

Dutch children's comprehension of actional and psychological passives

February 2015

Elly Koutamanis

3915212

e.k.a.koutamanis@students.uu.nl

BA Thesis

BA Linguistics

Utrecht University

Supervisor: Dr. Shalom Zuckerman

Table of contents

Abstract.....	4
Introduction.....	4
Language acquisition.....	4
The passive.....	5
Properties of the passive: Dutch and English.....	6
Acquisition of the passive: Dutch and English.....	8
Production.....	9
Comprehension.....	9
Theories on acquisition.....	11
Passives as adjectives.....	11
Maturation of A-Chains.....	12
The by-phrase: Theta-Transmission.....	12
Universal Phase Requirement.....	13
Research questions.....	15
Hypotheses.....	15
The experiment.....	17
Participants.....	17
Method.....	17
Pilot.....	18
Procedure.....	20
Modification.....	20
Final test.....	20
Measures.....	22
Results.....	22
General performance.....	22
Exclusion criteria.....	22
Pre-analysis conditions.....	23

Answers to hypotheses	23
Discussion	28
Conclusions on research questions.....	28
Theoretical implications.....	30
Method	31
Future research.....	32
Bibliography.....	34
Appendix	36
Test sentences with English translation	36
Practice sentences.....	36
Version 1	36
Version 2	37
Examples of drawings	40
Drawing for the verb 'see'	40
Drawing for the verb 'follow'	40
Drawing for the verb 'hit'	42

Abstract

It has been claimed that English and Dutch children have complete knowledge of the passive around the age of seven but already use passives at earlier ages. In the current study, Dutch children between four and ten years old (divided into a five-year-old group and a seven-year-old group) were tested on their comprehension of the passive using the coloring task (a new and improved alternative to picture selection). The items varied in structure (active vs. passive, truncated vs. untruncated) and verb type (actional vs. psychological). Both age groups were able to understand at least some forms of the passive. For both age groups, however, the passive was significantly harder to understand than the active, which suggests that difficulties persist even beyond the age of seven. Similar results were found for verb type: psychological verbs remained harder for both age groups than actional verbs. Strikingly, psychological passives were understood significantly better when truncated. This means the results support the much-discussed theory that children's problems with passives lie with the *by*-phrase. As an additional result we can also conclude that the coloring task is a promising new method, as it was able to clearly show the effect of truncation on children's comprehension.

Introduction

Language acquisition

Children's acquisition of their native language is a much studied, yet mysterious topic. First of all, there is the question of the input needed to learn a language. On the one hand, one must consider the poverty of the stimulus: although the input by children's parents is inevitably always deficient or even faulty, all normally developing children eventually reach native speaker level and can produce grammatically correct sentences they have never heard before. On the other hand, children who do not receive any linguistic input before puberty may never learn to speak. Language acquisition thus appears to be a complex combination of innate language abilities and input from children's environment.

Even at a purely descriptive level, studying children's language acquisition is complicated. Especially when studying comprehension, a lot of interpretation by the researcher is needed: does a child really understand what you are saying or is he just guessing what you want him to do? Furthermore, children's production can be difficult to describe as well. This is partly due to phonological development; it may be hard to understand the words a child is trying to say. Additionally, young children often make short sentences, such as in the two-word stage (usually

between 1;6 and 2;6). This makes it difficult to determine the parts of grammar a child has already acquired. For example, if a child says 'eat cookie', does he mean 'I am eating a cookie', '(you must) eat a cookie' or 'cookies can be eaten'?

The example from the two-word stage brings us to the development of word order. Children use their native language's canonical word order as soon as they start combining words. In English, children's two-word utterances have the form of a verb followed by a noun (or of two nouns), e.g. 'eat cookie', while in Dutch the verb follows the noun (Neeleman & Weerman, 1997), e.g. 'koekje eten' ('cookie eat'). This in itself is already quite impressive. The acquisition of non-canonical sentences (i.e. sentences with a different structure, such as question sentences) is even more notable, especially considering that children, at least until the age of four, depend greatly on canonical word order¹ (Slobin and Bever, 1982). Although different claims exist about what children know at different ages and when non-canonical sentences are completely acquired, all children are eventually able to move from the canonical structure to more complicated word orders.

In this paper, I focus on the acquisition of one particular non-canonical construction: the passive – a well known, yet uncommonly used structure. This means that the passive is also rare in the input that children receive. Still, as we will see later, they may already start using passives by the age of two. The study of the acquisition of the passive provides insight in children's language development in light of the poverty of the stimulus in general and in non-canonical structures in particular.

The passive

As the two-word examples above illustrate, languages differ in canonical word order, like SVO (subject-verb-object) or SOV (subject-object-verb). In active sentences these are typically associated with the thematic relations of, respectively, agent-verb-patient, and agent-patient-verb. Besides this canonical word order,

¹ In Dutch, canonical word order differs between matrix sentences (SVO) and subordinate clauses (SOV). In early utterances, such as the two-word utterances mentioned above, children use SOV-order (Neeleman & Weerman, 1997). Although not much research has been conducted on Dutch language acquisition, one might assume that when the canonical word order is relatively difficult (i.e. a choice between two options), it takes even longer to acquire non-canonical structures.

however, many examples of non-canonical word orders are found. One of these is the passive, where the patient fills the subject position and the agent is optionally mentioned in a by-phrase, creating a sentence of the form: patient-verb(-by-agent), e.g. 'the cat is chased (by the dog)'. The passive is an example of a non-canonical structure related to topicalization: the patient is being brought into attention by moving it to the beginning of the sentence. The passive may be used when telling a story from the patient's perspective. Because the by-phrase can be left out, passives can also be used when the agent is unknown, or when the speaker does not want to mention this person for any other reason.

Passive sentences are found in many languages. How often passives are exactly used is unknown but several corpus countings have been held. Vandebosch (1992) found that 8% of Dutch written sentences are passives, while Svartvik (1966) found that the percentage in English written sentences is 12%. In spoken language these numbers might be higher, keeping in mind that in both Dutch and English the use of passive sentences in writing is discouraged (Cornelis, 1996).

In the 1960s it already was noted that children have problems with the comprehension of passive sentences (Slobin, 1966). Children's production also seemed to reflect this: passive utterances were found to be very rare in children's speech (Wells, 1979). Although at the moment several theories about children's capacities exist, one may expect children to need quite some time to acquire passives, like all non-canonical sentences.

Since there has not been sufficient research on Dutch children's passives yet, in this section I will describe the results of several studies on the acquisition of the passive by English speaking children. In the next subsection, I consider several properties of Dutch and English passives. This comparison is important to know how the research on English children should be conducted with Dutch children.

Properties of the passive: Dutch and English

In this study, I concentrate on three parameters relevant for passives: reversibility, truncation and actionality. Actionality falls under verb type, while truncation, like voice itself (i.e. active vs. passive), is part of the sentence structure.

First, reversibility is a semantic property of the arguments involved in a sentence: the sentence is reversible when the patient and agent can be exchanged. For example, 'the dog is chased by the cat' and 'the cat is chased by the dog' are both correct, so these sentences are reversible. A sentence like 'the book is read by the man' is not reversible, as # 'the man is read by the book' is not correct. Obviously, only transitive verbs can be involved in reversible sentences. Still, reversibility is

not a property of the verb type, as can be seen when comparing the two sentences below:

- (1) The man is seen by the woman. [reversible]
(2) The chair is seen by the woman. [nonreversible]

Second, truncation refers to the presence of a by-phrase. An untruncated (or long) sentence contains a by-phrase, while in a truncated (short) sentence the by-phrase is being left out. 'The dog is chased by the cat' is an untruncated passive; 'the dog is chased' is its truncated counterpart. The by-phrase does not always have the same thematic relation (Verrips, 1996). Although one might typically expect it to have an agent role, in the next examples the by-phrases respectively have a recipient role and an experiencer role:

- (3) The letter was received by the prisoner.
(4) The picture is seen by John.

The third parameter, actionality, concerns the verb and is a semantic property, just as reversibility. Actional verbs refer to actions, like hitting, kissing, reading, painting etc. Non-actional verbs, or psychological verbs, refer to states of the mind, like loving or hating. Perception verbs, such as seeing and hearing, are also considered non-actional. In untruncated passives, actional verbs typically go with an agent in the by-phrase.

So far there are no differences between Dutch and English passives: in both languages these three parameters are relevant when describing a sentence. When looking closer to both form and meaning, however, several differences can be found. According to Cornelis (1996) there is a subtle difference in meaning between the Dutch passive and the English passive. In English, using a passive means that the patient's point of view is taken, while a Dutch passive is used when the causer's point should not be taken. These differences in meaning are beyond the scope of this paper, but according to Cornelis they are a result of the differences in form.

In both Dutch and English a verb takes an auxiliary to become a passive. The Dutch auxiliary used is 'worden', meaning 'to become'. The verb itself takes a form similar to the perfect participle (Verrips, 1996). Although it is possible to form a Dutch passive with a form of 'zijn' ('to be'), this is usually considered to be a perfective form of the 'worden'-passive (Cornelis, 1996):

- (5) Ik word gebeld.
I become called
'I am being called.'

(6) Ik ben gebeld.

I am called

'I have been called.'

In English there are two different auxiliaries a passive verb could take: 'to be' or 'to get'. Get-passives are more common in spoken English, while be-passives are more traditionally used in written English. As Fox and Grodzinsky (1998) showed, there is a grammatical difference between the two, and get-passives are actually easier to acquire for children. Because in Dutch there are no two different passives like be- and get-passives, I will from now on restrict myself to worden- and be-passives, so that the comparison between the two languages is fair.

Unlike in English, in Dutch it is possible to form a passive with an intransitive verb:

(7) Er wordt buiten gerookt.

there becomes outside smoked

'People are smoking outside.'

'Er', meaning 'there', appears at the subject position to fulfill the Extended Projection Principle, which states that all sentences must have a subject. The use of 'there' in the subject position is also known in English, e.g. 'there was laughter', but not in passive sentences. English, as most languages, does not allow intransitive verbs to be passives. Since intransitive passives are rare, one might expect them to be harder to acquire. However, as Verrips (1996) shows in an elicitation study with Dutch children aged 2;6 – 6;6, Dutch children do not acquire intransitive passives later than transitive passives. In the experiment of this study, I considered only transitive passives because testing the understanding of intransitive passives would have required a different testing method (see 'method').

To summarize, in this subsection several properties of Dutch and English passives were presented. The languages do not differ when it comes to actionality, reversibility and truncation; the same verb types and sentence structures are possible. When we look into the two languages in more detail, we see some differences in both meaning and structure. In this study, however, I consider only the aspects that are similar across both languages.

Acquisition of the passive: Dutch and English

In this subsection, I describe the acquisition of the passive by both Dutch and English children, starting with production, as these findings are usually more certain. Then I discuss several studies on comprehension in more detail, as this is the focus of the experiment.

Production

Horgan (1978) studied the spontaneous utterances of English children between 2;0 and 13;11. He found that children may start producing passives as young as 2;0 but there are grammatical differences with adult passives. The early passives are nearly exclusively truncated. Untruncated passives are not produced until the age of five (Horgan, 1978).

Verrips (1996) studied Dutch children's acquisition of the passive, focusing on production. According to corpus research she conducted, Dutch children start producing (truncated) passives around age 2;6. The passives do not necessarily contain 'worden' or even the participle form of the verb but can still be considered passives. An example of such a passive is:

(8) worden koken
become cook
'Be cooked.'

The example is by a two-year-old, cited in Verrips (1996). According to that study, passives with a by-phrase do not appear in spontaneous speech until the age of five.

Turner and Rommetveit (1967) did an experimental study on children's production of the passive. The children, aged between approximately four and nine years old, were asked to describe a picture, in which what they saw first, the patient or the agent, varied. This was combined with syntactic priming. Their results suggest that even in young children the use of passives increases when their attention is drawn to the patient. Unfortunately Turner and Rommetveit do not report the number of truncated and untruncated passives uttered by the children, so it is unclear if the production of untruncated passives can be manipulated as well.

To conclude, for both English and Dutch children the production of (truncated) passives may start around the age of two, but only at five years old, children's passives have an adult form. Next, I will discuss children's comprehension.

Comprehension

Moving on to comprehension, Verrips (1996) claims that Dutch children have a full understanding of the passive by the age of seven. In English, it has been observed that children have full understanding of the passive by the age of seven or eight. So even though by the age of five they are using passives in an adult form, they still might not use them correctly. This does not mean that children younger than seven do not understand passives at all. Maratsos, Fox, Becker and Chalkley (1985) showed that four-year-old children are actually capable of understanding actional

passives, although they have problems with psychological passives. Their procedure was simple: the children were presented with a sentence, e.g. 'Goofy was liked by Donald.' Then they were asked: 'Who did it?' The children answered using finger puppets or spring-up boxes with the characters mentioned in the sentences. The responses on actional passives were significantly more often correct than the responses on psychological verbs. Theories on these and the following results are presented in the next subsection.

Fox and Grodzinsky (1998) investigated the ability of three-to-five-year-olds to understand actional and psychological passives, with the passives further divided to truncated and untruncated. They used a truth-value judgement task: the children were told a story, played out with toys and narrated by the experimenter. Then a puppet made a statement about the story, which could be either true (match) or false (mismatch):

'Match (M): Puppet: I know what's happening. The rock star is being chased by the koala bear.

Mismatch (MM): Puppet: I know what's happening. The koala bear is being chased by the rock star.'

The child then was asked to punish or reward the puppet, thus stating whether the (passive) sentence was true or false. When the sentence was judged false, the child was asked what the right answer was. Fox and Grodzinsky found that English-speaking children have more problems with the comprehension of untruncated passives than with truncated passives but only on the psychological passives. The children were capable of understanding actional passives, both truncated and untruncated.

By contrast, Hirsch and Wexler (2006) did not find any difference between truncated and untruncated psychological passives. They tested three-to-six-year-olds on the same conditions as Fox and Grodzinsky, using a picture selection task. The children heard sentences, which were all reversible, and for each sentence they had to pick one of two pictures to match. Since there turned out to be no significant difference between truncated and untruncated passives in their study, there is disagreement about the effect of truncation, as I explain in the next subsection.

It is often suggested that before they have full understanding of the passive, children interpret passive forms as adjectives. This counts for Dutch as well as English. Grammatically there is a difference between adjectives and passives, although sometimes they are homophones. In Dutch one can use word order to find out if a sentence contains an adjective or a passive:

- (9) ... dat de winkel geopend is / is geopend [passive]
... that the store opened is / is opened
'... that the store is opened.'
- (10)... dat de winkel open is / * is open [adjective]
... that the store open is / *is open
'... that the store is open.'

Verrips (1996) tested this knowledge in children within a wide range of ages. She concluded that children older than 5;0 do see passives as verbs and not as adjectives but she was unable to reach a firm conclusion for younger children. As we shall see in the next subsection, many theories claim that children approximately five years old do still use the adjectival interpretation to understand passives.

For both production and comprehension, not much information on Dutch children's development is available. As other aspects of their development seem to be parallel with English-speaking children, one may assume that there are no salient differences between Dutch and English children concerning production and comprehension of the passive at different ages.

To conclude, several recent findings show how children four to five years old do understand actional passives. Psychological passives are understood correctly by the age of seven, when the development of the passive is supposedly complete and production and comprehension are adult-like.

Theories on acquisition

In this section I consider three theories that explain children's problems with the passive and one widely accepted rule of thumb that goes with all of these theories: the passive as adjectives hypothesis.

Passives as adjectives

As mentioned above, Maratsos et al (1985) tested four-to-five-year-olds' understanding of actional and non-actional passives and actives. Young children turned out to understand actional passives but not psychological passives. An explanation for the lack of problems with actional verbs is that children interpret them as adjectives. This adjectival interpretation is actually not exclusive to any theory: the fact that in English (and Dutch, as we have seen) many passive verbs and adjectives are homophones is often observed. In other languages, such as Greek, where passive verbs and adjectives have distinct forms, actional passives were not found to be easier for the children (Terzi & Wexler, 2002). Children's problems with psychological verbs have been explained in several ways, of which three important

ones are mentioned below: Maturation of A-chains, Theta-Transmission, and the Universal Phase Requirement.

Maturation of A-Chains

Borer and Wexler (1987) explain Maratsos' (1985) results with their Maturation Hypothesis (also: A-Chain Deficit Hypothesis or ACDH). They claim that some innate abilities needed to form passive sentences are not developed yet for children to understand the passive. The ability in question is the forming of A-chains (argument chains). The theory states that, to form a passive from an active sentence, movement is required: the patient moves from the object position to the subject position. The A-chain forms a link between these two positions and enables the patient to receive a thematic role in its new position (Friedmann, 2007). This is only a problem with psychological passives, as explained by the adjectival interpretation hypothesis. Consequently, according to Borer and Wexler, no movement is required in the children's interpretation of actional passives.

However, later studies have shown many instances of movement with which children do not have a problem. The most important example stems from the so-called VP-Internal Subject Hypothesis (Koopman & Sportiche, 1991). This hypothesis claims that the subject is formed within the verb phrase but moves to a position outside of the VP. This means that even in canonical active sentences, movement and A-chains are involved – and children have no problem with these. As the VP-Internal Subject Hypothesis is now generally accepted, Borer and Wexler's Maturation Hypothesis cannot be accepted, at least in its strongest form.

The by-phrase: Theta-Transmission

Fox and Grodzinsky (1998) use the VP-Internal Subject Hypothesis as one of their arguments to claim that children's problems with passives cannot stem from a problem with A-chains, not even in a weakened form. As described before, they conducted a truth-value judgement task on three-to-five-year-old children, testing the differences between actives and passives, actional and psychological verbs and truncated and untruncated passives. Concerning the actional verbs, Fox and Grodzinsky find the same results as Maratsos et al. (1985), which is explained by the adjectival interpretation hypothesis. However, they found a difference with the psychological verbs: the children did have trouble understanding these passives but as soon as the by-phrase was removed (truncated), they scored perfectly. This led Fox and Grodzinsky to claim that the problem lies in the presence of a by-phrase. The adjectival interpretation hypothesis is not able to explain this, since non-actional passives are not likely to be interpreted as adjectives (e.g. *the seen car).

Fox and Grodzinsky explained the problem with the by-phrase as follows: children lack a mechanism called theta-transmission. This means they are unable to assign the external theta-role to the by-phrase, which prohibits an adult interpretation of a passive with a by-phrase. The reason that children do not seem to have a problem with actional untruncated passives is that theta-transmission is not required when assigning the 'agent' theta-role to the by-phrase, as action verbs typically select for an agent.

Universal Phase Requirement

Fox and Grodzinsky's study is problematic in several respects. First, only thirteen children were tested, of which only eight children behaved in the way described. Second, other researchers were not able to replicate their results (Orfitelli, 2012).

Hirsch and Wexler (2006) argue against Fox and Grodzinsky because they did not find any difference between truncated and untruncated non-actional passives in their picture selection task for three-to-six-year-olds. Hirsch and Wexler's results are therefore the same as Maratsos et al.'s (1985) but, as ACDH turned out to be insufficient, they suggest a new hypothesis: the Universal Phase Requirement.

The Universal Phase Requirement (UPR) rests within Chomsky's Minimalist Framework theory and in particular the notion of phases. According to this theory, syntactic derivation happens in cyclic phases. After each phase phonological and semantic processing takes place, which freezes the syntactic derivation up until that point. After this processing, a new phase starts. With passives, there is movement across phases, which should not be possible. To solve this problem, we have to look closer at the phase called vP. When there is no external argument in the vP, as is the case with passives, the vP is defective. This means that it is not 'closed' and there can still be movement to higher phases. While adults are able to handle defective phases, children consider all phases as full and therefore passive sentences are not grammatical. This explains why children have trouble with passives in general. Moreover, Hirsch and Wexler (2007) showed how the UPR not only explains children's problems with passives but also with raising structures, e.g. 'Mary seems to Bill to be dancing'. Hirsch and Wexler also claimed that the UPR can account for children's understanding of unaccusatives.

The UPR, like the ACDH, predicts the same results: children actually cannot cope with passives but the adjectival interpretation helps them handle actional passives. There are a few other alternative theories, such as the Argument Intervention Hypothesis (Orfitelli 2012). However, no convincing evidence exists for or against these theories, since the studies have not been replicated yet.

The existing theories and their predictions are summarized in the table below:

Theory	Researcher(s)	Theory	Prediction
Passives as adjectives	Several	When passives and adjectives are homophones, the passives can be interpreted as adjectives.	Children can handle passives when they are interpreted as adjectives.
Maturation of A-chains outdated	Borer & Wexler (1987)	No movement whatsoever is possible for children; compatible with adjectival interpretation.	Children can only handle passives when they are interpreted as adjectives (i.e. actional passives).
By-phrase: theta-transmission	Fox & Grodzinsky (1998)	Children lack theta-transmission; only the agent role can be assigned to the by-phrase.	Children only have problems with psychological, untruncated passives.
Universal Phrase Requirement	Hirsch & Wexler (2006)	Children cannot handle defective phases (in this case: passives), compatible with adjectival interpretation.	Children can only handle passives when they are interpreted as adjectives (i.e. actional passives).

As can be seen from the predictions, the main difference between the theories concerns the question whether or not the by-phrase is problematic. Hirsch and Wexler predict no difference between truncated and untruncated passives, while according to Fox and Grodzinsky the by-phrase in untruncated passives is problematic. Therefore, in this study I concentrate on the by-phrase and its role in the understanding of the passive.

Research questions

The main question in this study is: 'Do children understand passives and if not, what is the reason for their problems?' The answer to this question should decide between UPR and Fox and Grodzinsky's theory. The main question involves several sub-questions:

- a. Can children of respectively five and seven years old understand passive sentences?
This will be investigated by comparing children's performance on passive sentences with expected scores on chance level, for both five-year-olds and seven-year-olds.
- b. Are psychological verbs more difficult than actional verbs and if so, is this only the case for five-year-old children or does it persist until the age of seven and older?
This will be investigated by comparing children's performance on psychological verbs and actional verbs for both five and seven-year-olds.
- c. Are untruncated sentences more difficult than truncated sentences and if so, is this only the case for five-year-old children or does it persist until the age of seven and older?
This will be investigated by comparing children's performance on truncated verbs and untruncated verbs for both age groups.
- d. Do sentence structures and verb types interact and, if so, how; do they cancel out or increase each other's effects?
This will be investigated by exploring the interaction effects between the different sentence types (i.e., truncated vs. untruncated) and verb type (i.e. psychological vs. actional) on children's performance on these sentences.

Hypotheses

The hypotheses underlying the sub-questions are as follows:

- a. As Maratsos et al. (1985) and others have already claimed, children are in some way able to handle passive sentences. Still, all non-canonical sentence structures take time to learn, so I expect all children but especially the younger ones to perform better on the active sentences. Therefore, children respectively five and seven years old are expected to be able to understand passive sentences, although they will perform better on the actives.

- b. From a semantic point of view, actional verbs should be much easier to handle, as well as from a syntactic perspective: in Dutch, an adjectival interpretation is possible for most actional verbs.² I, therefore, expect a significant difference between children's performance on psychological verbs and actional verbs, for both age groups.
- c. The question of the effect of truncation remains open, as Fox and Grodzinsky's results were never replicated³, but more researchers have suggested that untruncated passives are more difficult than truncated (e.g. Gordon & Chafetz, 1990). Therefore, whether or not children's problems with passives lie with the by-phrase remains an interesting question.
- d. I expect the effects of sentence structure and verb type to reinforce each other; e.g. an actional active should be easiest and a psychological passive should be hardest, with psychological actives and actional passives in between.

The combined effect of truncation and verb type cannot be hypothesized here, as it depends on the effect of truncation. If Fox and Grodzinsky are right, psychological truncated passives are more difficult than their untruncated counterparts, but this effect would not occur with actional passives. In that case, the effect of verb type cancels out the effect of truncation in the actional passives but not in the psychological passives. If Hirsch & Wexler are right, however, there is no significant effect of truncation at all – or this is cancelled out completely by verb type.

² Additionally, many psychological verbs in Dutch take a preposition, e.g. 'houden van' (to love) and 'denken aan' (to think of someone), which are much more frequent than psychological verbs without a preposition (Vandeweghe, 2011). Because of their frequency, these words are probably earlier acquired than some of the psychological verbs I used in the experiment; e.g. 'denken aan' is easier for a child to understand than 'herinneren' (to remember). I did not include verbs with preposition though, because it takes a more complicated passive construction ('van ... wordt gehouden door ...') that is beyond the scope of this paper. This could also cause the children to have more problems with psychological verbs.

³ Still, this does not prove the opposite. Hirsch & Wexler used a different method, which could count for the different results. See 'method' for more.

For all sub-questions, it is important to keep in mind that development is not always parallel to chronological age. Some five-year-olds might already have quite good understanding of all passives, while some seven-year-olds may still have problems with even the actional passives.

The experiment

Participants

The subjects are 77 (of which only 63 were included in the analysis; see 'results') children aged 4-10 ($M=7;0$, $SD=1.48$). They were divided into two groups: one group consists of children aged 4-5 ($M=5;0$, $SD=.83$) and the second group consists of children aged 6-10, ($M=7;10$, $SD=.83$). The younger group corresponds to the children used in earlier studies as mentioned before. All children were already going to school, as schools in The Netherlands begin at age 4 (the first two school years are parallel to preschool in other countries). For even younger children the test might have been too hard, although this was not tested in a pilot study. I chose to test only school-going children because they are expected to be used to listening to a teacher and to performing tasks like coloring in pictures. The older age group is included as a control group. Among others, Fox and Grodzinsky (1998) suggested that the age of seven or eight is the age where children have full understanding of the passive. Most of the children were tested at their school. I visited De Touw ladder in IJsselstein (Utrecht), Anne Frankschool in Bunnik (Utrecht) and De Schakel in Woerden (Utrecht). I also visited some children at home in the region of Utrecht and in the region of Delft.

Method

The last two studies mentioned in the previous section show quite different results. This could relate to the test method: Fox and Grodzinsky (1998) used a truth-value judgement task, while Hirsch and Wexler (2006) used a picture selection task. Although their research question was a different one, Baauw, Zuckerman, Ruigendijk and Avrutin (2011) compared a picture selection task and a truth-value judgement task among the same children and found different results. Overall, the children performed better on the picture selection task. The reason for this was that a truth-value judgement task usually contains a story and therefore has a high processing load, while picture selection has a low processing load.

Since in this study I test young children, a truth-value judgement task seems less suitable. Not only is the processing load a disadvantage but also the length of the test: if several stories must be told, the child will eventually lose interest.

Although a picture selection task can be quicker, it has its own disadvantages. The participant typically has to choose between two contrasting pictures, e.g. a cat following a dog vs. a dog following a cat. This makes it easier to guess what the task is about which may influence the participant's natural language use. Therefore, in this study I use a variation on the picture selection task: the coloring task (Pinto & Zuckerman, in progress). Instead of choosing between two separate pictures, the children have to choose (implicitly) the right situation among two or more. They are presented with a coloring picture and given instructions like: 'The boy with the green hat is touched by the girl'. The coloring picture has a boy touching a girl, touching a boy, and the children have to pick the right boy. The coloring task is assumed to be a more natural activity for children, which makes it more appealing to them, and it is less easy to guess what is being tested when there is no explicit picking between two contrastive situations.

The coloring task can be conducted on paper but also on a computer or tablet, in a specially developed application called Coloring Book (Pinto, Zuckerman & Gonggrijp, in progress). In Coloring Book, pictures can be shown, along with a recorded or written sentence, and the participant can color the picture accordingly. Some of the advantages of digitally coloring pictures above coloring on paper are that all data are saved automatically and that participants can easily correct mistakes. The advantage of the tablet above a computer is that many children already have experience with touch screens, and even if not, they can easily learn this. More about this new method can be found in the discussion.

Pilot

To evaluate the design of the experiment, a pilot test was conducted. In it, 15 verbs were chosen, seven of which were psychological verbs and eight were actional verbs. All verbs were transitive. The actional verbs were: *aanraken* (to touch), *aantikken* (to tap), *achtervolgen* (to follow), *natekenen* (to draw), *roepen* (to call), *slaan* (to hit), *vangen* (to catch) and *vastpakken* (to hold). The psychological verbs were: *begrijpen* (to understand), *bewonderen* (admire), *haten* (to hate), *herinneren* (to remember), *horen* (to hear), *missen* (to miss) and *zien* (to see). Every verb appeared in three forms: active, untruncated passive and truncated passive. The active forms are used as control sentences. There were two versions of the test. In both tests all active sentences appeared, while the passives were balanced out: if in one version the truncated sentence was present, then in the other version the untruncated sentence was used. The sentences had the following forms:

- (11) The girl with the red hair touches the boy. [active]
(12) The girl in the blue dress is touched by the boy. [passive
untruncated]
(13) The girl in the blue dress is touched. [passive truncated]

Another person recorded the sentences, so that the children would not be confused or distracted when they recognized the experimenter's voice.

Every sentence was presented together with a coloring picture. The picture in the touching-example showed a boy touching a girl touching a boy. The child had to pick the correct boy to color. These drawings were inspired by Friedmann, Belletti and Rizzi (2009), who used pictures of, for example, a dog biting a cat biting a dog in their test on young children's comprehension of Wh-questions.

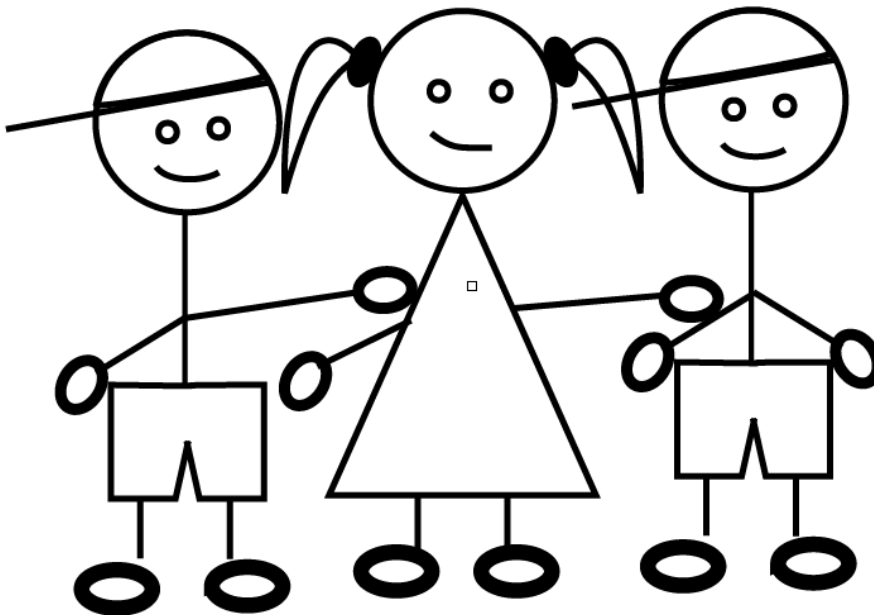


Figure 1 The drawing for 'touching', used for both the active and the passives.

Most psychological verbs were drawn with the aid of thought bubbles, as suggested by Hirsch and Wexler (2006). For more examples of drawings, see 'appendix'. The coloring pages were shown on an iPad, in the application called Coloring Book (Pinto, Zuckerman & Gonggrijp, in progress).

In addition to the test sentences, six practice sentences were created: three psychological verbs and three of the actional verbs were used in active sentences. These sentences were used with completely unambiguous pictures, e.g. 'the girl in the yellow dress touches the boy', linked to a drawing of one girl touching one boy.

Procedure

The tests consisted of six practice items and 30 test items in a randomized order. In the final test version the items were modified but the procedure described here remained the same.

The pictures were presented on an iPad. At the same time, the sentences were played on a laptop, because the recorded sentences could be played but unfortunately not repeated in the iPad application.

All children were tested individually. They were instructed just to listen carefully to the recording and to color the right part. Only in the practice sentences was, I, the experimenter, still allowed to help and explain.

Most children said they had used iPads or tablets before, but for some of the children who had not, additional instructions on how to use the program were required. Given the young age of the participants, I tried to encourage the children by telling them they were doing great and indicating when they were nearly finished. After the test, the children received a sticker or a lollipop as reward.

Modification

The two versions of the pilot test were both tested, one on a six-year-old girl and the other on a four-year-old boy. Initially the test seemed to be rather long, especially for the younger boy. To shorten the test, the active sentences with the verbs 'tap' and 'follow' were omitted, as the sentences and the drawings were quite similar to 'touch' and 'catch'. If a child understands the latter, the former should not pose any problems.

Both children got all of the sentences with the verb 'admire' wrong. This suggested that the verb was rather difficult to understand and the drawing was not completely clear (as it was not simple to draw children admiring each other without the aid of text). 'Admire' was omitted completely from the test.

Finally, the practice sentences were modified: 'catch' was removed (while 'follow' remained, to compensate for the omission of 'follow' in the active sentences) and a practice item for 'hear' was added because the pilot participants seemed to have some difficulty with this verb, probably due to the unclear drawing.

Final test

After all modifications, the items were randomized. The test thus consisted of five (active) practice items, where the drawings did not demand a choice because only one boy and one girl were shown; and 26 test items, consisting of 12 active

sentences (six psychological and six actional verbs) and 14 passive sentences (seven psychological and seven actional verbs, three or four of which (depending on the version) were truncated). As in the pilot, the truncated and untruncated forms were balanced over the two versions. The procedure was the same as in the pilot study.

	<i>Active</i>	<i>Passive: trunc (v1)</i>	<i>Passive: untr (v2)</i>	<i>Passive: untr (v1)</i>	<i>Passive: trunc (v2)</i>	<i>Practice: active</i>
<i>Action</i>	Catch Tap Hit Hold Draw Call	Catch Follow Hit Tap	Catch Follow Hit Tap	Hold Draw Touch Call	Hold Draw Touch Call	Follow
<i>Psych</i>	Remember Hear Understand Miss See Hate	Hate Miss See	Hate Miss See	Remember Hear Understand	Remember Hear Understand	Miss Hear Remember Understand

Table 1 English translation of the verbs used in each condition

	<i>Active</i>	<i>Passive: trunc (v1)</i>	<i>Passive: untr (v2)</i>	<i>Passive: untr (v1)</i>	<i>Passive: trunc (v2)</i>	<i>Practice: active</i>
<i>Action</i>	Vangen Aantikken Slaan Vastpakken Natekenen Roepen	Vangen Achtervolgen Slaan Aantikken	Vangen Achtervolgen Slaan Aantikken	Vastpakken Natekenen Aanraken Roepen	Vastpakken Natekenen Aanraken Roepen	Achtervolgen
<i>Psych</i>	Herinneren Horen Begrijpen Missen Zien Haten	Haten Missen Zien	Haten Missen Zien	Herinneren Horen Begrijpen	Herinneren Horen Begrijpen	Missen Horen Herinneren Begrijpen

Table 2 Dutch verbs used in each condition

Measures

An answer was classified as correct when a child colored the right figure, so an answer was also correct if the wrong color was used or, for example, a boy's pants were colored instead of his cap. A wrong answer thus meant that the wrong figure was colored, so that the child did not correctly indicate which figure was meant in the sentence. For each child, all correct answers were added up and divided by the amount of actually given answers (sometimes, due to technology problems, a particular picture could not be loaded or colored), thus creating a proportion score for each child, for the total test as well as per category. These category scores were needed, for example, when comparing truncated and untruncated psychological passives. Therefore, all children also received a score for the following subsets: active, passive, actional, psychological, truncated, untruncated, actional active, actional passive, psychological active, psychological passive, actional truncated passive, actional untruncated passive, psychological truncated passive and psychological untruncated passive sentences.

Results

General performance

All children participated voluntarily and with pleasure, as the test was presented like a game on the iPad and they appreciated the promise of a small reward in the form of a sticker or lollipop. The children seemed to understand that they had to choose one of two girls or boys in the picture and color it in as the recorded sentences suggested. Not all children seemed to understand what it was that they had to focus on in order to choose the right girl or boy on the picture. These children were excluded from further analysis, as I will explain below. A few complained that the test was long but as is explained below, this did not seem to affect their results.

Exclusion criteria

Children who had not understood the task correctly were eliminated from the analysis. Two criteria were used: (1) a child could not have more than two mistakes out of the five practices sentences or (2) more than four mistakes out of the twelve active sentences (which were used as control sentences). After excluding children based on these criteria, the sample consisted of 63 participants, of which 29 were in the younger group (4-to-5-year-olds) and 34 in the older group (6-to-10-year-olds).

Pre-analysis conditions

Before the analyses to test the hypotheses, I checked whether there were any differences between the two versions in how well children performed on the test. As a *t*-test revealed no significant differences in the children's scores between the two versions, $t(50) = -.52, p = .605$ (version 1: $M = .74$; $SD = .26$; version 2: $M = .78$; $SD = .23$), the versions were combined in the analyses.

Next, I checked the results for order effects, as children may have gotten tired near the end of the test. To do this, I compared the first 13 items and the last 13 items (the practice sentences were not included) for both versions in a *t*-test. Again, no difference was found in the scores of version 1, $t(24) = -.41, p = \text{n.s.}$ (first part: $M = .72, SD = .23$; second part: $M = .76, SD = .31$), nor for version 2, $t(24) = .28, p = \text{n.s.}$ (first part: $M = .79, SD = .21$; second part: $M = .77, SD = .26$). Consequently, there is no reason for assuming that the children performed worse on the final items.

Finally, I checked for differences between the verbs. For each verb, one active, one passive truncated and one passive untruncated item appeared in the tests. Therefore, per verb a mean score could be calculated, showing the average of correct answers for all three constructions together. I compared the scores of all verbs in a one-way ANOVA. No effect of verb was found, $F(13,26) = 2.06, p = 0.57$. This suggests that no verbs or drawings were significantly more difficult than others, despite of the form in which they were presented. Therefore, all verbs were included in the analyses.

Answers to hypotheses

The results are summarized per age group in the following tables. The tables show the number of correct answers out of all given answers and the percentages of correct answers.

	<i>Active</i>	<i>Passive: trunc</i>	<i>Passive: untr</i>	<i>Practice: active</i>	<i>Total (Practice not included)</i>
<i>Action</i>	155/173 89.6%	91/116 78.4%	82/115 71.3%	29/29 100%	328/404 81.2%
<i>Psych</i>	144/174 82.8%	28/87 32.1%	24/87 27.5%	116/116 ⁴ 100%	196/348 56.3%
<i>Subtotal</i>		119/203 58.6%	106/202 52.5%		
<i>Total</i>	299/347 86.2%	225/405 55.6%			

Table 3 Results for the younger group (29 children aged 4-5). The table shows the number of correct answers, followed by the number of actually given answers, and the percentage of correct answers per condition.

	<i>Active</i>	<i>Passive: trunc</i>	<i>Passive: untr</i>	<i>Practice: active</i>	<i>Total (Practice not included)</i>
<i>Action</i>	187/201 93.0%	130/136 95.6%	104/134 77.6%	34/34 100%	421/471 89.3%
<i>Psych</i>	181/199 90.9%	51/100 51.0%	36/101 35.6%	132/132 100%	258/400 64.5%
<i>Subtotal</i>		181/236 76.7%	140/235 59.6%		
<i>Total</i>	368/400 92.0%	321/405 68.2%			

Table 4 Results for the older group (34 children aged 6-10). The table shows the number of correct answers, followed by the number of actually given answers, and the percentage of correct answers per condition.

As expected, for all categories together, the older children ($M=.70$, $SD=.10$) scored better than the younger children ($M=.79$, $SD=.10$), $t(61) = -3.62$, $p = .001$. The data were further analyzed to answer the four research questions:

⁴ Four of the practice sentences contained a psychological verb, while only one was actional.

- a. Can children of respectively five and seven years old understand passive sentences?

The first hypothesis stated that children of both five and seven years old can understand passives, although they perform better on actives. A repeated measures ANOVA shows how the children scored significantly better on active verbs ($M=.90$, $SD=.10$) than on passive verbs ($M=.62$, $SD=.18$), $F(1,61) = 144.91$, $p < .001$. This is the case for both groups, as no interaction effect of age group and voice was found, $F(1,61) = 2.46$, $p = \text{n.s.}$ With the actives, the younger children scored lower on average ($M=.86$, $SD=.11$), than the older children ($M=.93$, $SD=.08$). This difference, $-.066$, BCa 95% $[-.115, -.017]$, was significant, $t(61) = -2.710$, $p = .009$. With passive sentences, the younger children again scored lower ($M=.55$, $SD=.17$) than the older children ($M=.69$, $SD=.17$). This difference, $-.138$, BCa 95% $[-.199, .026]$, was significant, $t(61) = -3.220$, $p=.002$.

The results thus show that children performed significantly better on the actives than the passives. However, to conclude whether or not the children truly understand the passive, a one-sample t -test was conducted to compare the passive results with a chance level of 50% correct responses. For the older children ($M=.69$, $SD=.17$), their results are significantly higher than chance, $t(32) = 6.29$, $p < .001$. However, when we consider the younger children ($M=.55$, $SD=.17$), their results do not differ from chance, $t(29) = 1.67$, $p = \text{n.s.}$ Still, this appears to be only the case for the young children's untruncated passives ($M=.51$, $SD=.19$), $t(29) = 0.43$, $p = \text{n.s.}$ The young children's scores on truncated passives ($M=.59$, $SD=.21$) are significantly higher than chance level, $t(29) = 2.18$, $p = .037$. To conclude, the first hypothesis was partly supported.

- b. Are psychological verbs more difficult than actional verbs and if so, is this only the case for five-year-old children or does it persist until the age of seven and older?

In the second hypothesis, I expected a significant difference between children's performance on psychological verbs and actional verbs. A repeated measures ANOVA showed that the actional verbs ($M=.86$, $SD=.13$) were performed better than the psychological verbs ($M=.62$, $SD=.15$), overall, $F(1,61) = 179.56$, $p < .001$, as well as per age group, as no

interaction effect was found between age group and verb type, $F(1,61) = 0.431$, $p = \text{n.s.}$

The young children scored lower on the actional verbs ($M=.81$, $SD=.13$), than the older children ($M=.90$, $SD=.12$). This difference, $-.094$, $BCa\ 95\% [-.156, -.032]$, was significant, $t(61) = -3.03$, $p = .004$. With psychological verbs, the younger children again scored lower ($M=.56$, $SD=.13$), than the older children ($M=.68$, $SD=.14$). This difference, $-.12$, $BCa\ 95\% [-.185, -.049]$, was significant, $t(61) = -3.453$, $p=.001$, as well.

To see if the children actually understood psychological verbs, another one-sample t -test was conducted. The younger children ($M=.56$, $SD=.13$) scored significantly above chance level, $t(29) = 2.517$, $p = .018$, as well as the older children ($M=.68$, $SD=.14$), $t(32) = 6.964$, $p < .001$. The second hypothesis was thus supported.

- c. Are untruncated sentences more difficult than truncated sentences and if so, is this only the case for five-year-old children or does it persist until the age of seven and older?

A repeated measures ANOVA showed that the truncated passives ($M=.69$, $SD=.21$) were easier than the untruncated passives ($M=.56$, $SD=.23$), overall, $F(1,61) = 15.74$, $p < .001$, as well as per age group, as no interaction effect was found between age group and verb type $F(1,61) = 0.78$, $p = \text{n.s.}$

When looking at the truncated passives only, results showed that young children on average scored lower ($M=.59$, $SE=.039$), than the older children ($M=.77$, $SE=.029$). This difference, $-.188$, $BCa\ 95\% [-.284, -.092]$, was significant, $t(61) = -3.898$, $p < .001$.

Also with untruncated sentences, young children scored lower ($M=.51$, $SE=.034$), than the older children ($M=.60$, $SE=.044$). However, this difference, $-.086$, $BCa\ 95\% [-.199, .026]$, was not significant, $t(61) = -1.535$, $p=\text{n.s.}$

For the truncated passives, a t -test showed that the young children ($M=.59$, $SD=.21$) scored above chance level, $t(29) = 2.184$, $p = .037$, just like the older children ($M=.77$, $SD=.17$), $t(32) = 9.288$, $p < .001$. For the untruncated passives however, only the older children ($M=.60$, $SD=.25$) scored significantly higher than chance, $t(32)=2.306$, $p = .028$. The

younger children's scores on untruncated passives ($M=.51$, $D.19$) did not differ from chance, $t(29) = .432$, $p = n.s.$

To conclude, for both age groups truncated passives are harder than untruncated passives.

- d. Do sentence structures and verb types interact and, if so, how; do they cancel out or increase each other's effects?

The final hypothesis predicted that the sentence structure and verb type increase each other's influence; e.g. an actional active should be easiest and a psychological passive should be hardest, with psychological actives and actional passives somewhere in between. A repeated measures ANOVA showed no interaction effect between voice and verb type on children's answers, $F(1,61) = 1.635$, $p = n.s.$. For actionality (verb type) and truncation (structure), however, results showed an interaction effect, $F(1,61) = 9.17$, $p = .004$, indicating the effects of verb type and structure reinforce each other's effects. No three-way interaction effect appeared between actionality, truncation, and age group, $F(1,61) = 2.73$, $p = n.s.$, which means that the interaction effect between actionality and truncation was the same for both age groups.

Next, to look deeper into the interaction, I considered the actional passives and psychological passives separately. For actional passives, the truncated passives ($M=.88$, $SD=.21$) were performed significantly better than the untruncated passives ($M=.74$, $SD=.25$), $F(1,61) = 14.648$, $p < .001$. No interaction of structure and age group was found, $F(1,61) = 1.536$, $p = n.s.$, so this was the same for both age groups. As was the case for all passives together, with actional truncated passives the young children on average scored lower ($M=.79$, $SD=.24$) than the older children ($M=.95$, $SD=.15$). This difference, $-.163$, BCa 95% $[-.261, -.065]$, was significant, $t(61) = -1.535$, $p = .002$. With actional untruncated passives the young children on average scored lower ($M=.70$, $SD=.23$) than the older children ($M=.78$, $SD=.27$), but this difference, $-.078$, BCa 95% $[-.203, .048]$, was not significant, $t(61) = -1.239$, $p = n.s.$

A one-sample t -test showed that, for the actional truncated passives, the younger children scored significantly above chance level ($M=.79$, $SD=.24$), $t(29) = 6.727$, $p < .001$, just like the older children ($M=.95$, $SD=.15$), $t(32) = 17.889$, $p < .001$. Results were similar for the actional untruncated

passives, where the young children ($M=.70$, $SD=.23$) scored significantly above chance level, $t(29) = 4.907$, $p < .001$, just like the older children ($M=.78$, $SD=.27$), $t(32) = 6.036$, $p < .001$. So both five and seven-year-olds were able to understand actional passives, both truncated and untruncated.

For psychological passives, the truncated passives ($M=.42$, $SD=.30$) were understood significantly better than the untruncated passives ($M=.32$, $SD=.28$), $F(1,61) = 6.15$, $p = .016$. This was the case for both age groups, as no interaction effect was found between structure and age group, $F(1,61) = 2.03$, $p = \text{n.s.}$ Again, with psychological truncated passives the young children on average scored lower ($M=.31$, $SD=.28$) than the older children ($M=.53$, $SD=.29$). This difference, $-.219$, $BCa\ 95\% [-.36, -.08]$, was significant, $t(61) = -3.07$, $p = .003$. With psychological untruncated passives, the young children scored lower ($M=.27$, $SD=.22$) than the older children ($M=.36$, $SD=.32$), but again, this difference, $-.070$, $BCa\ 95\% [-.24, .04]$, was not significant, $t(61) = -1.41$, $p = \text{n.s.}$

A one-sample t -test showed that, for the psychological truncated passives, the young children ($M=.31$, $SD=.28$) scored significantly below chance level, $t(29) = -3.76$, $p = .001$, while for the older children ($M=.53$, $SD=.29$) it did not differ from chance level, $t(32) = .59$, $p = \text{n.s.}$ For the untruncated passives, the young children ($M=.27$, $SD=.22$) scored significantly below chance level as well, $t(29) = -5.80$, $p < .001$, just like for the older children ($M=.36$, $SD=.32$), $t(32) = -2.49$, $p = .018$.

The last hypothesis was thus supported.

Discussion

Conclusions on research questions

The main question in this study was: 'Do children understand passives and if not, what is the reason for their problems?', which was divided into four sub-questions. Below, I discuss the results for each sub-question.

- a. First of all, I can conclude that passives, like all non-canonical sentences, do take more time to acquire than actives. In general, the results showed that children had more difficulties with passives than with actives. Five-year-olds were only able to handle truncated passives; untruncated passives are still too hard. Although seven-year-olds have complete understanding of the passive, it clearly remained harder than the active.

On both actives and passives, the older children scored significantly higher, which shows that even for canonical, active sentences, children's development seems not to be complete at the age of five.

- b. For psychological and actional verbs, similar conclusions can be stated: for both the five-year-olds and the seven-year-olds, psychological verbs remained more difficult than actional verbs. This in itself is not surprising, since some of the psychological verbs used were not that common for young children. As I explained earlier, this was done to avoid difficult constructions with prepositions, as many Dutch psychological verbs take a preposition. The difference in scores between actional verbs and psychological verbs may also, at least partly, be explained by issues with the drawings, as it turned out to be difficult to draw situations that clearly depict some psychological verbs. Consequently, not all children may have understood what was really going on in some of these pictures and have been resorted to guessing in this category. Still, both age groups on average scored significantly above chance level on the psychological verbs, which shows that both age groups are able to understand both psychological verbs correctly.
- c. When only looking at the passives, I found differences between the two age groups: although for both five-year-olds and seven-year-olds truncated passives were easier than untruncated passives, the older children only scored significantly better than the younger children on truncated passives. From this we can conclude that untruncated passives remain difficult, even for seven-year-olds, but it does seem to be the case that children develop significantly in their understanding of truncated passives between the ages of five and seven. The comparison with the chance level of 50% correct answers showed that five-year-old children did not understand untruncated passives, while they did understand truncated passives correctly, and the seven-year-olds understood both truncated and untruncated passives. It is interesting that seven-year-old's scores on untruncated passives were not significantly better than five-year-old's, but unlike five-year-old's, were better than chance. So, this suggests that, even though seven-year-olds still appear to have problems with untruncated passives and the comprehension of untruncated passives, this does not seem to develop

significantly between the ages of five and seven. However, by the age of seven children are actually capable of understanding these sentences.

- d. The only interaction found was between verb type and truncation: the effect of verb type on children's comprehension of passives is affected by the effect of structure (i.e. truncation). This was found for both age groups. For both actional and psychological verbs the truncated passives were easier than untruncated passives, also for both age groups. Children in both age groups appear to understand actional passives both truncated and untruncated but with psychological passives this is more complicated.

The five-year-olds scored significantly below chance level for both truncated and untruncated psychological passives, which does not just mean they do not understand them but that they actually interpret psychological passives as actives. For the seven-year-olds the same was found for untruncated psychological passives. Their chance scores on truncated psychological passives suggest that children develop in their comprehension of these sentence types between the ages of five and seven years but by the age of seven they still do not really understand untruncated psychological passives.

To conclude, children of five years old seem to interpret psychological passives as actives, as the combination of a psychological verb and a passive construction is probably too difficult for them. However, these children do understand actional passives. By the age of seven, children have become slightly, but not significantly, better at understanding untruncated psychological passives. Moreover, they have become significantly better at understanding truncated actional passives. This clearly shows that verb type and structure influence each other in children's development of the comprehension of the passive.

The main question of the current study can thus be answered as follows: children aged five or older are capable of understanding at least some forms of the passive correctly. Their problems lie within a combination of verb type (actionality) and structure (truncation).

Theoretical implications

The results found in this study are not identical to Fox and Grodzinsky's, as the current study found an effect of truncation at both actional passives and psychological passives for both age groups. Hirsch and Wexler predict no significant

effect of truncation whatsoever, so the present results still remain closer to Fox and Grodzinsky's.

Five-year-old children probably rely heavily on the adjectival interpretation, which could explain why truncated actional passives are the easiest for the children (as they are closest to adjectives), and untruncated psychological passives are the hardest. Fox and Grodzinsky claim that psychological passives are unlikely to be interpreted as adjectives in English. However, more research is needed to investigate if this is the case in Dutch before it is possible to conclude whether the adjectival interpretation hypothesis can account for all results found in the current study.

Fox and Grodzinsky, amongst others, have claimed that children have full understanding of the passive by the age of seven. In this study, I showed that this is not the case: seven-year-olds were still developing and did not comprehend all passives correctly.

As far as can be concluded based on the current results, this study does not contradict Fox and Grodzinsky's theory that by-phrases are problematic for children's comprehension of the passive. In contrast, they do contradict Hirsch and Wexler's predictions, as an effect of truncation was clearly found for both age groups.

Method

The main goal of this study was to study Dutch children's development of the comprehension of the passive between the ages of five and seven, testing if either Fox and Grodzinsky's or Hirsch and Wexler's predictions could be replicated. A sub-goal was to test a new method, the coloring test.

The present experiment was one of the first to use Zuckerman and Pinto's coloring test. From a practical point of view, the test has many advantages over, for example, a picture selection task. The children saw it as a fun game and there was no focus on contrastive situations, which made it less obvious what the test was about and ensured that the children were showing their natural comprehension skills. Moreover, all expectations were clearly supported by the data, and even the much-debated effect of truncation was made visible using the coloring test. The coloring test is, thus, a promising new method that can be developed further for application in different research topics.

For future use of the method, I have some suggestions for improvement. In this study, I chose to combine only two situations, e.g. a girl touching a boy and a boy

touching a girl. Ideally though, each coloring picture would contain more than two situations, so that it is not clear to the participants what the test is about. This would make it an even more natural task, and a more effective alternative to the picture selection task. The reason that I chose not to do this was that prevent that the processing load would become too high, especially for the youngest participants. In future experiments with the coloring picture task, one should try to maintain this balance between a natural game style and a low processing load.

Another point to consider is how much information should be provided to the participants. In this experiment, I only instructed children to look and listen carefully and to color the right figure with the right colors. I did not point out differences between the figures or explain what was happening in the pictures, because I tried to keep it natural and game-like, instead of a test. However, this may have led some children to only focus on the right colors or on how to color as quickly as possible, instead of trying to find out which figure was meant in the recordings. There was even one incident of a girl who made a deliberate mistake, because she wanted to know what would happen. This shows that the game-style has clear advantages, but also some disadvantages that should be worked on.

Overall, the children seemed to enjoy doing the test. Most of them reported that it was not too hard (even if they made mistakes), and only incidentally a child seemed bored or unwilling to finish the test. All children seemed curious to what kind of game they were going to play and looked forward to be allowed to play on an iPad, which all of them really seemed to like.

Future research

In this study I found that even at the age of seven, children still seemed to have some difficulties in the comprehension of passives. Therefore this experiment should be replicated with older age groups. It would be interesting to see if the differences between actives and passives, actional and psychological verbs, and truncated and untruncated passives persist until adulthood or if they eventually disappear.

Another suggestion for further research is to conduct this experiment on English speaking children, to see if the found effects are exclusive to Dutch. Although the differences between Dutch and English passives seem minor, it is not correct to blindly assume the results would be the same. If the same results are indeed found for English speaking children, this will provide more support for Fox and Grodzinsky's theory on by-phrases. It would also be interesting to focus on language-specific properties that were ignored in this study, such as the possibility

to form intransitive passives in Dutch and the comprehension of get-passives in English.

Next, to find out exactly how universal the by-phrase effect is, the effects investigated in this study need to be studied in more languages, especially those less similar to English. An example of a language to be studied is Greek, since the adjectival interpretation of passives is not an option in Greek. It would be interesting to see what this means in combination with the truncation effect.

Finally, other constructions should be investigated using the coloring task. As mentioned, according to Hirsch and Wexler the UPR accounts for children's comprehension of not only passives but also raising and unaccusatives. Since this study shows how the UPR is not sufficient to explain the truncation effect, one may wonder whether it is sufficient for other constructions. From the perspective of the test method, it is interesting to see for which other constructions it can be used.

Bibliography

- Baauw, S., Zuckerman, S., Ruigendijk, E. & Avrutin, S. (2011). Principle B delays as a processing problem: Evidence from task effects. In: Production-comprehension asymmetries in child language, ed. A. Grimm.
- Borer, H., & Wexler, K. (1987). The maturation of syntax (pp. 123-172). Springer Netherlands.
- Cornelis, L. (1996). English and Dutch: the passive difference. *Language Sciences*, 18 (1-2)
- Fox, D. & Grodzinsky, Y. (1998). Children's Passive: A View from the *By-Phrase*. *Linguistic Inquiry*, 29 (2)
- Orfitelli, R. (2012). Argument Intervention in the Acquisition of A-movement. Dissertation University of California, Los Angeles.
- Friedmann, N. (2007) The acquisition of Hebrew unaccusatives: Young Children and A-chains. *Language Acquisition*. Vol. 14 (4)
- Friedmann, N., Belletti, A., & Rizzi, L. (2009). Relativized relatives: Types of intervention in the acquisition of A-bar dependencies. *Lingua*, 119(1), 67-88.
- Gordon, P., & Chafetz, J. (1990). Verb-based versus class-based accounts of actionality effects in children's comprehension of passives. *Cognition*, 36(3), 227-254.
- Hirsch, C. & Wexler, K. (2006). Children's Passives and Their Resulting Interpretation. The proceedings of the inaugural conference on generative approaches to language acquisition–North America, University of Connecticut Occasional Papers in Linguistics (Vol. 4, pp. 125-136).
- Hirsch, C., & Wexler, K. (2007). The late development of raising: What children seem to think about seem. In *New horizons in the analysis of control and raising* (pp. 35-70). Springer Netherlands.
- Horgan, D. (1978). The development of the full passive. *Journal of Child Language*, 5(01), 65-80.
- Koopman, H., & Sportiche, D. (1991). The position of subjects. *Lingua*, 85(2), 211-258.
- Lenneberg, E.H. (1967). *Biological Foundations of Language*. Wiley

- Maratsos, M., Fox, D., Becker J. & Chalkley M. (1985). Semantic restrictions on children's passives. *Cognition* (19)
- Neeleman, A., & Weerman, F. (1997). L1 and L2 word order acquisition. *Language Acquisition*, 6(2), 125-170.
- Pinto M. & Zuckerman, S. (in progress)
- Pinto, M., Zuckerman, S. & Gonggrijp, J. (in progress)
- Slobin, D. I. (1966). Grammatical transformations and sentence comprehension in childhood and adulthood. *Journal of verbal learning and verbal behavior*, 5(3), 219-227.
- Slobin, D. I., & Bever, T. G. (1982). Children use canonical sentence schemas: A crosslinguistic study of word order and inflections. *Cognition*, 12(3), 229-265.
- Svartvik, J. (1966). On voice in the English verb. Mouton & Co, The Hague/Paris.
- Terzi, A. & K.Wexler. 2002. A-Chains and S-Homophones in children's grammar: evidence from Greek passives. In *Proceedings of North East Linguistic Society* 32, 2.
- Turner, E. A., & Rommetveit, R. (1967). Experimental manipulation of the production of active and passive voice in children. *Language and Speech*, 10(3), 169-180.
- Vandenbosch, L. (1992). Aspecten van passievorming in het Nederlands. Een kognitiefpragmatische benadering. Dissertation UI Antwerp.
- Vandeweghe, W. Categorieën van predicaten met voorzetselvoorwerp.
- Verrips, M. (1996). Potatoes must peel. The acquisition of the Dutch passive. ICG Printing, Dordrecht.
- Wells, G. (1979). Variation in child language. In *Language Acquisition*, ed. P. Fletcher & M. Garman. New York: Cambridge University Press

Appendix

Test sentences with English translation

Practice sentences

1. De jongen met de blauwe pet mist het meisje.
The boy with the blue cap misses the girl.
2. Het meisje met de gele jurk hoort de jongen.
The girl with the yellow dress hears the boy.
3. De jongen met de gele broek herinnert zich het meisje.
The boy with the yellow pants remembers the girl.
4. De jongen met de blauwe broek begrijpt het meisje
The boy with the blue pants understands the girl.
5. Het meisje met de blauwe jurk achtervolgt de jongen.
The girl with the blue dress follows the boy.

Version 1

1. De jongen met de blauwe broek wordt gevangen.
The boy with the blue pants is caught.
2. Het meisje met het rode haar herinnert zich de jongen.
The girl with the red hair remembers the boy.
3. De jongen met de blauwe broek wordt gehaat.
The boy with the blue pants is hated.
4. Het meisje met de blauwe jurk wordt gemist.
The girl with the blue dress is missed.
5. Het meisje met de blauwe jurk pakt de jongen vast.
The girl with the blue dress holds the boy.
6. De jongen met de rode broek wordt geroepen door het meisje.
The boy with the red pants is called by the girl.
7. De jongen met de gele broek wordt achtervolgd.
The boy with the yellow pants is followed.
8. De jongen met de groene broek hoort het meisje.
The boy with the green pants hears the girl.
9. Het meisje met het gele haar wordt vastgepakt door de jongen.
The girl with the yellow hair is held by the boy.
10. Het meisje met het rode haar tikt de jongen aan.
The girl with the red hair taps the boy.
11. De jongen met de groene pet wordt gezien.

- The boy with the green cap is seen.*
12. Het meisje met de rode jurk wordt herinnerd door de jongen.
The girl with the red dress is remembered by the boy.
13. De jongen met de gele pet begrijpt het meisje.
The boy with the yellow cap understands the girl.
14. Het meisje met de groene jurk slaat de jongen.
The girl with the green dress hits the boy.
15. Het meisje met de gele jurk wordt nagetekend door de jongen.
The girl with the yellow dress is drawn by the boy.
16. De jongen met de rode pet vangt het meisje.
The boy with the red cap catches the girl.
17. Het meisje met het gele haar tekent de jongen na.
The girl with the yellow hair draws the boy.
18. Het meisje met het rode haar wordt geslagen.
The girl with the red hair is caught.
19. Het meisje met het gele haar mist de jongen.
The girl with the yellow hair misses the boy.
20. De jongen met de blauwe pet wordt aangeraakt door het meisje.
The boy with the blue cap is touched by the girl.
21. Het meisje met de groene jurk wordt aangetikt.
The girl with the green dress is tapped.
22. De jongen met de gele pet wordt gehoord door het meisje.
The boy with the yellow cap is heard by the girl.
23. De jongen met de groene broek wordt begrepen door het meisje.
The boy with the green pants is understood by the girl.
24. De jongen met de blauwe broek ziet het meisje.
The boy with the blue pants sees the girl.
25. De jongen met de groene pet haat het meisje.
The boy with the green cap hated the girl.
26. De jongen met de blauwe pet roept het meisje.
The boy with the blue cap calls the girl.

Version 2

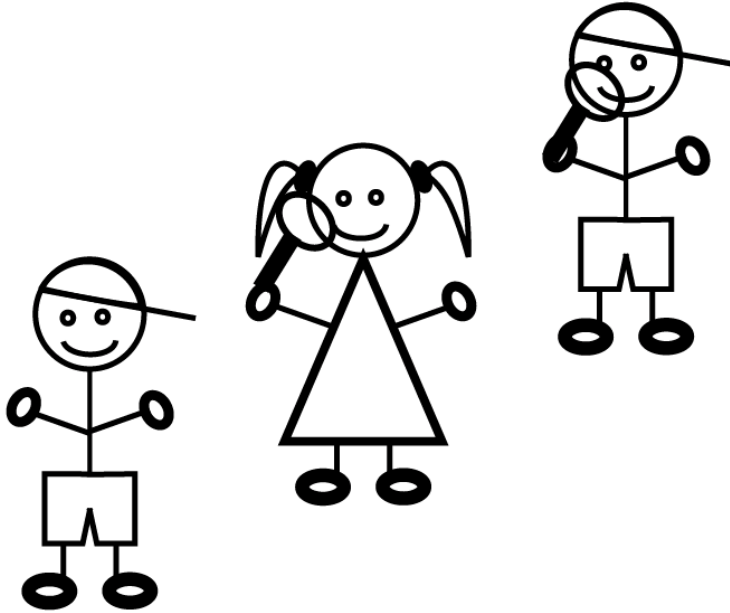
1. Het meisje met het gele haar tekent de jongen na.
The girl with the yellow hair draws the boy.
2. De jongen met de gele broek wordt achtervolgd door het meisje.
The boy with the yellow pants is followed by the girl.

3. Het meisje met de blauwe jurk pakt de jongen vast.
The girl with the blue dress holds the boy.
4. De jongen met de groene pet wordt gezien door het meisje.
The boy with the green cap is seen by the girl.
5. Het meisje met de rode jurk wordt herinnerd.
The girl with the red dress is remembered.
6. De jongen met de groene broek wordt begrepen.
The boy with the green pants is understood.
7. Het meisje met het rode haar herinnert zich de jongen.
The girl with the red hair remembers the boy.
8. De jongen met de gele pet begrijpt het meisje.
The boy with the yellow pants understands the girl.
9. De jongen met de blauwe broek ziet het meisje.
The boy with the blue pants sees the girl.
10. De jongen met de blauwe broek wordt gevangen door het meisje.
The boy with the blue pants is caught by the girl.
11. Het meisje met het gele haar wordt vastgepakt.
The girl with the yellow hair is held.
12. De jongen met de blauwe pet wordt aangeraakt.
The boy with the blue cap is touched.
13. Het meisje met de gele jurk wordt nagetekend.
The girl with the yellow dress is drawn.
14. De jongen met de blauwe broek wordt gehaat door het meisje.
The boy with the blue pants is hated by the girl.
15. De jongen met de rode broek wordt geroepen.
The boy with the red pants is called.
16. Het meisje met het gele haar mist de jongen.
The girl with the yellow hair misses the boy.
17. De jongen met de gele pet wordt gehoord.
The boy with the yellow cap is heard.
18. Het meisje met het rode haar tikt de jongen aan.
The girl with the red hair taps the boy.
19. De jongen met de rode pet vangt het meisje.
The boy with the red cap catches the girl.
20. De jongen met de groene broek hoort het meisje.
The boy with the green pants hears the girl.
21. De jongen met de blauwe pet roept het meisje.
The boy with the blue cap calls the girl.

22. Het meisje met het rode haar wordt geslagen door de jongen.
The girl with the red hair is hit by the boy.
23. Het meisje met de groene jurk wordt aangetikt door de jongen.
The girl with the green dress is tapped by the boy.
24. Het meisje met de groene jurk slaat de jongen.
The girl with the green dress hits the boy.
25. De jongen met de groene pet haat het meisje.
The boy with the green cap hates the girl.
26. Het meisje met de blauwe jurk wordt gemist door de jongen.
The girl with the blue dress is missed by the boy.

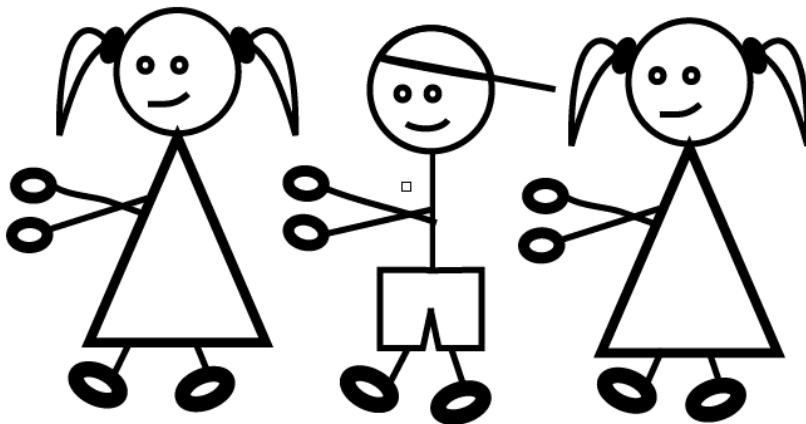
Examples of drawings

Drawing for the verb 'see'



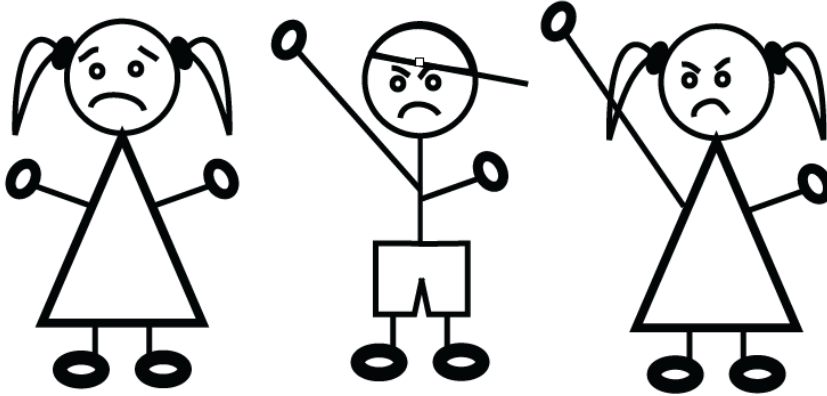
- De jongen met de groene pet wordt gezien.
The boy with the green cap is seen.
- De jongen met de groene pet wordt gezien (door het meisje).
The boy with the green cap is seen (by the girl).

Drawing for the verb 'follow'



- Het meisje met de blauwe jurk achtervolgt de jongen.
The girl with the blue dress follows the boy.
- De jongen met de gele broek wordt achtervolgd (door het meisje).
The boy with the yellow pants is followed (by the girl).

Drawing for the verb 'hit'



- Het meisje met de groene jurk slaat de jongen.
The girl with the green dress hits the boy.
- Het meisje met het rode haar wordt geslagen (door de jongen).
The girl with the red hair is caught (by the boy).