

# **A New Method for Testing Language Comprehension Reveals Better Performance on Passive and Principle B Constructions**

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## **1. Introduction**

In this paper we report the results of an experimental study on the comprehension of passives sentences and of pronouns vs. anaphors (Delay of Principle B) in 58 Dutch children (3;11-8;7). The children were tested with two different methods: the Picture Selection Task (PST) and the Coloring Book (CB), a new method for testing language comprehension developed by the authors. The results of a larger comparative study in which the CB is compared with the PST confirm the validity of the CB method and show that it provides an average of 5% more adult-like answers than the PST, with a maximum effect of 25%. In this paper we focus on a part of this study showing that the data obtained with the CB shed new light on a number of issues on early language comprehension.

The paper is organized as follows. In section 2 we introduce an - in our view - important methodological problem in language comprehension research, the Explicit Presence of Alternatives problem, and we discuss the conditions that have to be met in order to obtain clean linguistic data on comprehension. We also argue that the Coloring Book may be quite promising in this respect. In section 3 we present the results of the sub-study on passives and in section 4 the results of the sub-study on pronouns vs. anaphors (Delay of Principle B). In both cases the CB data reveal a better performance of the children across all groups/ages. The higher scores on the comprehension of these linguistic structures seem to suggest that children's competence at this age is more adult like than claimed thus far. In section 5 we elaborate on the theoretical consequences of these findings and briefly summarize the main points of this study and make some suggestions for future research.

## **2. Language Comprehension from a Methodological Point of View**

Research on comprehension of linguistic structures has to deal with the challenge of reproducing in the experiment the same conditions as in real life. When confronted with the task of assigning an interpretation to a certain construction like the passive sentence in (1), we normally evaluate a number of options and choose the most suitable one to identify the scratcher and the scratched.

- (1) The green monkey is being scratched by a blue monkey.

In real life both the evaluation and the choice take place in the mind of the subject, who is unaware of this process and who accomplishes this task quickly and effectively. An experimental setting aiming at reproducing the same conditions as in real life has thus the demanding task of making a number of options available without making them explicit. Off-line methods like the Picture Selection Task or the Truth Value Judgement Task are widely used in such studies and have provided interesting data. Yet these methods suffer from a number of shortcomings that appear to interfere with the information we need (the subjects' linguistic competence) and that cause overestimation or underestimation of their capabilities (Schmitt & Miller, 2010). We think that one major problem with these methods is precisely caused by the explicit presence of alternatives - the EPA problem (Pinto & Zuckerman, *in prep.*) - i.e. by the fact that subjects are presented with two or three options they have to consider when making a choice. For example, testing the interpretation of (1) with a PST would require two or three pictures showing some possible interpretations, as illustrated in Figure 1.



**Figure 1:** PST for the sentence ‘*The green monkey is being scratched by a blue monkey*’.

In a PST the subject is asked to consider these three alternatives and to decide which picture matches the stimulus. We claim that this procedure introduces an additional layer between the stimulus and the reaction to it. The subject is forced to consciously consider some alternative interpretations he may not have thought about in a normal situation and he is expected to select one.

In order to circumvent the EPA problem, we developed a new method - the Coloring Book method - that satisfies two crucial requirements in language comprehension: 1) it provides alternatives 2) without making them explicit. The Coloring Book method is based on a simple idea: subjects do not explicitly tell their choice by using words, but by coloring specific items on a coloring picture. The task consists of listening to or reading a test sentence containing the dependent variable, for instance an anaphoric expression, and additional instructions about how to color the picture. Each picture is devised in such a way that it contains several uncolored characters, all of them eligible as possible referents for the anaphoric expression. In this way, the colored character indirectly

(and subtly) reflects the subject's choice of the referent reproducing as close as possible a communicative situation in real life. In order to increase its usability, the CB method has been implemented in an application for smart phone/tablet which offers a number of practical advantages. In a previous study (Pinto & Zuckerman, *in prep.*) we tested the validity of the CB method by comparing it to the PST. 58 children aged 3;11-8;7, mean age 6;7 (4 age groups/classes) were tested on four different constructions of grammar – subject anaphora interpretation, passives, delay of principle B and aspectual properties of the periphrastic construction *gaan + Vinf* in Dutch – using the CB method and the PST method. In the PST each sentence was accompanied by three colored pictures (Fig.2). In the CB each sentence was accompanied by a single coloring picture (Fig.3). For both methods we used the same sentences, the same pictures and the same items order. Half of the children performed PST first and the other half CB first, and there was a week difference between the two sessions. The test consisted of 24 items: pre-recorded spoken sentences – matching pictures.

The results of this experimental study confirm the validity of the CB method showing a high correlation between the two methods ( $r=0.688$ ,  $p<0.01$ ). In addition, a t-test (paired samples) calculated on the four constructions and comparing the two methods shows an average advantage of 5% for the CB ( $t=-3.3844$ ,  $p<0.01$ ). Most importantly, the results obtained with the CB provide new insight about the competence of preschoolers and first and second graders in the tested constructions. In the next two sections we present and discuss the data on passives and on the Delay of Principle B.



Figure 2: Example of the PST



Figure 3: Example of the CB

### 3. The comprehension of passive constructions: New insights from the Coloring Book Method

Passive constructions are widespread across languages and are one of the most studied non-canonical sentence types. It takes children a while to master their comprehension and production: for both Dutch and English it has been

claimed that children have difficulties until the age of seven. However, what children exactly know at earlier ages remains unclear, with some quite contradictory claims. The focus of this study lies on comprehension. As discussed in the previous section, methods for testing language comprehension like the PST and the TVJT suffer from what we called the EPA problem, the problem deriving from the explicit presentation of alternatives. The CB method may overcome this problem and it may also shed more light on children's comprehension of passives. Fifty-eight Dutch children between four and eight years of age were tested on their comprehension of two types of passive constructions with different types of verbs. We distinguish between untruncated passives, which contain a by-phrase, e.g. *'The cat is chased by the dog'*, and truncated passives, which do not have a by-phrase, e.g. *'The cat is chased.'* The verbs were classified as: 1) actional verbs, which denote a physical action, e.g. 'to touch', and 2) mental verbs, which denote a mental state, e.g. 'to miss'.

### 3.1. Passives in production

Dutch- and English-speaking children seem to go through similar development in their acquisition of passives. Horgan (1978) found that English-speaking children do not produce untruncated passives until five years of age, which is similar to what Verrips (1996) found for Dutch children. Although children in both languages may produce truncated passives at earlier ages, these utterances are different in both form and meaning from adult passives (Horgan, 1978; Verrips, 1996). It is therefore questionable if these constructions should actually count as passives.

### 3.2. Passives in comprehension

As mentioned, Dutch children, like English-speaking children, have adult-like comprehension of passives around the age of seven (Verrips, 1996). For earlier ages, contradictory claims have been made about what children understand.

Maratsos, Fox, Becker and Chalkley (1985) tested four- and five-year-olds with a simple procedure: the children would hear a sentence like *'Goofy was liked by Donald'* and were then asked: *'Who did it?'* Both actional and mental verbs were used, and only untruncated passives. Maratsos et al. found that the children were able to understand actional passives correctly, but not mental passives. Their results are commented upon by Borer and Wexler (1987), who state that in young children the ability to form A-chains is not fully developed yet (A-Chain Deficit Hypothesis or ACDH). A-chains are needed for the correct interpretation of sentences with A-movement, which takes place in passives. This would mean that children actually cannot process passive sentences. For most actional passives this is not a problem, as these verbs can usually be interpreted as adjectives, and as such they do not require movement. This adjectival interpretation hypothesis is widespread among researchers and it is supported by findings from languages where passives and adjectives do not have the same form, such as Greek. Greek

children cannot interpret actional passives as adjectives, and therefore they score equally low on actional passives as on mental passives (Terzi & Wexler, 2002). The adjectival interpretation of passives is also supported by production data. According to Horgan (1978), English children's early passives, as discussed previously, are more like adjectives, and Verrips (1996) states that this may also happen in Dutch children younger than five. Whereas the adjectival interpretation hypothesis seems to be compatible with many (recent) theories, the A-Chain Deficit Hypothesis is clearly outdated. Since the VP-Internal Subject Hypothesis became generally accepted, A-movement is assumed to be present also in canonical sentences, therefore children must know how to form A-chains.

Fox and Grodzinsky (1998) tested three- to five-years-olds using a truth value judgment task. Their results support the claim that children understand actional passives. For mental verbs, however, they found a difference between truncated and untruncated passives: children understood the truncated passives correctly, but not their untruncated counterparts. Fox and Grodzinsky claim that children do know passives, but that they lack theta-transmission: they cannot assign the external theta-role to the *by*-phrase, which is necessary for correctly understanding untruncated passives. For actional passives this is not a problem, as there is another way to assign a theta-role to the complement of *by*: in many contexts, the preposition itself can assign the agent role to its complement. Children use this strategy instead of theta-transmission, and for most actional verbs, which need an agent role in their untruncated passive forms, this yields a correct interpretation. However, as mental verbs are by definition non-agentive, this strategy fails with untruncated mental passives.

Hirsch and Wexler (2006) tested three- to six-year-olds, on both actional and mental verbs and in truncated and untruncated passives, using a picture selection task. They too found that children understand actional passives correctly, but on truncated and untruncated mental passives the children scored equally low. Hirsch and Wexler's results closely resemble those of Maratsos et al., and their theoretical explanation can be considered an updated version of the ACDH: the Universal Phrase Requirement, which rests in Minimalism. In Minimalism, when working on a particular phrase such as *vP*, only the head and the specifier of a lower phrase are visible for movement. However, in passives, raising constructions, and unaccusatives *vP* is defective, meaning that it does not block movement of lower elements. According to Hirsch and Wexler, children do not have knowledge of defective phrases and consider all phrases as strong, which is why they cannot handle passives. So, according to this theory, children do not understand passives, but, as in the A-Chain Deficit Hypothesis, they interpret actional passives as if they were adjectives.

The most striking difference between these three studies is the effect of the *by*-phrase. However, there are also important differences between the scores on actional passives. Table 1 below summarizes the results from these studies for children aged between four and six years old. It shows that even for similar conclusions the actual scores still differ. For Maratsos et al. and for Hirsch and Wexler the fact that children score above chance seems to be sufficient to

conclude that children can handle actional passives. In Fox & Grodzinsky's study, however, the children's scores are (nearly) adult-like on both actional passives and mental truncated passives, which is in contrast with the results reported in other studies. Therefore the question is not only if there is a difference between truncated and untruncated passives, but rather what children exactly know and do not know in actional passives.

**Table 1: Previously reported pre-school childrens' scores for actional and mental passives**

	study	method	n	active	truncated passives	untrunc. passives
<b>actional</b>	M. et al.(1985)	'Who did it?'	38	91%		67%
	F& G (1998)	TVJT	13	100%		100%
	H&W (2006)	PST	60	94%	81%	71%
<b>mental</b>	M. et al.(1985)	'Who did it?'	38	89%		40%
	F& G (1998)	TVJT	13	100%	87%	46%
	H&W (2006)	PST	60	97%	43%	39%

### 3.3. Experimental study

In order to test passive constructions with the CB method, we needed to develop coloring pictures that encapsulate alternative interpretations without presenting them explicitly. This goal is achieved by presenting two similar characters, for example two ballerinas, where one performs a transitive action on the other (see figure 4 in the next section). In this way, when the child is presented with the coloring instruction, all possible interpretations remain equally available, while the child is not distracted by the explicit presentation of any of them.

#### 3.3.1. Method

We tested 28 Dutch preschool children (3;11-6;6, mean 5;5) and 30 school children (6;7-8;7, mean 7;7). For the test we used four actional verbs: *krabben* ('to scratch'), *natmaken* ('to make wet'), *optillen* ('to lift'), and *bijten* ('to bite'), and two mental verbs: *zien* ('to see') and *missen* ('to miss'). The test sentences appeared in three constructions: the active, the untruncated passive, and the truncated passive. Each figure in the sentences is assigned a color, as in the examples below:

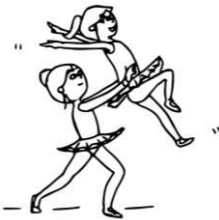
- (2) *De rode ballerina tilt de groene ballerina op.* Active  
 The red ballerina lifts the green ballerina up  
 'The red ballerina lifts the green ballerina.'

Passive untruncated

- (3) *De rode ballerina wordt opgetild door de groene ballerina.*  
 The red ballerina becomes up-lifted by the green ballerina  
 ‘The red ballerina is being lifted by the green ballerina.’

- (4) *De rode ballerina wordt opgetild.* Passive truncated  
 The red ballerina becomes up-lifted  
 ‘The red ballerina is being lifted.’

Three versions were prepared and each verb appeared only once per version, so that in each version each verb appeared in a different form. For the mental verbs, a short story of two sentences was added before the test sentences. This helped to make more clear to the children what was going on. All children did both a picture selection task and a coloring task. Half of the children did the picture selection task first and the coloring task a week later. The other half of the children did the opposite. Each version of the test was used with both methods and with the same drawings in order to be sure that any differences in score were solely due to the testing method and not to the particular verb-form combinations used or to different pictures. In the coloring task the children had to color in the picture themselves according to the colors they heard in the test sentence. In the picture selection task the figures were already colored and the children had to choose the correct match out of three options. Figure 4 shows the image used for the actional verb *optillen* (‘to lift’) and figure 5 the drawing for the mental verb *zien* (‘to see’).



**Figure 4: Image used for ‘to lift’**



**Figure 5: Image used for ‘to see’**

The CB items were presented using the iPad web application. The child listened to the prerecorded sentence and was then asked to fill in the color(s) based on what he had just heard. If asked the sentence was played again as many times as needed. The child’s choices (the colored areas) were automatically sent to the server and afterwards downloaded as a data file. Each correctly colored item received a score of 1.

### 3.3.2. Results

Table 2 below shows the scores of all 58 children for all six verbs taken together.

**Table 2: Total scores for both methods**

	<b>active</b>	<b>truncated</b>	<b>untruncated</b>
<b>PST</b>	96%	91%	84%
<b>CB</b>	97%	90%	92%

For the picture selection task, repeated measures ANOVA show a significant difference between the constructions ( $F=8.573$ ;  $p<0.01$ ). A matched pairs t-test analysis shows that the scores on untruncated passives are significantly lower than active sentences ( $t=2.928$ ,  $p<0.01$ ). For the coloring task, repeated measures ANOVA show no significant difference between the constructions ( $F=3.053$ ;  $p>0.05$ ). A matched pairs t-test analysis strengthens this finding and shows that with CB the scores on untruncated passives are not different than active sentences ( $t=1.74$ ,  $p>0.05$ ). For the 28 preschool children, the effects are similar to those of the whole group: PST reveals a difference between the conditions ( $F=4.889$   $p<0.05$ ) with untruncated being significantly lower than active ( $t=2.221$ ,  $p<0.05$ ). With CB there is no difference between the conditions  $F=3.779$ ,  $p>0.05$ ; t-test active – untruncated  $t= 1.944$ ,  $p>0.05$ .

Next, we look at the difference between actional verbs and mental verbs. Here, we only consider the 28 preschool children, as they form our group of interest. The results are presented in table 3 below. For both the coloring task and the picture selection task, the preschool children score better on actional verbs than on mental verbs on all constructions. The small number of items for mental verbs does not allow for a reliable statistical analysis and should be considered only as an indication of the possible outcome.

**Table 3: Scores for 28 preschool children with CB divided to actional and mental verbs**

	<b>active</b>	<b>truncated</b>	<b>untruncated</b>
<b>actional</b>	100%	100%	97%
<b>mental</b>	88%	56%	68%

### 3.3.3. Conclusion

Comparing the results for preschoolers from previous studies (table 1) with those from our study (table 4) we see a clear increase in adult-like performance. Especially striking is the 68% score on mental untruncated passives, which is even higher than Fox & Grodzinsky's results. The differences between the studies may be due to the methods used. The reason why children may perform better on one method than on the other becomes clear when looking at the effect of truncation. In our PST study we found that children score significantly lower on truncated



passives, whereas with the CB task there was no such effect. We propose that the different options that children are explicitly presented with in a picture selection task may confuse them (the EPA problem). This confusion becomes visible in the truncated passives: these are most likely to be misleading as they contain the same thematic roles as in the active, but in a different order. In the CB task this does not happen, as there are no alternative interpretations presented.

For the actional verbs, the preschool children scored around 100%, meaning that by the age of four children seem to have adult-like understanding of actional passives. Children's high scores on actional passives can be explained by the adjectival interpretation hypothesis, which holds for Dutch as well. Although this interpretation cannot guarantee 100% scores, it still can explain why actional passives are easier for children. As for the mental verbs, the scores are clearly lower, but they are significantly above the chance level of 50%. Scores above 50% on actional passives were enough for earlier researchers to conclude that the children in their studies had acquired actional passives. However, we feel that the difference between 'better than chance' and 'adult-like' is very important: Preschool children do not have adult-like understanding of mental passives, but do have at least some general knowledge of them. This is the case for both truncated and untruncated mental passives, meaning that children do not seem to have particular difficulty with the *by*-phrase.

To conclude, in this section we presented the data obtained by testing comprehension of passives with two different methods, the PST and the CB task. The results show that the CB method yields better results than previously reported. Of course we are fully aware of the fact that this was a pilot study and that more research is needed to confirm whether our findings hold across all mental verbs in Dutch, as well as in other languages.

#### 4. Principle B-constructions

In this section we turn to a second test case for the Coloring Book method. The well-known Principle B-construction in (5) (Chien & Wexler, 1990) was shown to be problematic for preschool children in many languages (see Hamann, 2011 for review).

(5) This is Mama bear; this is Goldilocks. Is Mama bear touching her?

The general claim is that in several languages (among them, Dutch and English) children up to 6 years allow for a local reading of (5) and thus consider the local antecedent '*Mama bear*' as a possible antecedent for the pronoun '*her*'. This phenomenon has come to be known as the Delay of Principle B Effect, or DPBE. The first distinctive fact about this phenomenon is the reverse asymmetry in production and comprehension (Hendrix & Spender, 2006). In most if not all grammatical constructions children show earlier proficiency in comprehension than in production. Principle B-constructions are different – no production study has shown a systematic use of pronouns as referring to a local antecedent while

many studies reported the DPBE in comprehension. This fact is somewhat confusing as it is difficult to see why children do not use the local reference option in production if their grammar allows it.

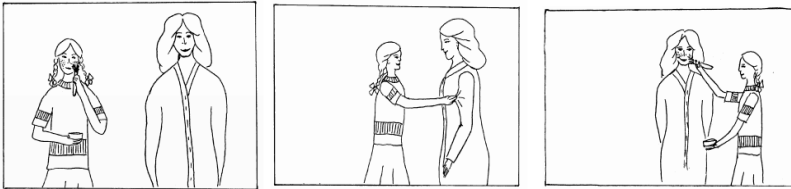
A second fact regarding the DPBE in comprehension studies is that the reported magnitude of the effect can immensely vary among studies, ranging from 40% to 100% correct performance. This large variation is seen not only across studies but also at the individual level.

A third fact regarding the DPBE, is that its existence and magnitude were shown to be strongly affected by many external variables, such as the type of antecedent. For example Chien and Wexler (1990) have shown that when the antecedent is a quantifier (e.g. *'every bear'*) the DPBE disappears and the performance is close to adult-like levels. Also the tested language was shown to be a crucial variable – for example McKee (1992), Baauw (2000) and others have shown that no DPBE is attested in Romance languages such as Italian and Spanish. The saliency of the antecedent also plays a crucial role in the magnitude of the DPBE. Grimshaw & Rosen (1990) and others have shown that the DPBE is reduced and even disappears when saliency and other properties of the context are manipulated. Finally and most importantly for the purpose of the current study, many authors claimed that methodological considerations may have an immense effect on the magnitude of the DPBE and may even be responsible for its existence. Elbourne (2005) and Conroy et al. (2009) have demonstrated that methodological choices can greatly affect the outcomes of the experiment. In the case of Conroy et al. (2009) a different methodology made the DPBE disappear. And finally Baauw et al. (2011) tested the DPBE with two different methods (PST and TVJT) with the same group of children and showed that the method has a significant effect on the results.

Based on the above, we decided to test whether the new Coloring Book method can also supply new results and contribute to the discussion on the DPBE. As mentioned in the previous sections, one of the advantages of the CB method over the PST and the TVJT is that it reduces the problem of explicit presence of alternatives (the EPA problem). We saw that with passive constructions the CB method indeed yielded more adult-like results. We think that this problem may be relevant also for studies on principle B-constructions. Consider for example figure (6) which was used in previous studies on DPBE. The picture on the right represents a false or a mismatched option with respect to the stimulus sentence. The problem may be, and in our opinion often is, that the child did not consider this mismatched option when presented with the stimulus and so the explicit presence of the incorrect alternative creates a whole new situation for the child. The natural, immediate and 'pure' interpretation is repressed by the newcomer – and the selection process is disturbed. It is conceivable that the EPA problem may partly be responsible for children's low performance with these constructions.

Returning to Conroy et al. (2009), where the DPBE was successfully eliminated by controlling the saliency of the possible antecedents, one could claim that there too it was the EPA problem that was successfully dealt with. In their study, Conroy et al. made sure – through a carefully designed story – that all the

possible scenarios are equally considered. Therefore, when the final sentence is presented to the child, the mismatch option does no longer represent a ‘newcomer’ option which was not previously considered. The antecedent selection process in that case remains natural and allows the child to follow her intuition, and to select the non-local antecedent.

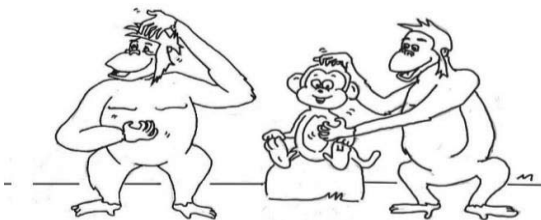


**Figure 6: Drawing from Baauw (2000), PST experiment**  
*‘In which picture the girl is painting her?’*

To conclude: based on the above, and given the higher performance attested with the CB method with other structures and the methodological effects on the DPBE mentioned above, we expect preschool children to show a more adult-like performance in Principle B-constructions such as (5) when tested with the CB method.

#### 4.1. Experimental study

In order to test principle B constructions with the Coloring Book method, we needed to develop coloring pictures in which both the reflexive and the pronoun readings appear as a single event. The pictures included three characters each. One character in the center of the picture and two additional characters at an equal distance to the left and to the right of the middle character, one performing a reflexive action and the other a transitive action as illustrated in Figure (7):



**Figure 7: Principle B item with the Coloring Book Method**

##### 4.1.1. Method

The same subjects participated in the experiment as in the previous section. Each child was presented with 6 Principle B items with the verbs *krabben* (‘to scratch’), *natmaken* (‘to make wet’), *schminken* (‘to put make up on’), *likken* (‘to

lick'), *bijten* ('to bite') and *fotograferen* ('to take a picture'). The items were divided into 3 conditions: one reflexive (principle A) and two pronoun (principle B) conditions. The two pronoun conditions came to control for a possible effect of saliency of the antecedent. Examples (6)-(8) correspond to the coloring item in figure (7) above:

(6) *reflexive condition*

Een groene aap zit op een steen, en een blauwe aap krabt zichzelf  
A green monkey is sitting on a stone, and a blue monkey is scratching himself

(7) *pronoun condition (salient)*

Een groene aap zit op een steen, en een blauwe aap krabt hem  
A green monkey is sitting on a stone, and a blue monkey is scratching him

(8) *pronoun condition (non-salient)*

Een groene aap zit op een steen, en er is ook een blauwe aap. De blauwe aap krabt hem.

A green monkey is sitting on a stone, and there is also a blue monkey. The blue monkey is scratching him.

In the 'salient' condition, the green monkey is the topic of the sentence and thus it may be seen as the preferred antecedent for the pronoun. In the 'non-salient' condition the topic shifts to the blue monkey when it is presented. In this way a possible saliency effect as discussed above is controlled for. The procedure was similar to the previous section.

#### 4.1.2. Results

The results with the Coloring Book show a very high performance for all conditions.

**Table 4: Correct performance preschool and school aged children with CB**

	Reflexive	Pronoun (salient)	Pronoun (non-salient)
Preschool (n=28)	93%	91%	94%
School age (n=30)	100%	97%	100%

Crucially, no difference is found between the three conditions for the 28 preschool children (Repeated measures ANOVA,  $F=.197$  ;  $p>0.05$ ). A matched pairs t-test between the conditions does not show any difference - not between the two pronoun conditions ( $t=-.704$ ,  $p>0.05$ ), nor between the pronoun and the reflexive conditions ( $t=.331$   $p>0.05$  ;  $t=-.441$   $p>0.05$ ). Based on these numbers, as well as on the subjective impression of the experimenters, we can conclude that most children understood the sentences in all conditions in an adult-like manner. As in the case of passives discussed in the previous section, a more extensive study with the CB is needed, yet the preliminary results reported here show that when

methodological considerations are being cared for, children as young as 4 are able to perform at an adult-like level with principle B constructions.

## 5. General discussion

This paper presented two test cases for the Coloring Book, a new method for testing language comprehension (Pinto and Zuckerman, *in progress*). We examined two grammatical constructions – passives and principle B constructions – which are known to have provided contrastive results and which were previously claimed to be affected by methodological issues. In the case of passives we compared transitive actions in the active and passive voice, both truncated and untruncated, with both actional and mental verbs. In the case of principle B constructions we compared sentences with reflexives and pronouns, and we controlled for saliency of the possible antecedent.

We suggested that the comprehension problems that children were shown to experience in previous studies may not have been caused by lack of competence in grammar but by an artefactual load or confusion added to the experiment by the chosen methodology. We argued that the factor that makes language comprehension less straightforward may be the explicit presence of alternatives in the testing material, the EPA problem. This problem is inherent to methods that require the subject to evaluate more than one option and to select the best match as they make explicit the process of comparison that otherwise would be unconscious. (see also Arnon (2005) and Adani (2015) on this matter). The new Coloring Book method avoids the EPA problem by including possible alternative interpretations in one single coloring picture. They are all there, but none is explicitly presented to the subject. We believe this new method allows children to demonstrate their competence in a much more ecologically valid way than existing methods as it remains closer to the manner these structures are being interpreted in daily life. The data on passives and on principle B constructions obtained with the CB method give a clearer picture of children's competence about these constructions and indicate that the CB may eliminate some serious shortcomings of existing methods (the EPA problem, a yes-bias, fear of tests or communication with adult investigators etc.).

Although the relatively small number of participants and of test items does not allow for any strong conclusions, these results definitely indicate that the Coloring Book is a promising method for the study of language comprehension. In addition, its user-friendly nature as an iPad application offers many possibilities in the study of different populations such as individuals with autistic spectrum disorders, language impairments and various cognitive impairments.

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