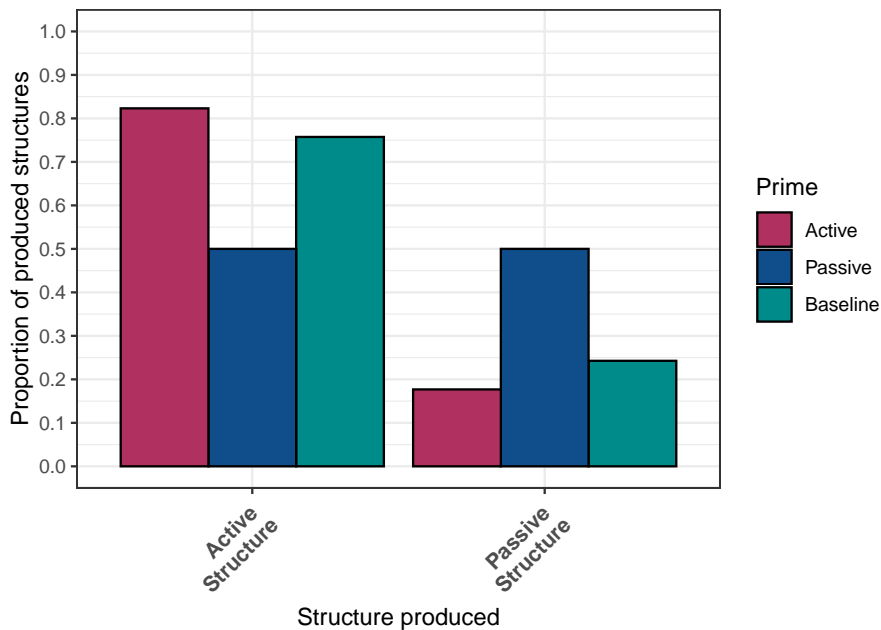
FIGURE 4.16: Proportions of produced active (left) and passive (right) structures in the different prime conditions of Experiment 2.

The proportions of produced structures depending on the animacy of the agent are shown in Figure 4.17 and Figure 4.18. For animate agents and animate patients (left), there was a passive proportion of 0.3 (0.2 in Experiment 1) following passive primes. The proportions of passives following active and baseline primes were again very low – 0.04 and 0.05 (0.01 and
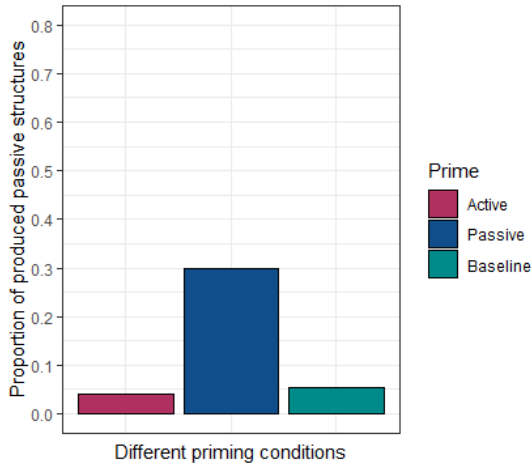
FIGURE 4.17: Proportions of passives in the different prime conditions of Exp 2 for animate agents (*to hug, woman, man*).
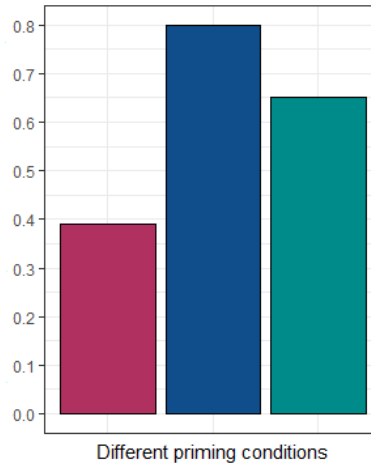
FIGURE 4.18: Proportions of passives in the different prime conditions of Exp 2 for inanimate agents (*to hit, pencil case, man*).

0.03 in Experiment 1). As in the first experiment, this pattern changed for the pairings of inanimate agents and animate patients (right). Following active primes, there was a proportion of passive descriptions of 0.39 (0.15 in Experiment 1). A higher passive proportion of 0.65 (0.41 in Experiment 1) was observed following baseline primes and an once again higher one of 0.80 (0.62 in Experiment 1) following passive primes.

TABLE 4.11: Summary of the mixed-effect model with passive as dependent variable of Experiment 2.

	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	-1.081	0.276	-3.92	8.8e-05 ***
Prime1 (active:baseline)	0.767	0.425	1.81	0.071 .
Prime2 (passive:baseline)	1.640	0.379	4.33	1.5e-05 ***
Agent	3.166	0.462	6.86	6.9e-12 ***
Prime1:Agent	0.916	0.851	1.08	0.282
Prime2:Agent	-1.315	0.736	-1.79	0.074 .

Formula: Passive $\sim$ Prime * Agent + (agent \|\| subject) + (1 \| sentence),

Signif. codes: *** 0.001 \| ** 0.01 \| * 0.05 \| . 0.1

Table 4.11 summarizes the results of the generalized linear mixed model. Note that in this experiment, there was one item which never elicited passive responses (see the discussion of this experiment), which is why the

number of items amounts to 23 instead of 24.

The results of the analysis show a significant main effect of Prime. Participants were significantly more likely to produce a passive target description following passive compared to baseline primes. Different from Experiment 1, there was only a marginally significant effect of the Prime contrast between active and passive primes. The results also show a significant main effect of Agent. For pictures including animate patients and inanimate agents, participants were significantly more likely to produce passive descriptions than for targets depicting animate patients and animate agents. Different from the first experiment, there was a marginally significant interaction of Prime (passive vs. baseline) and Agent.

4.4.2.1 Experiment 1 vs. Experiment 2 – Monologue vs. dialogue

TABLE 4.12: Summary of the mixed-effect model for Experiment 1 vs. 2.

	Estimate	Std. Error	z value	$Pr(>|z|)$
Intercept	-1.7757	0.2493	-7.12	1.1e-12 ***
Prime1 (active:baseline)	1.0382	0.3843	2.70	0.0069 **
Prime2 (passive:baseline)	1.9151	0.3141	6.10	1.1e-09 ***
Agent	3.1929	0.4489	7.11	1.1e-12 ***
Study	1.1970	0.3810	3.14	0.0017 **
Prime1:Agent	0.6017	0.7671	0.78	0.4328
Prime2:Agent	-1.0923	0.5744	-1.90	0.0572 .
Prime1:Study	-0.5513	0.7668	-0.72	0.4721
Prime2:Study	-0.1814	0.5904	-0.31	0.7587
Agent:Study	0.1401	0.6431	0.22	0.8275
Prime1:Agent:Study	0.5036	1.5325	0.33	0.7425
Prime2:Agent:Study	-0.0546	1.1273	-0.05	0.9614

Formula: Passive ∼ Prime * Agent * Study + (prime2 * agent || participant) +
(prime2 * agent || sentence), Signif. codes: *** 0.001 | ** 0.01 | * 0.05 | . 0.1

A visual inspection of the passive proportions produced in Experiment 1 (Figures 4.10 and 4.11) – a monologue setting – and Experiment 2 (Figures 4.17 and 4.18) – a dialogue setting – suggests that participants produced more passive descriptions in Experiment 2 than in Experiment 1. To statistically evaluate this hypothesis, a combined analysis of the two experiments was conducted. Table 4.12 summarizes the results of a generalized linear

mixed model including the binary factor *Study* (Experiment 1 vs. Experiment 2) in addition to the experimental factors included in both prior analyses. The results of the analysis indeed show a significant main effect of Study in addition to the main effects of Prime and Agent (i.e., animacy of the agent). Participants were more likely to produce passive description in the dialogue setting of Experiment 2 compared to the monologue setting of Experiment 1.

4.4.3 Discussion

Experiment 2 replicates an effect of structural priming in German. In a dialogue setting, after the comprehension of a passive structure (produced by the interlocutor), participants are more likely to produce passive structures in their subsequent picture description. The current experiment also replicated an effect of inherent conceptual accessibility on sentence production. A pairing of an animate patient and inanimate agent causes significantly more passive descriptions than a pairing including an animate agent and inanimate patient. Speakers of German use grammatical function assignment to promote the animate patient to the subject of the sentence and to the element occupying the German prefield position, the first position of the sentence.

Remember that in the current study, the verb was always repeated, which is why the terms structural priming (for Experiment 1) and structural alignment (for Experiment 2) may in fact be better named *lexically boosted structural priming* or *alignment*, especially given the current debate about structural priming vs. lexical boost effects of structural priming summarized in the discussion of Experiment 1.

The pattern found in Experiment 2 exhibits many similarities to the first experiment. This was expected given the fact that prime materials were kept as close as possible to the ones used in Experiment 1 and identical target pictures were used.

As in the first experiment, participants also produced anticausative structures in reaction to the animacy manipulation. The significant effect of the (in)animacy of the agent found in the final analysis including only active and passive descriptions, was therefore even stronger when regarding all productions made by participants. The possibility to exchange the verbs used in the experiment, which is elaborated on in the discussion of Experiment 1, also holds for this experiment. In other words, the results of Experiment 2 show that, unsurprisingly, the items, which were inadequate in the first experiment, were also inadequate in the current experiment. Note that the items eliciting barely any passive structures in Experiment 1 were kept intentionally in this experiment, instead of exchanging some of the target materials, for reasons of comparison. However, the dialogue

TABLE 4.13: Mean proportion of passive structures based on the animacy pairing in Experiment 2.

animacy	Prime		
	active	passive	baseline
animate-animate	0.04 (4)	0.30 (30)	0.05 (5)
inanimate-animate	0.39 (25)	0.80 (53)	0.65 (28)

setting was not strong enough to markedly override the anticausative bias for specific verbs. In general, less target descriptions could be analyzed in the second compared to the first experiment. It is not clear, whether the dialogue setting influenced participants to be less constrained than in the monologue setting, though the congruence of the materials used suggests this may be the case. Note that the two marginal significant effects of Experiment 2, which were significant (the contrast between active vs. baseline primes) and non-significant (the interaction between the passive vs. baseline prime) in the first experiment, are not interpreted at this point.

A difference between the two experiments, which is ascribed to the dialogue instead of monologue setting, is the proportion of passive structures produced within the experiment. The overall proportion of passive descriptions following passive primes was 0.5 in the current experiment. In Experiment 1, this proportion amounted to 0.37, resulting in a difference of 0.13. This difference is in line with prior findings comparing monologue and dialogue studies of structural priming, which suggest that structural alignment may be stronger in dialogue. This assumption was confirmed by the statistical analysis including both Experiment 1 and Experiment 2 of this thesis, which showed a significantly stronger influence of Experiment 2 (dialogue setting) compared to Experiment 1 (monologue setting) on passive productions.

Since the number of structural alignment studies including active and passive sentences is very low, comparisons with further studies are difficult at this point. To get a first (superficial) impression, the proportions of passive responses are once again presented based on the animacy pairing in Table 4.13.

To the author's knowledge, there is no further study which included an animacy manipulation in a structural alignment experiment. Therefore only the conditions including both animate agents and patients are shortly discussed in the following. In the study conducted by Branigan and McLean (2016), the student control group showed a differing proportion of 0.55 in the passive responses following passive, compared to active,

primes in the verb identical condition. In the study conducted by Hardy, Messenger, and Maylor (2017), the difference in the proportion of passive responses in the verb identical conditions following passive compared to active primes, in the young control group, amounted to about 0.49. In the current dialogue study, the difference in the proportion of passives following passive compared to active primes was 0.26, which is noticeably lower than the differences found in English. Though these comparisons are purely descriptive, and based on a small sample size in the current experiment, they may nevertheless be starting points for further questions. In general, the rate of passives produced in production studies is usually higher in English than in more flexible languages (see also chapter 3). Moreover, the rate of priming for the active/passive alternation (in English and other languages) compared to priming of the DO/PO alternation is generally lower (e.g., Bock and Griffin, 2000).

A comparison of the current experiment with the alignment study conducted by Deng, Ono, and Sakai (2012) in Japanese is not possible due to the verb identity, which was always present in this experiment, and never present in their study. A comparison of Deng, Ono, and Sakai's (2012) study can, however, be made to the two studies conducted in English, since they also included verb differing conditions. The difference in the proportion of passive descriptions following passive and active primes in Deng, Ono, and Sakai (2012) amounts to about 0.10. The differences found in Branigan and McLean (2016) were about 0.26 and 0.17 in Hardy, Messenger, and Maylor (2017) and therefore numerically larger than in Japanese.

Speculatively, the differing rates are influenced by the licensing of passive structures as well as structural options of the different languages. The difference in terms of structural priming in English for transitive vs. ditransitive structures already suggests that passive structures may need more specific conditions compared to the dative alternating structures. Factors of inherent as well as conceptual accessibility (discussed in chapter 3) license the production of non-canonical structures. This finding is also supported by structural priming studies which include conditions with referents differing in animacy. Based on these findings, the prior and the current experiment included items with animate patients and inanimate patients to have an independent licensing of passive structures in half of the cases and to generally make the passive *available* to participants.

In the structural alignment studies conducted so far, the materials usually include pictures with referents not differing in animacy, i.e., materials depicting animate agents and animate patients. Though these pairings allow for more independent (in terms of conceptual accessibility) investigations of structural priming, this may also be the reason why there are only few studies reporting structural alignment of passive structures (especially

compared to dative structures, which do not demand licensing conditions that strong) and more importantly, why there are mostly studies conducted in English. The prevalence of English in this case may partially be caused by the less flexible word order of the language. German and Japanese, the two languages for which there are studies of structural alignment including passives, on the other hand, both are flexible languages with more structural options than English. This difference may influence the differing alignment rates in Deng, Ono, and Sakai (2012) compared to Branigan and McLean (2016) and Hardy, Messenger, and Maylor (2017) in the verb differing conditions on the one hand, and the differing alignment rates found in this experiment compared to Branigan and McLean (2016) and Hardy, Messenger, and Maylor (2017) in the verb identical conditions on the other hand.

The possible influence of word order flexibility on structural choices during grammatical encoding is resumed in the next chapter, which addresses this relationship more directly.

The effect of structural alignment shows that the processing of a certain structure, conveyed by the production of the interlocutor, changes the speaker's likelihood of using this structure. Different from most monologue studies and Experiment 1, the participants in this experiment did not (overtly) produce the prime sentences. As mentioned in the discussion of Experiment 1, this modality alternation opens further important questions about the language processor. The alignment between speaker and interlocutor is summarized by Ostrand and Ferreira (2019) in the following quote:

> *"The process of alignment begins when the language processing system adapts its representations of linguistic knowledge to match the statistics of its current (but constantly changing) environment. When the language system receives a particular linguistic feature in its input (e.g., a particular syntactic structure), that indicates the increased prevalence of that feature in the linguistic environment, and so the system comes to expect that feature more in the future. Then, when the speaker produces speech, the system is more likely to produce that feature back, in comparison to if the system had not previously processed that linguistic feature in its input. In short, as the comprehension system learns the statistics of its current environment and adapts its representations to those statistics, the production system reflects that contextual statistical learning in its own subsequent produced utterances. This results in the behavioral effect of alignment."* (Ostrand and Ferreira, 2019, p. 2)

The importance of bringing together language comprehension and production is apparent from this quote as well as further models of structural priming and structural alignment reviewed in this chapter (e.g., Chang,

Dell, and Bock, 2006 for the former; Pickering and Garrod, 2004 for the latter). Experimental work in psycholinguistics has long kept the classic distinction between language comprehension and production by only investigating processing in one of the modalities in experimental studies. Research within the domain of structural priming suggests, however, that the interplay of the modalities plays a central role not only in monologue, but also dialogue settings, which approach language processing more closely to everyday language.

Exemplary approaches combining language production and comprehension and the role of structural priming in this context are resumed in the general discussion (chapter 6.

A final note in this discussion concerns the methodology used in Experiment 2. Though the setting created in this experiment may be *closer* to everyday situations than monologue settings in front of a computer screen, it is far from *close* to them and may raise further criticism. The use of a confederate, for example, comes with a price (see Kuhlen and Brennan, 2013 for a comprehensive review of problems and possible limitations when using confederates in dialogue settings). Though the confederate in Experiment 2 (the author of the thesis) was always the same person, trying to keep the variation as small as possible, there was certainly variation present in the confederate's speech.

Furthermore, the confederate was not naive regarding the research question, a circumstance which might cause a problematic *bias*. Though these concerns cannot be wiped out completely, there are arguments why the data obtained in Experiment 2 are valid. The first one is based on the similarity of the findings obtained in Experiment 1 and Experiment 2. The prime sentences in Experiment 1 were pre-recorded (they were also spoken by the author) and therefore the same for all participants of Experiment 1. In the second experiment, they were scripted and spoken by the same speaker. The data pattern between the two experiments is as similar as one might expect given the same materials used and the difference being caused by the setting instead of the presentation of the prime sentences, given prior work of structural priming in monologue vs. dialogue settings. A second argument concerns the game character created in Experiment 2. The joint task of finding *messed up pairs* caused a very interactive situation and worked well in focusing participants' attention towards the picture matching task. Note that many of the pictures given in the picture selection pool were intentionally chosen to cause uncertainty as to whether the picture matches the description given by the confederate. Participants statements following the experiment as well as their differing picture selection behavior during the experiment supports the argument that the main task for them was the picture matching. As an example, whereas some participants were wondering

why they had so many pictures left after the experiment, other participants had stored all pictures on the game board before finishing the experiment. As a concrete example, one of the filler sentences produced by the confederate was "There are shoes lying on a table". In the participants' selection pool, there was a picture of shoes lying under a table. Of the 26 participants, 8 put the (clearly) non-matching picture on the table. They reported afterwards that they noticed the differing positions, but thought the occurrence of the two objects was enough to build a pair. Participants not only aligned in their structural choices, but also tried to align in the memory game. There are further arguments regarding the alignment of the participants and the confederate, such as the joint positioning on the game board and the description of the symbols shown on the board, i.e., spatial and lexical alignment. All the participants aligned with the description of the positions in relation to the symbols shown on the table. Although some participants occasionally used a description such as "the upper left corner", they were to rare for statistical analysis. Furthermore, lexical alignment was visible in the fact that all participants started the game with naming the symbol shown in the bottom left corner a *Totenkopf* (*"death's head"*) in the training phase. Though this was not intentionally scripted this way (it was basically a coincidence), the confederate's term for this symbol is *Schädel* (*"skull"*). During the experiment, most of the participants changed their lexical description of this symbol at least once to *skull* or *death's skull*. Since these arguments are only anecdotal at this point, it is refrained from giving further examples for alignment of participant and confederate during the game.

Taken together, the uniformity of Experiment 1 and 2 as well as several suggestions for more than structural alignment in Experiment 2 support the assumption that the differences found between Experiment 1 and Experiment 2 are differences due to alignment within the dialogue setting.

One last point addressing criticism about the setting argues in a different direction. Note that in usual conversations, (structural) alignment can occur reciprocally. In the current experiment, the confederate did not align to the participant. Alignment could only occur one-sided, since the confederate's productions were scripted. Speculatively, a reciprocal alignment may increase the general rate of alignment (see also the work cited above on social influences to (structural) alignment).

In sum, Experiment 2 has shown that speakers of German structurally align in dialogue settings. The experiment offers an encouraging starting point for future studies of structural alignment, which will allow to address possible points of criticism (e.g., regarding the methodology), to eliminate possible shortcomings in the materials used (e.g., in terms of verb identity, thematic structure, or verb biases), and to investigate and

compare structural alignment of not only different syntactic structures (e.g., active/passives vs. datives), but also in different languages.

The importance of cross-linguistic research on grammatical encoding, including considerations of word order flexibility, is strengthened in the following chapter, investigating *Perceptual Priming* in German sentence production.

Chapter 5

Perceptual priming in sentence production

look at the blade
look into my eyes

Blitzkid – My dying bride

A lot of talking in everyday life is devoted to verbalize perceived events, very often visually perceived events. Speakers then use their words and structures to refer to events, the participants, their relations, and possible information of the surroundings.

In the excerpt introducing this chapter, there are explicit requests guiding the attention of the interlocutor. The speaker guides the visual attention of the opposite within the situation by telling where to look, but also signals an order by mentioning the *blade* before the *eyes*. In an usual conversation, the eyes of the interlocutor might naturally be a preferential region to look at. Given the surroundings or context of the conversation, it might however be relevant to look at the object held by the conversational partner. A *blade* (e.g., of an axe as in the song above) can be a very dangerous object and the comprehender better takes this knowledge about the object into account in the respective situation. In other words, the *perspective* of the comprehender better includes the danger of the given situation, represented by the blade. In case the comprehender in this situation has not detected the object and the potential hazard resulting from it, note that the production of the speaker also helps to adapt the *perspective*. By directing the comprehender's attention to the blade, the speaker manipulates the perception of the comprehender. By following the requests of the speaker, the listener not only allows the speaker to guide his or her attention, but also to consequently shape his or her *perspective* of the event.

The interface of language and vision or visual attention has received a great amount of research within psycholinguistics (e.g., Henderson and Ferreira, 2004; Trueswell and Tanenhaus, 2005; Myachykov, Thompson,

Scheepers, and Garrod, 2011 for general overviews and Carpenter, Nagell, Tomasello, Butterworth, and Moore, 1998; Dominey and Dodane, 2004; and Ibbotson, Lieven, and Tomasello, 2013 for developmental studies on the attention-language interface). In the following, the relationship between visual attention and language is looked at under the question of how visually perceived events and differences in terms of the (perceptual) accessibility of the referents can influence structural choices. This line of research is subsumed as a special case under the notion of *derived accessibility* (see chapter 3). During message encoding, speakers are influenced by multiple factors; their own goals and intentions, the prior discourse, and the inherent as well as derived accessibility of the referents being some of them. Myachykov, Thompson, Scheepers, and Garrod (2011, p. 97) proposed that during message encoding, *"the attentional system may operate as a filter that selects referents for preferential processing on the basis of whether they are more or less salient"*. The previous chapters included factors of inherent (e.g., animacy) and derived accessibility (e.g., topicalization) as potential influences on the (relative) salience of referents. A further factor affecting the overall salience of referents, that has been disregarded in the prior reviews, is their perceptual salience. This chapter is dedicated to incorporating this factor into investigations of language production. Just as linguistic factors of prominence – instantiated, for example, via differences in terms of the givenness or contextual salience of referents – have been shown to influence structural choices of speakers, temporary differences of visual factors also consistently influence speakers in choosing their syntactic structures. The following section reviews experimental investigations within this area. The review focuses on work using perceptual priming as a way to increase the accessibility of one of two referents in transitive constructions. As in the previous chapters, cross-linguistic differences in terms of structural flexibility are taken into account in the discussion of the studies.

After a general overview of work investigating perceptual priming and structural choices in the first section, the object of investigation is narrowed down to *implicit visual cueing*, a way to visually increase the accessibility of a referent without giving explicit linguistic information. The cross-linguistic pattern of implicit cueing on structural choices once again highlights the importance to extend experimental work within this domain from English to more flexible languages. German, the language considered within this thesis, offers an important possibility not only to broaden the range of languages, but especially to empirically test assumptions established based on prior cross-linguistic work. The second part of this chapter therefore includes an experimental investigation of perceptual priming in German. The general aim of this experiment is to evaluate whether perceptual accessibility (or visual attention) adds to the list of factors universally influencing

structural choices of speakers. In other words, the question is whether perceptually accessible elements also make good *starting points* (chapter 3).

5.1 Perceptual priming and structural choice

One of the definitions to capture the term *attention*, which is used informally in the prior passage, has been given by Corbetta (1998, p. 831): *"Attention defines the mental ability to select stimuli, responses, memories, or thoughts that are behaviorally relevant, among the many others that are behaviorally irrelevant"*. Supplementary to the important task of selection, Posner (1980, p. 4) coined the term *orienting* for *"the aligning of attention with a source of sensory input or an internal semantic structure stored in memory"*. For the investigation of attentional influences on structural choices, the question then is whether speakers are influenced in their selection of syntactic structures based on the attention status as well as by orienting their attention towards a specific referent. As Myachykov, Thompson, Scheepers, and Garrod (2011) noticed, the assumption of a correlation between attentional and linguistic performance (e.g., MacWhinney, 1977; Landau and Jackendoff, 1993) allows for the hypothesis that the *"distribution of the speaker's attention across the elements of a described scene may predict the structural pattern of the corresponding spoken sentence"* (Myachykov, Thompson, Scheepers, and Garrod, 2011, p. 96).

One way to manipulate the attentional state or the attentional focus of speakers that has been used in experimental work is *referential priming*. Prentice (1967) used a cue in form of a preview of the later agent or patient/theme of an action to investigate structural choices of English speakers. She presented the respective agent or patient on a slide prior to the response slide. The structures chosen to describe the transitive action of the response slide showed that speakers were influenced by the cued referent. The rate of active responses significantly decreased in the patient cued condition compared to the agent cued condition. The participants used passive structures to structurally react to the visually primed or attentionally focused patient. This result of a referential prime influencing sentence structures was supported by further evidence from sentence recall data of children (Turner and Rommetveit, 1968), sentence verification studies (e.g., Olson and Filby, 1972 for active and passive sentences and Clark and Chase, 1972 for locative structures), and a recent study investigating a referential (and linguistic) preview manipulation in perspective predicates in English and Spanish (Anton-Mendez, 2017). More recent work replicated an influence of attentional manipulations in terms of referent priming on structure choices. Myachykov, Thompson, Scheepers, and Garrod (2012) also included a referential preview manipulation in their study. The respective agent or patient of the target picture was shown with the same size and
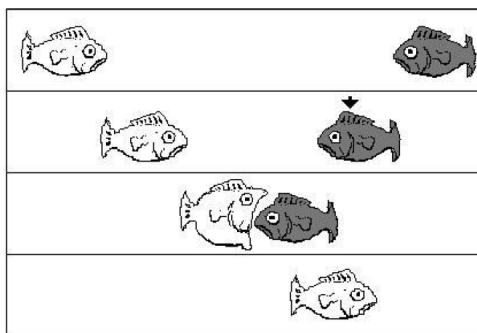
FIGURE 5.1: The *Fish Film paradigm* (Myachykov and Tomlin, 2008, p. 32)

at the later position within the target event for 700 ms prior to the target. Speakers of English produced significantly more passive structures in the patient cued compared to the agent cued condition.

The visual priming of one of the two referents does not establish a purely attentional manipulation in the strict sense. A preview of a referent not only includes perceptual, but also semantic information about the referent and is therefore not *uninformative* about the respective agent or patient (Myachykov, Thompson, Scheepers, and Garrod, 2011). This confounding factor might lead to an increase not only in the perceptual accessibility or salience, but also in the conceptual (lexical) accessibility (see chapter 3).

To induce a pure attentional and uninformative perceptual prime, researchers within psycholinguistics have adopted the classical visual cueing paradigm (Posner, 1980) used in psychology to investigate visual attention and structural choices. In a visual cueing paradigm, an explicit or implicit cue is used to manipulate the visual attention of speakers. This cue, however, does not provide any semantic information, but is neutral in this regard. Using an uninformative prime or cue allows to specifically investigate attentional manipulations or to manipulate the attentional focus.

One of the first experimental investigations using a mere attentional cue in the domain of structural choices is Tomlin (1995). Tomlin used the so called *Fish Film Paradigm* that includes an explicit attentional prime in form of a black arrow pointing towards one of two entities. Participants within this paradigm observed two color-coded fish in a dynamic event on the screen. At the end of each trial, one of the two fish always ate the other fish. All trials included the perceptual cue in form of an arrow, in half of the trials the arrow was placed above the agent fish of the eating event, and in the other half the arrow was placed above the patient. An exemplary trial including the patient prime is shown in Figure 5.1.

The results of Tomlin (1995) showed that when the agent fish was cued, participants only produced active structures in their descriptions. When the patient fish was cued, on the other hand, participants mostly (*"in nearly*

100%"; Myachykov, Thompson, Scheepers, and Garrod, 2011, p. 103, the exact numbers are not given in the original article) produced passive structures. Hence, the manipulation of the attentional focus had a strong impact on the structural choices. Speakers of English use passive structures to promote the attentional focus to the subject (and first) position of the sentence. The conclusion of Tomlin (1995) states that the referent established as attentional focus via visual cueing is encoded as the syntactic subject in English. Myachykov and Tomlin (2008) also used the Fish Film Paradigm to investigate Russian sentence production. Russian provides an important test case for a potentially general influence of focal attention on grammatical function assignment, rather than linearization. As discussed before, flexible languages allow for a separation between the subject and first position of a sentence, different from English. Russian not only has the option of a passive structure in the respective transitive context, but also allows speakers to use object fronting to linearly promote the object over the subject. The results of Myachykov and Tomlin (2008) showed that speakers of Russian indeed used object-initial active structures to promote the cued patient. Speakers produced about 20% more OS sentences in the patient-cued compared to the agent-cued condition.

The (methodological) design of the Fish Film Paradigm has received several critical remarks in the literature. Bock, Irwin, and Davidson (2004, p. 258) pointed out the *"brutality of the manipulations"*. Speakers in Tomlin (1995) for example were instructed to always watch one fish and to immediately describe the event when happening. Further criticism hinted at the facts that no filler materials were used, the event was always the same, and that the explicit cue was always jointly presented with the respective referent (Myachykov, Thompson, Scheepers, and Garrod, 2011).

A different way of perceptually cueing a referent that has been exercised in psycholinguistic research is to present an explicit cue before the onset of the target picture. By using a perceptual cue, the cue itself is still uninformative and by presenting it prior to the target picture, the above mentioned joint presentation of the cue and the target referent can be avoided. Myachykov, Thompson, Scheepers, and Garrod (2012) included a perceptual prime as experimental factor in addition to the above mentioned manipulation including a referential preview. They presented participants with a perceptual prime (or visual cue) in form of a red dot that was present for 700 ms at the respective position of the agent or patient of the target picture. The cue vanished before the picture was shown on the screen. The structural choices of the participants showed an effect of the cueing manipulation. In the patient cued condition, participants produced significantly

more passive structures than in the agent cued condition. Note that by including a referential priming manipulation as well as a visual cueing manipulation, Myachykov, Thompson, Scheepers, and Garrod (2012) could investigate possible effects of the cue type itself. However, their results only showed a reliable main effect of the location of the cue and no effect of the cue type or an interaction between type and location. Thus, the informative referential preview cue (compared to the uninformative perceptual cue) did not show a stronger effect on participants' structural choices.

A last point of criticism exists in the *unnaturalness* of a consciously perceived dot at the corresponding position of the agent or patient. As Myachykov, Thompson, Scheepers, and Garrod (2011) noticed, the presentation of an *explicit* cue is far from subtle. To make sure that this explicit character of manipulating the attentional focus does not determine the effects found on structural choices, one last change to the visual cue has been made in several studies. Instead of using an explicit cue prior to the target image, the visual cue has been shrunk to an implicit cue, a cue that is presented for only 60-70 ms. Such a cue is typically not consciously noticed by participants. The following section reviews experimental investigations using implicit cues to investigate influences of attention on structural choices in English as well as cross-linguistically.

5.1.1   Implicit cueing in English

In implicit perceptual cueing studies of language production, participants usually have to describe pictures while their eye movements are tracked. The implicit cueing is imposed by presenting a small geometrical object (a dot or a square), that is shown for between 60 and 80 ms, before the picture onset. This cue is presented at the position of the subsequent agent or patient (in transitive action verbs) shown on the picture. By using a small object rather than a lexical item or the referent itself, the cue is uninformative about the referent that will appear at the respective position. Due to the brief presentation of the cue, participants are not aware of the cue itself. Importantly, an effective cue nevertheless attracts participants' looks.

Gleitman, January, Nappa, and Trueswell (2007) used an implicit perceptual cue, a small black square that was presented for 65 ms before the stative target pictures. Pictures always included two entities and the location of the cue was manipulated for both subsequent referents. The materials used in their study included the "classic" alternation in form of active/passive pairs (e.g., *X kicking Y* vs. *Y being kicked by X*), perspective predicates (e.g., *X chasing Y* vs. *Y fleeing X*), which describe the event happening from the standpoint of one or the other referent, symmetrical predicates (e.g., *X meeting Y*

vs. *Y meeting X*), and conjoined NPs (*X and Y* vs. *Y and X* do something). The picture description results of the active/passive pairs showed a reliable main effect of the cue location. Participants used less active structures and correspondingly more passive structures in patient cued compared to agent cued conditions. The passive allows the patient to become the subject of the event and to occupy the first position.

Myachykov, Garrod, and Scheepers (2010) included English (and Finnish; see next section) speakers in their study and investigated possible influences of an explicit compared to an implicit cue in their first experiment. In both conditions, the cue was a small red circle. In the explicit prime condition, the cue appeared on the screen for 700 ms, whereas it was presented for only 70 ms in the implicit prime condition. After the cue, the target pictures involving two human referents in an agentive action appeared on the screen. The authors found a reliable main effect of the cue location. In the patient cued condition, participants produced significantly less active structures and more passive structures than in the agent cued condition. The effect of the duration of the cue was not significant and did not interact with the cue location. English speakers therefore showed an influence of perceptual priming independent of the duration of the cue.

Hwang and Kaiser (2015) used an implicit visual cue and also included speakers of English (and Korean; see next section) to investigate possible influences on structure choices due to the attentional prime. A small black square was shown for 60 ms before the target picture. The target pictures showed transitive actions involving two animate entities (humans as well as animals). The results show that the visual cueing once again had a significant effect on the structural choices of English speakers. They produced less active structures and more passive structures when the (position of the) patient was cued compared to agent cueing conditions.

Summing up, several studies of implicit visual cueing have shown that the presentation of a short perceptual cue at the position of the agent or patient of the subsequent picture influences structural choices in English. Speakers of English are more likely to start their sentence with a referent that their (visual) attention was drawn to. In English, the coincidence of the first and subject position leads to an influence of perceptual cueing on the grammatical function assignment during grammatical encoding. To evaluate a potentially universal influence of visual attention in the sense of guiding speakers' starting point, more flexible languages have to be included to assess grammatical function, word order, or mixed accounts of factors influencing grammatical encoding (see chapter 3).

5.1.2 Implicit cueing cross-linguistically

Myachykov, Garrod, and Scheepers (2010) extended their investigation of visual attention on structural choices to Finnish, a structurally flexible language. In general, speakers of Finnish can choose between passive or scrambled constructions in the grammatical encoding of transitive action events. In their second experiment, Myachykov, Garrod, and Scheepers (2010) investigated speakers' structural choices when presented with an implicit (70 ms) perceptual cue in form of a small red dot. The cueing of the subsequent agent or patient position of the transitive event however did not cause participants to deviate from the canonical SVO active structure. A 100% active SVO rate changed to 99% in the patient prime condition, therefore no significant effect was found.

Hwang and Kaiser (2015) included a further flexible language in their visual cueing study, Korean. In the default structure of Korean, the subject precedes the object and both are followed by the verb (SOV). Korean also allows word order flexibility, with the possibility to front the object before the subject and furthermore provides the option of passive structures. After the implicit cueing of the agent or patient position of the subsequent transitive picture, speakers of Korean did not show a significant effect in their structural choices. Note that participants in this study indeed used passive structures within the experiment. However, the rate of deviating from the canonical structure was not influenced by the location of the cue.

Two studies investigated influences of visual attention on structure choices in German. Reuters, Dolscheid, Esaulova, and Penke (2018) investigated inherent conceptual as well as visual factors in German sentence production. Participants in their study described pictures of transitive action events. The animacy of the patient was manipulated in the pictures by including animate and inanimate patients, whereas the agent was always animate. The visual attention was investigated by using three different versions of a patient perceptual cue; no cue, an explicit cue in form of a small dot that was shown at the position of the subsequent patient before the picture onset for 700 ms, and an implicit cue that appeared for 85 ms at the position of the subsequent patient. The results of their study showed an influence of the patient animacy on the structural choices. Participants produced significantly more passive structures in the animate patient condition compared to the inanimate patient condition. A rate of about 1.2% passive structures in the inanimate patient condition increased to a rate of about 4.6% passives in the animate patient condition.

As for the visual attention, there was a significant effect on structural choices only for the explicit cue. With an explicit cue at the location of the patient, participants produced significantly more passive structures than in the no cue or implicit cue condition. There was, however, no difference
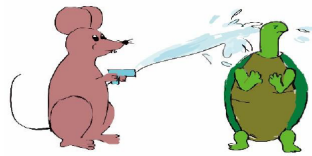
FIGURE 5.2: Examplary target picture of Wu (2018, p. 97)

between the no cue and implicit cue condition in the rate of passive structures. The rate of passive structures in the no cue and implicit cue condition amounted to about 2% and increased to about 5.7% in the explicit cue condition.

Wu (2018) conducted three experiments that investigate influences of visual, semantic, and contextual salience in German. The implicit cueing manipulation always comprised a small black square that was presented for 80 ms before the onset of the target picture. The target pictures depicted transitive actions involving two animate entities (see Figure 5.2).

The experiments conducted by Wu (2018) always included a short auditory lead-in discourse, as shown in Example (1), that was accompanied by an introduction picture showing the two characters of the subsequent target picture positioned next to each other in a neutral way, without any event.

(1)   Introduction of the characters:
        Auf diesem Bild siehst du eine Maus [Referent 1]
        und eine Schildkröte [Referent 2].
        In this picture, you see a mouse [referent 1] and a tortoise [referent 2].

The introductory lead-in discourse was followed by a question. After the introduction and a following 500 ms fixation cross, the visual cue was shown for 80 ms, following a 200 ms blank screen. After the cue, the target picture with both introduced referents (see Figure 5.2) appeared on the screen. This presentation was accompanied by an auditory presentation of a question prompting the picture description.

In the first experiment, the question following the introduction of the two referents was held neutral by only asking what happens in the next picture, as shown in Example (2).

(2)   Experiment 1 – Question :
        Sag mir bitte, was auf dem zweiten Bild passiert.
        Please tell me what happens in the second picture.

After the lead-in discourse, the position of either the agent or the patient of the subsequent picture was primed by using a visual cue. The results of Experiment 1 showed no significant influence of the position of the cue on the structural choices made by participants. Participants used 99% active

SO sentences in the agent cued condition and 100% active SO sentences in the patient cued condition.

An analysis of participants' fixation showed that the visual cue itself was successful in attracting the visual attention. The percentage of first fixations to the agent position was about 73% when the agent was cued. When the patient was cued, 65% of the first fixations landed in the patient region of the picture.

In Experiment 2 and 3, Wu (2018) changed the question following the introduction of the characters. The question in both experiments included a *topicality manipulation* by asking specifically about one of the two referents, as shown in Example (3). The distribution of the depicted agent and patient was balanced with half of the trials establishing the agent as referent 1 and half of the trials establishing the patient as referent 1 in the lead-in discourse.

(3)   Experiment 2 and 3 – Question :
          Auf dem zweiten Bild siehst du die Maus wieder, sag mir bitte,
          was mit der Schildkröte passiert.
          In the second picture, you will see the mouse [referent 1] again, please tell
          me what happens to the tortoise [referent 2].

In Experiment 2, it was always the position of the patient that was cued via an implicit prime. The structural choices of the participants show a strong effect of the topicality manipulation. When the agent of the picture was made the topic in the lead-in discourse by asking what happened to it, participants produced 100% active structures. When the patient was made the topic on the other hand, the rate of active descriptions decreased to 3%.

In Experiment 3, the visual manipulation was changed compared to Experiment 3 in the form that in this experiment, only the position of the subsequent agent was cued. The lead-in discourse manipulation was the same as in Experiment 2. The results of the third experiment show the same pattern as in the second experiment for participants' structural choices. The topic manipulation again had a significant effect on the structures, with 100% active SO sentences produced in the agent topic condition, and 3% active responses in the patient topic condition.

The results of the first fixations in Experiment 2 and 3 of Wu (2018) also showed a significant effect of the topicality manipulation. In both experiments, the first fixation landed in the area of the topic in 79% of cases when the agent/patient was the topic, whereas the rate of first fixations to the non-topic made up 37% when the agent/patient was the non-topic.

5.1.3 Interim discussion:
Perceptual priming and structural choices

The first part of this chapter, a summary of previous work of influences of perceptual priming on structure choices, shows that speakers of English are systematically influenced by perceptual priming in their grammatical encoding. In picture description tasks that involve transitive action events, the pre-activation of one of the two referents leads to a significant increase in deviations from the default active structure and towards the choice of passive sentences when the patient of the action was primed via a referent preview (e.g., Prentice, 1967; Myachykov, Thompson, Scheepers, and Garrod, 2012) or an explicit, uninformative, attentional cue (e.g., Tomlin, 1995; Myachykov and Tomlin, 2008; Myachykov, Thompson, Scheepers, and Garrod, 2012; Myachykov, Garrod, and Scheepers, 2010). An important finding of perceptual priming that allows for a broader discussion in the domain of accessibility effects on grammatical encoding is the finding of Myachykov, Thompson, Scheepers, and Garrod (2012) that a referent preview does not produce a stronger effect on structural choices compared to a pure uninformative cue. Different from an uninformative cue, a referent preview allows for some lexical and/or semantic information about one of the two subsequent referents. The absence of a stronger priming effect in the referent preview condition has been argued by the authors to suggest that there is no additive effect of lexical/semantic and perceptual accessibility on grammatical encoding.

The inclusion of an uninformative, but explicit prime, allows for a purely attentional cue. An effect of attentional cueing or attentional focus on structural choices has also been replicated several times for English. The investigation of the Fish Film Paradigm in Russian (Myachykov and Tomlin, 2008) furthermore allows for a first cross-linguistic comparison between English and more flexible languages. Though an effect of the attentional cue has been found in Russian, the rate of deviations from the canonical structure varies remarkably between Russian and English. Whereas the patient cuing in the Fish Film Paradigm led almost to a complete reversal of structures compared to the agent cuing in English in Tomlin (1995), the rate of deviations amounted to 20% in the patient cued condition in the study of Myachykov and Tomlin (2008) in Russian. A further important finding from the cross-linguistic comparison of the Fish Film Paradigm is established in the choices speakers of Russian made to promote the attentionally cued referent. Different from English, speakers did not choose passive structures, but scrambled object-before-subject sentences in Russian. Thus, the relative differences in perceptual accessibility led to an influence on word order (i.e., positional processing) during grammatical encoding in Russian. The absence of an effect on the grammatical function assignment in Russian has

been explained by Myachykov and colleagues due to the rare occurrence of passive structures in Russian.

Although many points of criticism about the Fish Film Paradigm, as discussed in the above summary, are canceled in using an uninformative visual cue before the presentation of the picture instead of during the presentation, the question about the *naturalness* of the cue (with participants noticing a cue before picture onset) still stands for explicit visual cues. The investigation of possible differences in the duration of the cue that was conducted in the first experiment of Myachykov, Garrod, and Scheepers (2010) in English offers an important step in the eventual elimination of this point of criticism. The authors compared the presentation of an explicit cue with the presentation of an implicit cue and found no effect of cue duration. Changing the explicit nature of the cue to an implicit one, which is not processed consciously by the participants, should therefore be the right direction to investigate visual attention and structural choices in a more natural way. Though in visual perception outside the laboratory, prominent perceptual features can be and often are consciously perceived, the inclusion of an implicit cue mirrors the fact that visual attention is also attracted by subtle features not entering consciousness. Furthermore, it eliminates the remaining question what participants in experimental settings might make of their awareness of an uninformative, but observed cue at the position of one of two referents before the appearance of a picture.

The finding of influences of an implicit perceptual cue on structural choices in English has been replicated several times (e.g., Gleitman, January, Nappa, and Trueswell, 2007; Myachykov, Garrod, and Scheepers, 2010; Hwang and Kaiser, 2015). Speakers of English deviate from the canonical active structure and use passive structures to promote the referent fixated first. Manipulations of visual attention can therefore be added to the list of factors of derived accessibility that influence grammatical encoding in English. Just as other factors subsumed under this notion, being the attentional focus influences the grammatical function assignment, with the attentional focus becoming the subject of a passive structure in patient cued conditions. It is discussed in chapter 3 that the investigation of different accessibility factors allows for an evaluation of potentially universal influences on language production. Furthermore, influences of accessibility allow for an evaluation of existing assumptions in models of language production. As argued before and demonstrated for the case of grammatical function, word order, or mixed accounts of accessibility on grammatical encoding, this aim can only be approached when expanding the range of investigated languages.

In the case of implicit visual cueing, the inclusion of flexible languages dramatically changes the pattern for the question of influences of perceptual priming on structural choices. A summary of studies investigating implicit

TABLE 5.1: Prior cross-linguistic work investigating implicit perceptual priming and structural choices by using visual cues.

Language	Study	Influence of implicit visual cue on grammatical encoding
English	Gleitman, January, Nappa, and Trueswell, 2007	gf
	Myachykov, Garrod, and Scheepers, 2010	gf
	Hwang and Kaiser, 2015	gf
Finnish	Myachykov, Garrod, and Scheepers, 2010	—
Korean	Hwang and Kaiser, 2015	—
German	Reuters, Dolscheid, Esaulova, and Penke, 2018	—
German	Wu, 2018	—

gf = grammatical function assignment

perceptual cueing and possible influences on grammatical encoding is given in Table 5.1. In all four studies investigating flexible languages, Finnish (Myachykov, Garrod, and Scheepers, 2010), Korean (Hwang and Kaiser, 2015), and German (Reuters, Dolscheid, Esaulova, and Penke, 2018; Wu, 2018), the visual cue was effective in attracting the first fixation of the participants, but did not show any significant influences on the structural choices. The only effect that was found to have an influence on the grammatical function assignment was found by Reuters, Dolscheid, Esaulova, and Penke (2018) when an explicit cue, instead of no cue or an implicit one, was presented before the target picture. The rate of passive productions nonetheless remained low with about 5.6%. Note that in the study of Reuters, Dolscheid, Esaulova, and Penke (2018), it was always the position of the patient that was cued. Different from studies including a visual cue at the position of the respective agent or patient, this finding cannot be compared with structural choices in the agent cued condition.

Based on the mixed results on English and more flexible languages, Myachykov, Thompson, Scheepers, and Garrod (2011) proposed that there are language-specific differences in the effects of visual cueing on structure choices, whose nature is yet to be clarified. The general availability of passive structures, as instances of an influence on grammatical function assignment, in the different languages offers a first disparity. Whereas passives are frequently used in English, they are very rare in, for example, Finnish

and Russian (Myachykov, Garrod, and Scheepers, 2010; Vilkuna, 1989). Furthermore, the effect of perceptual priming is weaker, if found at all, in more flexible languages compared to English. Studies which used the same materials and manipulations in different languages (e.g., Myachykov, Garrod, and Scheepers, 2010 for English and Finnish; Hwang and Kaiser, 2015 for English and Korean) are especially valuable in this regard.

To accommodate these differences, Myachykov, Thompson, Scheepers, and Garrod (2011, p. 103) suggested that *"speakers universally attempt to employ the grammatical-role assignment mechanism in order to represent the perceptually salient referent in the structural plan of the sentence"*. Speakers attempt to adjust attentional focus or perceptual salience by assigning the grammatical function of the subject to the more salient entity. In English, this results in the systematic use of passive structures. In languages in which this structural contrast (Myachykov, Thompson, Scheepers, and Garrod, 2011, p. 103) is not available to speakers, they have to find an alternative. In case of free word order languages, scrambling instantiates this alternative. Myachykov, Thompson, Scheepers, and Garrod (2011, p. 104) claimed that *"as a result, a linear-ordering mechanism is used to accommodate referential salience in terms of word order, but with detrimental effects on perceptual priming magnitude"*.

A first dissent to this proposal comes from the implicit cueing study conducted by Hwang and Kaiser (2015). In their study, speakers of Korean overall produced more passive structures than speakers of English. The mechanism of assigning the grammatical subject function to the non-default subject of the transitive action (i.e., the patient) was consequently available to the speakers of Korean. Yet, they did not make use of the mechanism to accommodate referential salience due to the visual cue.

Hwang and Kaiser (2015) offered a different point of view on the differences between English and more flexible languages. They argued that in English, the accommodation of the perceptually primed referent[1] allows speakers to quickly assign grammatical roles. The grammatical functions in English are determined in terms of word order, the first element gets the subject function. Due to this rigid relationship between word order and grammatical functions, assigning the grammatical subject function to the more accessible referent results in a "smooth" transition from message encoding to grammatical encoding. In more flexible languages, on the other hand, the grammatical function assignment and word order linearization are not as closely tied as in English. In case of a difference in terms of perceptual salience or accessibility, speakers can decide between assigning the (initial) subject function to the more salient referent or to

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[1]Hwang and Kaiser (2015) talked about *lexical accessibility* instead of only perceptual priming, because they also conducted a semantic priming experiment.

assign the object function, and to front the object over the subject. Hwang and Kaiser (2015) noticed that different from English, speakers of more flexible languages still have several options in the grammatical function assignment and respective syntactic structures when accommodating the more salient referent and stated that *"if Korean speakers experience competition between two different grammatical function assignments, the accommodation of lexical accessibility could hinder utterance formulation in Korean – in contrast to the facilitatory effects on English"* (p. 202). The authors concluded that the same pattern *presumably* holds for typologically similar languages.

The two accounts of cross-linguistic influences of perceptual priming by Myachykov, Thompson, Scheepers, and Garrod (2011) on the one hand and by Hwang and Kaiser (2015) on the other hand make different predictions for flexible word order languages. The following experiment seeks to evaluate the two accounts in another flexible language, German.

5.2 Experiment III: Perceptual Priming in context

In the following eye tracking study, participants were presented with short stories about two human characters. Afterwards, participants had to describe pictures including the two entities after reading the stories. The pictures showed transitive actions involving the agent and patient of the event. Before picture onset, a short visual cue was presented at the position of the agent or patient.

The discussion in the last section shows inconclusive evidence for the question of whether implicit perceptual cueing exerts an universal influence on speakers' structural choices.

Myachykov, Thompson, Scheepers, and Garrod (2011) and Hwang and Kaiser (2015) offer two opposite accounts of cross-linguistic visual attention and structural choices. The proposal made by Myachykov and colleagues is summarized in the following quote:

> *"We propose that the grammatical-role assignment mechanism operates as the primary structural device responsible for representing the speaker's attentional focus, while linear ordering of the constituents is only employed when the grammatical-role assignment mechanism is not easily available."*
>
> (Myachykov, Thompson, Scheepers, and Garrod, 2011, p.104)

The proposal by Myachykov, Thompson, Scheepers, and Garrod (2011) captures findings from studies conducted on English. The grammatical-role assignment mechanism is easily available for speakers and they use the mechanism to promote the perceptually salient referent. Note that in

English, this mechanisms is basically the only mechanism that can be employed by speakers in transitive action events to adapt to accessibility differences due to the visual cue.

Findings from flexible languages are difficult to arrange with the above proposal. A significant influence of structural choices has been found in flexible languages only with an explicit cue (Myachykov and Tomlin, 2008 for Russian in the Fish Film paradigm, and Reuters, Dolscheid, Esaulova, and Penke, 2018 in German). Reuters, Dolscheid, Esaulova, and Penke (2018) found an increase in the use of passive structures with an explicit compared to an implicit or no cue. This finding is in accordance with the proposal by Myachykov and colleagues, though it does not account for the difference between explicit and implicit cues in the study of Reuters, Dolscheid, Esaulova, and Penke (2018). Speakers of German used the grammatical-role assignment mechanism to represent the (explicit) attentional focus. The proposal also holds for the explicit cueing in Russian. The grammatical-role assignment mechanism results in a passive structure, but the passive is rare and dispreferred in Russian. The missing availability of the mechanism causes speakers to revert to the linear ordering to accommodate visual attention caused by the cue on structural choices. This pattern is predicted by the above proposal.

When it comes to implicit cueing in flexible languages, the proposal by Myachykov, Thompson, Scheepers, and Garrod (2011) fails to capture empirical findings on Finnish, German, and Korean (Myachykov, Garrod, and Scheepers, 2010 for Finnish, Reuters, Dolscheid, Esaulova, and Penke, 2018 and Wu, 2018 for German, and Hwang and Kaiser, 2015 for Korean). In all of these experimental investigations, there was no significant effect of the visual cue on participants' structural choices in the picture descriptions.

The second account of cross-linguistic visual attention and structural choices, provided by Hwang and Kaiser (2015), predicts this cross-linguistic pattern. Their proposal is summarized as follows:

> *"In sum, lexical accessibility might influence structural choice in English – and presumably other typologically similar languages – because it allows speakers to cope with a rather rigid relationship between word order and grammatical function by accommodating more accessible nouns earlier and assigning grammatical functions as early as possible. But in Korean – and presumably other typologically similar languages – where speakers have to choose between alternative grammatical function assignments, lexical accessibility could hinder, rather than facilitate, grammatical function assignment."*

> (Hwang and Kaiser, 2015, p.202)

The account proposed by Hwang and Kaiser focuses on typological characteristics of the different languages rather than explicit mechanisms of grammatical encoding. Implicit visual cueing constitutes one of the factors they subsume under the notion of *lexical accessibility*. An implicit perceptual cue increases the lexical accessibility of one of the two referents depicted. Their account captures the different cross-linguistic findings of implicit visual cueing so far. Whereas an effect of perceptual priming on structural choices was found for rigid word order languages (i.e., English), there is no effect in flexible languages (Finnish, German, and Korean).

When it comes to German, the two accounts make different predictions with regard to structural choices in the perceptual priming paradigm:

Under the account of Myachykov, Thompson, Scheepers, and Garrod (2011), speakers of German should show a significant effect of visual cueing on their structural choices. With an experimental manipulation cueing the position of the subsequent agent and patient, the cueing of the patient position should cause participants to produce more non-canonical structures (i.e., less active SO sentences) compared to cueing the agent position.

If the grammatical-role assignment mechanism is *easily available* for speakers, this effect of the visual cue is expected to show up in passive structures. If, on the other hand, this mechanism is not easily available to participants, speakers should show an influence of the visual cue in the linear ordering of the constituents. More specifically, the patient cueing should cause participants to employ object fronting and to produce more OS active sentences (i.e., less default SO active sentences) compared to the agent cueing.

Under the account of Hwang and Kaiser (2015), speakers of German should not show a significant effect of visual cueing on their structural choices. German, as Korean, is a flexible word order language that, next to passives, allows for object fronting and uses overt case marking (compared to the limited overt case marking in English). Speakers of German also have to choose between alternative grammatical function assignments in case of accommodating perceptual salience. Corresponding to the pattern found in Korean, participants in German should use the default SO active structure independent of the agent or patient cueing.

The present experiment tests the two diverging accounts of influences of visual cueing on structural choices. Note that this question can also be framed within the bigger context of language production research. The question then is whether visual attention in terms of implicit cueing is one of the factors that show universal influences on structural choices.

The first experimental manipulation therefore was using an implicit visual cue at the position of the subsequent agent or patient of the picture.

To ensure that participants make use of their preferred mechanisms of grammatical encoding in the production of non-canonical structures (grammatical function assignment or linearization), a second manipulation as well as a specific context setup was included.

In general, contexts were included to introduce the referents, thereby eliminating potential differences in the lexical accessibility of the nouns, and to create a more "natural" surrounding for the potential non-canonical structures. The contexts were always patient prominent in the sense that both referents of the pictures were introduced, but more information was given about the patient of the subsequent picture (cf. Prat-Sala and Branigan, 2000).

The second experimental manipulation consisted of using questions as a factor of *derived accessibility*. The inclusion of questions, more specifically, of patient questions as topicalization strategy, was chosen to make sure that participants employ structural variation within the experiment. As discussed in chapter 3 , patient questions show universal influences on structural choices and allow to generally investigate influences of accessibility on grammatical encoding.

5.2.1 Method

5.2.1.1 Participants

Forty-four students (33 female, 11 male; ranging in age from 20 to 28 with a mean age of 22 years) of the Goethe University Frankfurt participated in this experiment for course credit. All of them were native speakers of German. Participants provided written consent before taking part in the experiment.

5.2.1.2 Picture norming study

In an online pretest implemented via SoSciSurvey, participants saw 30 different pictures of transitive action events involving two animate referents. The pictures were black and white line drawings and involved different masculine nouns. The pairings of the two nouns in one picture were made in a way that each referent could easily be distinguished and that the two referents looked distinct from each other. The intended verbs for the pictures were *befragen/interviewen, begrüßen, beißen, (be-)schimpfen, betäuben/ersticken, boxen, erschießen, fotografieren, füttern, jagen, kitzeln, kneifen, massieren, messen, rasieren, rufen, schlagen, schminken, schubsen, stoppen, streicheln, treten, trösten, unterstützen, untersuchen, verarzten, verhaften, verletzen, waschen, würgen* ("to interview, to welcome/greet, to bite, to insult, to benumb/suffocate, to box/punch, to shoot, to photograph, to feed, to chase, to tickle, to pinch, to massage, to measure, to shave, to call, to punch/hit, to make up, to shove, to stop, to pet, to kick, to soothe, to support, to examine, to doctor, to arrest,

to hurt, to wash, to choke"). Participants were asked to describe the pictures in one sentence including both entities shown on the picture and the respective action. Furthermore, they were asked to write down a second sentence, when they could think of a second variant to describe the picture.

In the instruction given for the pretest, a black and line drawing of a hiker who is struck down by a rock was shown. The first exemplary description for the picture was the active SO version; *Der Fels erschlägt den Wanderer* ("the rock strikes down the hiker"). The second exemplary description used a passive structure; *Der Mann wurde von dem Fels getroffen* ("the man was hit by the rock"). Different nouns and different structures were chosen to encourage participants to use them as well and to provide two possible descriptions.

Twenty-one participants gave written picture descriptions in the online questionnaire. The participants were mainly students that participated voluntarily. For the final materials of the experiment, two criteria were considered for the choice of the pictures. In the first step, the pictures that most frequently elicited the intended verbs were chosen. In the second step, the pictures that elicited at least one passive description (in one of the two versions) were chosen.

The two criteria resulted in the final selection of 12 different action verbs that were each used twice in the experimental materials of Experiment 3.

5.2.1.3 Materials and design

Twenty-four experimental item sets were created. Each set consisted of a patient prominent context, followed by a question, and a subsequent picture involving two human characters in an action event, which had to be described by the participants. The complete experimental materials can be found in Appendix B. An example for a patient prominent context is illustrated in Table 5.2.

TABLE 5.2: Exemplary context of Experiment 3.

|	
C1	Jetzt geht es um einen siegreichen Boxer und einen Trainer in einer Sporthalle. *"Now, there is a victorious boxer and a coach in a gym."*
C2	Der Boxer hat bereits seine Kampfkleidung an – Boxhandschuhe sowie Schuhe. *"The boxer already wears his sportswear – boxing cloves and shoes."*
Q	Question following the context: ▷ general question: Was passiert? *(What happens?)* ▷ patient question: Was passiert mit ihm? *(What happens to him?)*
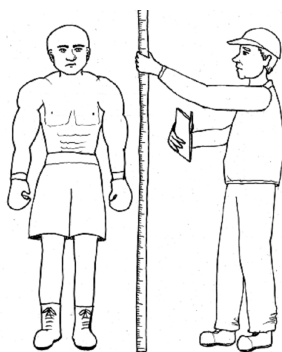
FIGURE 5.3: Exemplary target picture for the verb *messen* ("to measure") of Experiment 3.

The first context sentence (C1) always began with an introductory phrase such as *jetzt*, *im Folgenden*, *in der nächsten Abbildung*, or *auf dem folgenden Bild* ("now", "in what follows", "in the next image", "in the following picture"). After this phrase, two male referents were introduced using indefinite NPs, coordinated with *and*. Only male referents were included in the experimental materials because (different from female nouns) they provide unambiguous case marking in German. To establish patient prominence, the patient of the subsequent picture was always introduced first and and the noun was preceded by an adjective (*victorious* in the example given). The subsequent agent was introduced without any additional materials. Instead of simply mentioning both nouns, the first context sentence always included a preposition or a relative clause about the location of the two referents. Half of the introductory sentences included a prepositional phrase and the other half included a relative clause. To further increase the patient prominence, the second context sentence (C2) only mentioned the patient of the subsequent picture in a definite NP and gave further information about him by mentioning additional features, such as his clothing or whereabouts.

For the target pictures, 24 black and white line drawings of nominative-accusative transitive actions were created. An example of an experimental picture following the context example given in Table 5.2 can be found in Figure 5.3.

Twelve different actions (*messen, rasieren, waschen, erschießen, massieren, (er-) würgen, befragen/interviewen, stützen, schubsen, trösten, verhaften*, and *fotografieren*; "to measure, to shave, to wash, to shoot, to massage, to choke, to interview, to support, to shove, to soothe, to arrest, to photograph") were chosen based on the picture norming study (described above). Each action was used twice in the target materials and the same verbs were paired with different nouns. The position of the agent and patient of the action was counterbalanced within the experimental pictures, with the agent appearing on the left side in half of the pictures and the agent appearing on the

right side in the other half. The referents were depicted equal in size and in terms of attributes to not create differences in the salience of the two characters depicted.

Forty-eight additional filler sets were created. The filler sets also included two context sentences, a question following the context, and a picture that had to be described by the participants. Twenty filler sets included contexts introducing and pictures showing only one character to elicit intransitive verbs. Twenty-eight fillers included two referents in the contexts and depicted on the drawings. The actions shown on the filler pictures were joined actions designed to always elicit coordinated NPs as subject (e.g., *Der Rentner und die Mitbewohnerin spielen Schach* "The retiree and the roommate play chess", or *Die Köchin und der Kellner decken den Tisch* "The cook [female] and waiter set the table"). In the filler materials, female nouns were included in all different variants; in intransitive items and paired with a male noun or with a second female noun.

Crossing the factor Cue (agent or patient position of the subsequent picture) and Question (general or patient question) resulted in four versions of each experimental set. The 16 sets were distributed across four lists according to a Latin square design. Each list contained exactly one version of each experimental set, but on each list, the verbs were used twice, though in different contexts and pictures. The number of sets was equal in all lists. The 48 filler sets were included for each list with the restriction that experimental sets were separated by at least one filler set. The resulting number of 72 sets was individually randomized for each participant.

5.2.1.4 Procedure

Participants were seated in front of a 24 inch monitor at a distance of about 60 cm. They were instructed to read aloud the contexts presented on the screen. Following the contexts, a question appeared and participants were asked to answer this question in their subsequent picture description. Furthermore, participants were asked to describe the pictures in one sentence using both characters displayed on the picture and to refrain from using pronouns in their descriptions. As a cover-up task, the instruction furthermore included the hint that participants would encounter several different characters during the study. Participants were asked to pay careful attention to the different female characters and they were informed that after the main experiment, they would receive a questionnaire. One example of a short story, a question following the story, and a subsequent picture was included in the instruction. The picture shown in the instruction included two referents that were fighting and the exemplary picture description was given in active voice ("Der Polizist und der Bettler streiten sich"; *The policeman and the beggar are having a fight*).

A practice session of three complete sets was given before the main experiment. On each trial of the experimental session, participants first focused on a black dot in the middle of the screen (*drift correction*). Afterwards, the context sentences appeared on the screen. After reading the sentences aloud, a keypress added the question to the screen, that also had to be read aloud. With the following keypress, the context and question disappeared and a crosshair appeared on the lower bottom of the screen, in the center of the vertical orientation of the screen. The position of the crosshair was chosen to make sure that participants' looks are not already in the area of the subsequent visual cue. After fixating the lower crosshair for at least 150 ms, the visual cue (a black dot with a diameter of 0.66cm) appeared at the center position of the interest area for the subsequent agent or patient for 60 ms, immediately followed by the target picture. Each picture onset was accompanied by a short (200 ms) beep. Participants had 8 sec (at maximum) to describe the picture. After their description, participants could automatically proceed to the next trial by pressing the space bar. Otherwise, *zu langsam* ("too slow") appeared on the screen and the next trial was initiated automatically. The procedure for a patient cued trial is shown in Figure 5.4.
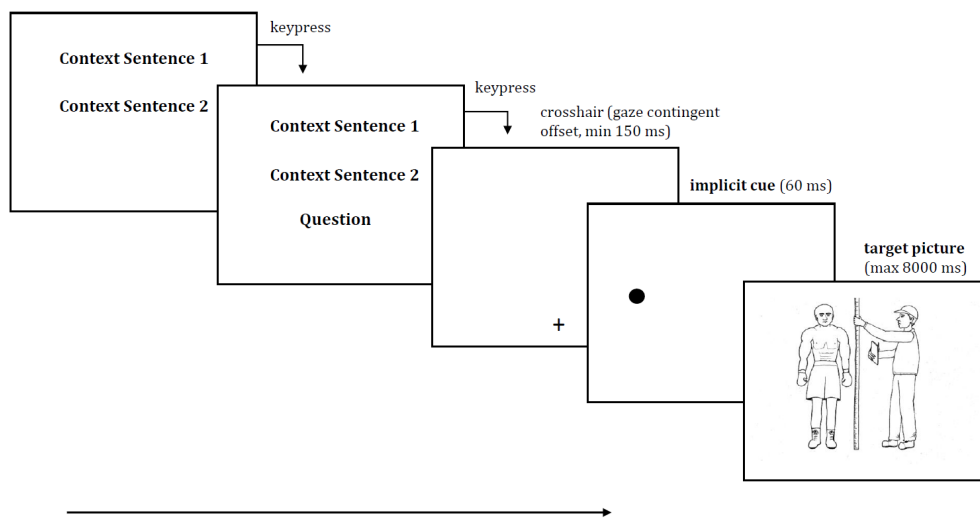

FIGURE 5.4: Procedure for a patient cued trial of Experiment 3.

Participants' speech was recorded with a recording device put on the table at which participants were seated. The eye tracking data were recorded with a SR EyeLink 1000+ eye tracker used in remote mode. A target sticker was placed on participants' forehead. After the experiment, participants received a written questionnaire including three questions. They were asked to write down the female nouns they could remember and to reflect on eight pictures, for which one of the two referents was mentioned in the questionnaire, whether they could remember the second character of the picture. In the last question, participants were asked if they noticed something else

within the study they would like to tell and specifically, whether they had noticed something when looking at the pictures.

Only one of the forty-four participants gave a hint that may be associated with the visual cue by reporting that when thinking about it, she felt that in some pictures, she looked straight to the center of the picture rather than the upper part, which surprised her.

5.2.1.5 Scoring

Participants' descriptions of the target pictures were transcribed and analyzed. Analysis included the choice of the structure (active or passive) as well as word order (SO and OS). In the 1056 target descriptions produced by the participants, active and passive sentences with OS order were very rare (2 instances) and for this reason excluded from further analyses. Another 10 instances were excluded because a *sich lassen* ("lets himself"; a structural option listed in chapter 2) structure was chosen. Though these instances are informative because in these cases, the patient also becomes the subject, they were excluded due to the low rate of less than 1%. 36 productions (about 3.4%) were excluded because no descriptions, descriptions including verbs not allowing the active/passive alternation, or descriptions including dative verbs were given. 1008 target descriptions were left for the analysis of structural choices.

5.2.2 Results

For all results reported in this chapter, the statistical analysis was conducted using the statistics software R (R Core Team, 2016). For the inferential statistics, generalized linear mixed models using the R package lme4 (Bates, Mächler, Bolker, and Walker, 2015) were computed. Figure 5.5 presents the mean proportions of the produced structures in the target picture descriptions.

The proportions of produced structures show clear effects of the Question manipulation. The active preference in the general question conditions, with a mean proportion of 0.75 and 0.72, is reduced to less than 0.5 in both patient question conditions. Note that even in the general question conditions, there is no ceiling preference for active structures, but a remarkable number of both full and short passive productions, with a mean proportion of 0.25 in the agent cued and 0.28 in the patient cued condition. This finding is taken up again in the following discussion. In the patient question conditions, passive structures prevail over active structures with a mean proportion of 0.56 and 0.52 in the agent and patient cued conditions. For the Cue manipulation, the visual inspection of the produced structures does not suggest differences in the agent cued vs. patient cued conditions.
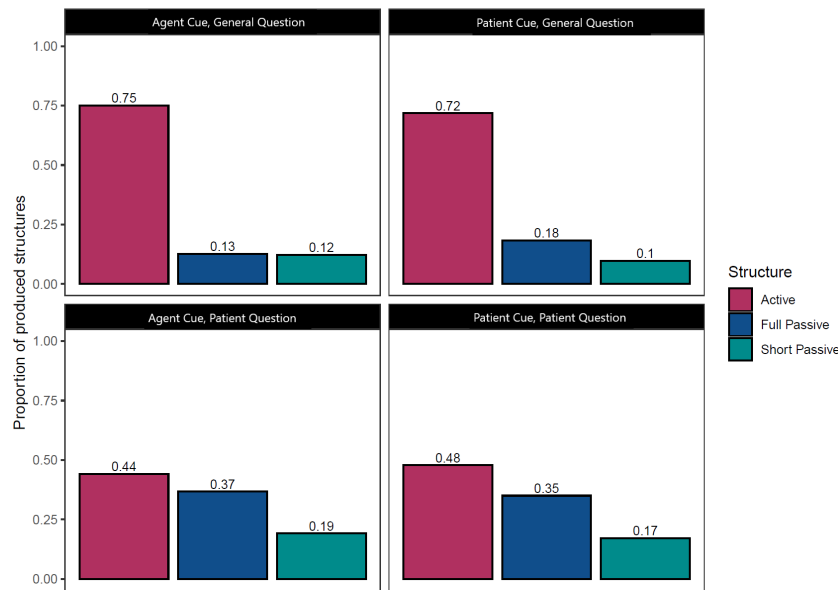
FIGURE 5.5: Mean proportions of produced target descriptions for active, full passive, and short passive structures in the four different conditions in Experiment 3.

For all three structures, the mean proportions in the agent cued and patient cued conditions are very close, with 0.75 to 0.72 and 0.44 to 0.48 for the active structures, and 0.25 to 0.28 and 0.56 to 0.52 for the passive structures.

A generalized linear mixed model with both main factors and the interaction term as fixed effects, using effect coding, was run for the structural choices. Random effects for items and subjects with maximal random slopes supported by the data were included, following Bates, Mächler, Bolker, and Walker (2015). The response variable was defined as passive response, including both full and short passive structures. Table 5.3 summarizes the results of the statistical analysis and reports which random slopes were included. There was a significant main effect of Question. Participants were significantly more likely to produce a passive structure after a patient question compared to a general question. There was no significant effect of the visual Cue or interaction of Cue and Question.

5.2.2.1 Eye tracking data

The main aspect of the eye tracking data in this experiment was the question whether the cue was effective in attracting speakers' looks. The data were analyzed using the VWPre Package (Porretta, Kyröläinen, van Rij, and Järvikivi, 2016). Figure 5.6 shows the proportion of looks in the four different conditions for the first 2000 ms after picture onset. The data show

TABLE 5.3: Summary of the mixed-effect model with passive structures (full and short passives) as dependent variable of Experiment 3.

	Estimate	Std. Error	z value	Pr(>|z|)
Intercept	-0.69877	0.28062	-2.49	0.013 *
Cue	0.00992	0.19076	0.05	0.959
Question	-1.77580	0.26463	-6.71	1.9e-11 ***
Cue x Question	0.48924	0.32772	1.49	0.135

Formula: Passive ∼ Cue * Question + (question || participant) + (cue + question || sentence)
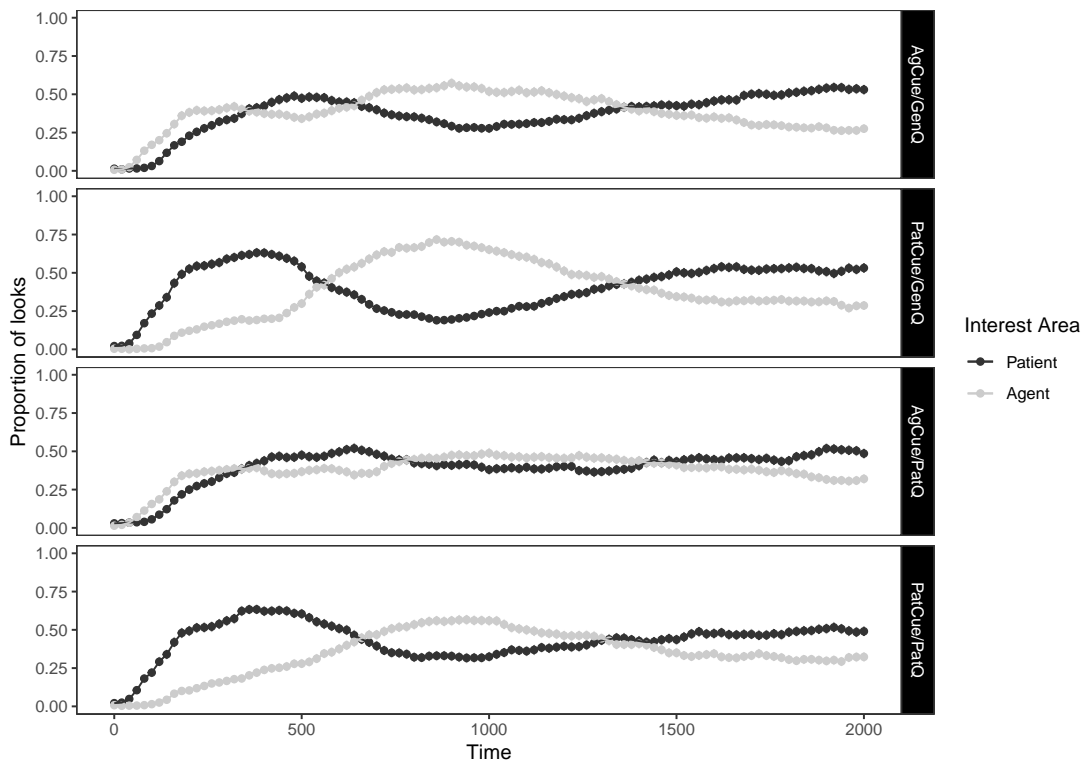

FIGURE 5.6: Proportion of looks to the patient and agent area of interest in the four different conditions relative to the time course in milliseconds in Experiment 3. Zero represents the onset of the target picture.

clear effects of the patient cueing and less strong effects of the agent cueing. The question manipulation on the other hand does not show effects on the proportion of looks. The generally higher proportion of looks to the patient area is taken up again in the discussion of the experiment.

The eye tracking data averaged over the Cue manipulation are shown in Figure 5.7. For the statistical analysis, the proportion of looks to the agent
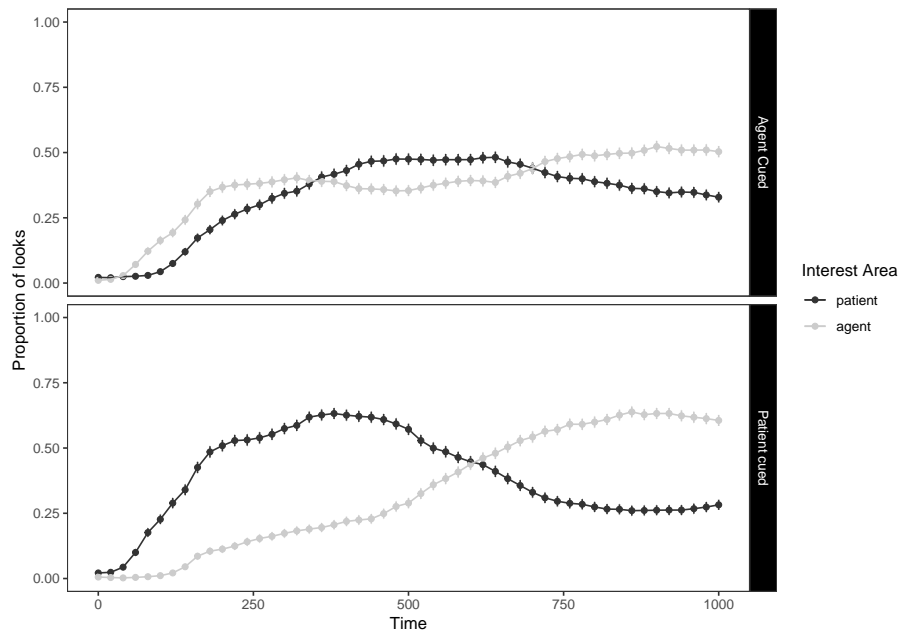
FIGURE 5.7: Proportion of looks to the patient and agent area of interest averaged over the cued entity relative to the time course in milliseconds in Experiment 3. Zero represents the onset of the target picture.
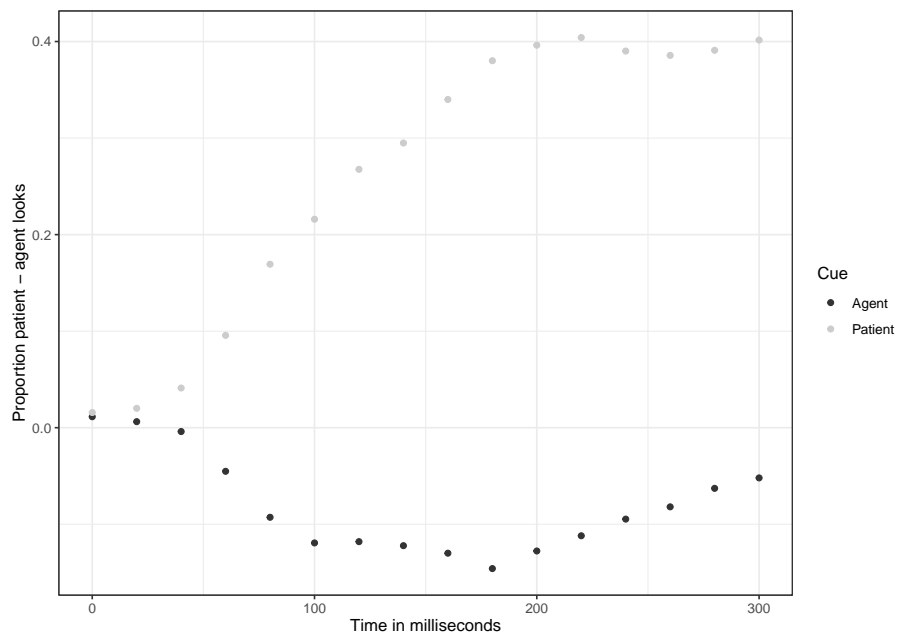

FIGURE 5.8: Proportion of looks to the agent area subtracted from looks to the patient area (*difference plot*) within the first 300 ms after the image onset in Experiment 3.

region were subtracted from the looks to the patient region to create the difference between the two regions of interest. The respective data are shown in Figure 5.8.

Eye movement analyses of the experimental trials revealed that the Cue manipulation had a reliable effect on the proportion of looks. The eye movement data were analyzed using a 2x2 repeated-measure analysis of variance (ANOVA) (following e.g., Hwang and Kaiser, 2015; Järvikivi, Gompel, and Hyönä, 2017) on both participants and items mean proportion of the difference between looks to the agent and patient area. 20 ms after the picture onset, there was a marginally significant effect of Cue in the subject analysis that was not significant in the item analysis ($F_{1(1,43)}$ = 3.301, p < 0.1, $F_{2(1,23)}$ = 1.289). There was a significant effect of Cue for both subjects and items in the 40 ms ($F_{1(1,43)}$ = 9.143, p < 0.01, $F_{2(1,23)}$ = 8.362, p < 0.01) and 60 ms time window ($F_{1(1,43)}$ = 24.25, p < 0.001, $F_{2(1,23)}$ = 36.56, p < 0.001). In sum, the Cue manipulation had a significant effect on participants' early eye movements, whereas the Question manipulation did not show any significant effects.

5.2.2.2 Speech onset latencies

A final dataset that was analyzed for this experiment are the speech onset latencies of participants, the time it takes participants to start their utterance after seeing the target picture. This measurement was a secondary aspect of the current experiment. Since each picture onset was accompanied by a short (200 ms) beep, the time between the beep and the onset of the utterance was manually analyzed using Praat (Boersma and Weenink, 2019).

The mean onset latency of participants in all four conditions was 1.8 sec and statistical analysis showed no significant effect of the experimental manipulations on the speech onset latencies. Figure 5.9 shows the speech onset latencies (in seconds) for the different structures produced (active, full passive, and short passive). The mean latency for active structures was 1.804 sec, 1.666 sec for full passive structures, and 1.901 sec for short passives.

To investigate whether speech onset latencies were significantly influenced by the respective structure produced in the target description, a linear mixed model including *latency* as dependent variable and *structure produced* (active, short passive, full passive) as its predictor was fitted. Results showed a marginal significant effect for full passive vs. short passive structures. There was no significant effect for the active vs. full passive responses on participants' speech onset latencies, suggesting that in this experiment, participants did not show significant differences in the time to prepare for active compared to full passive descriptions.
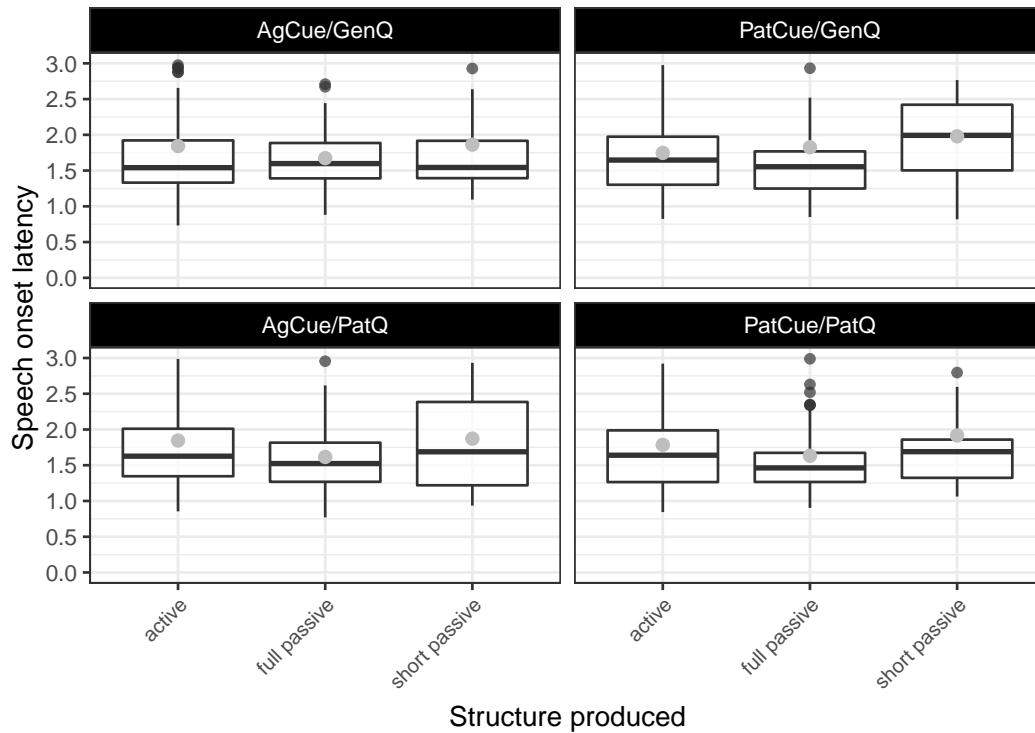
FIGURE 5.9: Speech onset latencies in seconds for the different structures (active, full passives, and short passives) produced in the four different conditions in Experiment 3. Zero represents the onset of the target pictures. Mean values are included as grey dots. Horizontal black lines represent the median.

5.2.3   Discussion

Experiment 3 investigated influences of implicit perceptual cueing and derived accessibility on sentence production. The results show that speakers are influenced by the topicalization manipulation that was carried out by using general and patient questions before the picture descriptions. The topicalization of the patient by asking *What happens to him?* leads to significantly more patient-initial sentences compared to a general question asking *What happens?*. The structural choices of the participants show that the more accessible patient is promoted to the subject position, resulting in a passive structure. In line with grammatical function and mixed models of accessibility, the derived accessibility of a referent showed effects on the grammatical function assignment. The possibility to front the object over the subject was not used by participants to promote the more accessible patient. This finding adds to the prior literature of cross-linguistic influences of derived accessibility on the choice of sentence structures (chapter 3). The topicalization of the patient via patient question shows

an universal influence on the grammatical encoding of speakers in the languages investigated so far.

The perceptual cueing manipulation of Experiment 3 does not show any significant influences on participants' structure choices. The analysis of the eye tracking data show that the cue was effective in attracting participants' looks. This result is not compatible with the proposal formulated by Myachykov, Thompson, Scheepers, and Garrod (2011), that speakers use the grammatical-role assignment mechanism (if *available*) to represent the attentional focus established by the visual cue. The derived accessibility manipulation clearly shows that the mechanism was available for speakers in Experiment 3. They did, however, not make use of it in reaction to the cueing manipulation. This finding replicates two further studies conducted in German. Reuters, Dolscheid, Esaulova, and Penke (2018) found no significant effect on the structural choices with an implicit cue. Their study did not include contexts, though an animacy manipulation in the target pictures was included. Whereas there was a significant influence on participants' structures due to the inherent conceptual accessibility manipulation, there was no significant influence of perceptual accessibility. Wu (2018) included contexts and also found no significant effects of the implicit perceptual cue on the structural choices of participants. The experimental manipulation of topicalizing one of the two referents did show significant effects on the structures produced. Taken together, the three different experimental studies on German show the same pattern: In descriptions of transitive action events, speakers of German use significantly more passive structures to promote the more accessible referent in terms of inherent or derived accessibility. Speakers show no influence of the perceptual accessibility of one of the referents. Speakers use the mechanism of grammatical function assignment to adjust to differences in terms of inherent and derived accessibility, but they do not employ this mechanism to promote a perceptually more accessible referent.

A possible modification of the claim made by Myachykov, Thompson, Scheepers, and Garrod (2011) is to limit their claim to cases of explicit visual cueing. The studies conducted so far which used an explicit cue (a cue shown for about 700 ms) are in line with their proposal. In studies on English (Tomlin, 1995; Myachykov, Garrod, and Scheepers, 2010), Russian (Myachykov and Tomlin (2008)), and German (Reuters, Dolscheid, Esaulova, and Penke, 2018) speakers showed significant influences of the explicit cueing in their structural choices. In line with the assumption that speakers use the grammatical function assignment, if available, to represent the cued entity, speakers of English and German used significantly more

passive structures when the patient of the action was cued. In both languages, passive structures have also been reported as the structural choice to adjust to inherent and derived accessibility needs (see chapter 3). The second assumption by Myachykov and colleagues, that speakers resort to linearization options if the grammatical function mechanisms is not easily available and passive structures are dispreferred, is borne out in the data on Russian. In Russian, speakers used object fronting instead of passive structures to promote the explicitly cued entity.

There are at least two important questions regarding the limitation of the proposal to explicit cueing paradigms. On the one hand, it is far from clear what speakers make of the explicit cue presented before or even during their picture description. Participants consciously notice the cue, but presenting a geometrical object at the position of a subsequent referent or while watching the event creates a questionable situation in terms of the *naturalness* of the task. In addition, two of the four studies using an explicit cue employed the Fish Film paradigm, a paradigm controversially discussed within the literature, as elaborated on in the introduction of this chapter.

The second, and most relevant, question relates to findings in English, which show that the explicitness of the cue did not result in significant differences in speakers' structural choices (Myachykov, Garrod, and Scheepers, 2010). Once again, this finding has merely been reported for English, a rigid word order language. In the more flexible language of German, one study (Reuters, Dolscheid, Esaulova, and Penke, 2018) reported significant differences based on the explicitness of the cue. By sticking with the proposal of Myachykov, Thompson, Scheepers, and Garrod (2011) limited to explicit cues, one would therefore have to explain why the explicitness of the cue causes significant differences in German, but not in English. At this point, it seems that even the limitation of the proposal by Myachykov and colleagues leads back to the basis for limiting their claim; the flexibility of the respective languages matter. Since this observation is based on only two studies so far, this argument is speculative rather than argumentative.

The finding of Experiment 3 (and the other studies conducted in German) supports the proposal made by Hwang and Kaiser, 2015. The authors argue that the several choices available in free word order languages might hinder, rather than facilitate, influences of perceptual accessibility (caused by implicit visual cueing). The hypothesis for Experiment 3 according to this proposal was borne out. German, typologically similar to Korean in the sense that speakers can use the grammatical function assignment as well as word order linearization to react to (lexical or perceptual) accessibility differences, showed the same pattern which was found for the other flexible languages investigated using implicit visual cueing. The open question of

how to reconcile this proposal with cross-linguistic findings of conceptual accessibility is taken up in the general discussion of this thesis (chapter 6).

In the following, further findings, shortcomings, and points of critique are discussed for the current experiment.

The main question of this experiment concerned the structural choices made by the participants to describe the target pictures. It has been argued that the experiment shows that the visual cue did not significantly influence participants in their structural choices. A possible objection to this result stems from findings obtained in Kuchinsky (2009).

Kuchinsky (2009) used implicit visual cueing in English. In Experiment 5 of her dissertation, she systematically varied the event (and referent) *codability* in the pictures presented to participants. She found a significant effect of visual cueing on speakers' structural choices when the depicted events were hard to interpret (i.e., when they had low event codability and were difficult to name). She argues that the location of a visual cue "*may only be influential when the event is difficult to name and when the cued character is easy to name*" (p. 112).

The picture materials used in this study were not matched for event codability. They were chosen based on a norming study and one could argue that by choosing the pictures that most frequently elicited the same verb, these were easy to interpret events. Therefore, the missing effect of a visual cue on structural choices might have been caused by easy to interpret events instead of a general absence of a cueing effect. There are several arguments speaking against this line of reasoning.

Unfortunately, a comprehensive evaluation of this possibility, which would be comparing the picture materials used in the different studies, is not possible based on the published articles. Kuchinsky (2009) used picture materials from Gleitman, January, Nappa, and Trueswell (2007) and Griffin and Bock (2000) in the transitive materials, which are the relevant materials for the question at hand. Of the 16 transitive events used in Kuchinsky's fifth experiment, 8 items were used as perspective predicate items in Gleitman, January, Nappa, and Trueswell (2007) and 8 items (5 *active events* and 3 *passive/active events*) were used in Griffin and Bock (2000). Notice that this picture composition differs from the implicit priming studies summarized in the introduction of this paper (and this experiment), in which perspective predicates are avoided. Three of the items used in Griffin and Bock (2000) are included in their article; *to squirt*, *to chase*, and *to shoot*. Without the five missing verbs and the codability ratings of the materials, comparisons with the current study are difficult to begin with. The structural choices in terms of active vs. passive structures were not the main aspect of Kuchinsky (2009), who was interested in the first mentioned character, and were thus not reported as such.

An argument for the assumption that the missing effect is not caused by low event codability comes from the fact that the event codability effect in Kuchinsky (2009, p. 112) came up in interactions with further manipulations: *"Specifically, the cueing effect was greatest when the cued character had high codability (was easy to name), but importantly this effect appeared much larger when the event had low codability (was difficult to name)"*. In the experiment presented in this chapter (as well as in Wu, 2018), the contexts introduced the subsequent nouns, which were therefore easily available to participants. A (small) effect of the cueing manipulation should therefore have been visible with easily interpretable events.

A strong argument for missing effects of visual cueing instead of a concealment of the effect due to low codability events comes from the homogeneity of (missing) effects in the different studies conducted so far. The studies conducted in German (including this experiment) would all need to have a strong low codability bias in their materials. An even stronger argument comes from those studies which used the same materials in different languages (Myachykov, Garrod, and Scheepers, 2010; Hwang and Kaiser, 2015) and found significant effects on the structural choices in one (English), but not the other – more flexible – language.

In terms of the collected eye tracking data, an important aspect of the current experiment was to make sure that the visual cue was effective. The analysis has shown that speakers' looks were significantly influenced by the visual cue of the agent or patient position of the subsequent picture. The eye tracking results also revealed a strong(er) preference for looks into the patient region. Speculatively, this finding may have been caused by the strong patient prominent contexts. Remember that in the last context sentence, only the referent that was going to be the patient of the subsequent picture was mentioned and further information was given about him. Just as for the production of passive responses in the general question condition, this speculation can be empirically tested by using the same materials and manipulations, but including agent prominent contexts.

A further point of this discussion concerns the speech onset latencies of the speakers in Experiment 3. Though these data were not of major interest in the current study, their analysis offers interesting issues for future work. The marginal significant difference between short and full passive structures offers a finding worth investigating in future experiments. Short passive structures are usually excluded from the analyses of production studies for reasons of meaningful comparisons between transitive active structures and respective full passive structures including the by-agent. Speculations about possible reasons for the (only marginally) longer speech onset times for the shorter version of the two passive structures are left out until there is further supportive evidence. There was no significant difference in

the speech onset latencies for active and full passive structures, the *classical* alternation, in this study. This finding runs counter to many findings of significantly longer speech onset times for passive compared to active structures (e.g., Ferreira, 1994 for English; Wu, 2018 for German, but see e.g., Sauppe, 2017 for no difference in the onset latencies for active and passive sentences in German). A possible influence of this finding due to the patient-prominent contexts stays as open question to investigate in future work. The same holds for the question whether there is a systematic relationship between (patient area) looks and speech onset latencies for the different structures.

A lot of psycholinguistic work is dedicated to the relationship between message encoding, eye movements, and speech onset latencies (*eye-voice span*). Even though the current data may potentially be informative in this regard, it was refrained from discussing the data within this area due to the strong contextual and visual manipulations. Whereas the patient prominent contexts alone may be an assessable influence on message encoding and the resulting data, the combination of the strong contexts, the even stronger question manipulation – once again acting upon message encoding – and the visual cue, that was always present in the experimental trials, is evaluated as too many influencing factors at once for a reasonable analysis in terms of message encoding.

When disregarding the contextual manipulations and the fact that there was no control (or baseline) condition, that did not include the experimental manipulations, the current data are also suggestive for the question of word- or structure driven grammatical encoding (see chapter 3 ans chapter 6). The effectiveness of the visual cue on the eye movement pattern paired with the missing effect on the structural choices argues for a structure-driven encoding process, in which speakers first apprehend the gist of the scene, and afterwards start to grammatically encode the syntactic structure. In other words, in the bridging from message to grammatical encoding, the perceptual *starting point* does not necessarily result in the (perceptually) more accessible entity as the sentence's starting point.

Before concluding, one last point of discussion concerns the comparison of the current experiment to Wu (2018), a very similar study on German. Wu also used a topicalization manipulation (in the second and third experiment) and visual cueing in his experiments. The nouns used in the target pictures were also introduced. The topicalizing manipulation was carried out by adding "sag mir bitte, was mit 'dem Topic' passiert" (*please tell me what happens to the "topic"*) before showing the target pictures. In the experiment presented in this chapter, there is a question asking "Was passiert?" (*What happens?*) or "Was passiert mit ihm?" (*What happens to him?*). The

TABLE 5.4: Percentages of active responses in Wu (2018) and Experiment 3.

	agent topic	patient topic	general question
Wu (2018)	100%	3%	—
Experiment 3	—	46%	74%

mean percentages of active SO responses (the default structure) in the experiments are summarized in Table 5.4.

Both studies found the same overall pattern in terms of structural choices. Speakers are influenced by the topicalization manipulation, but they are not influenced by the visual cue in their structure choice. The rates of structures produced in the different condition differ within the studies. There are at least two important differences that add to the different rates of active (and corresponding passive) structures. First, in Wu (2018), the agent topic condition, which caused 100% active responses, asked directly for what happened to the agent. In Experiment 3 presented here, there was no isolated active topic condition but a general (neutral) question. Though one might expect that participants also produce 100% active SO structures in the general question condition, it has to be kept in mind that Experiment 3 used patient prominent contexts in all experimental trials, a second difference to Wu (2018). The decreased rate of active structures may have been caused by this patient prominence or salience manipulation of the contexts (in line with Prat-Sala and Branigan (2000) who found significant differences in the structural choices of speakers after a general question for agent- vs. patient-salient conditions). The hypothesis that the rate of responses in Experiment 3 is influenced by the patient prominent contexts can (and will) be empirically tested by using the same materials, but agent prominent contexts.

In the patient topic condition of Wu (2018) and Experiment 3, the active rates also differ. While in Wu (2018), the patient topic manipulation almost completely reversed the structural choices (with only about 3% actives), there remained around 46% of active structures in Experiment 3. Once again, there are at least two possible explanations for this difference. On the one hand, there is the difference in linguistically realizing the topicalization. Whereas the noun was explicitly rementioned in the prompt of Wu (2018), there was an isolated question in Experiment 3, that included a pronoun instead of the lexical item itself. On the other hand, though the tasks were very similar, there was no response time restriction imposed on participants in Wu (2018). In Experiment 3 participants were limited in their time to describe the target pictures.

In sum, the combination of the experiments conducted by Wu (2018) and

Experiment 3 of this thesis nicely strengthen the conclusion that there are influences of derived accessibility on speakers' structural choices in German. They also allow for the observation that there is no influence of perceptual priming in form of visual cueing on the use of structural options in German.

TABLE 5.5: Prior cross-linguistic work investigating implicit perceptual priming and structural choices by using visual cues.

Typological status of the language	Influence of implicit visual cue	Studies
rigid word order	**grammatical functions**	
English		Gleitman, January, Nappa, and Trueswell, 2007; Myachykov et al., 2010; Hwang and Kaiser, 2015
flexible word order	**no effect**	
Finnish		Myachykov et al., 2010;
German		Reuters et al., 2018; Wu, 2018; Experiment 3;
Korean		Hwang and Kaiser, 2015

In conclusion, the current experiment shows that speakers of German show systematic effects of derived accessibility – in terms of topicalizing one of two referents via questions – on their structural choices. To promote the more accessible referent (or *topic*) during grammatical encoding, speakers use the grammatical function assignment, resulting in passive structures, rather than object fronting. This finding is a replication of studies on German as well as cross-linguistically. *Topics make good starting points*. The second experimental manipulation, the presentation of an implicit perceptual cue prior to the onset of the target pictures, does not show any significant effects on participants' structural choices. In line with perceptual priming studies on German and other flexible languages, such as Finnish and Korean, the visual cueing manipulation was effective in attracting participants' eye movements, but does not cause participants to promote the perceptually more accessible element in their sentence structures. This finding stands in contrast to English, where several studies show that the visual cue not only attracts participants' looks, but also significantly influences their structure choices. *In English, a structurally rigid language, the attentional focus in form of a perceptually cued entity makes a good starting point. In flexible languages, which license structural options not only via grammatical function assignment, but also*

via scrambling, the attentional focus in form of a perceptually cued entity does not make a good starting point.

In line with the proposal put forward by Hwang and Kaiser (2015), the cross-linguistic pattern of implicit cueing effects on structural choices diverges based on the structural flexibility of the languages investigated so far. The summary table given in the introduction of this chapter is re-arranged in Table 5.5 to capture this pattern. A first approach towards the *why* of this pattern instead of just summarizing it, is found within the next chapter, the general discussion of this thesis.

Chapter 6

General Discussion

It goes on
and on
and on
and on
and on
and on
and on
forever.

Argyle Goolsby – Your enemy's best friend

The final chapter of this thesis presents a short summary of the findings obtained in the experiments. Afterwards, the research reviewed and the experimental work conducted within this dissertation are embedded within a more extensive frame of (psycho)linguistics. Several open questions as well as first approaches for future work are presented on the basis of the previous chapters.

6.1   Summary

The current thesis investigated different aspects of *accessibility* during language production in German.

Three experiments showed that *conceptual accessibility* influences speakers' grammatical encoding. Animacy, a factor of *inherent conceptual accessibility*, showed significant effects on speakers' structural choices. To promote an animate patient over an inanimate agent, speakers of German employ grammatical function assignment, resulting in passive structures. This finding is in line with prior cross-linguistic work investigating influences of conceptual accessibility on grammatical encoding.

Speakers also use grammatical function assignment to adapt to the *derived accessibility* of referents. A *topicalization* manipulation in form of questions asking about one of two referents led to significantly more passive responses than a general question not highlighting one of the referents. This

finding replicates prior-cross linguistic work within the domain of derived accessibility.

Influences of conceptual accessibility on grammatical function assignment are in line with *grammatical function models of accessibility effects* (e.g. Bock and Warren, 1985). In the conducted experiments, accessibility only influenced the level of functional processing within the classic two-stage architecture of grammatical encoding during language production (see chapter 3). Participants produced passive structures to promote more accessible entities and did not produce object-fronted structures, a structural option also given in German (see chapter 2).

A comprehensive review of cross-linguistic work of accessibility, given in chapter 3, suggests however that conceptual accessibility can influence both functional as well as positional processing. The literature review and the subsequent discussion showed that the cross-linguistic production pattern is not reconcilable with mere grammatical function models of accessibility.

The results in terms of conceptual accessibility are also informative for linguistic accounts of filling the German prefield (chapter 2). The hypothesis that animacy as well as topic status are important factors in the use of non-canonical structures was derived from general accounts of word order variation (e.g., Siewierska, 1988) as well as linguistic accounts of the German prefield (e.g., Frey, 2006; Speyer, 2010). The production data obtained in the three experiments support this hypothesis.

The finding that speakers only employed passive structures instead of object-fronted structures suggests that object-fronted structures require "stronger" licensing conditions than passive sentences. These conditions as well as further possible influences due to different tasks (see chapter 3) must be left for future research.

Experiment 1 and 2 show that, in addition to a preference for animate entities preceding inanimate entities, speakers can be *structurally primed*. Structural priming of passive structures led to significantly more passive responses compared to (intransitive) baseline structures. This holds for monologue settings (Experiment 1) as well as dialogue settings (Experiment 2). Deriving the accessibility of a specific structure by structurally priming it influences speakers' structural choices. This finding is in line with studies investigating structural priming in different languages. Yet, the literature review suggested that many open questions are left for future work. The prevalence of studies investigating dative structures, compared to studies investigating transitive structures, indicates a first aspect worth investigating.

Whereas a comprehensive literature review as well as the experimental work conducted within this thesis suggest that animacy and topicalization

may exert universal influences on language production, *perceptual accessibility* does not seem to have this potential (chapter 5). In line with previous cross-linguistic work, perceptual priming in form of an implicit visual cueing manipulation (Experiment 3) did not show significant effects on speakers' structural choices in German. These findings contrast with findings obtained for English, suggesting that language-specific characteristics in terms of word order flexibility may influence effects on grammatical encoding during language production. A growth of the (currently) small number of studies investigating structural choices within the domain of perceptual priming will allow future evaluations of (non)universal influences due to perceptual priming.

In conclusion, this thesis shows that for speakers of German, animate entities as well as topics make good sentential starting points. Good sentential starting points are realized as sentence-initial subjects of passive structures (occupying the German prefield). The production of passive structures can also be structurally primed. Speakers are more likely to produce a passive structure after having produced a passive (compared to different structures). Speakers are also more likely to produce a passive structure after having heard a passive (compared to different structures) from a linguistic interlocutor. Perceptual starting points, instantiated via implicit visual cueing, do not make good sentential starting points for speakers of German.

6.2 Outlook

The following outlook starts with a discussion of methodological aspects based on the two phenomena investigated in this thesis, structural and perceptual priming, in section 6.2.1. The (methodological) level is enlarged in section 6.2.2, discussing the importance of cross-linguistic work within the general domain of language production. Finally, in section 6.2.3, the relevance of language production research, with a focus on the special status of structural priming, is integrated within future work of language processing.

6.2.1 Methodological aspects

6.2.1.1 Structural priming and structural alignment

In their recent *"experimental approach to linguistic representation"*, Branigan and Pickering (2017) argue for the ability of structural priming to tap into (abstract) linguistic representations. Structural priming has been found in

the absence of word repetitions, in the absence of repeated metrical structures, and between structures of different event types, arguing for *"consistent priming of representations that are specified for syntactic information but not semantic, lexical, or phonological information"* (p. 2).

Though the authors indicate that structural priming can also inform further levels of linguistic structure, the proposal made by Branigan and Pickering (2017) focuses on the ability of priming to provide evidence about syntactic representations – as usually done on the basis of *acceptability judgments*.

Note that their account touches on the *big question* about the relationship between representations of grammar and representation of language processing (e.g. Lewis and Phillips, 2015). There are at least two overarching positions concerning this relationship. The first position is that during processing, *"the grammar is drawn upon directly"* (p. 3). The second position is that grammar and processing form two distinct systems and that *"the grammar is not used directly in processing"* (p. 3). Branigan and Pickering (2017) argue for the first and simpler assumption, summarized in the following quote:

> *"We therefore assume – in the absence of compelling evidence to the contrary – that there is a single representational system for language structure, which is implicated during language processing, and that people do not have other (inaccessible) mental representations of language structure. If any such representations were to exist, they would clearly be of interest. But they do not form part of our account, and it is for theories that propose such representations to motivate them and to specify the mapping between them and those used in processing."*
>
> (Branigan and Pickering, 2017, p. 3)

Under this approach, structural priming offers an important tool to investigate structural representations and provides the possibility to inform syntactic theory - in addition to (or even instead of) judgment data. The careful design of prime and target structures in terms of features or properties of different linguistic levels builds the foundation of future research within this domain. Whereas at this point, the prevalence of structural priming studies investigating dative structures enables some first steps in this direction, much less is known about structural priming of the active/passive alternation. Although this observation also holds for passive structures in English, the desideratum is even bigger in cross-linguistic research, and also in German. The experimental materials used in this dissertation do not allow an evaluation of the syntactic representations behind passive priming. They only provide a first step, with the successive removal of overlapping factors in terms of verbs, event structure, and conceptual features being one possibility to approach the representations

involved.

In a recent proposal, Scheepers (2019) offered a starting hypothesis for the investigation of syntactic representations behind the structural priming of passives. Based on the finding of Bock and Loebell (1990) that passive and active locative structures were equally strong in priming passive structures in English, Scheepers noticed that syntactically, both structures can be represented as intransitive structures including a PP.[1] To investigate the question whether the intransitivity, the PP-adjunction, or both factors are contributing to effects of structural priming, Scheepers (2019) proposed to investigate active transitive structures, example (1), intransitive passive structures, example (2), and intransitive active structures, example (3), without (a) and including by- (b) or locative (c) PPs:

(1)   a.   The construction worker was driving the bulldozer.
        b.   The construction worker was driving the bulldozer by the lake.
        c.   The construction worker was driving the bulldozer near the lake.

(2)   a.   The construction worker was hit.
        b.   The construction worker was hit by the bulldozer.
        c.   The construction worker was hit near the bulldozer.

(3)   a.   The construction worker was digging.
        b.   The construction worker was digging by the bulldozer.
        c.   The construction worker was digging near the bulldozer.

Note that different from usual studies investigating structural priming of the active/passive alternation, target responses in form of short passives have to be included to evaluate the priming effects.

In German, the current availability on data investigating structural priming of the active/passive alternation is rare. The influence of thematic structure in passive priming has (to the author's knowledge) not been investigated. Though the hypothetical materials cannot be adopted or translated easily to German, the investigation of structures allowing to distinguish thematic and syntactic influences on priming offers a first approach for future work.

Independent of the assumption of unified or distinct syntactic representations of grammar and processing, the investigation of processing representations via structural priming offers further applications. A big domain, which was only mentioned indirectly so far, is the use of structural priming

---

[1]Scheepers represented the structures within the framework of Lexicalized Tree Adjoining Grammar (LTAG; see e.g., Joshi and Schabes, 1997; Ferreira, Lau, and Bailey, 2004; Mazzei, Lombardo, and Sturt, 2007; Bangalore and Joshi, 2010), with both structures being represented as intransitive initial verb trees with VP adjoining prepositions.

in language processing of different populations (see the references given in chapter 4 and Pickering and Ferreira, 2008 for a review).

Within the area of language acquisition, for example, structural priming can be used to address questions about the similar or different nature of structural representation in language processing of children vs. adults or in questions about item-based vs. general (abstract) knowledge.

In the domain of bilingualism, structural priming is used to investigate questions of second- vs. first language learning, codeswitching, and shared representations between languages.

Note that structural priming can also be used to investigate linguistic interaction and learning effects in student-teacher relations (e.g., Hesketh, Serratrice, and Ashworth, 2016; Hite, 2016).

Another important aspect in the research domain of structural priming concerns the applicability within the domain of impaired language processing. In the following passage, the benefit of structural priming is exemplified for some of the research conducted in language processing of aphasic patients.

Findings of several studies suggest that the mechanisms of structural priming are available for aphasic patients. Though the patients are known to have problems in the processing of non-canonical structures, such as passives, participants showed significant effects of structural priming in the production of passive responses. Saffran and Martin (1997) structurally primed five English speaking patients with *"structural difficulties in sentence production"* (p. 878). Using the structural priming paradigm of Bock (1986b), they investigated both transitive (active vs. passive) and ditransitive (PO vs. DO) structures. The patients showed significant effects of the structural priming in the production of passive responses, whereas there were no significant effects for active sentences or ditransitive structures. Note that Saffran and Martin (1997) also found an indication that the priming effect may persist over time. The authors included a pre- and post-test elicitation task in which participants had to describe pictures. The proportion of passive responses increased from 0.30 in the pre-test to 0.49 in the post-test of the patient group. Though this difference was not statistically significant, numerically more passive responses emerged in the elicitation task following the structural priming.

Lee, Man, Ferreira, and Gruberg (2019) investigated aphasic sentence production using structural priming in a dialogue setting. In the experimental game designed for their study, a confederate and a participant took turns in describing blocks of pictures to an interlocutor. The participant and the confederate could not see each other. The confederate began and described several pictures (cards) using transitive, ditransitive, and locative

structures (the prime structures). The participant, who had the same pictures as the confederate lying on her table, had to arrange the cards in the mentioned order. After a block of 12 cards, it was the participant's turn to describe the same pictures (the *production block*) while the confederate should arrange them in the right order. The authors investigated effects of *syntactic entrainment, "the participant's tendency to re-use the same sentence structure as the confederate experimenter to refer to the same picture card during the production block"* (Lee, Man, Ferreira, and Gruberg, 2019, p. 7). In the first experiment, the patient group only heard the descriptions given by the confederate. In the second experiment, the patients had to repeat the sentence produced by the confederate before arranging the cards. Whereas the patient group showed no significant effects of syntactic entrainment in the first experiment (different from the young adult control group), they showed significant effects in the second experiment. Thus, whereas people with aphasia did not significantly re-use the structure chosen by the confederate after only hearing the structure, they showed significant re-use of the structures after hearing and repeating the confederate's sentence. Note that the target descriptions in this study did not follow the prime sentences directly. Based on the block design of the game, the prime and target trials were separated by 10-12 trials.

Hartsuiker and Kolk (1998a) conducted an important study of structural priming with Broca patients in Dutch, using the structural priming paradigm of Bock (1986b). In their study, participants took part in three experimental sessions, separated by at least three weeks. In the first session, the prime sentence was presented both visually on a screen and was read aloud by the experimenter before participants had to repeat the sentence. In the second session, the memory part of Bock's design was dropped and participants did not have to indicate whether a sentence or picture had appeared before. In the third session, participants were explicitly instructed to reuse the prime structure for their target description.

The results of their study for the transitives show that aphasic patients produced significantly more passive responses following passive primes (compared to active primes) in all three sessions. Note that the control participants, matched in age and educational background with the patients, only showed significant effects on the production of passive responses in the third session. Thus, whereas the patient group showed automatic effects of structural priming, the control group only showed strategic effects, with a significant re-use of syntactic structure occurring only when explicitly told to repeat the prime structure.

In sum, experimental work of structural priming in aphasic patients shows that although the production of non-canonical passive structures is impaired in patients' language processing and although participants do not

or only rarely produce passive structures spontaneously, the production of passive responses can be primed. The results suggest that the mechanisms of structural priming can help participants to temporarily overcome processing difficulties, offering important implications for language treatment. Given the limited amount of research within this domain, a first important step is the further investigation not only of structural priming in general, but also regarding possible differences based on the presentation modality of the primes. A further finding in need for future research is the result of Hartsuiker and Kolk (1998a), that whereas aphasic patients showed significant effects of (automatic) priming, the control group did not. Taken together with the reviews and discussion about cross-linguistic differences in structural priming in chapter 4, several questions arise.

The first one concerns the mixed results in the priming literature on Dutch. Hartsuiker and Kolk (1998b) found different patterns in their study. In one of three experiments, they found a significant effect on the production of passive structures. In the other two experiments, there was no reliable effect of the prime structure on the passive target descriptions. In their experiments, the verbs between prime and targets were never repeated. Segaert, Wheeldon, and Hagoort (2016), on the other hand, found significant effects of passive primes on the production of passive targets both when the verb was repeated between prime and target and when it was non-identical. The data of unimpaired speakers in Hartsuiker and Kolk (1998a) did not show significant effects of (implicit) structural priming for the control group (with a mean age of 53 years compared to student participants in the two further studies on Dutch). The inconsistent pattern of structural priming (of the same structures) within one language suggests that differences in materials and tasks used constitute important aspects for future research within the domain of structural priming.

The second question concerns the different finding of the aphasic patients and the control group in Hartsuiker and Kolk (1998a). Although the finding of one single study does not establish a sufficient basis for argumentation, the results point towards a question worth investigating in future research. The missing effects in the production of healthy adults compared to the existing effect of aphasic patients suggest that effects of structural priming may also be influenced by the necessity of employing the priming mechanisms. Whereas the mechanisms may establish a support in impaired language processing, an unimpaired language processor may be less susceptible to employ the mechanisms, because it (simply) does not need to. Note, however, that this does not mean the processor cannot employ it. The (missing) gain of being structurally primed might, however, be one of the many factors influencing magnitudes of structural priming. The study of Hartsuiker and Kolk (1998a) was conducted in a monologue setting. The joint interaction in dialogue settings may, on the

other hand, create a further (positive) influencing factor adding to the overall susceptibility of the language processor towards structural priming. Together with the finding of Lee, Man, Ferreira, and Gruberg (2019) that aphasic patients showed syntactic entrainment after having produced, but not after having heard the primes, more questions than suggestions worth pursuing in future research arise at the present time.

In sum, investigations of structural priming offer important opportunities for future research. The reviews and prospects given in this passage aim to show that structural priming can not only be informative about (abstract) linguistic representations, but also about representations in different populations. The variety of possible tasks to investigate structural priming allows the inclusion of various different populations – and the comparison of several groups. Along with the importance for linguistic research, structural priming is one of the phenomena applicable and helpful in applied domains of linguistics.

6.2.1.2 Visual attention and structural choice

In this section, some of the advantages of investigating language production in the context of visual processing, in addition to syntactic choices, are summarized and connected to central research questions. The combination of eye tracking, an online method, with offline structural choices offers the opportunity to investigate the time course of language production. This advantage may be especially important in light of the *starting point problem* (see also chapter 3). Given the assumption that the most accessible or most prominent element becomes the starting point of grammatical encoding, *"eye tracking seems to offer unprecedented validity as a method for addressing this traditional hypothesis"* (Bock, Irwin, and Davidson, 2004, p. 249).

The literature review of visual attention (in form of implicit cues) and structural choices has shown that there are mixed results regarding perceptual effects on grammatical encoding. Whereas an implicit cueing manipulation has repeatedly been shown to affect grammatical encoding in English, there is no reliable effect in flexible word order languages.

In their review of syntax in language production, Bock and Ferreira (2014) assign a central role to findings of implicit cueing in the discussion about *word- vs- structure driven* sentence formulation (see also Figure 3.3 and Figure 3.4). The findings of Gleitman, January, Nappa, and Trueswell (2007) have shown that speakers of English are more likely to mention referents that have been implicitly cued as the first element in their target sentences. This finding is in line with word-driven sentence production, because the referent initially perceived enters the initial position of the sentence.

In line with structure-driven production, on the other hand, Kuchinsky (2009) found the assignment of the cued element to the first position of the sentence to be dependent on the codability of the depicted event (see also section 5.2.3). In less codable events, i.e. events that are hard to interpret, Kuchinsky replicated the effect of Gleitman, January, Nappa, and Trueswell (2007). The referents cued using an implicit visual cue were more likely to occupy the initial position of the target picture description. For easy to interpret events, on the other hand, the cueing manipulation did not result in cued referents being more likely mentioned in the initial position of the picture description. According to Bock and Ferreira (2014), the findings of Kuchinsky (2009) and further studies investigating eye movements and language production (e.g, Norcliffe and Konopka, 2015), show that speakers can also employ structure-driven sentence production. In structure-driven production, relational information about the event and the role of the involved referents is assembled before speakers start their sentences. Although there is evidence for both word- and structure-driven production in English, the different roles the two formulation mechanisms play during language production are largely unknown, as formulated in the following quote:

> *"What is harder to assess is how common structure-driven formulation occurs relative to word-driven formulation, or how common the circumstances are that promote one or the other.*
> *The honest answer is that we do not know."*
>
> (Bock and Ferreira, 2014, p. 29)

The essential property of incrementality during language production is covered by both mechanisms. Note, however, that linear incrementality is only entailed in word-driven production, whereas structure-driven production is hierarchically incremental (Bock and Ferreira, 2014).

The picture regarding word- and structure-driven production on the basis of perceptual priming during language production gets even more complicated when including cross-linguistic research. The eye tracking studies conducted in more flexible languages (including the third experiment of this thesis) did not show significant effects of visual cueing in the assignment of the initial sentence and/or subject position. Within the account discussed in this section, this pattern represents missing evidence of word-driven production and, consequentially, of linear incrementality.

Next to the need of future research investigating circumstances of word- and structure driven production, important empirical research within the domain of language production therefore has to explore word- and/or structure-driven production in more flexible languages. The manipulation of event codability in experimental research represents a first important

step into this direction.

Fifteen years ago, Bock, Irwin, and Davidson, 2004, p. 261 argued that *"because empirical work on eye tracking coupled to production is in its infancy, there are relatively few findings relevant to the starting point hypothesis"*. Although in the meantime, there have been many many studies monitoring eye movements during sentence production, the starting point hypothesis continues to be in need of further empirical research. In sum, the review in this section has shown that research investigating perceptual and structural starting points has provided important findings regarding the transition between levels of message and grammatical encoding. The classic debate by Paul and Wundt (see chapter 3) has been informed with findings of English speakers employing both word- and structure-driven production, whereas the situations causing one or the other remain largely unknown. An even bigger uncertainty arises within the domain of different languages, language-specific grammatical characteristics, and perceptual influences on language production.

6.2.2   Cross-linguistic language production

The discussion so far shows that for both phenomena investigated in this thesis, one arrives at a point where it is stated that *"Research in English . . . , but in more flexible languages . . . "*. The following section summarizes some important findings from cross-linguistic production research that reveal the necessity to enlarge the scope of languages in future research.

This dissertation started out with a short introduction to linguistic characteristics of German (chapter 2), which led the way to a review of functions of non-canonical structures (section 2.3). Before turning to psycholinguistic investigations of non-canonical structures, a word about the relationship between linguistic and psycholinguistic research investigating the filling of the German prefield position is advisable. Note that the following observation also holds for the more general pattern of theoretical and psycholinguistic accounts to word order variation and the role of sentence-initial positions specifically.

Though the main aspect of including a linguistic background was to offer an overview for readers not familiar with the structural characteristics of German, there is a deeper reason to include theoretical accounts of non-canonical structures. Linguistic accounts of filling the prefield (e.g., Frey, 2006; Speyer, 2010) as well as cross-linguistic work about the functions of non-canonical structures (e.g., Siewierska, 1988) revert to the notion of *topic*. Furthermore, the role of *animacy* as well as thematic roles is apparent from

several hierarchies of both factors proposed to to capture grammatical function choice, linearization, and the likelihood of becoming a topic (see chapter2). The first important observation is the similarity of factors proposed in linguistics and factors subsumed under the notion of conceptual accessibility in psycholinguistics in the investigation of word order variation. Although the term of conceptual accessibility is not explicitly included in linguistic accounts, it is incorporated indirectly. This holds for inherent accessibility, factors such as animacy which are intrinsic features of the referents, as well as derived accessibilty, a temporary advantage of one of the referents given the discourse or context.

The conceptual similarity (and terminological confusion) continues in the case of *information structure*, a term classically used in linguistics, and *perspective*, a term primarily used within psycholinguistics. The concrete factors subsumed under these umbrella terms are in many cases very similar if not the same.

In sum, the observation formulated in the above passage suggests an important gain in bringing together linguistic and psycholinguistic accounts to word order variation (more specifically, non-canonical structures) more closely than done today. Linguistic accounts can profit from the empirical data collected in psycholinguistic research as well as the potential of experimental work to manipulate and disentangle often confounded factors. Psycholinguistic accounts, on the other hand, can profit from the linguistic research on functions of non-canonical structures and, especially, cross-linguistic similarities and differences in connection to language-specific (typological) characteristics.

The importance of language-specific properties in terms of word order variation paves the way for the next point of discussion, the importance of cross-linguistic patterns in influences on grammatical encoding during sentence production.

In research of factors influencing grammatical encoding in language production (chapter 3), cross-linguistic studies have shaped assumptions of language production models substantially. Prior work of both inherent and derived accessibility (summarized in Tables 3.1, 3.3, 3.4, and 3.6) has, for example, essentially influenced the discussion about *grammatical function* and *word order models* of conceptual accessibility (e.g., section 3.2.2). The prevalence of experimental studies conducted in English leads to a bias which can only be counterbalanced with cross-linguistic work. In the domain of conceptual accessibility, the review has shown that proposals such as the grammatical function model of accessibility, which assumes that only functional processing can be influenced by accessibility, cannot account for the cross-linguistic pattern. Note that it is fully compatible, though, with the pattern

found in English. However, given the limited flexibility during grammatical encoding in English, this finding may be expected.

One way to keep the classic "two-stage architecture" (see, for example, section 3.1.2) is the modification of grammatical function (and word order) accounts of accessibility to *mixed* accounts – a modification incorporating the findings that both functional and positional processing can be influenced by accessibility. The circumstances and relationships to structural characteristics of different languages leading to influences of one, the other, or both remain an important area for future research.

Note that the challenge of psycholinguistic research does not only involve influences of cross-linguistic characteristics to language production, but also the further investigations of influences due to the different nature of the tasks employed in experimental research on language production. Differences emerging in the comparison of studies using diverging tasks are found not only within research on accessibility (included in, for example, Table 3.1), but also in the domain of structural priming (chapter 4 within one and the same language).

A second option proposed in the literature to accommodate cross-linguistic findings of accessibility, which received independent evidence from studies of structural priming, is the modification of the two-stage architecture (Figure 6.1) to an one-stage architecture (Figure 6.2), with the language processor specifying both grammatical functions and linear order in a single stage (e.g., Branigan, Pickering, and Tanaka, 2008; Cai, Pickering, and Branigan, 2012; Pappert and Pechmann, 2014).

In sum, cross-linguistic investigations of language production have not only been used to evaluate components of the model architecture in language production research, but they have also suggested the modification of central components of the model itself. There is a need for future (cross-linguistic) work to find (counter)evidence for/against the differing proposals, in this case to inform *stages of grammatical encoding*.

Within research on structural priming (chapter 4), cross-linguistic differences might be one of the reasons adding to the prevalence of English over other languages on the one hand, and of studies investigating the dative alternation compared to the active/passive alternation on the other hand.

Experiments investigating language production (chapter 3) have shown that grammatical function assignment is the central way of English speakers to adapt to accessibility needs. Given the rigid word order of English, this is strictly speaking the only way (excluding structures such as left-dislocations which are subject to contextual conditions usually not present in the studies discussed) to promote a more accessible entity.
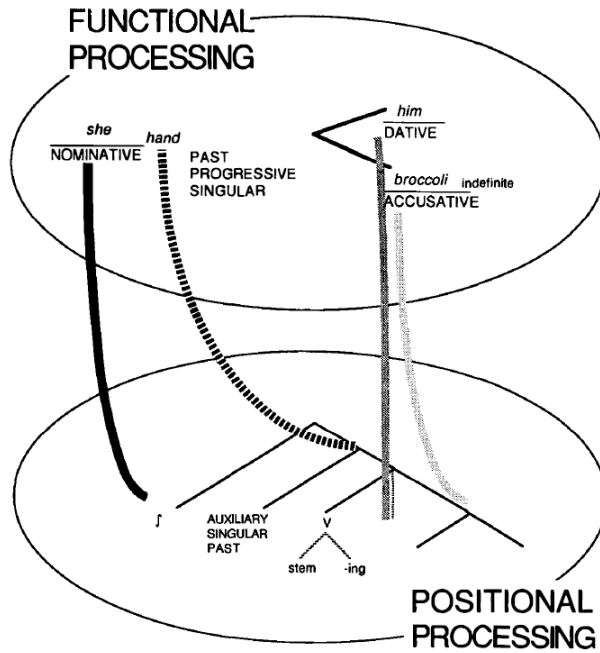
FIGURE 6.1: Grammatical encoding of "She was handing him some broccoli" within the two-stage architecture (Bock and Levelt, 1994, p. 977).
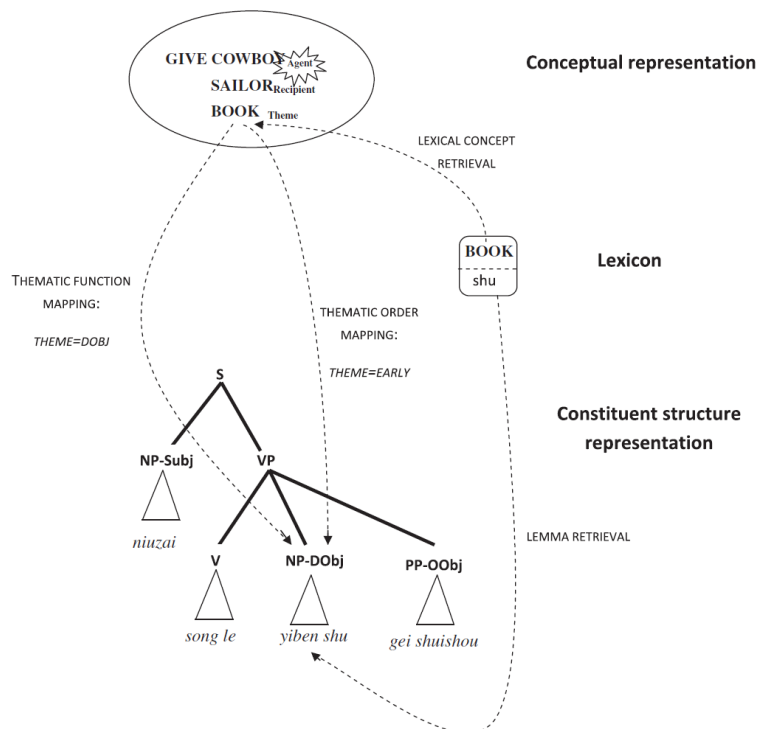

FIGURE 6.2: Grammatical encoding of "The cowboy gave a book to the sailor" ("*Niuzai song le yiben shu gei shuishou*" in Mandarin Chinese) within the one-stage architecture (Cai, Pickering, and Branigan, 2012, p. 845).

Although findings of structural priming of transitive structures have been replicated in English several times, the majority of priming studies in English includes dative structures. The *classic* demonstration of structural priming by Bock (1986b) showed stronger priming effects for dative compared to transitive structures.

Another important finding from Bock (1986b) with regard to transitive structures, which is often neglected in the literature, is the fact that in two out of three experiments, "*descriptions of human agent events were essentially immune to the priming manipulations*" (p. 373). Given the immunity of animate agent events (which was only suspended in the third experiment, strictly balancing the left-right orientation of the agent in the pictures) combined with the low proportions of passive responses for events including two animate referents in English (a language with passives being the most common structure to adjust to, e.g., accessibility needs), missing cross-linguistic studies of structural priming for the active/passive alternation may be not that surprising. Structural priming of passive sentences (alone) may not be strong enough to override the default structure, especially in monologue compared to dialogue settings, for events including animate entities. In line with this assumption, although there are many studies of structural priming conducted in further (and more flexible) languages, most of them include dative structures (compared to transitive structures).

A combination of events including animate patients and inanimate patients, as done in Bock (1986b) and Experiment 1 and 2 of this thesis, together with events including animate agents and animate patients may constitute a helpful manipulation for future cross-linguistic studies of structural priming. The inclusion of an animacy manipulation ensures that, at least in cases of animate patients and inanimate agents, passive structures are *licensed*. Once speakers' language processor has licensed, or rather initialized, the passive within the experiment, structural priming of passives might more rewardingly be investigated. Note that this does not mean that possible priming effects are carried by the animacy manipulation. Statistical analyses allow for the investigation of main effects and/or possible interactions.

The inclusion of derived accessibility offers another (maybe even more promising) way to investigate structural priming cross-linguistically. *Topicalization* as one factor shaping *information structure* or *perspective* in language production, has been shown to exert even larger influences on grammatical encoding, more specifically on grammatical function assignment. Though the implementation of derived accessibility within structural priming experiments may be less straightforward and more challenging than manipulations of inherent accessibility, such as animacy, it might also be more rewarding, given findings within accessibility effects on language production.

A third possibility to investigate structural priming for transitive structures is offered by the replicated finding of lexical boost effects. Both cross-linguistic studies (including repeated verb and different verb conditions) as well as the meta-analysis conducted by Mahowald, James, Futrell, and Gibson (2016) suggest that the lexical boost is a very strong, or even the strongest, factor (or moderator) influencing the magnitude of structural priming.

A last opportunity to overcome possible immunity to structural priming in case of events including two animate entities is offered by dialogue studies. Priming studies conducted in dialogue settings (summarized in 4.4) have shown structural alignment of passive structures for animate agent and animate patient pairings. Though the number of dialogue studies within the context of structural alignment is rather low at this point, the (numerical) comparison, drawn in section 4.4.3, between English, Experiment 2 of this thesis, and Japanese also provides first hints that the flexibility of the respective languages influences the magnitude of structural alignment. Without doubt, a more detailed investigation of the mentioned aspects is necessary.

In sum, the current section suggests that the (missing) licensing of specific non-canonical structures, such as passive sentences, may be an important factor contributing to the imbalance within the structural priming literature. Supposedly, and underpinned based on research not specifically investigating structural priming, the licensing factor furthermore interacts with the flexibility of the languages investigated. To better understand structural priming and alignment of different structures and influences due to language characteristics, future research is offered several starting points (both regarding manipulations and tasks/settings).

In the words of Branigan and Pickering (2017, p. 47), *"failure to find priming does not demonstrate that it does not occur; a study may have been insensitive or underpowered"*. Note that the aspect of (statistical) power can be estimated based on helpful recommendations offered in the meta-analysis of structural priming conducted by Mahowald, James, Futrell, and Gibson (2016). The authors give advice for both number of items and subjects (depending on the effects or moderators to be investigated) in terms of sufficient statistical power. Indications for aspects regarding the sensitivity (of the structures to be investigated) have been given within the literature reviews and the discussion in this section.

Within research of perceptual priming (chapter 5), the difference between English and more flexible languages is more evident than in any other of the domains discussed in this thesis. Whereas accessibility factors, such as animacy and topicalization (in form of questions asked) seem to show

universal influences on language production, influences of perceptual (visual) cues diverge when comparing English with more flexible languages.

The data obtained in Experiment 3 do not support the assumption of Myachykov, Thompson, Scheepers, and Garrod (2011) that speakers use grammatical function assignment to represent the attentional focus and linear orderings when this assignment is not easily available. The results of Experiment 3 show that speakers employ grammatical function assignment to represent the more accessible, the topicalized, element. At the same time, there is no significant influence of the perceptual accessibility (the attentional focus) on speakers' structural choices.

Note that speakers also showed no use of linear ordering of the constituents in reaction to the perceptual manipulation, a structural option available in German in form of OS active sentences.

The results of Experiment 3 support the claim of Hwang and Kaiser (2015) that perceptual accessibility instantiated as implicit visual cueing (a factor subsumed under the term lexical accessibility in their account) may hinder, rather than facilitate, grammatical function assignment in flexible languages. This observation unveils several follow-up questions for future investigations. The first one concerns the fact that the hypothesis of Hwang and Kaiser (2015), at this point, is rather an observation than an explanatory approach.

The authors themselves hint at the relationship between word order flexibility and case marking in approaching the question of typological characteristics and possible consequences in language production when taking into account *"differing levels of flexibility that English and Korean offer in grammatical function assignment, which is closely linked to how they indicate grammatical functions – word order (English) and case-marking (Korean)"* (Hwang and Kaiser, 2015, p. 201). Bock, Irwin, and Davidson (2004, p. 251) also notice that *"Correlated with freedom of order is whether a language requires the case-marking of constituents, since the functions served by location with respect to the verb in word-order languages can be taken over by case-marking"*.

A comprehensive evaluation of the interplay of structural options and case-marking during language production, however, can only be undertaken if future research aims at incorporating more flexible languages – trying to counteract the prevalence of English. As apparent from the following quote given by Bock, Irwin, and Davidson (2004), until then the investigation of structural choices in language production will rather be an investigation of subject selection (except for structural priming of dative structures):

> *"Regarding language variation, we will have little to say about how differences among languages or the constraints of the grammar within a language influence formulation options in general or starting points in particular. Instead, we take what evidence the psycholinguistic literature offers, which is often (although not exclusively) about English and*

about the ordering of noun phrases within sentences. Because the first noun phrase in an English sentence is often its subject, the offerings of the literature tend to be about the selection of subjects, explicitly or by default. The selection of a subject has complications and consequences that go beyond simple word order, which we will largely circumvent (see the discussion in Bock, Loebell, & Morey, 1992)."

<div align="right">(Bock, Irwin, and Davidson, 2004, p. 251/252)</div>

Another important point in need for future research based on the account of Hwang and Kaiser (2015) concerns the differences arising in terms of *lexical vs. conceptual accessibility*. Influences of conceptual accessibility (relative differences of the referents included in the utterance) have repeatedly been found to significantly affect structural choices – in English as well as more flexible languages. If lexical accessibility (*the ease of retrieving lexical realizations for concepts*; Bock, Irwin, and Davidson, 2004, p. 251), on the other hand, does hinder grammatical function assignment in flexible languages, compared to more rigid languages such as English, the questions remains of how to incorporate these differences in terms of differing levels of accessibility into models of language production. This incorporation may be far from trivial, since different levels of accessibility then influence grammatical encoding language-specifically, or rather dependent on the word order flexibility of the respective language. Without research investigating accessibility more detailed in flexible languages, this central question must be left open. Note that the claim made by Hwang and Kaiser (2015) does not explicitly address structural choices. Given the fact that their proposal targets the *facilitation or hindrance of grammatical function assignment*, an alternative approach arises for future research. This alternative (or rather additional possibility) includes measurements of speech onset latencies. Whereas the investigation of structural choices centers around the question which factors are strong enough to override the default structure, speech onset latencies allow for investigations of speakers' time course during language production. A hindrance (compared to a facilitation of grammatical function assignment) should emerge in longer speech onset times. Investigating latencies for different factors of accessibility crosslinguistically therefore offers the possibility to directly test the assumption made by Hwang and Kaiser (2015).

Note that in Experiment 3 of this thesis, speech onset latencies did not differ in the four conditions. Furthermore, there was no significant difference in the speech onset times of active compared to passive target structures. It is not clear at this point whether the numerical differences found are caused by chance or do not yield statistical significance. Taken together with the experimental manipulations in form of patient prominent contexts as well as the presentation of a visual cue that always preceded

the target picture (i.e., there was no baseline condition without a visual cue), this findings cannot be interpreted adequately at this point. The focus of the experimental investigations presented was on the structural choices made by speakers. The thorough investigation of speech onset latencies, possibly in addition to eye movement data, must be left for future research (see, for example, Norcliffe and Konopka, 2015 or Konopka, 2018 for recent investigations within this domain).

In sum, the current section shows that cross-linguistic considerations run like a common thread through this thesis. The discussion of cross-linguistic patterns in the domain of syntactic choices clarifies the need for future cross-linguistic research within language production. Studies of structural priming will benefit from cross-linguistic evaluation of the licensing of non-canonical structures. Studies focusing on case marking and structural choices as well as speech onset latencies, eye movements, and structural choices (influenced by accessibility) will help the investigation of cross-linguistic *starting points* and the consequential evaluation of models of language production. The cross-linguistic expansion has the potential to differentiate universal from language-specific influences during language production, an approach which already provided fruitful results within the domain of conceptual accessibility. The domain of visual attention has provided first, but limited, results raising many questions for future work. As a final note, the discussion presented here focuses on the inclusion of more flexible languages in future research. This does not mean that the counterpart, the investigation of more rigid languages, should be neglected. Investigations of languages, showing typological characteristics similar to English, constitute the complementary basis needed to evaluate recent accounts within the domain of influences on structural choices during grammatical encoding in language production.

Before turning to the last point in the general discussion of this thesis, some general remarks about methodological aspects adding to studies discussed within this thesis and relevant for future cross-linguistic work in language production are presented in the following passage. The mentioned aspects are enriched for German, the language investigated in this thesis.

The experimental work reviewed and the experiments presented in this thesis focus on structural choices during grammatical encoding. Note that the use of structural choices is only *one* of the possibilities for speakers to adapt to influences of accessibility.

Limiting the discussion to exemplary influences of derived and perceptual accessibility investigated in Experiment 3, the following aspects may contribute to the findings obtained in the laboratory setting compared to

natural language production. In Experiment 3 as well as many studies investigating sentence production, participants were asked to refrain from using pronouns. This limitation of choosing referential expressions deviates from everyday language production in a noticeable way (see also research on reference production in e.g., Ariel, 2001; Arnold, 2008; Rohde and Kehler, 2014). Given the fact that to derive accessibility (e.g., in terms of *topicalization*), contexts are included, this sanction constitutes an important aspect when trying to generalize from experimental work in the domain of language production to language production in *natural* settings. In German, the language investigated in this thesis, for example, pronouns are relevant in the investigation of non-canonical structures, because they bring along certain word order preferences (e.g., Lenerz, 1992; Bader and Portele, 2019). By asking participants to refrain from using pronouns, this influence is tried to be factored out to a certain degree. Since this sanction was imposed on all the participants, this factor does not diminish the findings obtained, but it represents an important deviation from everyday language use.

Furthermore, the focus on syntactic choices during language production disregards the phonological encoding of speakers' choices. In the discussion of Experiment 3 (section 5.2.3), it was noticed that participants' passive structures were not *at ceiling* in the topicalization conditions. Several factors possibly influencing this result have been discussed. A factor that is not mentioned within the discussion of Experiment 3 and that is usually only implicitly entailed in studies investigating structural choices is the phonological or prosodic realization of, in this case, information structure or contextually derived accessibility. Although answering a topic-question with a passive structure, promoting the referent asked for to the subject position, is a common way for speakers, it is not the only one. Speakers can, for example, also use prosodic means (prosodic *prominence*), such as accentuation and intonational phrasing (e.g., Baumann, 2006; Féry, Skopeteas, and Hörnig, 2010; Baumann and Riester, 2013). Note that this optionality (and possible consequences for syntax) has also been discussed within theoretical linguistics in German, as evident in the following quote by Fanselow (2006, p. 3): *In German, syntactic responses to information structure are always optional, while the prosodic encoding of information structure is mandatory.*

In sum, the final remarks of this section show that studies of language production have the potential to incorporate several further factors. Another important observation from this final "detour" is the helpful linguistic background available. It offers an encouraging basis and theoretical foundation for future psycholinguistic work. The collaboration of theoretical and psycholinguistic work offers the opportunity to enter future research within the domain of language production (more frequently) with respect to

cross-linguistic evaluations, for example regarding the use of non-canonical structures, the underlying main topic of this thesis. Put differently, the theoretical literature on typological differences, case-marking (systems), and realizations of information structure offers a foundation for psycholinguistic work that will hopefully be incorporated more often in future research. Several experimental studies, such as the one conducted by Christianson and Ferreira (2005) and Verhoeven (2014) discussed within this thesis, have shown the potential of this collaboration to promote research on language production and to reveal important future questions.

6.2.3   Models of language processing

In the last subsection of this chapter, two final aspects of future research on language production are addressed. The domain of the following section incorporates not only an alternative model of language production to the one outlined in this thesis, but also discusses accounts of language processing combining production and comprehension research assigning a central role to language production.

The dual-path model of Chang and colleagues has already been mentioned and presented in a simplified version in Figure **??** in chapter 4. The connectionist-learning model of sentence production is subject to remarkably different assumptions from both the two-stage architecture (e.g., Bock and Levelt, 1994) of grammatical encoding as well as the one-stage account (e.g., Cai, Pickering, and Branigan, 2012) reviewed within this thesis.
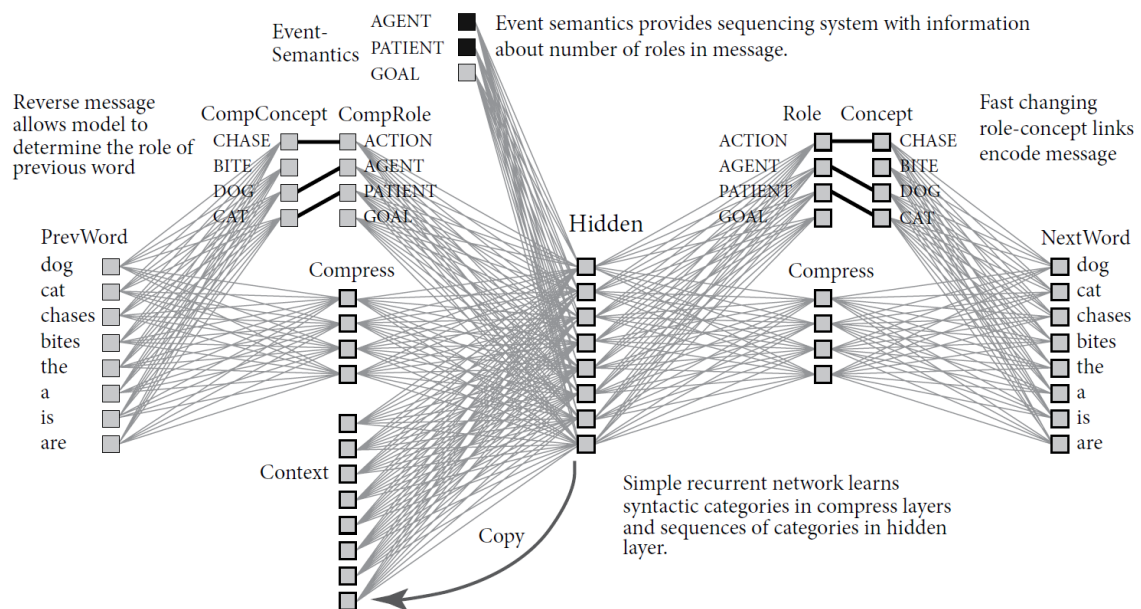

FIGURE 6.3: The dual path model of Chang and Fitz (2014, p. 73).

In the dual-path model (see Figure 6.3), language knowledge is represented within a neural network, whose connections are learned via *backpropagation of error*. During learning, the error (the difference between expectations and the actual input) changes the weights in the network (Chang and Fitz, 2014). The learning mechanism is incorporated into a simple recurrent network (SRN), which predicts an upcoming word ("NextWord" layer on the right in Figure 6.3) based on the previous one ("PrevWord" layer on the left in Figure 6.3). The previous and next word layers are linked via a "Hidden" layer, which copies the activation into the "Context" layer. The "Compress" layers in Chang's model serve to compress the number of word categories, with their units acting *"like syntactic categories, such as nouns or verbs"* (Chang and Fitz, 2014, p. 74). The components mentioned so far (the lower part of Figure 6.3) represent the syntactic path (the *sequencing pathway*; Dell and Chang, 2014) of the model. The "(Comp)Role" and "(Comp)Concept" layers of the model (the upper part of 6.3, including "Event-Semantics") represent the semantic path (the *meaning pathway*; Dell and Chang, 2014).

During training, the reverse messages and Hidden layer linking make sure the model learns associations between thematic roles and the respective structure (e.g., active or passive for transitive verbs). With the connection between Event-Semantics and message linking (via the Hidden layer), the model could select one of several possible structures based on the activation pattern of the role-concept links and in generally *"learn different constructions with slots for each role."*.

Different from the model of Levelt (1989), the dual-path model does not include different processing stages. Note, however, that the *dual*-path model separates lexical content and syntactic knowledge, with this separation allowing the model to represent *abstract* syntax. The semantic and syntactic processes within the model work in parallel in the prediction of the next word.

To test whether the dual-path model captures cross-linguistic influences found for structural choices, Chang (2009) tested the model's choices within the domain of accessibility effects in a Japanese and an English model. Based on the input given, the model learned that animate entities tend to precede inanimate ones in form of stronger weights from animate concepts to animate words, which in turn made them more *prominent*. *"The learned prominence of words and the reverse word-role system can work together to create the accessibility-sensitive nature of structure selection in English and Japanese transitives"* (Chang and Fitz, 2014, p. 82). Chang showed that the learning mechanisms of the dual-path model was successful in modeling the behavioral data found in McDonald, Bock, and Kelly (1993) for English and Tanaka, Branigan, and Pickering (2011) for Japanese, two studies also discussed within chapter 3 of this thesis. As already mentioned in the discussion of Experiment 1, Chang, Dell, and Bock (2006) investigated

the question whether the learning mechanisms of the dual-path model can model effects of structural priming found within the experimental literature. Their model of English was successful in modeling effects found in, for example, Bock and Griffin (2000) and Bock and Loebell (1990), which led the authors to conclude that structural priming can be explained in terms of error-based learning. Note that the *classic* finding of the lexical boost in form of verb repetition by Pickering and Branigan (1998) was not captured by the model of Chang, Dell, and Bock (2006), which did not exhibit effects of the lexical boost. The authors concluded that whereas (abstract) syntactic priming is caused by long-term changes, the lexical boost effect is caused by a different mechanism, which is only short-lived. As summarized in the discussion of Experiment 1, this finding has been empirically supported by studies finding differences in the duration of abstract vs. lexically boosted priming.

The learning mechanism underlying the dual-path model operates on the *comprehended* input. The representations used in language production are therefore learned from language comprehension. In the remainder of this section, the connection between the two modalities is examined in light of recent models of language processing.

The *P-chain* framework proposed by Dell and Chang (2014) is shown in Figure 6.4. *"Processing"* (language comprehension) involves *"prediction"*, which in turn is (derived from) language *"production"*. During prediction, *"prediction error"* is the mechanisms behind *"priming"*, which in turn represents *"implicit learning"* (see the above section about the dual-path model). Implicit learning is also the mechanism assumed by Chang and colleagues behind language acquisition. The P-chain combines the three overarching research domains of psycholinguistics, traditionally investigated independent of one another – comprehension, production, and acquisition.

Note that within this framework, both language production in general, and the mechanisms of (structural) priming specifically play the central roles in overall language processing.

In a similar vein, the *Production-Distribution-Comprehension* (PDC) account of MacDonald (2013) links language comprehension, language typology, and language comprehension. Language production, in this account, is established as the source shaping both language form and comprehension. MacDonald (2013) assumes that during utterance planning, speakers are subject to three overarching biases improving fluency and shaping the word order patterns and variation found cross-linguistically. The first planning bias, *Easy First*, incorporates the fact that *"easily retrieved words and*
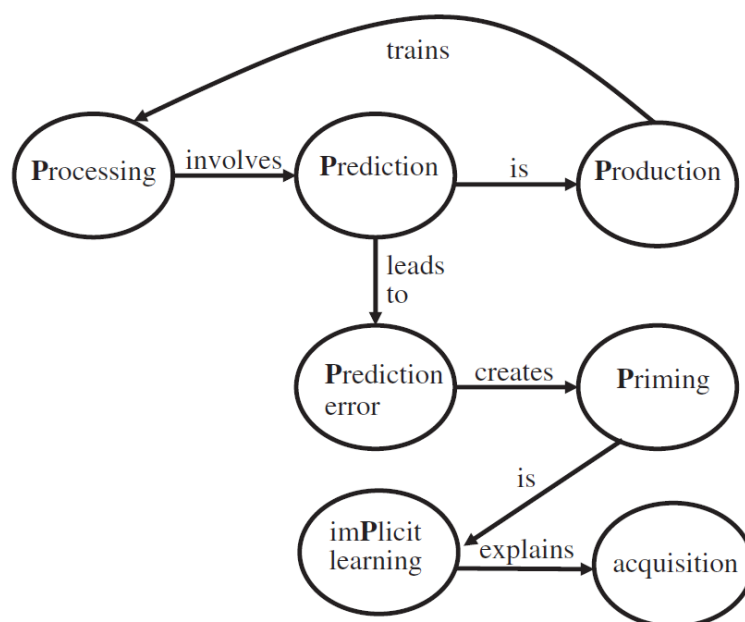
FIGURE 6.4: The P-chain framework of Dell and Chang (2014, p. 2).

phrases tend to appear both earlier in utterances and at more prominent syntac-
tic positions (e.g., sentence subject) than ones that are more difficult to retrieve)"
(MacDonald, 2013, p. 3). Note that this bias represents cross-linguistic find-
ings of accessibility effects (chapter 3 and findings of inherent (Experiment 1
and Experiment 2) as well as derived accessibility (Experiment 3) obtained
in this thesis). The second bias, *Plan Reuse*, refers to findings of speakers
reusing abstract sentence plans from recently executed utterance plans. This
bias incorporates cross-linguistic findings of structural priming (chapter 4
and Experiment 1 and Experiment 2 of this thesis). The last planning bias,
Reduce Interference, mirrors the fact that from the conceptual message layer
to word selection, speakers have several alternatives, with usually only one
of them entering the utterance. The last bias formulated by MacDonald
(2013) refers to speakers mitigating possible interference (resulting from the
inhibition of alternatives, which might in turn be retrieved in subsequent
utterances) via choices of utterance form (p. 5).

   According to MacDonald (2013), the three biases working together dur-
ing language production create the statistical regularities of utterance forms
in different languages. During language comprehension, the comprehen-
der implicitly learns these regularities, with the statistics of prior exposure
(of structures shaped by the three biases) serving as the basis for prediction
during comprehension.

   The central role of language production within the *Production-*
Distribution-Comprehension account is evident from both the role of

production in establishing the input of utterances during language processing as well as from the three production biases shaping the utterance forms in the beginning.

Finally, in a recent psycholinguistic theory, Pickering and Gambi (2018) also claim that during language comprehension, comprehenders use their production system to predict. Based on a review of the psycholinguistic literature on prediction during comprehension, the authors conclude that there is "*strong and converging evidence that the most effective means of prediction during comprehension utilizes the system that is used to produce utterances, a system that is both sophisticated and already available to the comprehender.*" (p. 1031). In their account, this finding is incorporated in the model as shown in Figure 6.5.
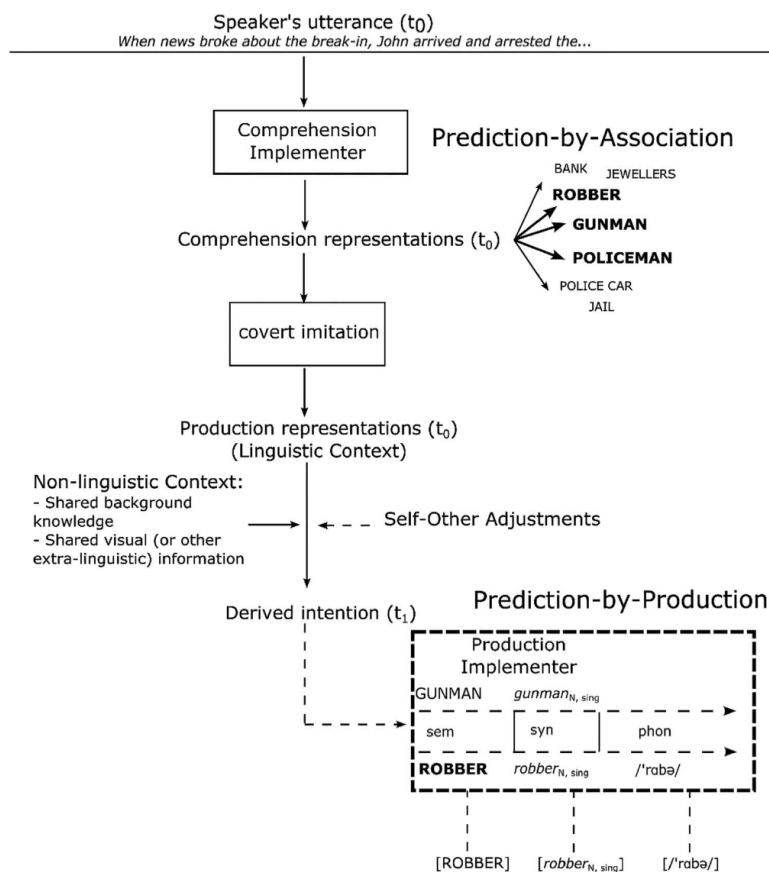
FIGURE 6.5: Prediction-by-production and prediction-by-association within the account of Pickering and Gambi (2018, p. 1016).

In Figure 6.5, the boxes represent processes during prediction. When comprehending an utterance, the "Comprehension Implementer" establishes the "Comprehension representations" (representations are illustrated

as unboxed decriptions). The "Prediction-by-Association" mechanism pre-activates several concepts given the respective comprehension representation based on the previous utterance. At the same time, the comprehension representation serves as input to processes of "covert imitation", which in turn create the "Production representations". By covertly imitating and additionally taking into account non-linguistic context, the comprehender constructs a "Derived Intention", a representation serving as input to the comprehender's own "Production Implementer". Via the use of the "Prediction-by-Production" mechanism, the comprehender activates (production) representations of the predicted word. Note that dashed lines in the figure of Pickering and Gambi (2018) illustrate optional processes, whereas solid lines represent processes *integral to language comprehension* (p. 1016).

Pickering and Gambi (2018) claim that the prediction-by-production mechanisms can (but does not need to) be used by comprehenders to predict. Based on previous psycholinguistic research, they identify different populations (e.g., older adults and children), which may use this mechanism less than others, such as native young adults (p. 1029).

In sum, the insight into models of language processing has shown that language production plays a central role – also in a more general framework of psycholinguistics. Future empirical research on language production will, for example, allow the evaluation of computational models of language production as well as the role of language production during language comprehension. Although this holds for language production research in general, a special role is assigned to research within the domain of structural priming. In recent models of both language production and language processing, structural priming is assumed as *"the"* mechanism in language learning and processing linking production and comprehension. Given the extensive literature on factors influencing grammatical encoding in English and given the immense literature on structural priming of (English) dative structures, important work has already been conducted. Regarding the noticeably smaller number of cross-linguistic studies investigating influences on grammatical encoding and looking at the low number of cross-linguistic studies investigating structural priming of non-dative structures, a lot of work is left for future research.

As Goolsby says, *it goes on and on and on.*

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Appendix A

Materials Experiment 1 and 2

A.1 Experimental picture stimuli of Experiment 1 and 2

treten

begrüßen
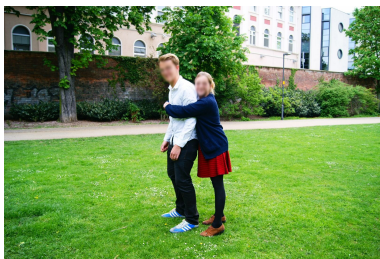
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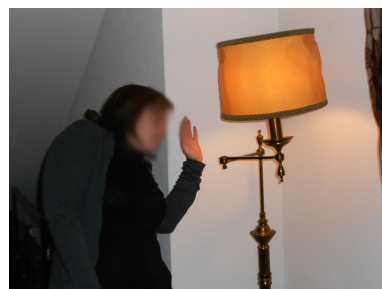

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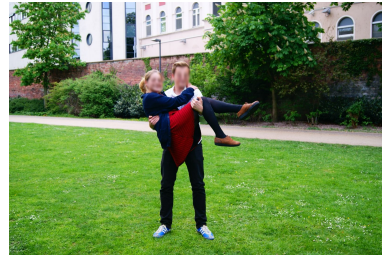
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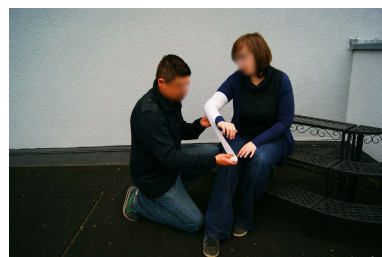
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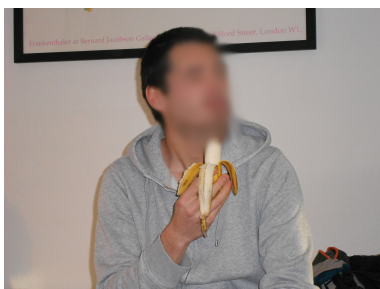
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beruhigen

A.2   Experimental priming stimuli of Experiment 1 and 2

a. Die Oma tritt den Jüngling.

b. Der Jüngling wird von der Oma getreten.

c. Der Wanderer kürzt ab.

a. Der Opa begrüßt die Schwiegertochter.

b. Die Schwiegertochter wird von dem Opa begrüßt.

c. Der Versuchsleiter wartet ab.

a. Die Rentnerin umarmt den Sohn.

b. Der Sohn wird von der Rentnerin umarmt.

c. Die Schülerin liest vor.

a. Der Junge boxt die Renterin.

b. Die Rentnerin wird von dem Jungen geboxt.

c. Der Paketdienst liefert aus.

a. Der Student küsst das Mädchen.

b. Das Mädchen wird von dem Studenten geküsst.

c. Die Lehrerin schaut zu.

a. Der Enkel jagt den Opa.

b. Der Opa wird von dem Enkel gejagt.

c. Die Jugendliche geht aus.

a. Die Studentin tröstet den Rentner.

b. Der Rentner wird von der Studentin getröstet.

c. Der Oberkellner räumt auf.

a. Der Junge beisst die Betreuerin.

b. Die Betreuerin wird von dem Jungen gebissen.

c. Die Haushaltshilfe kauft ein

a. Die Fußballerin tritt den Spieler.

b. Der Spieler wird von der Fußballerin getreten.

c. Der Wanderer kürzt ab.

a. Der Chef begrüßt die Politikerin.

b. Die Politikerin wird von dem Chef begrüßt.

c. Der Versuchsleiter wartet ab.

a. Das Mädchen umarmt den Prinz.

b. Der Prinz wird von dem Mädchen umarmt.

c. Die Schülerin liest vor.

a. Der Junge boxt die Trainerin.

b. Die Trainerin wird von dem Jungen geboxt.

c. Der Paketdienst liefert aus.

a. Der Prinz küsst die Braut.

b. Die Braut wird von dem Prinzen geküsst.

c. Die Lehrerin schaut zu.

a. Der Enkel jagt den Opa.

b. Der Opa wird von dem Enkel gejagt.

c. Die Jugendliche geht aus.

a. Die Mutter tröstet den Jungen.

b. Der Junge wird von der Mutter getröstet.

c. Der Oberkellner räumt auf.

a. Der Junge beisst die Betreuerin.

b. Die Betreuerin wird von dem Jungen gebissen.

c. Die Haushaltshilfe kauft ein

a. Der Onkel schubst das Patenkind.

b. Das Patenkind wird von dem Onkel geschubst.

c. Das Problemkind läuft weg.

a. Der Mann trägt die Rentnerin.

b. Die Rentnerin wird von dem Mann getragen.

c. Die Oberärztin wandert aus.

a. Die Schülerin schlägt den Betreuer.

b. Der Betreuer wird von der Schülerin geschlagen.

c. Der Pflegebedürftige wacht auf.

a. Der Lehrer verarztet die Schülerin.

b. Die Schülerin wird von dem Lehrer verarztet.

c. Der Einbrecher gibt auf.

a. Das Gebet stärkt den Kranken.

b. Der Kranke wird von dem Gebet gestärkt.

c. Das Flugzeug hebt ab.

a. Die Sonne blendet die Läuferin.

b. Die Läuferin wird von der Sonne geblendet.

c. Das Theaterstück fängt an.

a. Die Überwachunskamera filmt den Dieb.

b. Der Dieb wird von der Überwachungskamera gefilmt.

c. Das Blumenbeet trocknet aus.

a. Der Mantel verdeckt die Rentnerin.

b. Die Rentnerin wird von dem Mantel verdeckt.

c. Das Verfolgerauto biegt ab.

a. Die Dusche erfrischt die Läuferin.

b. Die Läuferin wird durch die Dusche erfrischt.

c. Die Warensendung kommt an.

a. Der Onkel schubst das Patenkind.

b. Das Patenkind wird von dem Onkel geschubst.

c. Das Problemkind läuft weg.

a. Der Zauberer trägt die Schauspielerin.

b. Die Schauspielerin wird von dem Zauberer getragen.

c. Die Oberärztin wandert aus.

a. Die Enkelin schlägt den Opa.

b. Der Opa wird von der Enkelin geschlagen.

c. Der Pflegebedürftige wacht auf.

a. Der Lehrer verarztet die Schülerin.

b. Die Schülerin wird von dem Lehrer verarztet.

c. Der Einbrecher gibt auf.

a. Das Gebet stärkt den Kranken.

b. Der Kranke wird von dem Gebet gestärkt.

c. Das Flugzeug hebt ab.

a. Die Sonne blendet die Läuferin.

b. Die Läuferin wird von der Sonne geblendet.

c. Das Theaterstück fängt an.

a. Die Überwachunskamera filmt den Dieb.

b. Der Dieb wird von der Überwachungskamera gefilmt.

c. Das Blumenbeet trocknet aus.

a. Der Vorhang verdeckt das Kind.

b. Das Kind wird von dem Vorhang verdeckt.

c. Das Verfolgerauto biegt ab.

a. Die Dusche erfrischt die Läuferin.

b. Die Läuferin wird durch die Dusche erfrischt.

c. Die Warensendung kommt an.

a. Das Paket behindert die Fahrerin.

b. Die Fahrerin wird von dem Paket behindert.

c. Der Kontrolltermin steht an.

a. Der Alarm weckt die Schülerin.

b. Die Schülerin wird von dem Alarm geweckt.

c. Der Nachmittagsunterricht fällt aus.

a. Die Narkose betäubt den Renter.

b. Der Rentner wird von der Narkose betäubt.

c. Der Ast bricht ab.

a. Der Ofen wärmt den Jungen.

b. Der Junge wird von dem Ofen gewärmt.

c. Der Wind nimmt zu.

a. Die Schleuder trifft den Spaziergänger.

b. Der Spaziergänger wird von der Schleuder getroffen.

c. Das Segelflugzeug stürzt ab.

a. Der Rollator unterstützt den Onkel.

b. Der Onkel wird von dem Rollator unterstützt.

c. Das Wasser fließt ab.

a. Die Übungen beruhigen die Patientin.

b. Die Patientin wird von den Übungen beruhigt.

c. Das Gemüse brennt an.

a. Das Paket behindert die Bewohnerin.

b. Die Bewohnerin wird von dem Paket behindert.

c. Der Kontrolltermin steht an.

a. Das Geräusch weckt die Schülerin.

b. Die Schülerin wird von dem Geräusch geweckt.

c. Der Nachmittagsunterricht fällt aus.

a. Die Narkose betäubt das Kind.

b. Das Kind wird von der Narkose betäubt.

c. Der Ast bricht ab.

a. Der Ofen wärmt die Familie.

b. Die Familie wird von dem Ofen gewärmt.

c. Der Wind nimmt zu.

a. Der Blitz trifft den Spaziergänger.

b. Der Spaziergänger wird von dem Blitz getroffen.

c. Das Segelflugzeug stürzt ab.

a. Der Rollator unterstützt den Onkel.

b. Der Onkel wird von dem Rollator unterstützt.

c. Das Wasser fließt ab.

a. Die Übungen beruhigen die Patientin.

b. Die Patientin wird von den Übungen beruhigt.

c. Das Gemüse brennt an.

Appendix B

Materials: Experiment 3

B.1 Experimental picture stimuli of Experiment 3
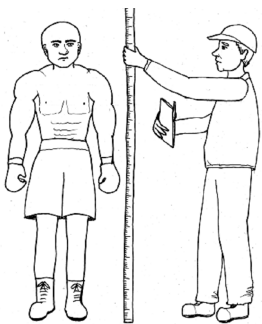
messen

rasieren

waschen

erschießen

massieren

würgen

befragen

stützen

schubsen

trösten

verhaften

fotografieren
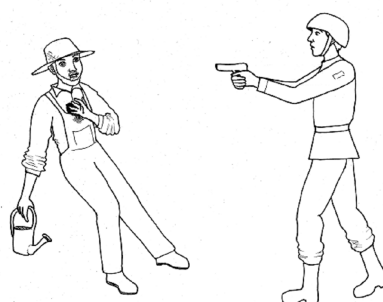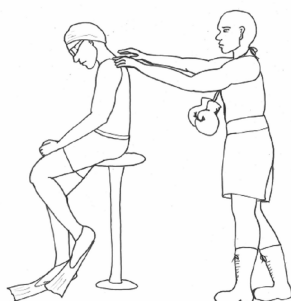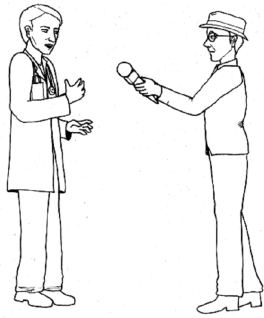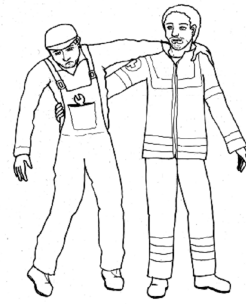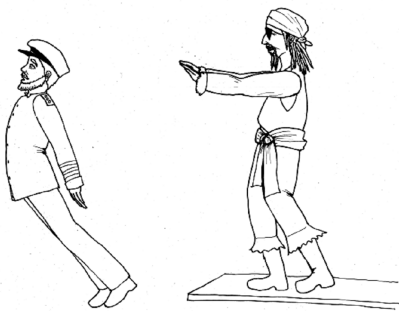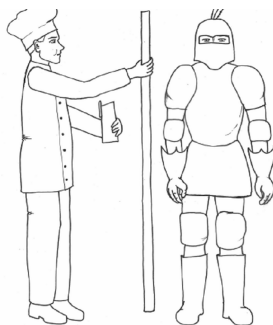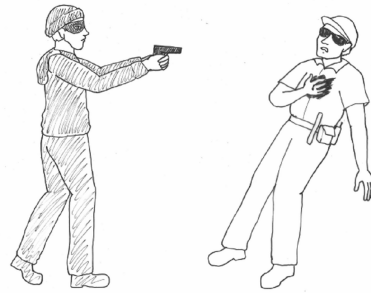

messen

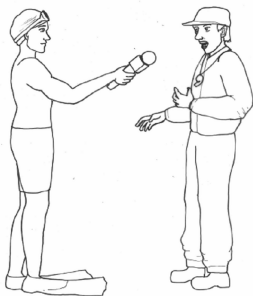rasieren

waschen
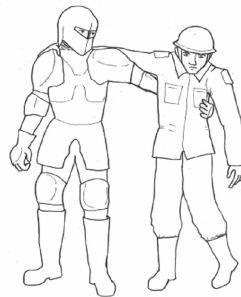

erschießen

massieren

würgen

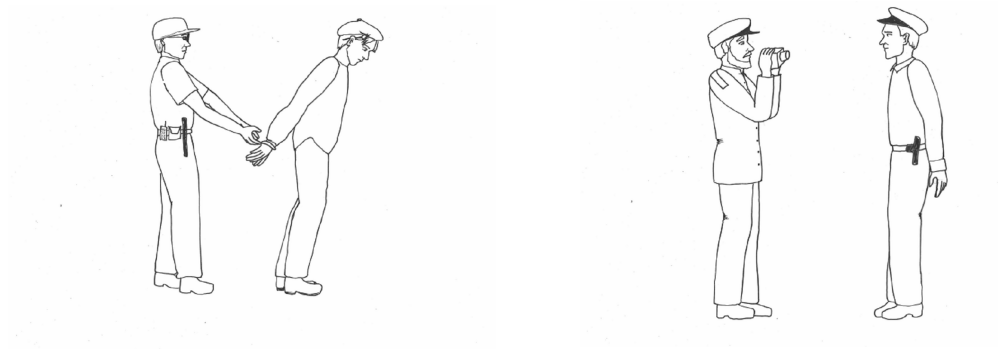befragen

stützen

schubsen

trösten

verhaften   fotografieren

B.2   Experimental patient prominent contexts of Experiment 3

(1)   Jetzt geht es um einen siegreichen Boxer und einen Trainer in einer Sporthalle.
Der Boxer hat bereits seine Kampfkleidung an - Boxhandschuhe sowie entsprechende Schuhe.

(2)   Im Folgenden geht es um einen eitlen Pfarrer und einen Barbier in einem Pfarrhaus.
Der Pfarrer hat es sich auf dem Stuhl bequem gemacht und trägt dabei sogar noch Talar und Kreuzkette.

(3)   In der nächsten Abbildung geht es um einen gehbehinderten Kranken und einen Mönch im Badezimmer.
Der Kranke muss sich um stehen zu können auf eine Krücke stützen.

(4)   Auf dem folgenden Bild geht es um einen sanftmütigen Gärtner und einen Soldaten auf einem abgelegenen Feldweg.
Der Gärtner hatte gerade seine Gießkanne aufgefüllt, um damit Blumen zu pflegen.

(5)   Jetzt geht es um einen aufgeregten Schwimmer und einen Boxer auf einer Terrasse.
Der Schwimmer trägt auch in seiner Pause Flossen und Badekappe.

(6)   Im Folgenden geht es um einen aufdringlichen Journalisten und einen Maler auf einer Messe.

Der Journalist will mit seinem Mikrofon heimlich Aufnahmen machen.

(7)   In der nächsten Abbildung geht es um einen erfolgreichen Arzt und einen Journalisten, die in der Uniklinik sind.
Der Arzt kommt gerade aus einer schwierigen OP und hat noch das Stethoskop umhängen.

(8)   Auf dem folgenden Bild geht es um einen verletzten Mechaniker und einen Sanitäter, die nahe der Werkstatt stehen.
Der Mechaniker hatte einen kleinen Unfall in seiner Arbeitskleidung.

(9)   Jetzt geht es um einen langjährigen Kapitän und einen Piraten, die sich an der Planke treffen.
Der Kapitän steht stolz in seiner Uniform auf dem Deck.

(10)   Im Folgenden geht es um einen niedergeschlagenen Mann und einen Clown, die sich vor der Aufführung treffen.
Der Mann hat viel geweint und seine Tränen sind noch deutlich zu sehen.

(11)   In der nächsten Abbildung geht es um einen verbrecherischen Dieb und einen Polizisten, die in einer Seitengasse sind.
Der Dieb trägt um nicht erkannt zu werden eine Maske und eine Mütze.

(12)   Auf dem folgenden Bild geht es um einen heldenhaften Mönch und einen Postboten, die sich zufällig treffen.
Der Mönch ist stadtbekannt für seine hilfreichen Tätigkeiten im Kloster.

(13)   Jetzt geht es um einen berüchtigten Ritter und einen Koch, die in einem Schloss leben.
Der Ritter hat soeben seine neue Rüstung bekommen.

(14)   Im Folgenden geht es um einen langjährigen Sanitäter und einen Opa, die in der Rettungsstation sind.
Der Sanitäter des DRK ist vollkommen erschöpft nach seiner Schicht.

(15)   In der nächsten Abbildung geht es um einen vogelfreien Piraten und einen Pfarrer, die sich in der Nähe eines Bergbachs treffen.
Der Pirat ist starr vor Dreck, aber behindert durch seine Hakenhand.

(16)   Auf dem folgenden Bild geht es um einen arroganten Sicherheitsmann und einen Dieb, die in einer Fabrik aufeinandertreffen.
Der Sicherheitsmann trägt um cooler zu wirken auch nachts seine Sonnenbrille.

(17)   Jetzt geht es um einen überarbeiteten Koch und einen Mitarbeiter, die in der Küche sind.
Der Koch hat sich auf einen Küchenhocker gesetzt und nicht mal die Mütze abgenommen.

(18)   Im Folgenden geht es um einen gruseligen Clown und einen Gärtner, die auf einem Gelände aufeinandertreffen.
Der Clown läuft mit seiner roten Nase nahe des Zirkuszelts herum.

(19)   In der nächsten Abbildung geht es um einen engagierten Trainer und einen Schwimmer im Sportstudio.
Der Trainer hatte heute den Startschuss mit seiner Trillerpfeife gegeben.

(20)   Auf dem folgenden Bild geht es um einen verwundeten Soldaten und einen Ritter beim Rollenspiel.
Der Soldat hat trotz Schutzkleidung und Helm eine Verletzung abbekommen.

(21)   Jetzt geht es um einen unverlässlichen Postboten und einen Mechaniker in einer Siedlung.
Der Postbote hat wieder einmal Briefe aus seiner Brieftasche verloren.

(22)   Im Folgenden geht es um einen Rentner und einen Arzt im Stadtpark.
Der Rentner hat durch die Therapie bereits fast all seine Haare verloren.

(23)   In der nächsten Abbildung geht es um einen zwielichtigen Maler und einen Sicherheitsmann in einer Ausstellung.
Der Maler hat sich seinen Pinsel hinters Ohr geklemmt und wollte Bilder verunstalten.

(24)   Auf dem folgenden Bild geht es um einen tapferen Polizisten und einen Kapitän im Präsidium.
Der Polizist hat vor einigen Tagen eine Ehrenmedaille bekommen.