

Shadow playing with Romanian 5-year-olds. Epistemic adverbs are a kind of magic!

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Abstract. The current paper employs a novel Shadow Play Paradigm to investigate the semantic knowledge and pragmatic ability of Romanian 5-year-olds with respect to the epistemic adverbs *poate* ‘maybe’ and *sigur* ‘certainly’. The paradigm is an improved version of the Hidden Object Paradigm, where, instead of merely looking at an inaccessible entity, participants can now infer the presence of the entity on the basis of evidence (a shadow, as well as a specific sound). We argue that Romanian children as young as 5 are able to derive implicatures with epistemic adverbs at an almost adult-like level. However, they exhibit the tendency to accept overly strong statements (i.e., statements where a certainty adverb is wrongly used instead of a possibility adverb) as optimal to a much higher degree than adults. This can be explained as a cognitive/communicative strategy to reduce multiple alternatives to a single one in cases of uncertainty.

Keywords. Language acquisition; Romanian L1; scalar implicatures; modality; epistemic adverbs; premature closure hypothesis

1. Aim. The current paper is among the first studies to investigate the semantics and pragmatics of epistemic adverbs (*possibility, not certainty* implicatures) in child Romanian (see also Bleotu 2019). Importantly, it employs a novel Shadow Play Paradigm, an improved version of the traditional Hidden Object Paradigm (Hirst & Weil 1982, Noveck, Ho & Sera 1996, Noveck 2001, Ozturk & Papafragou 2015, Moscati, Zhan & Zhou 2017, a.o.), where participants have to make inferences about the presence of a hidden object/animal on the basis of evidence. While, in the traditional paradigm, participants have no direct access to the hidden object/animal and rely solely on reasoning, sometimes showing caution in their answers, in the Shadow Play Paradigm, additional cues (the object/animal’s shadow and specific sound) support participants’ logical reasoning. As we will show, in the improved paradigm, children behave more adult-like than in the Hidden Object Paradigm with respect to implicature-generation with the epistemic *poate* ‘maybe’. However, they behave non-adult-like in accepting as optimal overly strong statements, where certainty adverbs are wrongly employed instead of possibility adverbs.

The paper is organized as follows: After presenting some background on the acquisition of epistemic modality in Section 2, we present our novel Shadow Play paradigm in Section 3. In Section 4, we discuss the implications of our experimental results, and Section 5 presents the conclusions of our research.

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2. Background on the acquisition of epistemic modality. The experiment we conducted deals with epistemic modality, a type of modality which refers to the degree of speaker-commitment to the truth of the proposition expressed by the complement (Kratzer 1981, Coates 1983, Sweetser 1982, 1990, Palmer 1986, a.o.). Epistemic modality translates into certainty or uncertainty about a situation, an attitude resulting from an inference based on evidence. This type of modality is usually set in contrast to root modality, which refers either to the necessity (obligation) or possibility (permission) of certain actions given society or moral rules (in the case of deontic modality) or to the ability or willingness (volition) to perform a certain action (in the case of dynamic modality). Given the wide literature on the acquisition of epistemic modality, we will briefly touch on some essential aspects, and then focus on the experiments relevant for our study.

In the acquisition literature, there is a general consensus that epistemic modality emerges after root modality (Schatz & Wilcox 1977, Wells 1979, Shepherd 1982, Perkins 1983, Stephany 1986). Children produce deontic modals as early as 1;1, while they produce epistemic modals later (around 3). Importantly, this order in acquisition is considered a reflection of a child's mental development, that is, their Theory of Mind (Wellman 1990, Gopnik 1993, Gopnik & Wellman 1994, Papafragou 1998, 2000). This refers to the ability to reflect upon one's and others' thoughts, to represent beliefs as belonging to someone else than themselves. Interestingly though, not all epistemic modals behave in the same way: Epistemic adverbs/adjectives (e.g., *possible/ly*, *certain/ly*) emerge before the age of 3 (O'Neill & Atance 2000, Cournane 2015, Veselinović and Cournane 2020), whereas epistemic verbs (e.g., *might*, *must*) emerge after this age. This contrast in production is unexpected under an explanation that relies solely on Theory of Mind. Thus, it has been proposed that, in addition to the cognitive account, there is a grammatical source for the acquisition of epistemic modal verbs (Heizmann 2006, Hacquard 2006, 2009, Cournane 2015). In contrast to adverbs/adjectives, in the case of modal verbs, children have to figure out that the same items can express both root and epistemic meanings, or that modal verbs followed by lexical verbs in the progressive/perfective aspect usually give rise to epistemic meanings (Kratzer 1981, Papafragou 1998, 2000, Avram 1999). The class of epistemic adverbs is not without its problems. Interestingly, there seems to be a much higher number of epistemic possibility adverbs in comparison to epistemic necessity adverbs. This cannot be captured by Theory of Mind alone, but rather by frequency in the input (Dieuleveut et al. 2019), or additional considerations, such as the necessity to resort to uncertainty markers in order to express uncertainty, but the absence of the necessity to resort to certainty markers in order to express certainty, as one can simply assert it.

Acquisition studies on epistemic modality have almost exclusively looked at epistemic verbs rather than adverbs (Hirst & Weil 1982, Noveck, Ho & Sera 1996, Noveck 2001, Heizmann 2006, Ozturk & Papafragou 2015, Moscati, Zhan & Zhou 2017, a.o.), but their methodology is essential for our purposes. All the experiments rely on some version of the Hidden Object Paradigm, where participants have to infer the presence of a certain object/animal based on certain statements. However, there is variation in the conclusions about whether children behave adult-like or not.

The first linguists to use this paradigm to investigate the semantics of epistemic modals were Hirst & Weil (1982), who implemented a *Look for the Peanut* Task, where 3-to-6-year-olds children heard statements (with epistemic modals) about a peanut, and they had to find it. Their results show sensitivity to modal strength: Children looked more for the peanut in a certain location when the sentence they heard contained a strong (certainty) modal than when it contained a weak (uncertainty) modal. This shows children as young as 3 have a grasp of the modal scale.

Noveck, Ho & Sera (1996) and Noveck (2001) further investigated the semantics and pragmatics of epistemic modal verbs through the Box Paradigm, a variant of the Hidden Object

Paradigm making use of boxes. For instance, participants were told that a covered box, Box C has either the content of an open Parrot + Bear Box (containing a Parrot and a Bear) or the content of an open Parrot-only Box (containing only a Parrot). They were then asked to evaluate certain sentences describing the location of animals in Box C. With respect to the semantics of epistemic modal verbs, Noveck, Ho & Sera (1996) showed through a Forced Choice Task that, unlike 5-year-olds, 7-year-olds prefer weaker true statements over stronger false (overly strong) statements at an adult-like rate. In addition, Noveck (2001) showed through a Truth Value Judgment Task that children derive implicatures with epistemic modals at a significantly lower rate than adults. However, these results may be considered slightly problematic given the complex nature of the task (the memory load, challenging instructions containing disjunctive statements, a.o.).

Ozturk & Papafragou (2015) then investigated epistemic modals through a simplified version of the Box Paradigm, one where there were two boxes instead of three, and the instructions no longer contained disjunction as in Noveck, Ho & Sera (1996) or Noveck (2001). Children as young as 4 were able to draw implicatures (though not at fully adult-like rates) in a Forced Choice Task. Moreover, children were also able to understand the meaning of epistemic modals in a variety of situations. However, they often had problems when faced with a situation open to multiple possibilities, and they had to evaluate an overly strong statement which referred to only one of these. Similar conclusions have been reached by Moscati, Zhan & Zhou (2017) on the basis of an eye-tracking experiment in the visual paradigm. Children showed different fixation patterns than adults at the end of sentences containing the strong epistemic modal *must* in undetermined scenarios, which can be explained by their reducing multiple alternatives to a single one.

While the results about how 5-year-olds treat overly strong epistemic statements seem to converge across experiments, the results about whether they derive scalar implicatures with epistemic modals do not. This could be an effect of the different tasks used, as children are known to perform more adult-like with Felicity Judgment/Forced Choice Tasks than with Truth Value Judgment Tasks, but it could also be related to the fact that the Hidden Object Paradigm may encourage participants to consider statements with weak epistemic modals optimal, given the fact that there is no direct access to the animal(s) hidden in the box, and children might be tempted to perceive the presence of an animal in the box as a possibility rather than a certainty. If this is so, however, it becomes unclear why children seem to accept overly strong statements: possible explanations involve cognitive considerations related to the reduction of uncertainty to certainty.

In order to probe into this matter further, Bleotu (2019) conducted an experimental study, investigating the semantic and pragmatic understanding of epistemic modals by Romanian 5-year-olds, focusing on the more frequent adverbs *sigur* ‘certainly’ and *poate* ‘maybe’. The first experiment employed a Coloring Task where participants were asked to color certain drawings based on various statements containing (certainty/uncertainty) epistemic adverbs. In this experiment, children were sensitive to modal strength, always coloring the object in the color mentioned in the statement containing the certainty adverb, but only half of the time in the color mentioned in the statement containing the uncertainty adverb. The second experiment was a coloring version of the Truth Value Judgment Task in Noveck (2001), aiming to see if children derive implicatures with epistemic adverbs. The results did not provide evidence that 5-year-olds derived implicatures, in fact, children derived no implicatures at all. Interestingly, adults also showed rather low implicature rates (around 40%). Overall, adults tended to give cautious answers, often rejecting pragmatically adequate sentences with *sigur* ‘certainly’, arguing that they could not be certain about the situation because they could not see what was going on with their own eyes. Lack of direct access thus made adults hold back from asserting certainty. While Noveck (2001),

Ozturk & Papafragou (2015) and Moscati, Zhan & Zhou (2017) report no such problems with adults, the problem noticed in Bleotu (2019) calls for an improvement of the Hidden Object Paradigm in such a way as to make sure that participants (adults and children) can embrace epistemic certainty even when they cannot access the hidden object. Moreover, since both Noveck (2001) and Bleotu (2019) obtained low implicature rates with children with a Truth Value Judgment Task, a different task (e.g., a Reward Task) might produce more adult-like results.

3. The Shadow Play experiment. Considering the *indirect access* challenge posed by the Hidden Object Paradigm, we decided to modify the paradigm so as to make it easier for children (and adults) to reason about a hidden entity. In our paradigm, participants are supported in their inferences by extra cues such as the animals' silhouettes and specific sounds.

3.1. RATIONALE AND GOAL. The experiment we designed aims to investigate the mastery of the semantics and pragmatics of the epistemic modal adverbs *sigur* 'certainly' and *poate* 'maybe' by 5-year-olds. We decided to focus on epistemic adverbs rather than epistemic verbs, given the fact that *trebuie* 'must' with an epistemic meaning is very rare in adult Romanian.

Using PennController (Zehr & Schwarz 2018), we implemented a novel Shadow Play Paradigm, where participants can see the animals' silhouettes and hear their specific sounds. We took inspiration from shadow play theatre, an ancient form of story-telling making use of shadows, as well as from Heizmann (2006), who used silhouettes behind a milky window to test whether German and English 3-year-olds are able to infer from a question such as *Who must be eating the banana?* that the banana-eater is hidden from sight and cannot be right before their eyes. Heizmann (2006) showed that, while the Theory of Mind definitely plays a part in the acquisition of modality, it seems that syntactic ambiguity or the lack thereof does too. While in contexts that are ambiguous between deontic and epistemic readings, children seem to prefer deontic readings over epistemic ones, children as young as 3 are able to understand epistemic verbs in a non-ambiguously epistemic context. The Shadow Play Paradigm takes the idea of employing silhouettes as a starting point for testing the semantic and pragmatic understanding of epistemic adverbs. Instead of focusing on indirect inferences (i.e., inferences about the lack of direct access to a certain entity), as in Heizmann (2006), we focused on epistemic modal strength and scalar implicatures with epistemic adverbs. Representing entities as silhouettes justifies the use of epistemic adverbs (given the lack of direct access to the animals). Moreover, it makes the indirect evidence more 'direct', as participants are no longer in doubt about the animal's location, but, instead, they can rely on evidence (the animal's silhouette and specific sounds).

In terms of task type, the paradigm asks participants to reward baby dragons with big or small apples depending on whether what they say is the best description of the situation or not. The Best Description Task we used is a binary version of the ternary Reward Task from Katsos & Bishop (2011), where children reward statements with huge/big/small strawberries. We decided to make optimality rather than truth value (right/wrong) a reward criterion due to the higher number of scalar implicatures obtained previously with the Best Description Task (Bleotu, Benz & Gotzner 2020), as well as with the similar Best Response Paradigm (Gotzner & Benz 2018). Thus, given the use of the Shadow Play Paradigm and of the Best Description Task, we expect Romanian 5-year-olds to perform somewhat better on the semantics and pragmatics of epistemic adverbs than in the previous tasks on modality (even if maybe not fully adult-like).

3.2. PARTICIPANTS. 35 5-year-olds (17 female and 18 male, Age range: 5-6;6, Mean age: 5;6) and a control group of 36 Romanian adults (undergraduates from the Faculty of Foreign Languages, at the University of Bucharest) took part in the experiment in exchange for course credit.

3.3. PRETEST. Given the worry that children might not be able to understand the meaning of *the best description* in the instructions, we decided to run a superlative pretest before the experiment and filter out the children unable to handle superlatives. The pretest aimed to see how children understand superlatives both in deictic contexts, i.e., contexts where they could point to a certain object/animal, as well as in pragmatic contexts, i.e., contexts where children decided which statement *best* described a picture (see (1) and Figure 1).

- (1) a. Show me the tallest giraffe/a peach which is big, but not the biggest.
- b. This is a bear (informative)/an animal (underinformative)/a frog (false).

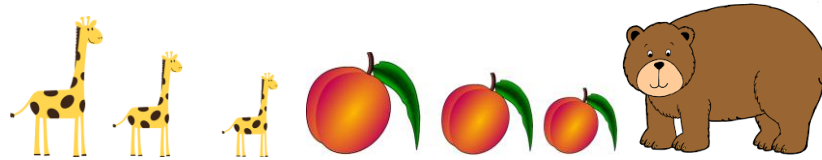


Figure 1: Example pictures for the superlative pretest

3.4. MAIN EXPERIMENT: METHODOLOGY. In the main part of the experiment, participants are told there is a wizard who plays a shadow game with two baby dragons Flurry and Bindy. In the game, there are various animals who go and hide behind the curtain, but they come in front of the curtain one by one later on, at different stages. The baby dragons take turns to say who they believe the shadow belongs to, based on the evidence they have. Participants have to reward them with a big apple if what they say is the best description of the situation and with a small apple otherwise.



Figure 2: The wizard and the baby dragons

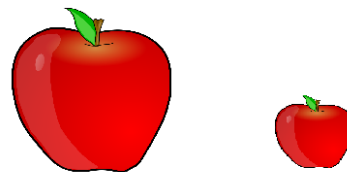


Figure 3: The rewards: a big or a small apple

The experimental materials involve several associated pictures and sentences referring to various groups of animals: A control/training group of two bunnies (orange and pink), and 4 testing groups of three animals of the same category (of different colors) each: dogs, frogs, cats, cows. The design of the pictures (see Figures 4, 5, 6) tries to make it easy for participants to figure out the reference of the shadow (the main silhouette center-stage) and prevent processing difficulties (Crain & Thornton 1998), by presenting participants not only with information about the animals that are in front of the curtain (through a small image in the bottom part of the picture), but also with information about all the animals in the game (through a small image on the left).

In total, participants saw 31 sentences (3 training sentences, $1 \times 4 = 4$ test sentences, $4 \times 7 =$ control sentences) containing *poate* ‘maybe’ or *sigur* ‘certainly’, presented in a randomized manner (see Table 1). All the sentences (except for the practice ones) have the same structure: the epistemic adverb *poate* ‘maybe’ and *sigur* ‘certainly’ followed by the complementizer *că* ‘that’ and an embedded sentence referring to the identity of the silhouette. Importantly, optimal sentences with *sigur* ‘certainly’ (uttered by one dragon) are always followed by the corresponding

underinformative sentences with *poate* ‘maybe’ (uttered by the other dragon). This contrast is maintained throughout to activate the modal scale and lead to implicature-generation.

ONE IN FRONT SCENARIO			TWO IN FRONT SCENARIO			
S _{POSSIBLE1} OPTIMAL	S _{POSSIBLE2} OPTIMAL	S _{SCERTAIN1} OVERINFO	S _{SCERTAIN2} OPTIMAL	S _{POSSIBLE3} UNDERINFO	S _{SCERTAIN3} FALSE	S _{POSSIBLE4} FALSE

Table 1: Types of sentences tested per scenario

The experiment comprises a training session and a testing session. In the training session, participants practice the reward task on a bunny shadow picture (see Figure 4). Subjects were presented with the sentences in (2): they were told which reward to choose (the small apple) in the first sentence, while, in the other sentences, they had to choose the reward themselves.



Figure 4: Item for the training session

- (2) a. Este un șoarece/o vacă. (FALSE)
‘It is a mouse/a cow.’
- b. Este un iepuraș. (TRUE/OPTIMAL)
‘It is a bunny.’

In *Scenario 1*, the *One in front Scenario*, one animal comes back in front of the curtain, in this case, the yellow dog (see Figure 5). This allows us to test participants’ understanding that the situation has two possible outcomes: the silhouette belongs either to the red dog or the blue dog. Subjects were presented with sentences such as those in (3): they had to choose a big apple for the optimal control statements in (3a) and a small apple for the overly strong statement in (3b).



Figure 5: One in front Scenario

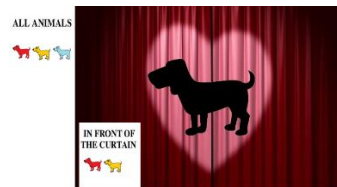


Figure 6: Two in front Scenario

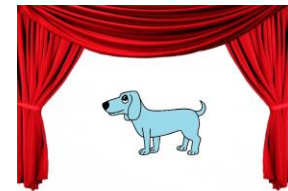


Figure 7: Disclosure

- (3) a. Poate că este câinele roșu/albastru. (OPTIMAL)
‘It is possible that it is the red/blue dog.’
- b. Sigur că este câinele roșu. (OVERLY STRONG)
‘It is certain that it is the red/blue dog.’

In *Scenario 2*, the *Two in front Scenario*, two animals come back in front of the curtain (see Figure 6). Given such evidence, participants are supposed to reason that the silhouette can only belong to the blue dog. Subjects were presented with the critical sentences (4a, b) and the

control sentences (4c, d). Subjects who only consider semantic meaning are expected to reward the baby dragon with a big apple in conditions (4a) and (4b), while subjects who strengthen the weak epistemic to ‘not certain’ are expected to give a small apple reward for (4a) but not for (4b). The scenario is thus critical for establishing whether subjects derive implicatures.

- (4) a. Poate că este câinele albastru. (UNDERINFO)
‘It is possible that it is the blue dog.’
- b. Sigur că este câinele albastru. (OPTIMAL)
‘It is certain that it is the blue dog.’
- c. Poate că este câinele roșu. (FALSE)
‘It is possible that it is the red dog.’
- d. Sigur că este câinele galben. (FALSE)
‘It is certain that it is the yellow dog.’

In the end, the identity of the animal is disclosed. While Hirst & Weil (1982) showed that disclosure does not affect experimental results, we decided to opt for disclosure regardless, as we felt it would keep subjects more engaged and quench their curiosity.

3.5. RESULTS. We analyzed the accuracy of the answers in control statements, depending upon whether more than half of the answers were correct, and we excluded two adults from further analyses. In the case of children, we looked at the accuracy of the answers in the pretest and removed no participants, since all children gave more than 3 correct answers out of 6. Moreover, since all children were more than half of the time accurate in the control sentences, they were all included in the analysis. The results were analyzed with logit mixed-effects models in R (2018).

3.5.1 WHOLE DATA ANALYSIS. We computed a logit mixed-effects model with the factors Group (Adults, Children), Sentence type (Underinformative, Overly Strong, Control), as well as their interaction as fixed effects, and random by-item and by-participant slopes. The Control Statements of the Adult Group were chosen as the reference level. The results do not show significance for Group, but there was a significant effect for Sentence type (both for Underinformative and Overly Strong statements), an interaction between Group and Underinformative Sentences, as well as an interaction between Group and Overly Strong Sentences (see Table 2).

Parameter	Estimate	Std. error	z	p
Intercept	-0.036	0.098	-0.369	0.712
Group (children)	0.174	0.142	1.217	0.224
Sentence type Overly Strong	1.375	0.226	6.088	1.14e-09***
Sentence type Underinformative	0.829	0.203	4.093	4.25e-05***
Group (children): Sentence type Overly Strong	-1.904	0.296	-6.423	1.33e-10***
Group (children): Sentence type Underinformative	-0.996	0.277	-3.596	0.000323***

Table 2: Results of a glmer performed on the whole data

3.5.2 SUBSET ANALYSIS. We divide the subset analysis into three parts: scalar implicatures, control statements, and overly strong statements.

For scalar implicatures, the whole data analysis does not reveal precise information about implicature derivation since a participant’s choice of a small apple for underinformative sentences like (4a) simply indicates the degree to which participants rejected underinformative statements as not the best description of a situation. However, such rejection can happen for two reasons: (i)

either because participants believe the stronger alternative is the best description, (ii) or because they believe the stronger alternative is false, hence, also not the best description. Since we did not ask subjects to motivate their answers, the only way to determine their pattern of thinking is by looking at the corresponding stronger alternatives. On this basis, we can distinguish between pragmatic, logical, cautious and erroneous participants (see Table 3).

Patterns of responses	Reward per statements		Two in front Scenario	
	Underinformative (possible)	Informative (certain)	Adults	Children
Pragmatic	small apple	big apple	66.18%	49.28%
Logical	big apple	big apple	30.88 %	49.28%
Cautious	big apple	small apple	2.2%	1.44%
Erroneous	small apple	small apple	0.74%	0%

Table 3: Subjects’ patterns of responses in underinformative and optimal true sentences

66.18% of the answers produced by adults were scalar implicatures with epistemic adverbs: 22 adults consistently rejected underinformative statements (3 or 4 answers out of 4). 49.28% of children’s answers were scalar implicatures with epistemic adverbs: 15 children consistently produced implicatures (see Figure 8). 49.28% of children’s answers were ‘overgenerous’ (logical): 14 were consistent in their answers. Importantly, there were few erroneous or cautious answers, thus showing that the Shadow Play Paradigm encourages logical reasoning. In the Hidden Object Paradigm, subjects had to rely exclusively on logical reasoning to infer that sentences with *certain* are correct, and experimental results show that purely logical inference is too weak a basis for inferring certainty (Bleotu 2019). The Shadow Play Paradigm remedies such worries by providing additional clues that support (but do not replace) logical reasoning.

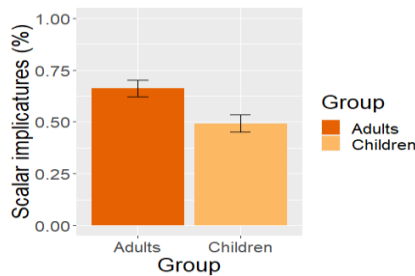


Figure 8: Scalar implicatures per group

In addition, we computed a logit mixed-effects model on a subset of the data, with the rate of scalar implicatures as the dependent variable, Group as a fixed effect, and random by-item and by-participant slopes. This model revealed no significant difference between the groups ($\beta = -1.816, SE = 1.0163, Z = -1.787, p = 0.0739$).

As presented in Table 4, children behaved adult-like with respect to the control sentences, as also revealed by running a logit mixed-effects model on the control data subset with Group, Truth and their interaction as factors, and Item and Participant as random effects. The results show non-significance for Group ($\beta = -0.578, SE = 0.625, Z = -0.925, p = 0.355$) and the interaction between Group and Truth ($\beta = -0.207, SE = 0.519, Z = -0.398, p = 0.691$), but a significant Truth effect ($\beta = -2.1607, SE = 0.391, Z = -5.529, p < 0.001$). Most errors (93.91% errors for children, 87.5% errors for adults) were made in evaluating true sentences containing a possibility adverb, especially

in the *One in front* Scenario, where participants had to acknowledge two alternatives.

Accuracy per group in control sentences	Children	Adults
Optimal true control sentences	75.2%	82.59%
False control sentences	96.07%	96.69%

Table 4: Accuracy per group in control sentence

As shown in Figure 9, children tend to reward overly strong statements (using ‘certainly’ instead of ‘maybe’) with big apples to a much higher degree than adults (59.29% > 21.33%). The difference between groups is significant, as shown by a logit mixed-effects model on the overly strong data with Group as a factor and random by-item and by-participant slopes ($\beta = -4.158$, $SE = 1.904$, $Z = -2.184$, $p = 0.029$).

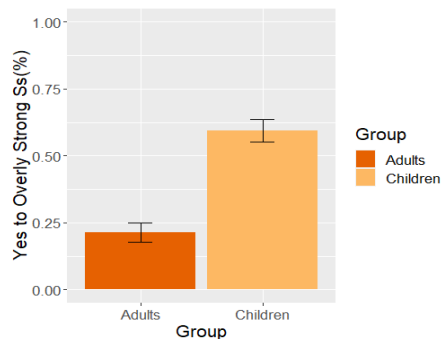


Figure 9: Yes to overly strong statements per Group (with SE)

4. Discussion. Our results show that Romanian 5-year-olds are able to derive implicatures with epistemic adverbs in underinformative contexts. While a whole data analysis reveals a significant difference between children and adults, as in Noveck (2001) or Ozturk & Papafragou (2015), the rejection of underinformative sentences does not equate with implicature-derivation. For this reason, we also performed several subset analyses taking into account adults’ answers to the strong alternatives of underinformative sentences. The subset analysis investigating implicature-generation showed children to be quite adult-like. This shows that children do not lack the capacity to derive implicatures, but, rather, they show sensitivity to the paradigm and task used. On the one hand, the current experiment makes use of an improved version of the Hidden Object Paradigm used in previous experiments on epistemic modal items, namely, the Shadow Play Paradigm, where children’s logical reasoning is supported by additional visual and acoustic cues. Unlike in Noveck (2001) or Ozturk & Papafragou (2015), children do not have to rely exclusively on logical reasoning in making inferences about a completely hidden animal, but they can, in addition, use silhouettes and sounds as further support. On the other hand, the current experiment also uses a different kind of task than the previous experiments on epistemic modals, namely, a binary Reward Task with optimality as a criterion. Noveck (2001) employs a Truth Value Judgment Task on which 5-year-olds perform significantly different from adults. Ozturk & Papafragou (2015) employ a Felicity Judgment Task on which children perform better than in Noveck (2001), but still not adult-like. In contrast, in our experiment, children perform adult-like. Since reward tasks are known to lead to more implicatures with quantifiers than other kinds of tasks (Katsos & Bishop 2011), it is not surprising that the same effect can be seen with epistemic adverbs. It is also

important that we were able to extend this result to Romanian. Improving the paradigm and changing the task reveal that Romanian children as young as 5 have pragmatic abilities.

In addition, we found that children also handle optimal true and false control statements with epistemic adverbs in an adult-like manner. Thus, when children's pragmatics is adult-like, the semantics seems to be in place also, an important result which is in line with the idea that semantic knowledge precedes pragmatic knowledge (Noveck 2001).

While adult-like in their derivation of scalar implicatures and their understanding of control statements, children are not adult-like in their treatment of overly strong statements, rewarding such statements with big apples to a higher degree than adults. The tendency to consider overly strong statements as adequate descriptions has previously been noticed in the studies by Noveck, Ho, Sera (1996), Ozturk & Papafragou (2015), and Moscati, Zhan & Zhou (2017). When faced with several possibilities, children tend to pick one possibility only. For example, in a situation where the silhouette could belong either to the blue dog or the red dog, there are children who give big apple rewards for statements which express certainty about the silhouette belonging to one of the dogs. There are several possible explanations for this. One possible explanation could be that children have a different semantics for the strong epistemic adverb *sigur* 'certainly': children could understand it as meaning 'maybe'. Nevertheless, this explanation is undermined by children's correct assessment of control statements with *sigur* 'certainly', as well as by children's sensitivity to epistemic adverb strength (see Bleotu 2019). Another possible explanation could be that children use a cognitive strategy to reduce uncertainty to certainty. Such a hypothesis, also known as the premature closure hypothesis (Acredolo & Horobin 1987), argues that children's answers reflect their cognitive intolerance of situations that allow multiple outcomes and their overarching preference for a single solution. Another explanation could be that children's answers reflect neither a faulty semantics for the strong epistemic adverb, nor a cognitive strategy to eliminate uncertainty, but rather a guessing communicative strategy, leading children to place a bet on one of the possibilities when the evidence is not conclusive. Teasing apart the cognitive and the communicative account is difficult, especially if we embrace the view that communication mirrors cognition. Children's 'guesses' could be a reflex of a cognitive tendency to make certainty subjective. For instance, when evaluating the statement *It is certain that it (the silhouette) is the red dog* in a context where it is only possible that the silhouette is the red dog, one child explicitly motivated his big apple answer by saying that he likes red a lot. This suggests that 'guesses' might not be random, and, instead, cognitive/communicative reductions of uncertainty to certainty may be modulated by personal likes/dislikes. However, subjective reasons do not fully explain the results since children only 'randomly' choose after having already restricted the set of possible outcomes through an inference. Importantly, when the silhouette can be the red or blue dog, children exclude the impossible outcome (giving small apples for false statements like *It is certain that it is the yellow dog*), and they infer the two possible alternatives (giving big apples for both optimal statements with *possible*). Reducing uncertainty to certainty thus involves a logical step, where children infer the two possible outcomes, followed by a subjective step, where children make a choice between them, depending upon their own preferences and inclinations.

5. Conclusion. The current experiment employed a novel Shadow Play Paradigm in order to test Romanian 5-year-olds' semantic and pragmatic knowledge of epistemic adverbs. Unlike more traditional versions of the Hidden Object Paradigm, the Shadow Play Paradigm gives participants additional evidence in order to help them perform in a more adult-like fashion. The results revealed children's near adult-like ability to draw implicatures with epistemic adverbs. However, children seemed to accept overly strong sentences to a much higher degree than adults. This can be

accounted for if one assumes a stage in language acquisition where, although children are able to infer that a situation has two outcomes, they make a subjective choice for one single outcome.

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