The Task Clears the Path for Comprehension: The Acquisition of Case in Russian

Sofja Volkova, Raffaella Folli, Christina Sevdali, and Juliana Gerard

1. Introduction

Cross-linguistically, case morphology is a widely used grammatical tool for identifying argument roles in sentences. While languages with little inflectional morphology occasionally retain some remains of a case paradigm (e.g., English *she* vs. *her*), morphologically rich languages like Russian often maintain a productive case-marking system including inflecting nominals, adjectives and determiners.

In general, for languages with a rigid word order using case to identify argument roles is rarely a requisite, due to the reliable consistency in the ordering of their arguments (e.g. Bates et al. 1984, Tomasello 2000; Gertner et al. 2006). For languages with greater flexibility in word order however, case can be crucial for determining 'who does what to whom.' In (1), like in English, Russian speakers can infer that *seal* is the subject and *penguin* is the object based on the default (SVO) word order alone. In (2) however, the subject appears sentence-finally, while the object is in the first position, i.e. the sentence has an OVS word order. Here, the only cue available for identifying the argument roles are the case markers attached to the arguments.

(1)	Tulen-∅	zabryzgivajet	pingvin-a
	Seal.NOM.MAS	splashes	penguin.ACC.MAS
	S	**V**	**O**
	'The seal splashes the penguin.'		Russian

(2)	Tulen-a	zabryzgivajet	pingvin-∅
	Seal.ACC.MAS.	splashes	penguin.NOM.MA**S**
	O	**V**	**S**
	'The penguin splashes the seal.'		Russian

* Sofja Volkova, Ulster University, volkova-s@ulster.ac.uk; Raffaella Folli, Ulster University; Christina Sevdali, Ulster University and Juliana Gerard, Ulster University. Special acknowledgements for their kind support go out to Prof. Maria D. Voeikova (ILS RAS; Saint Petersburg State University) Dr. Natalia Gagarina (ZAS Berlin), and the staff and pupils from the Kindergartens No. 115 (Saint-Petersburg) and No. 26 (Sestroretsk) in Russia.

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For children acquiring a flexible-word order language, using case morphology for identifying argument roles can thus potentially be a useful tool early on. Yet, many studies find that the comprehension of case arises rather late, with children often struggling to assign argument roles correctly based on case morphology alone (e.g., Dittmar et al. 2008; Schipke et al. 2012; Knoll et al. 2012). This is all the more puzzling in light of the general consensus that the systematic use of the relevant canonical case markers occurs quite early in language production (Stephany and Voeikova 2009).

The present study investigates the source of the difficulty with case comprehension in children. More specifically, the study is aimed at determining the nature of Russian children's grammatical knowledge by measuring their accuracy with using case for interpretation across two tasks: Picture Selection task and Referent Selection task. Our results reveal that children's use of case morphology in isolation is sensitive to the chosen methodological approach. Children display a high accuracy with using case for comprehension in one of the two tasks, which indicates an adult-like knowledge of case. This suggests that the source of children's difficulty is not related to their internal grammatical competence and it is rather best accounted for by an extra-grammatical influence.

2. Background

2.1. A comprehension issue

Children start producing nominative and accusative morphological case markers consistently between the 2nd and the 4th year of age, depending on the language acquired (e.g., Babyonyshev 1993; Stephany and Voeikova 2009; Eisenbeiss et al. 2006). However, the production of these case markers generally also aligns with the default word order of the acquired language (see (1) above). This raises the question of how much awareness children have of the function of case, if it's active use is not required. To address the question of how children use case for identifying argument roles, studies generally test children's comprehension of sentences in a non-canonical word order (see (2) above).

In (1), Russian children can theoretically use both word order and case morphology as cues for argument role assignment. Comprehension research shows that these sentences are generally well-comprehended early on. This could be due to children benefitting in their understanding from multiple cues supporting a single interpretation (Bates and MacWhinney 1987; Grünloh et al. 2011). Alternatively, word order alone could be the cue that leads children's interpretation, like with English children (Tomasello 2000; Gertner et al. 2006).

In (2) however, case morphology overrides the default word order cue, marking the first argument as an object and the second argument as the subject. Here, the cues of word order and case are in contradiction and according to the adult grammar children ought to select case to guide their interpretation. However, children often assign sentences like (2) an SVO interpretation instead of OVS. This potentially means that children opt for a non-adult-like cue ranking or that they fail to incorporate case as a cue.

The tendency to (initially) interpret the pre-verbal argument as the *agent* has been observed for both adults and children in a number of languages for related linguistic phenomena such as non-canonical sentences (Grewe et al. 2007; Dittmar et al. 2008), passives (Ferreira 2003; Huang 2013) and relative clauses (Trueswell et al. 1994). While adults have been found able to shake the initial preference to classify the pre-verbal argument as the subject, children appear to have difficulty overcoming this strategy for reasons yet unknown.

2.2. The source of the difficulty

Studies do not seem to agree on the underlying cause of children's difficulty with case comprehension. The main point of the discussion often revolves around the nature of children's grammar. One possible explanation for children's difficulty with using case is that their grammar is not yet adult-like. This grammatical approach rests on the assumption that children's linguistic behaviour is a direct representation of the underlying grammar. In contrast, a processing approach does not assume a direct link between children's behaviour and their grammatical competence (Omaki and Lidz 2015). Rather, the cause of the difficulty is placed outside of the grammatical domain. According to this theory, extra-grammatical factors can obscure children's competence and cause non-adult-like behaviour on the surface (Trueswell et al. 1999; Özge et al. 2019).

2.2.1. The grammatical accounts

The first grammatical theory (-a neurological account) predicts that young children should not be able to process non-canonical word orders, as their brain does not yet have the relevant neurological bundle to enable this type of complex syntactic processing (Knoll et al. 2012, Schipke et al. 2012; see also Friederici 2011). The processing becomes possible once the required neural networks are in place, which is roughly between the 6th and the 7th year of age. Until then, children are relying on an agent-first parsing preference for interpretation, resulting in the classification of the first sentence argument as the doer.

Meanwhile, the second theory (-a frequency-based account) proposes that children have not yet obtained a rule-like understanding of case (Dittmar et al. 2008). Under this account, the acquisition of the case cue is preceded by other more frequent, transparent and stable types of cues like word order (Dittmar et al. 2008; Brandt et al. 2016). Case is acquired at a later stage through repeated exposure in the input, in a way that enables the learner to move from a construction-based knowledge to a rule-like generalization. Children incorrectly analyze OVS sentences as SVO because they have not yet acquired the case rule.

2.2.2. The processing account

Under the processing account, the source of children's errors lies outside of the grammatical domain. At this stage, children's knowledge of case is already adult-like. However, children's linguistic behaviour is additionally shaped by the

developments in the domain-general processes. While children may possess the required linguistic knowledge for using case, they may be yet constrained by the developing cognitive mechanisms such as working memory or cognitive control mechanisms (see Omaki and Lidz 2015 for a further discussion). These developments, while not directly related to the grammar, may affect the manner in which the linguistic input is encoded or the behaviour on the surface (e.g., Trueswell et al. 1999; Choi and Trueswell 2010; Özge et al. 2019).

3. Predictions for the grammar types

The theoretical approaches make different predictions about how children's grammatical competence interacts with the context, in which a linguistic act, like decoding an OVS sentence, is performed. Importantly, the context in which the decoding takes place can vary: the accounts make different predictions about children's behaviour in these contexts. For example, in a context that imposes high processing costs (*high demand)*, children's behaviour may be a less accurate representation of the underlying grammar. For a low-demand context, in which children are able to perform the required linguistic operation without the external pressure, their behaviour will reflect the internal competences more clearly.

3.1. Predictions of the grammatical accounts

For both grammatical accounts, children are not expected to display an adult-like behaviour, given that they do not yet possess the required rule for interpreting the OVS word order. However, how the specific nature of their grammar deals with the assignment of interpreting an OVS sentence can be determined more clearly in a low demand context than a high demand context.

3.1.1. Predictions with a strict SVO grammar

For a version of a grammatical account with a strict subject-first rule, a low demand context will more accurately reflect children's grammar, resulting in a consistent re-analysis of the OVS sentences as SVO. In a high-demand context however, children's behaviour will less clearly reflect their subject-first grammar, which will result in a chance performance.

3.1.2. Predictions without a strict SVO grammar

An alternative version of the grammatical account is one in which children's parsing is guided by the general agent-first parsing preference. While this preference does not need to reflect an underlying grammatical rule per se, it may result in the same pattern of behaviour as with the strict subject-first grammar. If children are parsing the OVS sentences with an agent-first parsing strategy, they are likely to apply this strategy more consistently in a low demand-context. This will result in a low accuracy for the OVS sentences. However, with a high demand context, children are more likely to display an at chance behaviour. Alternatively,

children may not rely on an agent-first parsing preference, in that case their performance will be at chance independent of the nature of the context.

3.2. Predictions of a processing account

For the processing account, children's grammar is assumed to be adult-like, but it is nonetheless susceptible to the demands of the context. With a low demand context, children will more consistently arrive at an adult-like interpretation of the OVS sentences. With a high demand context on the other hand, children's behaviour will be a less accurate reflection of their grammar, resulting in a chance performance.

4. Experiment rationale

4.1. Language

The current study investigates the understanding of the canonical morphological case markers in young Russian monolinguals. Russian is well-known for its rich nominal inflectional morphology. It productively marks 6 different cases (*nominative, accusative, genitive, dative, instrumental and partitive*) on the nouns, adjectives and pronouns. The cases occur in four different declensions, each with their own set of endings (Babyonyshev 1993). Russian case paradigm has relatively little syncretism, which results in a high availability rate for the case cue, i.e. opportunities to encounter case in its unambiguous form in the input. (Kempe and MacWhinney 1999, see for instance Sauermann & Gagarina 2018).

Additionally, Russian is known to be a flexible word order language: while SVO is the basic word order, SOV, VSO, VOS, OSV, and OVS are also acceptable, albeit often linked to a certain pragmatic context (Kallestinova 2007). This flexibility in word order can potentially provide children with the type of context, in which the reliance on case morphology is required.

4.2. Experimental design

Earlier, we introduced the dimension of the context in the case comprehension model: here the link between children's underlying grammatical competence and their behaviour may get coloured by the contextual factors, which are independent from the nature of children's grammar. One way of investigating the role of context in children's behaviour is by manipulating the demands of the context across tasks. Here, we have used two tasks for testing case comprehension: Picture Selection task and Referent Selection task (for a similar approach see Sekerina and Mitrofanova 2017).

Each of these tasks has been employed in the past for testing case comprehension in children and each has its own methodological advantages. Picture Selection task is relatively simple and has been proven in the past to be less-demanding, than tasks like the act-out task (Dittmar et al. 2008). The design of the Referent Selection task (Kamide and Altmann 2003; Özge et al. 2019) has the advantage of representing a non-ambiguous selection environment (see Arnon

2005). As both tasks require children to access their case knowledge differently, they can be associated with a different type of high or low demand context.

5. Study predictions

The above discussed theoretical accounts make different predictions for children's behaviour in different contexts. In the current study, where the context amounts to a variation in the task type, it is expected that children show a different pattern of performance across tasks, depending on the nature of their underlying grammar. Given the predictions outlined in section 3.1, we expect following will for children's accuracy with the use of case in the OVS sentences across tasks:

Table 1: Predicted accuracy estimates for the OVS condition across tasks.

		Task	
		Easy	**Hard**
Account	*Grammatical*	low (A) or chance (B)	chance (C)
	Processing	high (D)	chance (E)

1) If Russian children have a non-adult-like subject-first grammar, they will show a systematically low accuracy for the OVS condition in the task, that is considered relatively easy (A). This is due to the fact that the easy task, as a low demand context, will allow for a more accurate application of the subject-first rule for the misinterpretation of the OVS sentences. On the other hand, children will have a chance accuracy for the harder task, as the link between the grammar and the behaviour will be affected by the context demands (C).
2) If Russian children have a non-adult-like grammar without an underlying subject-first rule, they may rely on an agent-first parsing preference instead. In that case, children's accuracy rates will closely mirror their performance with the subject-first grammar: they will display a low accuracy in the low-demand task, as it will allow them to exercise their parsing preference more consistently (A). However, they will display a chance accuracy for the high-demand task, as they will be required to put an increased effort into handling the task demands on the side of the OVS sentence analysis (C).
3) If children have a non-adult-like grammar with no underlying subject-first rule and they do not rely on an agent-first parsing preference, they will have no overall consistent strategy of analyzing OVS sentences across tasks. The varying task demands will have no visible effect on the accuracy, as children will display chance accuracy even in a low-demand context (B and C).

4) If children have an adult-like grammar, which includes an SVO and OVS rule, they will display the following sensitivity to the task demands: a low-demand context will allow to establish a clearer link with the grammar, resulting in a higher accuracy in the easy task (D). However, a high-demand context will result in a chance accuracy in the hard task (E).

6. The study
6.1. Picture Selection Task
6.1.1. Methods

Russian 3-5-year-old monolingual children (N=37; 3:10-5:10; 4:8) participated in the experiment, with 9 Russian adult native speakers acting as control subjects. Participants were recruited from two kindergartens in Saint-Petersburg area and tested following written consent from a parent**.** For the Picture Selection task, a total of 22 children passed the control trials for further analysis.

6.1.2. Materials

Children were presented with two pictures simultaneously, each showing the same two size-matched animal pairs participating in a transitive action (see Fig. 1). For instance, one picture would show a penguin splashing a seal, while the second picture depicted the reversed roles for the same action:

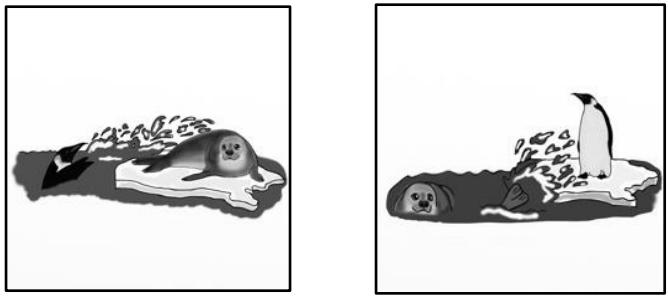

Figure 1: Example of a visual trial in the Picture Selection Task.

Each picture pair was accompanied by audio of a sentence describing the role division on one of the images. The sentences were pre-recorded in the SVO (3a) or the OVS (3b) word order by an adult female native speaker of Russian.

(3a) Tulen-∅ zabryzgivajet pingvin-a
Seal.NOM.MAS splashes penguin.ACC.MAS
'The seal splashes the penguin.' *Russian*

(3b) Tulen-a zabryzgivajet pingvin-∅
Seal.ACC.MAS. splashes penguin.NOM.MAS
'The penguin splashes the seal.' *Russian*

(3c) Zdes' spit lis-a
Here sleeps fox-NOM.FEM.
'Here sleeps fox'. *Russian*

The experimental conditions were interspersed with control trials (3c), this amounted to a total of (8 + 8 + 8 =) 24 trials. Eight transitive action verbs were used in the experimental conditions, appearing twice each; they were *lick* (lizat'), *splash* (zabryzgivat'), *scratch* (tsarapat'), *push* (tolkat'), *peck* (kl'uvat'), *bite* (kusat'), *carry* (nesti) and *kick* (pinat'). The control trials were sentences with the (semi) intransitive verbs *clean* (ubirat'), *sleep* (spat'), *read* (chitat'), *knit* (vyazat'), *sneeze* (chixat'), *paint* (risovat'), *dig* (kopat') and *drink* (pit').

6.1.3. Procedure

Children were seated in a kindergarten room in front of a touch-screen computer with the experimenter beside them. The experimenter first showed an introductory slideshow. In the introduction, the experimenter told a story about an alien girl named Anya. Anya was curious about life on Earth and in particularly interested in the Earth's animals. Anya loved listening to her radio, as it told short facts about the animals. However, Anya did not know what these tales looked like, hence the participants were encouraged to help her learn in a follow-up game. An E-Prime experiment followed consisting of familiarisation, training and the main task. In each phase, children were instructed to point at the correct picture by touching it on the screen. Video recordings were conducted during the testing for offline coding purposes. During the familiarisation, children were tested on their knowledge of animals. They received 6 random trials, encouraging them to select the correct animal out of four in a '*Show me the X'* fashion. In the training, children had to select a picture of the animal missing in the audio story, choosing out of three options.[1] In the main task, children listened to the sentences and selected a matching picture for each, choosing out of two.

[1] The training phase was designed to prepare the children for the sentence completion assignment in the Referent Selection task specifically and was included in each tasks for the consistency in the build up across tasks.

6.2. Referent Selection Task
6.2.1. Methods

Initially, the same group of Russian 3-5-year olds participated in both tasks (N=37; 3:10-5:10; 4:8). However, different children passed the exclusion criteria for each task. As a result, the two groups analysed for each experiment were slightly different. For the Referent Selection task, 27 children in total passed the control trials for further analysis.

6.2.2. Materials

The experimental design was built on the design in Kamide et al. (2003) and Özge et al. (2016; 2019), with a modification including a pointing task. Children were simultaneously presented with pictures of three different animal referents (see Fig. 2). One animal would be semantically ambiguous (e.g., *seal*), as it could be potentially an agent or a patient. The remaining two referents were examples of a prototypical agent (e.g., *shark*) and a prototypical patient (e.g., *fish*).

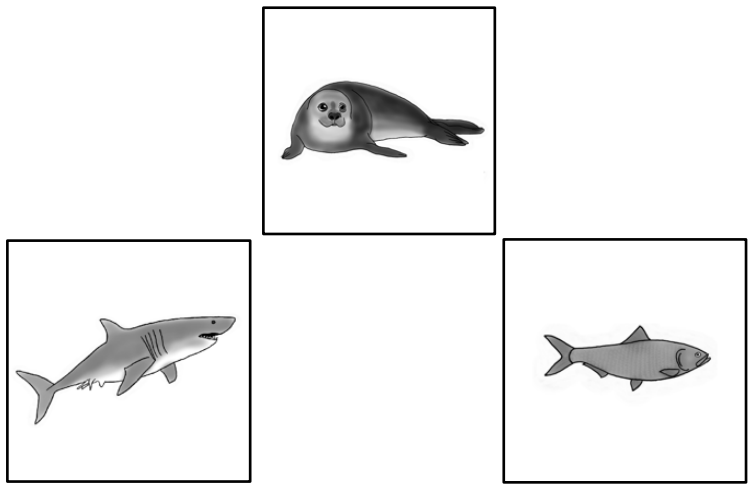

Figure 2: Example of a visual trial in the Referent Selection Task.

The visual trial would be accompanied by an audio sentence fragment, which would describe the semantically ambiguous referent (=the sentence-initial argument) participating in a transitive action. For each of the sentence fragments, the second referent (=the final argument) was deliberately covered by the sound of bubbling water. Depending on the morphological case ending attached to the named semantically ambiguous argument, the choosing of one of the follow-up arguments would be rendered more or less likely. For instance, a nominative-marked *seal*, would lead to *fish* as a likely follow-up (4a), whereas an accusative-marked *seal* would render *shark* a likely follow-up (4b).

(4a) Tulen-∅ jest [masked animal]
Seal.NOM.MAS. eats
'The seal eats X.' Russian

(4b) Tulen-a jest [masked animal]
Seal.ACC.MAS. eats
'The X eats the seal.' Russian

(4c) Zdes' spit [masked animal]
Seal.ACC.MAS. sleeps
'Here sleeps X.' Russian

Audio trials appeared in the SV or OV word order and were interspersed with control trials, this amounted to a total of (8 + 8 + 8 =) 24 trials. Eight different transitive action verbs were used in the experimental conditions, appearing twice each. The verbs were *catch* (lovit') *lick* (lizat'), *eat* (jest'), *swallow* (proglatyvat'), *bite* (kusat'), *carry* (nesti), *catch up with* (dogon'at') and *kick* (pinat'). The control trials were sentences with (semi) intransitive verbs *clean* (ubirat'), *sleep* (spat'), *read* (chitat'), *knit* (vyazat'), *sneeze* (chixat'), *paint* (risovat'), *dig* (kopat') and *drink* (pit').

6.2.3. Procedure

For the Referent Selection task, children received a modified introduction: The alien girl Anya had accidentally dropped her radio in a puddle, which caused it to play incomplete tales about the animals. Children were then encouraged to help finishing the tales correctly, allowing Anya to learn more about the animals. In the experimental phase, children were instructed to listen to the sentence fragments and point at the correct referent for finishing the story.

7. Results

The adults showed generally an expected high performance in both conditions and for both tasks. Children's data was included for further analysis in a task, provided that they had achieved an accuracy level of 62,5% or higher on the control trials in that particular task. The accuracy rates for the analyzed children's Picture Selection data showed a 73.8% accuracy for the SVO condition and a 63.6% accuracy for the OVS condition. The accuracy rates for the analyzed children's Referent Selection data however, showed a 35.6% accuracy rate for the SVO condition and 43.0% accuracy rate for the OVS condition.

A two-way ANOVA with the factors of *Task* (- Picture Selection vs. Referent Selection) and *Word Order* (SVO vs. OVS) revealed that children overall performed significantly better in the Picture Selection task, than in the Referent Selection task ($F=34.09$, $p<.001$). Figure 3 depicts children's overall performance on both tasks, with on the x-axis the task type (*from the left to the right* Picture Selection and Referent Selection) and on the y-axis the accuracy level. For each

task, the light grey bar represents the SVO condition and the dark grey bar represents the OVS condition:

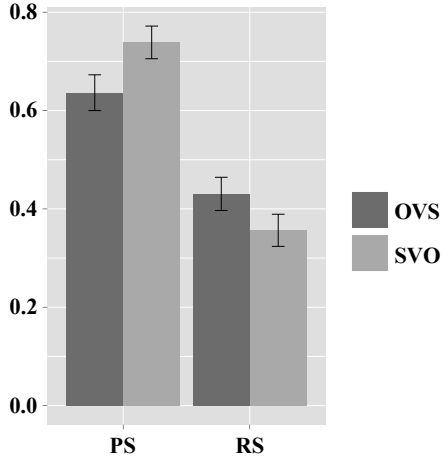

Figure 3: The accuracy rates for SVO and OVS conditions in the Picture Selection and the Referent Selection Tasks.

Furthermore, the ANOVA also revealed a *Task* by *Word Order* interaction, indicating that the difference between the experimental conditions in the Picture Selection task was significantly bigger than the difference between the experimental conditions in the Referent Selection ($F=3.06$, $p=0.08$).

A follow-up two-sample t-test revealed that children's accuracy for the OVS condition was significantly better in the Picture Selection task than their accuracy for the OVS condition in the Referent Selection task ($t=3.08$, $p=.003$). Crucially, an additional follow-up one-sample t-test revealed that children's accuracy in the OVS condition in the Picture Selection task was significantly above chance ($t=3.32$, $p=.003$).

8. Discussion

The results of the current study indicate that Picture Selection task is considered by the tested children to be a low demand type of context in comparison to the Referent Selection task. The performance in the Picture Selection task alone provides evidence that children have an adult-like grammar, enabling them to comprehend OVS sentences through relying on case.

These results are challenging for the non-adult-like grammar approaches: for instance, children with a strict subject-first grammar account would have shown a low accuracy rate in the OVS condition in a low-demand task. Furthermore, the results are also in contradiction with a non-adult-like grammar with an agent-first parsing principle: children's performance in the OVS condition in the low-demand task would have mimicked the behaviour for the strict subject-first

grammar account with a low accuracy rate. For children, who would have not made use of the agent-first parsing principle, the accuracy for both tasks would have been at chance.

Differences in children's performance across different types of tasks, or 'task effects', have been demonstrated in the past demonstrated for other linguistic phenomena such as binding effects, subject-verb number agreement and adjunct control (Conroy et al. 2009; Lukyanenko and Fisher 2016; Gerard 2016; see also Hamburger and Crain 1984; Crain and Thornton 1998). These patterns suggest in general that children have an adult-like understanding of the investigated phenomena, while other factors may affect their behaviour.

9. Conclusion

The current study has investigated children's ability to rely on case morphology for argument role assignment, motivated by the conflicting results in the literature. A two-task approach was employed for testing which of the two major theories can best account for children's mixed performance with the use of case for argument roles assignment. Children's accuracy was found to be overall high in the Picture Selection task and at chance in the Referent Selection task. The significantly differing accuracy rates for the OVS conditions across tasks, show that children are sensitive to the chosen methodological approach. More generally, this implies that children's ability to use case for interpretation is sensitive to the contextual demands. Additionally, children's accuracy in the OVS condition in the Picture Selection task was significantly above chance. This indicates that the tested children possess the ability to rely on case in the absence of other cues. In sum, the current results suggest that the difficulty children exhibit with case is due to extra-grammatical factors, rather than due to the lack of knowledge of case. That is, our results are in contradiction with the non-adult-like theories accounts and provide support the processing account.

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