Imitation of Peers in Children and Adults*

Jose Apesteguia† Steffen Huck‡ Jörg Oechssler§ Elke Weidenholzer¶
Simon Weidenholzer‖

November 13, 2015

Abstract

Imitating the successful choices of others is a simple and superficially attractive learning rule. It has been shown to be an important driving force for the strategic behavior of (young) adults. In this study we examine whether imitation is prevalent in the behavior of children aged between 8 and 10. Surprisingly, we find that imitation seems to be cognitively demanding: Most children in this age group ignore information about others, foregoing substantial learning opportunities. While this seems to contradict much of the psychology literature, we argue that success-based imitation of peers may be harder for children to perform than imitation (non-success-based) of adults.

1 Introduction

Imitation learning can be an attractive heuristic in many circumstances; it saves on decision costs and requires relatively low cognitive ability.[1] Offerman and Schotter (2009) have, thus, referred to it as "poor man's rationality". Imitation learning is however far from being flawless, as under particular adverse circumstances it may lead to suboptimal outcomes. For instance, in Offerman and Schotter (2009) a random idiosyncratic component to payoffs may lead imitators to adopt actions that only performed well due to luck. Similarly, Vega-Redondo (1997) observed that in Cournot games imitation learning leads to the emergence of Walrasian states with payoffs lower than those obtained in the Nash equilibrium. Much of the experimental-empirical literature in economics has consequently focused on circumstances under which imitation is harmful.

*Financial support from the Vienna Science and Technology Fund (WWTF) under project fund MA 09-017 is gratefully acknowledged.

†ICREA, Universitat Pompeu Fabra and Barcelona GSE. jose.apesteguia@upf.edu

‡WZB Berlin and Department of Economics, University College London, steffen.huck@wzb.eu

§Department of Economics, University of Heidelberg. oechssler@uni-hd.de

¶Department of Economics. University of Vienna, elke.weidenholzer@gmx.net

‖Department of Economics. University of Essex, sweide@essex.ac.uk

[1]See Alós-Ferrer and Schlag (2009) for a broad review.

In contrast, scholars in other disciplines are less pessimistic about the merits of imitation learning. In the words of Albert Bandura (1971, p.2): "Man's capacity to learn by observation enables him to acquire large, integrated, units of behavior by example without having to build up the patterns gradually by tedious trial and error."

We have thus decided to cast our study in a setting where imitation is not self-harming, but will in fact lead to outcomes with strictly higher payoffs than those received under rules that ignore information received by others. In particular, we study a multi armed bandit problem where the distribution of payoffs across urns is known to subjects. In this setting, imitation is not only superficially attractive as in previously studied settings but indeed payoff-improving as compared to only reinforcing own previously successful actions.

Our main contribution lies in showing that imitation is not necessarily a straightforward heuristic subjects are able to apply, regardless of their age. In particular, we compare behavior of children between the age of 8 and 10 (the vast majority of whom are aged 9) with university students. We identify imitative behavior through two treatment variations. In a *Baseline* treatment subjects cannot observe other participants such that imitation cannot occur. In the *Observation* treatment subjects do observe the choice and outcome of one other subject such that imitation is possible and desirable.

While university students make efficient use of being able to observe others, we find that most children almost completely ignore the feedback they receive about others and refrain from imitation – despite clear evidence that they do understand the rules of the game and use the feedback they receive about their own choices in a rational manner. There is, however, a subgroup of children from elite schools that does better on average but still does not imitate as efficiently as university students.

1.1 Related literature

Imitation has been studied in economics, psychology, anthropology, and many related fields. As a comprehensive review of the literature is beyond the scope of the current paper, we try to focus here on the experimental literature that is most relevant to the current study. For our purpose it is useful to divide the literature on imitation into two strands: i) *success-based imitation*, where imitation is based on the success other people were observed having with a given action, and (ii) *non-success-based imitation*, where actions are imitated regardless of their success. The latter includes conformity based imitation (Asch 1952) or reflex-driven, automatic imitation (Ray and Heyes 2011). Most of the evidence from child psychology also falls into this category since infants mostly imitate parents or other adults without accounting for or even observing the (relative) success of an action. For example, Meltzoff (1988) in a famous experiment found that infants imitated adults by using their foreheads to switch on a lamp. However, there is also evidence that even infants can perform "rational imitation". This term was coined by Gergely, Bekkering, and Király (2002) and refers to the observation that

the infants in Meltzoff's study, noticing that the adult declined to use her hands although they were free, may have inferred that the adult, using her head, must have known what she is doing. Gergely et al. replicated Meltzoff's study with the adult's hands visibly occupied during her head action, and in these circumstances imitation of the head action dropped from 69% to 21%.

A second important dimension in the imitation literature is the question who are the role models. Most studies in child psychology use adults as models.[2] With adults as models, children may assume that it is a good idea to imitate even if they do not observe or understand the success of an action simply because they trust the adult to have a reason for choosing a certain action. When peers are role models, this is much less clear. Zmyj and Seehagen (2013) review the literature on children's imitation of peers. One of their main conclusions is that young children are more likely to imitate adults than peers when the setting is unfamiliar.

In the experimental economics literature, imitation has also been an important agenda, mostly in the form of success-based imitation of peers. Huck, Normann, and Oechssler (1999) and Offerman, Potters, and Sonnemans (2002) consider various scenarios where subjects differ in the information they receive in Cournot games. If subjects do not know how payoffs are determined but are informed about profits and quantities in the market, imitation learning is a good predictor of actual behavior and convergence to the Walrasian state can be observed. Apesteguia, Huck, and Oechssler (2007) show that it matters both empirically and theoretically whether agents observe their competitors or firms in different markets. If subjects observe their competitors, convergence to Walrasian states remains. If subjects observe others in different markets (whose payoff they do not influence) we are essentially in a situation which is reminiscent of a decision problem. As predicted by theory Apesteguia, Huck, and Oechssler observe convergence to the Nash equilibrium in this case.

Relatively close to the current design is the experiment by Offerman and Schotter (2009) as it also studies success-based imitation in a decision problem. There is a random idiosyncratic component to payoffs, which may lead imitators to adopt suboptimal actions that only performed well due to luck. A group of agents is presented with the opportunity to observe another group of agents who have already participated in the same decision problem. In theory the ability to observe others would allow subjects to derive the optimal solution to the problem. However, this is not observed in the experiment. Instead, subjects sample those who performed best and also copy their actions. Imitation in this context, thus, leads to a situation where suboptimal strategies, which happened to have performed well in one instance, are adopted by a large fraction of society.

Our paper also contributes to a recent literature that studies decision making in children. Harbaugh, Krause, and Vesterlund (2007) document strategic sophistication in bargaining

[2]There are a number of exceptions, see e.g. Hanna and Meltzoff (1993), and the review by Zmyj and Seehagen (2013), where peers are used as models.

games in children as young as 8. Fehr, Bernhard, and Rockenbach (2008) show that egalitarianism in simple distributional conflicts increases between the ages of 3 and 8. Almås, Cappelen, Sørensen, and Tungodden (2010) show how children when they enter adolescence start to accept inequality that is the result of effort differentials as fair and how efficiency concerns are acquired in adolescence. Sutter, Kocher, Glatzle-Rutzler, and Trautmann (2013) show how adolescents' risk attitudes, ambiguity attitudes, and time preferences correlate with their real life behavior. Lergetporer, Angerer, Glätzle-Rützler, and Sutter (2014) study how third party punishment in children can increase cooperation rates in prisoner's dilemma games. Finally, Sher, Koenig, and Rustichini (2014) analyse how children's ability to reason about other's incentives and thinking develops in a strategic setting with age.

2 Experimental Design

In total, 162 subjects participated in the experiment, of which 82 were fourth grade school children from 4 different elementary schools in Vienna. The comparison group consisted of 80 adults recruited from the subject pool of the experimental lab at the Department of Economics, University of Vienna. The average age of the school children was 9.6 (Std. Dev. = 0.47 with a minimum age of 8.8 and a maximum of 11.1) and 37.8% were female. Average age of the adults was 25.5 (Std. Dev. = 3.9) and 41.0% were female.

The task for all subjects was to repeatedly choose among six different "urns", $i = 1, \ldots, 6$. Each urn i contained two balls that determined payoffs, $P_i \in \{i, i+1\}$. That is, the worst urn either yielded a payoff of 1 or 2 while the best urn yielded a payoff of 6 or 7. Urns were labeled with a circle, a triangle, a cross, a square, a star, and a hexagon. Subjects did not know how the labels corresponded to the potential payoffs. There were ten rounds and the points from all rounds were added up to obtain the final payoff. In each round subjects chose one of the six urns. After their choice, one of the two balls that were contained in their chosen urn was randomly drawn with fifty-fifty probabilities and subjects received feedback about the drawn ball and their payoff. The task was, thus, to find over time better and better urns. We have selected a decision problem that is easy to explain even to children yet fairly hard to solve optimally. In fact, we do not expect anyone (even the university students) to use the optimal solution.[3]

There were two treatments. In the Baseline treatment, subjects only received feedback from their own chosen urn. In the Observation treatment, subjects received additional information about the choice and payoff from one (fixed) other subject who was facing the exact same decision problem. That is, after each round, subjects received a sheet detailing "...what one of the other kids in class who plays the exact same game as you do, chose to do

[3] In fact, one would have to assume a particular utility function to solve the problem. Even then, it is extremely tedious, although possible, to solve the problem via backward induction.

Figure 1: The classroom experimental setting.

in the previous period and how many points this kid earned with its choice." See Figure 5 in the Appendix for a feedback/decision sheet in the Observation treatment. It is important to notice that in the context of this game, this was useful information. Indeed, the information about the other's choice and payoff was as informative as the information about one's own payoff. Both should have received equal weight.

For the school children, the experiment was conducted with pen and paper within the familiar environment of the classroom. Upon arrival the tables were arranged to face the blackboard. Partition walls were put up (see Fig. 1). Six different urns were set up on a table clearly visible to all children. The instructions were read out aloud. To illustrate the distribution of balls across urns, the experimenter reached into each of the urns and presented the balls in front of the children. The distribution was also displayed on the blackboard and remained visible for the entire duration of the experiment. When explaining the random selection of balls by the computer, the experimenter reached into a random urn blindfolded, displayed the drawn ball to the subjects and put it back into the urn. The children were paid in vouchers for a book and stationary chain and made aware of the exchange rate between points and vouchers (10 Cents Vouchers for each point). On average, children received vouchers with a value of 5.41 euro.

The experiment lasted approximately 90 minutes including instructions, questionnaire, and payment of subjects. We used an Excel program to calculate payoffs and to gather

and print feedback information. In each period we first provided the children with the feedback/decision sheet containing information on the previous round. Each period, we gave them 30 seconds to go through the previous period's information and choose an urn. In-between these decision periods children were allowed to either read a comic or draw something on sheets of paper provided beforehand. After the last period, they were handed a questionnaire, which was filled in with the assistance of the experimenters. At the end of the experiment each child was handed an envelope containing her vouchers. In addition, we also asked teachers to fill in questionnaires about all children, in particular, we asked them whether they expected that a child was likely to be accepted for the "Gymnasium", the higher (selective) track in the Austrian school system. The instructions (see Appendix) have been carefully adjusted to the children's age group.

The university students receive almost the same instructions, with the only difference being the use of the German polite form of address. The experiments with adults were conducted in 6 sessions at the Vienna VCEE experimental lab. Adults received monetary payoffs with an exchange rate of 25 Cents per point. Average payoffs were 14.74 euro.

3 Results

Table 1 shows the overall means and standard deviations of the chosen urn's number, 6 being the best, 1 being the worst. For children, we distinguish between pupils who were assessed by their teachers as suitable for the "Gymnasium", a selective kind of grammar school, which is attended by about 1/3 of pupils in Austria, and all other pupils. In terms of their cognitive abilities, Gymnasium children are, adjusted for age, probably closer to university students than other children.

We find that university students significantly outperform all children in both treatments (Mann-Whitney U-test, two-sided, $p < .0001$ for the Baseline and for the Observation treatment).[4] Also, university students are doing better in the Observation treatment than in the Baseline treatment as predicted by imitation ($p = .01$). In contrast, we find no significant difference between Baseline and Observation for the children, neither for Gymnasium ($p = .53$) nor for other children ($p = .96$).

Figure 3 plots histograms of urn choices for the six different cells. In all six cells, the best urn is also the most frequently chosen one. The histograms also show that the incidence of the optimal urn vastly increases for university students when they receive additional information about another subject in treatment Observation. This is not the case for children where, as shown above, the two distributions are not significantly different.

In order to study learning dynamics, we first examine how the average choice moves

[4] For non-parametric tests, we consider the average choice of one subject (in Baseline) or one pair of subjects (in Observation) as one independent observation.

Table 1: Summary statistics urn choice

	Children				University students	
	Gymnasium		Other			
	Baseline	Observation	Baseline	Observation	Baseline	Observation
mean	4.20	4.32	3.89	3.90	5.03	5.40
std.dev.	1.75	1.77	1.75	1.76	1.40	1.31
obs.	27	12	15	28	40	38

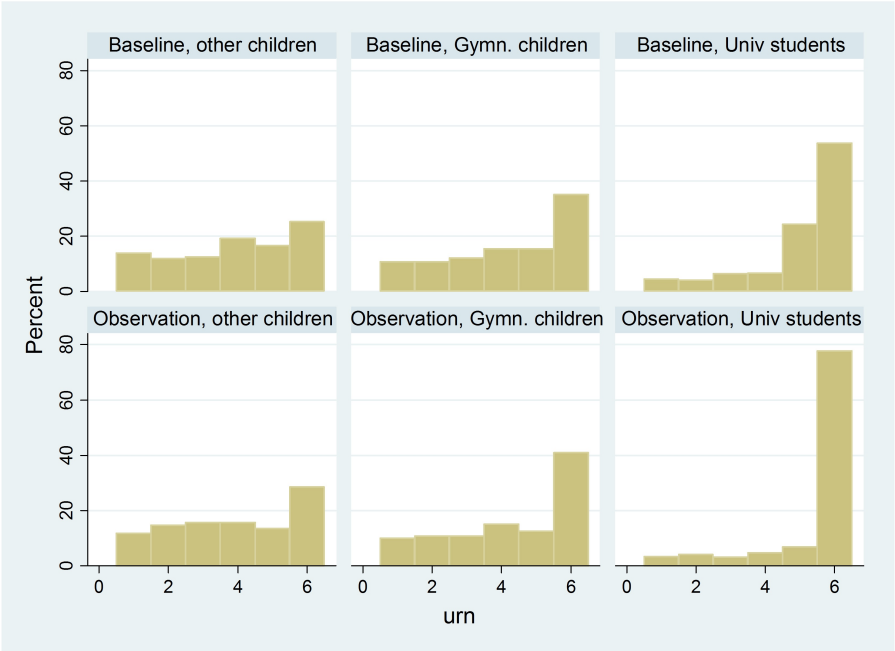

Figure 2: Histograms of urn choices

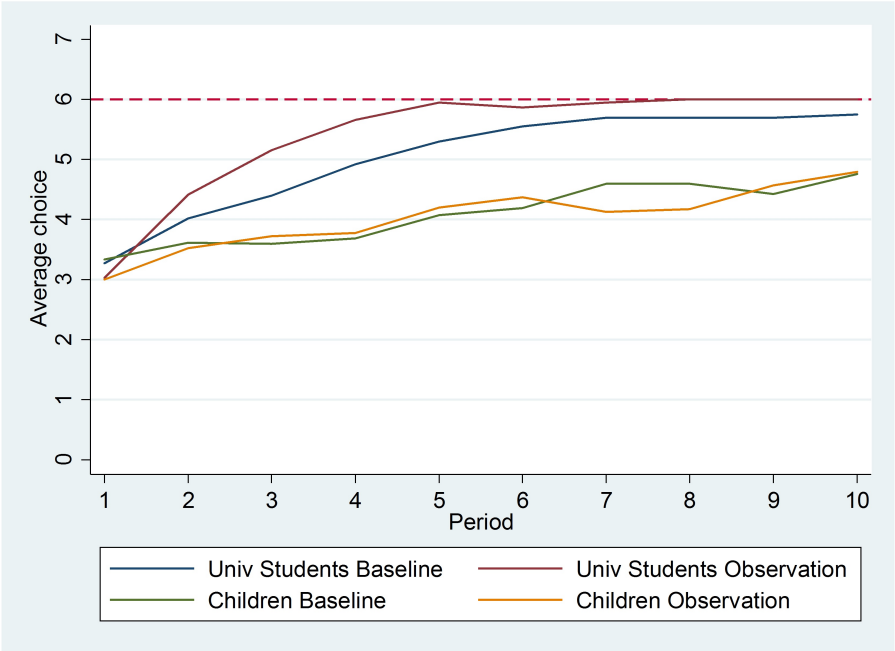

Figure 3: Average Choices over time

over time. Figure 3 plots the development of the average choice for children and adults.[5] Fundamentally, the figure reveals that all subjects are able to learn. Learning is steeper for university students and steepest for university students in treatment Observation. In contrast, there are no treatment differences in the development of the average choice for children over time.

While the absence of treatment differences in children is strongly indicative of the absence of imitation, the evidence is, of course, indirect. Direct evidence can be obtained by examining how often subjects copy others' behavior when others have found a better urn. In Figure 4 we examine changes in behavior for the Observation treatment. The figure inspects to which mode of behavior subjects resort, when the other has chosen a different urn, as a function of the payoff difference. We differentiate between three different types of behavior: repeat own action, imitate the other's action, and do something else. While university students repeat choices when they have earned significantly more than the other player and imitate others with higher payoffs, the picture is much more noisy with children. This becomes most apparent at the two extremes of the distribution of payoff differences where children display a much stronger taste for experimentation. Neither do they imitate the other's action as much as one would expect when the difference in payoffs is 6 or 5, nor do they stick to their action as much as one would expect when they are actually the ones earning the maximum payoff

[5]Differentiating between Gymansium and non-Gymnasium does not change much (see Figure 6 in the appendix).

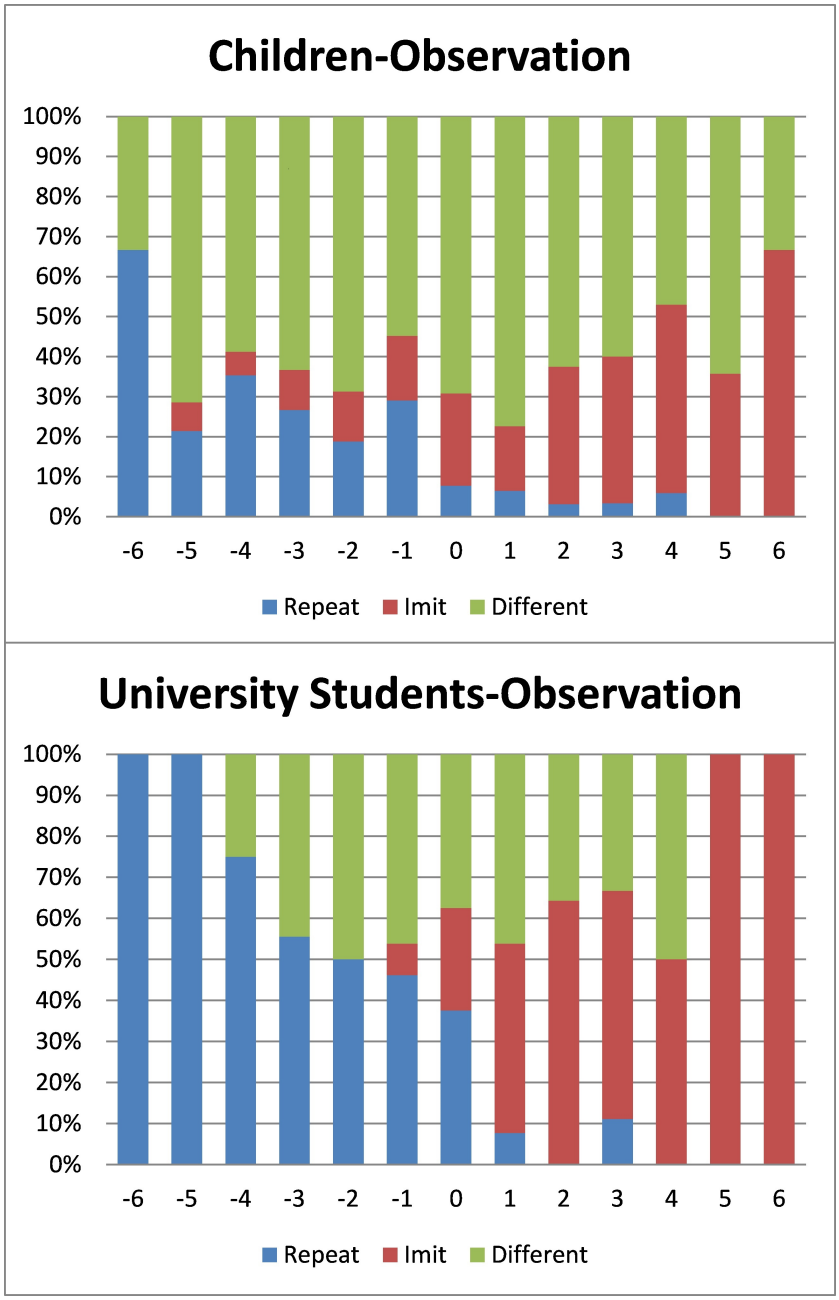

Figure 4: Relative frequencies of the strategies "repeat the own action from the previous period", "imitate partner's action if payoff was higher", and "experiment with an action not used in the previous period in the team"

difference of -6 and -5.

We now investigate whether the differences between university students and children can be accounted for by the composition of treatment groups in terms of "Gymnasium" and "non Gymnasium" rather than age. To do so, we employ the entire data set and regress urn choice on treatments and dummies for university students and children viewed suitable for higher school education ("Gymnasium") and also include interaction terms that capture heterogenous treatment effects. The results are shown in Table 2. The results show that while more able children are doing generally better in our task than those predicted not to reach the "Gymnasium", they fail to do better in the Observation treatment. That is, they, too, ignore the additional information from others' urn choices. In other words, our finding that, in contrast to adults, children at the age of 10 are unable to engage in rational imitation is not due to selection bias in our sample. Smarter children do better at the learning task but still fail to make use of feedback about others' choices and outcomes which is, in principle, as valuable as their own feedback.

Table 2: OLS regression: urn choice

dummy treatment observation	0.02
	(0.18)
dummy university	1.15***
	(0.15)
dummy Gymn	0.31*
	(0.19)
dummy observation × univ	0.35*
	(0.21)
dummy observation × Gymn	0.10
	(0.30)
constant	3.89***
	(0.13)
N	1600

Clustered standard errors in parentheses. ***,** ,* significant at 1%, 5%, 10% level; $R^2 = 0.13$.

4 Conclusion

While much of the recently growing literature on economic and strategic decision making in children points to various forms of sophistication being acquired early on in life, we document that children at the age of around 9 fail to engage in success-based imitation of peers, that is, they are unable to extract relevant information from peers' choices and outcomes. Given the prevalence of other forms of imitation in child behavior, we find this surprising and we realize that our finding seems to contradict much of the earlier literature. Nevertheless, we believe such contradictory findings need to be published (in particular to avoid publication bias). More research is required to find out what could account for the different findings.

We document that our result is not due to selection bias. Even the most able children do not gain an advantage through rational imitative behavior. Instead, all children appear to discard information that stems from others' choices even though the symmetry between own and others' actions is made explicit

Another aspect that may account for our findings is that in our experiment, children had to learn from observing peers. Most of the literature in child psychology uses adults as role models. Moreover, in line with previous literature in psychology, it has been argued that in unfamiliar settings, children trust their peers less and rely more on their own experience. We speculate that evolution might have forced prepubescent children to focus very carefully on own feedback. The wealth of new information provided to children at this age is enormous and a clear focus on feedback about own behavior might have been extremely useful (and perhaps still is).

References

Almås, I., A. W. Cappelen, E. Ø. Sørensen, and B. Tungodden (2010): "Fairness and the development of inequality acceptance," *Science*, 328(5982), 1176–1178.

Alós-Ferrer, C., and K. Schlag (2009): "Imitation and Learning," in *The Handbook of Rational and Social Choice*, ed. by P. Anand, P. Pattanaik, and C. Puppe. Oxford University Press.

Apesteguia, J., S. Huck, and J. Oechssler (2007): "Imitation—theory and experimental evidence," *Journal of Economic Theory*, 136, 217–235.

Asch, S. (1952): *Social Psychology*. Prentice Hall, Englewood Cliffs.

Bandura, A. (1971): *Social learning theory*. General Learning Press, New York, NY.

Fehr, E., H. Bernhard, and B. Rockenbach (2008): "Egalitarianism in young children," *Nature*, 454(7208), 1079–1083.

Gergely, G., H. Bekkering, and I. Király (2002): "Developmental psychology: Rational imitation in preverbal infants," *Nature*, 415(6873), 755–755.

Hanna, E., and A. N. Meltzoff (1993): "Peer imitation by toddlers in laboratory, home, and day-care contexts: implications for social learning and memory.," *Developmental psychology*, 29(4), 701.

Harbaugh, W. T., K. Krause, and L. Vesterlund (2007): "Learning to bargain," *Journal of Economic Psychology*, 28(1), 127–142.

Huck, S., H.-T. Normann, and J. Oechssler (1999): "Learning in Cournot Oligopoly - An Experiment," *Economic Journal*, 109, C80–C95.

Lergetporer, P., S. Angerer, D. Glätzle-Rützler, and M. Sutter (2014): "Third-party punishment increases cooperation in children through (misaligned) expectations and conditional cooperation," *Proceedings of the National Academy of Sciences*, 111(19), 6916–6921.

Meltzoff, A. N. (1988): "Infant imitation after a 1-week delay: long-term memory for novel acts and multiple stimuli.," *Developmental Psychology*, 24(4), 470.

Offerman, T., J. Potters, and J. Sonnemans (2002): "Imitation and Belief Learning in an Oligopoly Experiment," *Review of Economic Studies*, 69(4), 973–97.

Offerman, T., and A. Schotter (2009): "Imitation and luck: an experimental study on social sampling," *Games and Economic Behavior*, 65(2), 461–502.

Ray, E., and C. Heyes (2011): "Imitation in infancy: the wealth of the stimulus," *Developmental science*, 14(1), 92–105.

Sher, I., M. Koenig, and A. Rustichini (2014): "Children's strategic theory of mind," *Proceedings of the National Academy of Sciences*, 111(37), 13307–13312.

Sutter, M., M. G. Kocher, D. Glatzle-Rutzler, and S. T. Trautmann (2013): "Impatience and uncertainty: Experimental decisions predict adolescents' field behavior," *American Economic Review*, 103(1), 510–531.

Vega-Redondo, F. (1997): "The Evolution of Walrasian Behavior," *Econometrica*, 65, 375–384.

Zmyj, N., and S. Seehagen (2013): "The role of a model's age for young children's imitation: A research review," *Infant and Child Development*, 22(6), 622–641.

Appendix

Instructions Treatment BASELINE - Additional text for Treatment OBSERVATION in [ ].

The non-verbal part of the instructions is in *(Italics characters).*

Hello, my name is (Name of Instructor) and these are (Name Helper 1) and (Name Helper 2). Thanks for letting us visit you in class today. Maybe your teacher has already told you, we're working at the University of Vienna and we would like to play a game with you today. In our game you will have the possibility to earn points. These points will be transferred into LIBRO vouchers at the end of the game. Do all of you guys know the LIBRO store? You can buy pencils, CDs or little toys there. Each point in the game will give you a 10 Cent voucher. The vouchers look like this *(Show the kids some sample vouchers).* The colorful vouchers are worth 1 or 5 Euros. The more points you earn in the game the more vouchers you will get by the end of the game and the more vouchers you can yourself spend in store.

Before we can start to play the game, I will explain the rules.

From now on, I would like to ask you not to talk to any of you classmates anymore. If one of you is talking to any other child in class we will exclude this person from the game and he or she will not get any vouchers at the end of the game. Please listen carefully to my instructions. The better you listen to me and understand the game the more points you can earn and the more vouchers you can spend in store afterwards.

Please raise your hand, if you do have a question concerning the game. One of us is going to come to your table and answer this question in private. Otherwise you just stay silent and listen carefully.

First, I'm going to explain the rules of the game to you. Then, we will play 10 periods of the game. After we've finished the game we will fill in a questionnaire together and each child will get an envelope with his vouchers.

Everything ok so far? Let us talk about the game itself then.

(*Drawing on the blackboard: six bowls with two balls inside each.)*

- There are six urns in our game (*point at the urns on the blackboard*)
- There are two balls in each of these urns (*point at the balls in the urns on the blackboard*)

- Inside one of these urns there is a ball worth one point and a ball that gives you two points (*label the balls in one of the urns on the blackboard with numbers one and two*)
- Inside another one of these urns there is a ball worth two points and a ball that gives you three points (*label the balls in one of the urns on the blackboard with numbers two and three*)
- Inside a further one of these urns there is a ball worth three points and a ball that gives you four points *(label the balls in one of the urns on the blackboard with numbers three and four)*
- Inside another one of these urns there is a ball worth four points and a ball that gives you five points *(label the balls in one of the urns on the blackboard with numbers four and five)*
- Inside one of these urns there is a ball worth five points and a ball that gives you six points *(label the balls in one of the urns on the blackboard with numbers five and six)*
- Inside another one of these urns there is a ball worth six points and a ball that gives you seven points *(label the balls in one of the urns on the blackboard with numbers six and seven)*
- Your task in each period is to choose one of the urns.
- After you've chosen one of the urns the computer is going to draw one of the balls inside the urn at random and you will get the points stated on that ball.

(*Six bowls with two tennis balls inside each, numbered from 1-7 and covered with colored lids are placed in front of the class.)*

- You can think of the game as follows. Here are six urns.
- If you, for example, decide to choose the red urn, then the computer will compute your points as if it would randomly draw a ball out of this urn. (*Draw a ball out of the red bowl with covered eyes and show the ball with its associated number to the kids.*) After having drawn the ball and after having allocated the associated points to you, the computer will put the ball back into the same urn and the next period of the game is about to begin. (*Put the ball back into the bowl.)*
- If you decide to choose the blue urn in the next period, then the computer will draw a ball out of the blue urn, you get the points that are written on this ball and the ball is placed back into the urn. (*Draw a ball with covered eyes out of the blue bowl and show the ball with it's associated number to the kids and put the ball back into the bowl.)*

- If you decide to choose the blue urn again in the next period, then the computer will again draw one of the two balls, you get the points that are written on this ball and the ball is placed back into the urn. (*Again, draw a ball out of the blue bowl with covered eyes and show the ball with it's associated number to the kids and put the ball back into the bowl.*)

(*Drawings of the six different signs (circle, square, triangle, cross, star, hexagon) on the blackboard.)*

- However, the urns in our game will not be differentiated by colors. But each urn will be associated with a sign. We have one urn marked with a circle *(point on the circle on the blackboard)*, one urn with a square *(point on the square on the blackboard)*, one urn with a triangle (point on the triangle on the blackboard), one urn with a cross *(point on the cross on the blackboard)*, one urn with a star *(point on the star on the blackboard)* and one urn with a hexagon *(point on the hexagon on the blackboard).* The urns will have the same sign throughout the whole game. But we will not tell you which sign belongs to which urn.

- What you know is that there is one urn with a ball labeled 1 and a ball labeled 2. There is one urn with a ball labeled 2 and a ball labeled 3. In one urn there is a ball labeled 3 and a ball labeled 4. In one urn there is a ball labeled 4 and a ball labeled 5. In one urn there is a ball labeled 5 and a ball labeled 6 and in one urn there is a ball labeled 6 and a ball labeled 7.

- In order for you to decide on one urn and to get to know how many points you've earned with one of the urn's balls we will provide you with a decision sheet at the beginning of each period. (*Show a period 1 decision sheet.)*

- On top of the sheet you will find your unique player's number, which lets the computer know who you are and you will find the period in which we're currently in.

- Underneath you will see the six signs of the urns. In each period your task is going to be to decide on one of the signs. As soon as you've decided on one of the signs, you tick off the box underneath the sign and wait for us to collect your decision sheet.

- From the second period on, you will find some more information on your decision sheet. On top of the sheet you will again find your player's number and the current period. (*Show a period 2 decision sheet.)*

- Underneath, you will see what happened in the previous period.

- You can see what urn you did choose. The sheet tells you "my choice" and shows you a ticked off box underneath your previous period's sign.

- You can have a look on how many points you did get with your choice. The sheet says "my points".
- Underneath, you will again find the six signs of the urns and you can again decide on an urn's sign.
- [**Only in treatment Observation:** Additionally, we will tell you what one of the other kids in class who plays the exact same game as you do, chose to do in the previous period and how many points this kid earned with her choice.]
- The game will last 10 periods. We will tell you when the last period is going to be.
- The important thing is that you understand that different urns can give you different numbers of points.

Before we start to play the game each of you is going to be provided with a comic book and some sheets of paper. Whenever there isn't any decision sheet on your table you're allowed to read the comic or to color on the blank sheets of paper. You will have to close the comic books, put away the drawings and concentrate on the new decision sheet as soon as I tell you that a new period of the game is going to start until we pick up the decision sheet again.

Each game period is going to last for 30 seconds. In this time you will carefully read through the previous period's information and decide on an urn for the current period afterwards.

Remember, in each period you can decide on one of the urn's signs. There are no guidelines on which sign to choose when or how often. It is completely up to you if you want to choose a different sign in each period or if you want to go for the same sign in some consecutive periods.

Remember, the more points you earn in the game, the more money in form of voucher you will get by the end of the game. If anybody has any more questions raise your hand now. Otherwise I wish you the best of luck and don't forget not to talk to any other kids.

Before every new period: Please close the comic book and put away all the drawings. *(Wait for some seconds*) We will now provide you with the decision sheets for the next period. Please read carefully through the information's provided and decide which sign you would like to choose in this period.
(*After the last period:)* The game's last period is now over. First, we will collect the comic books. Second, we will provide you with a questionnaire. Since we will fill it in together, please wait until everybody was provided with the questionnaire. In the mean time, the computer is going to calculate your earnings. When we are finished filling in the questionnaires each child is going to get an envelope with his vouchers.

(Before giving away the envelopes:) Before each of you is going to get his envelope we would like to thank you for being able to be with you today and also say thanks to your teacher that she/he allowed us to visit your class. We will now hand each of you an envelope with your player's number on the outside. Inside the envelope you will find a sheet of paper that tells you how many points you've earned in the whole game and how many vouchers this number of points is going to give you. The vouchers look like that (show them sample vouchers). They are labeled 5 Euro or 1 Euro. We wish you a lot of fun with your envelopes and the vouchers.

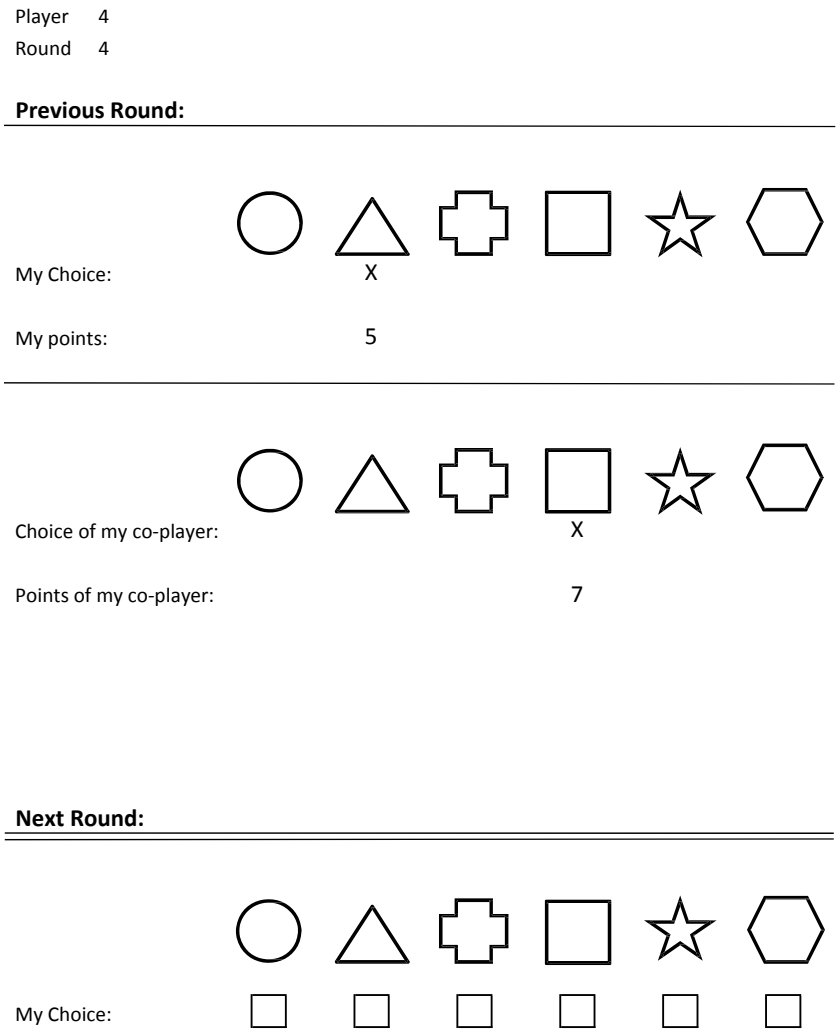

Figure 5: Feedback/decision sheet in the Observation treatment

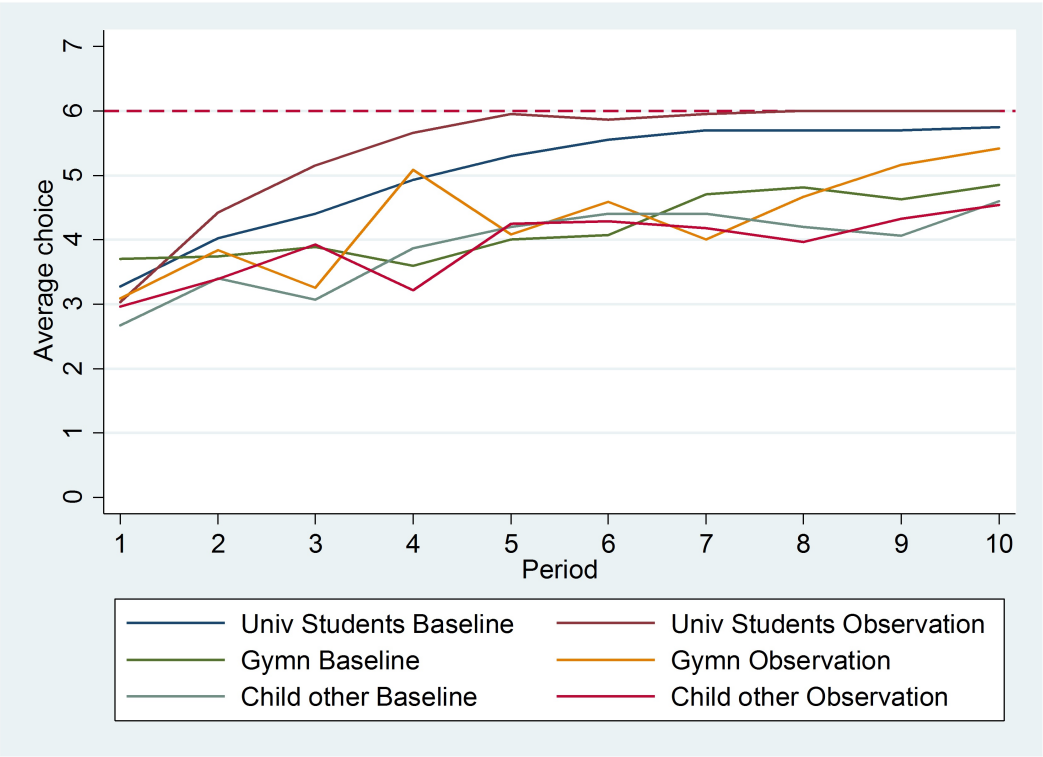

Figure 6: Average Choices over time