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Trajectories of Aggressive Behavior and Children's Social-cognitive Development

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### Abstract

The current study investigated developmental trajectories of teacher-reported aggressive behavior and whether these trajectories are associated with social-cognitive development (i.e., aggressive problem-solving) across the first three elementary grades in a large sample from Switzerland ( $N = 1,146$ ). Semiparametric group-based analyses were employed to identify distinct pathways of aggressive behavior across grades. Five distinct trajectory classes were identified: low-stable, medium-stable, decreasing, increasing, and high-stable. Childrens' aggressive problem-solving strategies differentiated the high-stable from the other aggressive behavior trajectories. The findings are discussed within a social-cognitive developmental framework.

**Keywords.** Aggressive behavior, trajectories, social-cognitive development, childhood.

### Trajectories of Aggressive Behavior and Children's Social-cognitive Development

Persistent aggressive behavior in childhood is one of the most serious risk factors for adolescent delinquency (Farrington, 1993). This being the case, an understanding of the risks and protections underlying changes in aggressive behavior can facilitate developmentally appropriate prevention programs. In this study, we investigated whether and how strategies of social problem-solving are associated with aggression trajectories during elementary school. Based on social-cognitive theory (Lemerise & Arsenio, 2000; Crick & Dodge, 1994), we suggest that cognitions such as social problem-solving strategies are important factors in the subsequent development of aggressive behavior because, depending on the quality of social-cognitive functioning, they can either buffer children from or exacerbate that behavior. According to the social information processing (SIP) model, children's social-cognitive interpretations of particular events influence their behavioral responses. SIP theory describes a series of steps through which social information is processed and social behavior instigated (Crick & Dodge, 1994). These steps include encoding, making attributions, selecting goals, generating potential responses, evaluating these responses, and making the responses. All of these steps are influenced by beliefs about one's own behavior and the people one interacts with. However, there is comparatively little information about whether and how children's thinking about conflict situations impacts the development of future aggressive behavior. Moreover, the longitudinal studies that have been undertaken were limited predominantly to samples from the US. In this study, we aimed to partly fill this research gap by investigating whether children's social problem-solving strategies affect the trajectory of their aggressive behavior, using a large and ethnically diverse longitudinal sample from

Switzerland.

### *Developmental Trajectories of Aggression*

Aggression is generally defined as behavior meant to harm others (Achenbach, Conners, Quay, Verhulst, & Howell, 1989). Longitudinal studies indicate that early childhood aggressive behavior predicts externalizing behavior in middle childhood, adolescence, and adulthood (e.g., Brook, Whiteman, Finch, & Cohen, 1996). Researchers have examined the developmental trajectories of two forms of aggressive behaviors in children: bullying and physical aggression (e.g., Brame, Nagin, & Tremblay, 2001; Broidy et al., 2003; Maughan, Pickles, Rowe, Costello, & Angold, 2000; Pepler, Jiang, Craig, & Connolly, 2008). Most researchers using trajectory analysis have identified two to five distinct groups of children; typically, one or two of these groups do not demonstrate serious aggression and thus are not at increased risk for later criminal behavior (e.g., Nagin & Tremblay, 1999). Among the remaining children, there are usually some who maintain consistently high levels of aggression throughout development and others whose aggression starts at a high level but decreases over time. Other researchers have identified yet another group of children whose aggressive behavior starts out low but increases through elementary and middle school (Schaeffer, Petras, Ialongo, Poduska, & Kellam, 2003).

### *Social-cognitive Development and Aggression Trajectories*

To date, there have been few large-scale longitudinal studies investigating whether children's social problem-solving strategies in conflict situations are associated with aggressive behavior over time.

Interestingly, whereas some researchers have found that aggressive children have

trouble at each step of social information processing (e.g., Dodge, Price, Bachorowski, & Newman, 1990; Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002), other researchers have argued that aggressive children demonstrate good social-cognitive understanding and problem-solving skills in some circumstances (Sutton, Smith, & Swettenham, 1999). Previous research supports this notion that aggressive children may not always have deficits in social-cognitive understanding (Gasser & Keller, 2009).

Likewise, longitudinal studies on aggressive behavior and social-cognitive development have not revealed a completely consistent picture. Dodge, Greenberg, Malone, and the Conduct Problems Prevention Research Group (in press) tested a dynamic cascade model of the development of serious adolescent violence in 754 children. Social-cognitive development in the preschool years predicted aggressive and externalizing behavior in the first grade, which in turn predicted later school failure and violence in adolescence. Other longitudinal studies revealed that the relationship between social-cognitive development is not necessarily straightforward but depends on the child's characteristics. For example, in a longitudinal study of 189 third- through seventh-graders, it was found that although aggression-encouraging cognitions promoted aggression during the school year, whether this progression occurred depended critically on the child's sex and initial level of aggression (Egan, Monson, & Perry, 1998). Furthermore, in a recent 12-year longitudinal study using a community sample of 576 children tested first in kindergarten and then in Grades 3, 8, and 11, the researchers identified four group profiles: no SIP problems, early-stage SIP problems, later-stage SIP problems, and pervasive SIP problems. Although patterns in which these problems manifested were related to aggressive behavior in elementary school, the relation between

social cognition and future externalizing behavior was stronger in Grades 8 and 11 than in elementary school, suggesting that age was an important moderator (Lansford et al., 2006).

Given these inconsistencies, our primary objectives were to identify aggression trajectories across the first 3 years of elementary school and investigate whether social problem-solving strategies would predict these trajectories. Based on past trajectory research, we expected to find a group that was consistently low on aggression, a group that was consistently high on aggression, a group that was aggressive in the first year but later reduced their aggressive behavior, and a group that was less aggressive than other children in the first year but became more aggressive over time (cf. Campbell, Spieker, Burchinal, Poe, & the NICHD Early Child Care Research Network, 2006). In addition, we hypothesized that the children would demonstrate either increasing or consistently high levels of aggressive behavior if they also exhibited aggressive problem-solving strategies at the beginning of elementary school.

## Method

### *Participants*

The data were drawn from an ongoing combined longitudinal and intervention study, the Zurich Project on the Social Development of Children. The original sample consisted of a large, ethnically heterogeneous group of 7-year-olds drawn from all 90 public primary schools in the city of Zurich. The schools were classified by enrollment size and the socioeconomic background of the school district. Subsequently, a stratified sample of 56 schools was drawn (for a more detailed description, see Eisner & Ribeaud, 2005).

The final sample consisted of 1,675 first graders (48% girls) from these 56 elementary schools. There were three main data collection waves that took place annually between 2004/5 and 2006/7. Each wave collected data from the primary caregiver, the child, and the child's teacher. In the present study, we analyzed only the teacher and child data. For the first wave (T1), the mean age of the children was 7.02 years ( $SD = 0.42$ ). The response rate at T1 was 81% for both the child interviews ( $N = 1,361$ ) and the teacher assessments ( $N = 1,350$ ). For the second wave (T2), when the children were 8 years old, the retention rate was 97% for the child interviews and 96% for the teacher assessments; for the third wave (T3), when the children were 9 years old, the retention rate was 96% for the child interviews and 94% for the teacher assessments.

At T1, 78% of the children lived with their biological parents, 20% with their biological mother only, and 2% with their biological father only or with foster parents.

### *Measures*

*Aggressive behavior.* The teachers evaluated the aggressive behavior of the children using the Social Behavior Questionnaire (SBQ; Tremblay et al., 1991). This instrument has been used in a variety of longitudinal studies, and it has been shown to be sensitive to behavior changes in many intervention studies (e.g., Lacourse et al., 2002; Lösel, Beelmann, Stemmler, & Jaurisch, 2006). The 11 items measure physical, proactive, and reactive aggression using a 5-point Likert scale (e.g., "is cruel, bullies or is mean to others"). The reliabilities (Cronbach's  $\alpha$ ) of the SBQ are .93 at T1, .93 at T2, and .93 at T3. The mean aggression levels on the SBQ were 0.59 ( $SD = 0.68$ , range 0 to 4.00) at T1, 0.55 ( $SD = 0.64$ , range 0 to 3.45) at T2, and 0.57 ( $SD = 0.64$ , range 0 to 3.55) at T3.

*Social-cognitive development.* The children's social problem-solving strategies were measured at T1 by having them respond to four hypothetical vignettes: playing on a swing, participating in a game, laughing at someone, and stealing a ball. These four scenarios, adapted from previous research (Crick & Dodge, 1996), were presented as three-frame sequences of gender-matched cartoons. For the first story, the child is read the following text:

Pretend that this is you and that this is another child. The other child has been on the swing for a long time and doesn't seem to want to share the swing with you.

You would really like to play on the swing.

Afterwards, the child is asked the following question: "What could you say or do so that you could play on the swing?" This question is the measure of the child's social problem-solving strategies. Responses to the question were audiotaped and later coded in the following categories: (a) aggressive strategy (e.g., "I'd just push him off the swing"), (b) socially competent strategy (e.g., "I'll ask to take turns"), and (c) other strategy (authority-oriented, irrelevant). For this study, we were specifically interested in the aggressive strategies. Two independent coders rated all the transcripts. Interrater agreement (Krippendorff's  $\alpha$ ) across the categories averaged at .79. Categorical answers were dichotomized and the matched pairs were averaged across both coders. A mean score for aggressive problem-solving strategies was then calculated. Across the entire sample, the mean level of aggressive problem-solving was 0.15 ( $SD = 0.20$ , range 0 to 1.00).

*Demographic (control) variables.* Sex was coded 1 for boys and 0 for girls ( $M = 0.51$ ,  $SD = 0.50$ ). Nationality was based on the caregivers' country of birth and assessed

only if both or a single caregiver was born outside Switzerland (coded 1 if yes and 0 if no;  $M = 0.46$ ,  $SD = 0.50$ ). Family stability was indicated by whether the children lived with their biological parents continuously since birth (coded 1 if yes and 0 if no;  $M = 0.72$ ;  $SD = 0.45$ ). Socioeconomic status (SES;  $M = 48.48$ ,  $SD = 19.57$ ) was based on coding the caregiver's current profession (Elias & Birch, 1994); the codes were then transformed into an International Socio-Economic Index of occupational status (ISEI) score (Ganzeboom, DeGraaf, Treiman, & Deleeuw, 1992). The final SES score was based on the highest ISEI score of the two caregivers. Ethnicity, family stability, and SES were derived from the parent interviews. Because the sample size was lower for these interviews ( $N = 1,225$ ) than for the teachers' interviews, there were missing values. After these data were removed, the final sample size of 1,146 was reached.

### *Procedure*

The parents were asked to sign an informed consent form at the beginning of the first interview. Computer-assisted 45-min interviews of the children were conducted at school by 44 interviewers who had been intensively trained by the research team, especially in techniques for interviewing children. Special care was taken to recruit native speakers or cross-culturally competent interviewers for the larger immigrant communities. The children completed the problem-solving strategy measure at T1. The demographic data were also collected at T1. The teachers completed a questionnaire on the child's social behavior at all three measurement times (T1–T3).

### *Data Analysis Strategy*

Semiparametric group-based analyses were used to identify relatively homogeneous clusters of developmental trajectories within the sample (Nagin, 1999).

The analyses proceeded in three steps: First, we identified the best fitting trajectory model for aggressive behavior using a SAS group-based modeling procedure (Jones & Nagin, 2007; Jones, Nagin, & Roeder, 2001). The censored normal model was used to account for cutting off at the lower bound of the aggression scale. In the second step, we added a multinomial logit model to examine whether the trajectory groups differed in aggressive problem-solving strategies. In the third step, the final model was identified by jointly estimating the trajectory parameters and the predicted probabilities of group membership (Nagin, 2005). Partial data on the trajectory variable (i.e., aggression) was allowed for in the analyses, but not missing data on the predictor variables.

## Results

### *Trajectories of Aggressive Behavior*

We estimated models for one to eight groups. The Bayesian Information Criterion (BIC) scores of the baseline first-order polynomial model (intercept + linear age) were inspected. BIC scores continued to improve as more groups were added. Because BIC scores are not useful for identifying the preferred number of groups in such cases, we determined the number of groups by identifying the model that was most parsimonious and that captured distinctive developmental patterns in the data (Nagin, 2005). The findings indicated that the five-group model is the most parsimonious and comprehensible, and adding more groups did not reveal other important features of the data. Quadratic orders were then added to the model and they improved the fit for three of the groups. The mean assignment probabilities, used to evaluate the precision of the group assignments (Nagin, 1999), were good (0.81 to 0.94). The parameter estimates and mean assignment probabilities for the final model are shown in Table 1.

Figure 1 depicts the developmental aggression trajectories for the five-group model from the first to the third grade: The first group of children (35.2%,  $n = 403$ ) were labeled low-stable because their aggression was consistently low over time; the second group (46.9%,  $n = 538$ ), labeled medium-stable, showed somewhat elevated but stable aggressive behavior over time; the third group (6.7%,  $n = 77$ ), labeled the increasing group, showed an increase in aggressive behavior over time; the fourth group (8.9%,  $n = 102$ ), labeled the decreasing group, showed a decrease in aggressive behavior over time; the fifth group (2.3%,  $n = 26$ ), labeled the high-stable group, showed a chronically high level of aggression. The observed scores were compared with the predicted scores, and the two sets of scores were found to be very similar.

Table 2 shows the total aggression scores split into the three subtypes, thus creating an “aggression profile” for each trajectory. As can be seen, all the groups had higher mean reactive aggression scores than mean physical and proactive aggression scores. However, as the total aggression scores increase from the low-stable to the high-stable group, the percentage of physical and proactive aggression in the total aggression score increases compared to the percentage of reactive aggression in the total aggression score.

#### *Links Between Aggressive Problem-solving Strategies and the Trajectories of Aggressive Behavior*

The descriptive statistics for aggressive problem-solving strategies and demographics across the five trajectories are displayed in Table 3. Note that the low mean on aggressive problem-solving strategies for the increasing group is an artifact of missing data on the demographic variables, because this group had more missing data

from the parent interviews than the other groups. When these control variables were removed, the mean on aggressive problem-solving strategies increased from 0.09 to 0.17, which is higher than the mean for the low-stable and medium-stable groups and comparable to that of the decreasing group.

Multinomial logistic regression models were then used to examine whether the children with elevated scores on a covariate were overrepresented in specific aggression trajectories (Table 4). The high-stable group served as the reference group. All other groups have significantly lower scores on aggressive problem-solving than the high-stable group.

Pairwise comparisons of all the groups (e.g., low-stable versus medium-stable, medium-stable versus increasing) were then performed to test any additional differences in aggressive problem-solving strategies. Except for the contrasts involving the high-stable group, there were no significant differences.

Results on the demographic variables (see Table 4) show that members of the low-stable group were less likely to be male and more likely to be high SES than members of the high-stable group. Members of the low-stable, medium-stable, and increasing groups were more likely to come from stable families than members of the high-stable group.

## Discussion

Drawing on social-cognitive theories (e.g., Lemerise & Arsenio, 2000; Crick & Dodge, 1994), we investigated if and, if so, how aggressive problem-solving strategies might predict aggressive behavior trajectories in children. We extended existing research by examining this question using a large and ethnically diverse

longitudinal sample from Switzerland.

In accordance with previous trajectory research on aggression, we found that the majority of children scored consistently low- or medium-stable on aggressive behavior. We also found a smaller group that decreased in aggression, a smaller group that increased in aggression, and an even smaller group that was consistently high on aggression. These results are consistent with other studies that found only a small fraction of the children to be persistently aggressive (e.g., Pepler, Craig, Jiang, & Connolly, 2008) and conduct disorders to be prevalent in childhood and adolescence (European Health Report, 2005; Malti & Noam, 2008; Zwirs et al., 2007).

Our findings indicate that aggressive problem-solving strategies at the beginning of the first grade predicted trajectory group membership: Consistent with our hypotheses, the children in the high-stable group scored higher on aggressive problem-solving strategies than the children in the other groups. However, in contrast to our hypotheses, we did not find that membership in the increasing trajectory group was significantly associated with the presence of aggressive problem-solving strategies. Differences among the low-stable, medium-stable, increasing, and decreasing groups on aggressive problem-solving strategies were not significant.

The findings that the children in the high-stable group scored higher on aggressive problem-solving strategies than the children in the other groups illustrates that deficits in competent problem-solving are specifically related to stable patterns of chronic aggressive behavior over time. Initially aggressive children who fail to develop nonaggressive problem-solving strategies are likely to remain aggressive over time. Hence, prevention efforts that focus on developing or enhancing the more functional

problem-solving strategies may be useful for preventing persistent aggressive behavior.

We found that members of the increasing trajectory group did not show significantly higher levels of aggressive problem-solving than the other children at T1. Social problem-solving scores for the increasing group were somewhat higher than for the low- and medium-stable groups, comparable to those of the decreasing group, and significantly lower than those of the high-stable group. This finding suggests that social problem solving at T1 may be related to aggressive behavior at T1, but not to aggression later on. Hence, future research addressing the development of social problem-solving strategies over time in relation to the simultaneous development of aggression may be fruitful.

We also found that members of the various trajectory groups differed on demographic characteristics. Children in the high-stable group were more likely to be male, have low SES, and come from an unstable family than children in the other trajectory groups. This is in line with prior research on trajectories of aggression from childhood into adolescence (Maughan, Pickles, Rowe, Costello, & Angold, 2000).

The trajectory groups differed not only in their problem-solving strategies and demographic characteristics, but also in the type of aggression they manifested. Although all the groups reported more reactive aggression than proactive and physical aggression, the proportion of proactive and physical aggression compared to reactive aggression increased as total aggression increased. The types of aggression used by the children in the different trajectory groups are therefore quite different. Physical and proactive aggression were only 28% of total aggression among the children in the low-stable group, compared to 61% for the children in the high-stable group. This finding suggests that

aggressive problem-solving strategies may be an especially important predictor of proactive and physical aggression.

The present study was not without limitations. First, our measure of aggressive behavior did not differentiate between the subtypes of aggression (e.g., reactive, physical). This limitation is potentially consequential because different aggression subtypes may be associated with different social problem-solving strategies (e.g., Crick, Grotpeter, & Bigbee, 2002). Additionally, previous research has shown that different subtypes of aggression sometimes relate differently to social cognitions (e.g., Crick, et al., 2002). Thus, it would be beneficial in future studies to investigate how different subtypes of aggressive behavior relate to differences in social problem-solving strategies over time. Finally, we did not investigate personality variables that might moderate the relationship between problem-solving strategies and aggressive behavior. Because research indicates that temperament variables such as impulsivity influence the relation between aggression and social cognition (e.g., Fite et al., 2008), future researchers may want to examine such moderators.

Despite these limitations, the findings provide new insights into how social problem-solving strategies in elementary school may be related to trajectories of aggressive behavior from the first grade to the third grade. Subsequent research investigating the link between social problem-solving strategies and long-term trajectories of aggressive behavior is thus recommended. This relationship is important, because identification of the risks and protective factors associated with social cognitions would provide useful input for the design of interventions aimed at preventing the development or persistence of aggression, thereby avoiding the long-term mental health

consequences for aggressive children.

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Table 1

*Parameter Estimates and Model Characteristics for the Latent Class Analyses*

	Trajectory Group				
	Low-stable	Medium-stable	Increasing	Decreasing	High-stable
Estimated model parameters					
Intercept	6.11*	3.73*	-1.60*	4.80**	25.84**
Age/10	-15.92*	-8.34*	3.62**	-4.21**	-59.05**
(Age/10) <sup>2</sup>	9.95*	5.33*	-	-	36.93**
Model characteristics					
Mean assignment probability	0.88	0.87	0.81	0.82	0.94

\* $p < .05$ . \*\* $p < .01$ .

Table 2

*Mean Aggressive Behavior Scores From T1 to T3 (% of total aggression) by Trajectory Group*

	Trajectory Group				
	Low-stable	Medium-stable	Increasing	Decreasing	High-stable
Reactive Aggression	0.18 (72)	1.02 (58)	1.79 (43)	2.09 (46)	2.90 (38)
Physical Aggression	0.02 (8)	0.38 (22)	1.27 (31)	1.36 (30)	2.46 (32)
Proactive Aggression	0.05 (20)	0.36 (20)	1.06 (26)	1.10 (24)	2.24 (29)
Total Aggression	0.25 (100)	1.76 (100)	4.12 (100)	4.55 (100)	7.60 (100)

Table 3

*Means (SDs) for the Independent Variables Across Trajectory Groups (N = 1,146)*

	Trajectory Group				
	Low-stable	Medium-stable	Increasing	Decreasing	High-stable
Aggr. problem solving	0.14 (0.21)	0.14 (0.19)	0.09 (0.14)	0.18 (0.21)	0.29 (0.25)
Control Variables					
Sex (male)	0.40 (0.49)	0.53 (0.50)	0.64 (0.48)	0.76 (0.43)	0.73 (0.45)
SES	53.95 (19.33)	46.54 (19.16)	39.55 (19.00)	45.45 (18.08)	41.23 (17.10)
Nationality (Swiss)	0.38 (0.49)	0.48 (0.50)	0.73 (0.45)	0.42 (0.50)	0.58 (0.50)
Family stability	0.81 (0.39)	0.74 (0.44)	0.77 (0.43)	0.55 (0.50)	0.42 (0.50)

Table 4

*Multinomial Coefficients (SD) for the Multinomial Logit Model*

	Trajectory Group			
	Low-stable	Medium-stable	Increasing	Decreasing
Aggr. problem solving	-2.19* (.85)	-2.50** (.83)	-3.36** (1.22)	-2.03* (.98)
Control Variables				
Sex (male)	-1.40** (.50)	-0.85 <sup>†</sup> (.49)	-0.26 (.58)	0.24 (.57)
SES	0.03* (.01)	0.01 (.01)	0.00 (.02)	0.01 (.01)
Nationality (Swiss)	-0.45 (.50)	-0.30 (.50)	0.33 (.62)	-0.43 (.56)
Family stability	1.71** (.47)	1.33** (.45)	1.25* (.61)	0.37 (.51)

*Note.* The high-stable group was the reference category.

<sup>†</sup> $p < .10$ .      \* $p < .05$ .      \*\* $p < .01$ .

Figure Caption

Figure 1. Fitted mean trajectories for teacher-reported aggressive behavior.

