

Preschooler's Acquisition of Deception and Its Relationship with Inhibitory Control

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Abstract: The development of children's deception behavior has drawn much attention recently. This paper presents an insight into the deception acquisition of preschoolers and its relationship with one's inhibitory control ability. By conducting the paper-cup guessing game modified from classical deception paradigm and the go-nogo inhibitory control test, the present study suggests that even 4 years old preschoolers can acquire the ability of deception after discovering the benefit of deception. Preschoolers showed a pattern of lower deception rate at the very beginning of the first session. However, the deception rates soared up to nearly 80%, as they went through 5 consecutive days of paper-cup guessing game. Besides, results also suggested that preschoolers' inhibitory control performance in the third session of IC test significantly better than the first session as an effect of deception experience. These findings extend our understandings of the initial development of human's deception behavior and its relationship with one's cognitive factors such as inhibitory control from the perspective of child development.

1. Introduction

Deception is a very common behavior in our daily life [1], which may bring different kinds of benefits and help us better adapt to social interactions. Large amount of literatures focused on finding indicators of human deception [2] [3], increasing human's accuracy on deception detection [4] and also proposing deception theories that might explain the psychological mechanisms under deceptive behaviors [5] [6].

Researches have studied the development of deception behaviors in children. However, the age at which children begin to lie remains unclear. Woolf (1949) stated that children as young as 4 years old can't lie as they have no differentiation between the reality and illusion [7]. Only as they came to 5 years old can then have a clear understanding of deception. However, this opinion has always been challenged since then. Chandler, Fritz & Hala (1989) found that even 2.5 years old child are capable of tell lies by employing a range of deceptive strategies [8]. Hala & Russell (2001) also found that child of 3-year-old was able to adopt different strategies in deception [9]. Other studies suggest that the onset of deceptive behaviors is relatively later, at about 4-5 years of age [10] [11]. One factor that may influence one's initial mastering of deception is the environment/experience he/she had about deception. Previous studies suggested parenting styles and parents' opinion toward deception can significantly influenced one's deception behavior. Children whose parents often tell lies and were positive with lie telling would deceive a lot [12]. Exposure to a punitive environment would also increase 3- and 4-year-old children's tendency to lie [13]. Therefore, the age of 4 might be a milestone that children start to show deception behaviors. However, how does child learn to deceive? Would children begin to tell lies after they could discover the benefit or reward of deception? The present study firstly attempts to investigate whether 4-year-old preschoolers would learn to deceive after finding the benefit of lying.

The ability of deception could also be related with one's cognitive functions. According to previous studies, children before 3.5 years of age are unable to tell lies because the one important

aspect of executive function - the development of inhibitory control ability - may affect children's performance on deception tasks [14] [15]. The inhibitory control ability is known to develop rapidly from 3 years onward [16]. Children must have inhibitory control ability in order to keep update of both truthful and false information and be able to inhibit revealing truthful information, which play an important role in children's decision to deceive after they have already discovered deception [17]. Researchers also found 3-year-old children deceived frequently in conditions requiring relatively low inhibitory control than high conditions [15]. These results showed a possible relationship between one's cognitive ability and deception, which has become a hot debated topic and attracted growing amount of attention recently [14] [17]. Researchers began to tap the question whether there exists a causal relationship between them in early childhood. For instance, Ding et al (2015) found that theory of mind training, one of human's core cognitive function, can help children discover how to deceive [18]. They also conducted a study showing that children with better performance in theory of mind test and executive function test are faster at learning how to deceive [17]. It seemed that children's deception was caused by the development of their cognitive ability such as executive function. As an important factor in executive function, whether the deception experience (training) can improve one's inhibitory control ability was still an open question. The present study attempts to further test the possible relationship between them.

Therefore, the present study aims to investigate the following two questions:

Whether 4-year-old preschoolers can learn to deceive after discovering the benefits of deception

Would children's inhibitory control ability get improved after sessions of deception games (deception experience)

Based on existing (albeit limited) findings, we expect 4-year-old preschoolers' deception rate to increase as the guessing game training goes on and preschoolers would find out the relationship between lying and the benefit. Besides, children's inhibitory control performance would get improvement as their deception rate increase.

2. Methods

2.1 Participants

32 preschoolers were recruited from one kindergarten in BJ to participate in this experiment (Mage= 48.2 months, 18 boys and 18 girls). All children were native speakers of Mandarin and all were Han Chinese. The data of socioeconomic level was not collected on individual level, only the reported data from the school officials that these children came from different socioeconomic backgrounds in terms of education levels, parental income and occupation. All parents or legal guardians provided formal or oral consent to the participation of their children in this research. Finally, 4 children were dropped out from the final sample because they failed to participate all the 5 sessions of deception game and inhibitory control test, which made the remaining participants sample including 28 children (Mage= 48.3 months, SD = 2.8, 17 boys and 11 girls).

2.2 Procedure

Preschoolers were seated in front of a table in a separate room in their classes. Two rounds of warm-up trials were conducted about the hide-and-seek game (describe below) to familiarize them of the experiment procedure.

The paper-cup game, modified from classical hide-and-seek game 'I win you lose' (described below), was then conducted across five sessions that took place on 5 consecutive days excluding weekends. Preschoolers were also given an experimental test to measure their inhibit control (IC) ability through a go-nogo task (The little crocodile task, described below) in three separate days: day 1 before the first paper-cup game and day 3 after the paper-cup game and day 5 after the paper-cup game.

2.3 Paper cup game

A paper cup game was used in this study, which was modified from the classical hide-and-seek game [17]. Two disposable paper cups were put upside-down on the table and the child need to hide one little colorful rubber under one of the two cups and play “you win and I lose” guessing game with the experimenter. The experimenter would pretend to cover their eyes with their hands while the child was hiding the rubber (actually, the experimenter could see the exact location where the child hid the rubber without children’s awareness). Then the experimenter would point to one of the cups and ask: “Did you put the rubber under this cup?” The child would choose to reply with a truthful answer or lying. The experimenter would win the rubber if he/she guessed the right location, otherwise the child would win the rubber. The children were only told that their task was to compete with the experimenter to win the rubber. Therefore, preschoolers need to lie about the right position in order to win the reward. The experimenter first played two practicing rounds to let the child get familiar with the procedure of the guessing game and then conducted the formal experiment in 5 consecutive days.

2.4 Inhibit control task

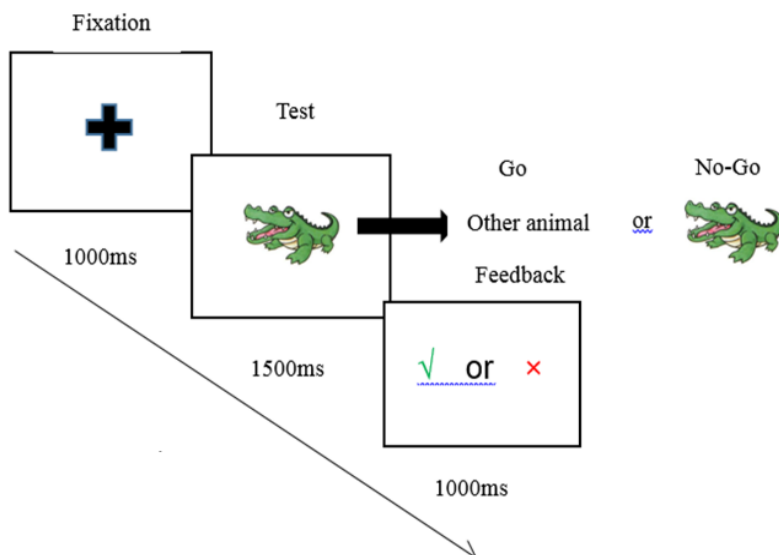


Figure 1. Illustration Of An Experimental Trial

The little crocodile task, a modified inhibit control ability test from previous studies was conducted at Day 1 (before the paper-cup guessing game), Day 3 (after the paper-cup guessing game) and Day 5 (after the paper-cup guessing game), to test their inhibit control ability. 40 different animal pictures were shown randomly on the monitor through the E-prime 2.0 software with either a Crocodile (35% of all the trials) or other animals (65% of all the trials). An example practicing trial of the experimental procedure was illustrated in Fig. 1. Firstly, a fixation was shown in the middle for 1000ms and then came the animal picture (either a Crocodile or other animals) for 1500ms and preschoolers were instructed “not to press” the space button for the crocodile and “press” the space button for other animals. A feedback green \checkmark or red \times were followed to prompt the children the soundness of their answer (feedback was only shown in the practice trial, no feedback was shown in the formal test). Five practice trials were conducted to let the children familiarize the procedure. Then preschoolers conducted the formal test. The experimenter prompted the child with “what do you think for this picture?” if the child hesitated. No prompt of “you should press or not” was given.

3. Results

We firstly analyzed the difference between boys and girls and found no gender difference on any of the variants we have measured. Then we conducted the following analyses with all data combined.

3.1 Overall deception rates of preschoolers' deception rates over the 5 sessions

Firstly, we examined the deception rates of children over the 5 sessions of hide-and-seek game (see Fig. 2). Results shown that 4-year-old child on average only lied 17.65% of the time during the first session, which was significantly below the chance level. The deception rate went to 33.3% in the 2nd session. However, the rate soared to 54.9% in the 3rd session, which had been over the 50% chance rate. In the 4th session, the deception rate went on to 60% and 77.7% in the 5th session. These deception pattern might indicated that preschoolers might don't know how to deceive and also have no idea on the relationship between the benefit and deception. However, after 2 sessions of practice, more and more preschoolers found the benefits of lying and began to deceive to win the game. These results might represent the relationship between discovering the reward and deception behavior, which further indicate preschoolers learn how to tell a lie during practice.

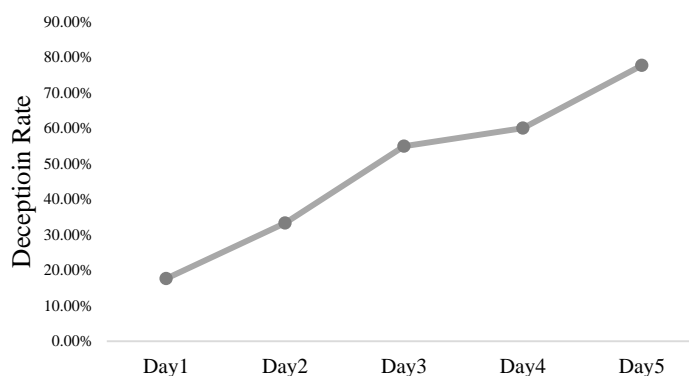


Figure 2. Overall deception rates on each session of paper-cup guessing game

3.2 Analyses on preschoolers' inhibitory control performance

Descriptive results of preschoolers' inhibitory control test over 3 times of IC tests were shown in Fig. 3. As the paper-cup guessing game went on, preschoolers' inhibitory control performance went up from 0.66 in the first IC test to 0.74 in the third test, which might indicate the effects of deception experience.

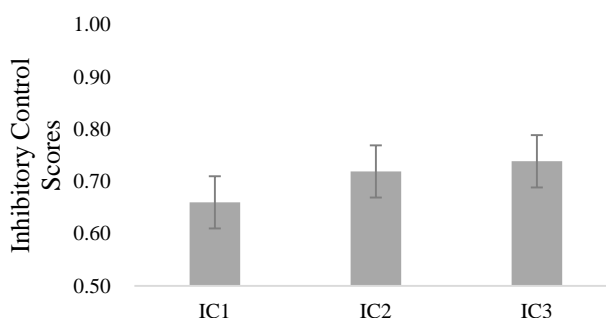


Figure 3. Preschoolers' inhibitory control performance in 3 inhibitory control (IC) tests

Secondly, data were evaluated by one-way analysis of variance (ANOVA) with the Tukey HSD post-hoc test for comparisons over three times of IC test scores using Statistical Package for the Social Sciences ver. 13 software (SPSS, Chicago, IL). Probability values of less than 5% was considered to be significant. Homogeneity of variance test showed no significant difference. ANOVA results showed a marginally significantly difference between three times of IC test scores (Table I). Post-hoc analysis suggested that IC score in third test was significantly better than the

first test (MD= 0.78, $p < 0.05$), which may suggest an improvement in preschoolers' inhibitory control ability after 5 sessions of deception experience.

Table 1. Anova Results on Three Times of ic Test Scores.

Group	IC1	IC2	IC3	<i>F</i>	<i>p</i>
MEAN	0.660	0.713	0.736	2.934	0.06
SE	0.133	0.111	0.106		

4. Discussions

In this study, we tapped on the relationship between preschoolers' deception acquisition and their inhibitory control ability. Among the age group of 4 years old preschoolers, they showed a pattern of lower deception rate at the very beginning of the first session of paper-cup guessing game. However, the deception rates soared up to nearly 80%, as children went through 5 sessions of paper-cup guessing game. Besides, we also found that preschoolers' inhibitory control performance in the third time IC test significantly better than the first time IC test.

Even 4-year-old preschoolers showed an increasing rate of deception as they experience 5 sessions of paper-cup guessing game on 5 consecutive days, in which they firstly consistently provided truthful information about the exact location of the rubber and then begin to telling lies about the rubbers' location when they discovered the benefits of lying. Previous studies have investigated the effects of environment on children's deception behavior [13]. Ding et al (2017) also indicated that children at very young age might begin to acquire the ability of deception after they had experienced the benefits from lying [17]. Our results were in line with these studies by showing that children as young as 4-year-old can acquire the ability of deception by consistently exposed to the rewarding environment of lying and discovering the relationship between deception and the reward.

In the process of 5 consecutive days of paper-cup guessing game, we found an interesting result regarding the development of inhibitory control ability. Preschoolers' performance in the third session of IC test was significantly better than that in the first session, which may indicate the paper-cup guessing game may improve their inhibitory control ability. In previous studies, researchers also found similar results by showing that children in the deception group acquired an improvement in their executive function performance than children in the control group. The present results may suggest a mutual-benefit relationship between deception and cognitive functions such as the inhibitory control.

Several limitations need to be mentioned when interpreting the present results. In the present study, we conducted the paper-cup guessing game only once in one session, the gaming time preschoolers experienced each day might also influence one's discovery of the benefit of deception and further affect one's deception rate. Future experiment might set the gaming time as a dependent variable and tap its possible effect on one's deception acquisition. Secondly, a control group that receive no paper-cup guessing game training should also be included to exclude the influence of other possible factors, such as natural maturity, parenting styles and so on, thus the comparison between three sessions of IC test would better prove the effects of discovering the benefit of lying on deception rate and the relationship between deception and one's inhibitory control ability.

5. Conclusion

The present study presented the development of 4-year-old preschoolers' deception behavior and its relationship with one's inhibitory control. Results suggested that the deception rate of 4-year-old preschoolers increase after discovering the benefit of deception. Besides, the inhibitory control ability might be improved as an effect of deception.

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References

- [1] J. A. Barnes and J. A. Barnes, *A pack of lies: Towards a sociology of lying*. Cambridge University Press. 1994.
- [2] B. M. DePaulo, J. J. Lindsay, B. E. Malone, L. Muhlenbruck, K. Charlton and H. Cooper, Cues to deception. *Psychological bulletin*, 2003, 129 (1): 74.
- [3] F. B. Qu, S. J. Wang, W. J. Yan, H. Li, , S. Wu and X. L. Fu, CAS (ME) 2: A Database for Spontaneous Macro-Expression and Micro-Expression Spotting and Recognition. *IEEE Transactions on Affective Computing*, 2018, 9 (4): 424 - 436.
- [4] C. F. Bond Jr, and B. M. DePaulo, Accuracy of deception judgments. *Personality and social psychology Review*, 2006, 10 (3): 214 - 234.
- [5] D. B. Buller and J. K. Burgoon, "Interpersonal deception theory." *Communication theory*, 1996, 6 (3): 203 - 242.
- [6] T. L. Carson, *Lying and deception: Theory and practice*. Oxford University Press. 2010.
- [7] M. Woolf, *The child's moral development. Searchlights on Delinquency*, 1949, 263 - 272.
- [8] M. Chandler, A. S. Fritz, and S. Hala, Small-scale deceit: Deception as a marker of two-, three-, and four-year-olds' early theories of mind. *Child development*, 1989, 1263 - 1277.
- [9] S. Hala and J. Russell. Executive control within strategic deception: A window on early cognitive development? *Journal of Experimental Child Psychology*, 2001, 80 (2): 112 - 141.
- [10] P. J. LaFrenière, *The ontogeny of tactical deception in humans*, 1988.
- [11] T. Ruffman, D. R. Olson, T. Ash, and T. Keenan, The ABCs of deception: Do young children understand deception in the same way as adults? *Developmental psychology*, 1993, 29 (1): 74.
- [12] J. Lavoie, K. Leduc, A. M. Crossman, and V. Talwar, Do as I say and not as I think: Parent socialisation of lie - telling behaviour. *Children & Society*, 2016, 30 (4): 253 - 264.
- [13] T. Victoria and K. Lee. "A punitive environment fosters children's dishonesty: A natural experiment." *Child Development*, 2011, 82 (6): 1751 - 1758.
- [14] K. Lee, Little liars: Development of verbal deception in children. *Child Development Perspectives*, 2013, 7: 91 - 96.
- [15] S. M. Carlson, L. J. Moses, and H. R. Hix, The role of inhibitory processes in young children's difficulties with deception and false belief. *Child development*, 1998. 69 (3): 672 - 691.
- [16] X. P. Ding, G. D. Heyman, Y. S. Li et al. Learning to deceive has cognitive benefits. *Journal of Experimental Child Psychology*, 2018, 176: 26 - 38.
- [17] X. P. Ding, G. D. Heyman, G. Y. Fu, B. Zhu, and K. Lee, Young children discover how to deceive in 10 days: a microgenetic study. *Developmental science*, 2017, 21 (3): e12566.
- [18] X. P. Ding, H. M. Wellman, Y. Wang, G. Y. Fu, and K. Lee, Theory of mind training causes honest young children to lie. *Psychological Science*, 2015, 26: 1812 - 1821.