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Impulsivity-Reflectivity and Cognitive Development in Preschoolers: A Longitudinal Analysis of Developmental and Trait Variance

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Because *impulsivity-reflectivity* (IR), as measured by the Matching Familiar Figures Test (MFF; Kagan, 1965) and KRISP (Wright, Note 1), is correlated with age and IQ, we sought to determine how much variance in impulsivity-reflectivity is attributable to an impulsivity-reflectivity trait and how much to cognitive development, as measured by mental age (MA). Since the usefulness of measures of impulsivity-reflectivity depends upon whether they predict behavior not predictable from developmental level, we included a test of *hypothesis behavior, which* Kagan (cf. Kagan & Kogan, 1970) believes is central to stylistic differences in cognitive processes.

Fifty-five boys and 47 girls in nursery and daycare settings were tested twice, at a mean interval of 6.0 months; 76 were white and 26 nonwhite. The Stanford-Binet short form was administered at each testing according to an optimizing procedure whereby easy items were alternated with difficult items. At Testing 1, mean chronological age was 50.0 months, mental age 57.3, IQ 103.8, and Hollingshead (Note 2) socioeconomic score 3.0, in which 1 is the highest and 7 the lowest parental occupation. At both testings, a measure of impulsivity-reflectivity and, at Testing 2, a measure of hypothesis usage followed the Stanford-Binet within 3 days. The impulsivity-reflectivity measure was a modification of the KRISP designed to obtain enough variance in impulsivity-reflectivity for a valid test of the target relationships. It comprised six items from Form A and six from Form B of the KRISP, Item 1 of MFF Set 1-F, and an item drawn for this study. The remaining KRISP items were omitted because pilot work showed few errors on them.

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The *hypothesis measure* was a *discrimination* learning task containing blocks of no-feedback (blank) trials. The stimuli were animal pictures, mounted three in a row by stapling their tops on posterboard cards. There were two practice problems and six test problems, each consisting of nine cards. Positions of the animals varied randomly with the constraint that each appear once in each of the three positions within each block of three trials. The child was to learn which animal picture had a gold star on its back surface. On each trial of Practice Problem 1, the child chose an animal and the experimenter lifted it to show whether it had the star. If the child did not reach a criterion of five consecutive correct choices, the problem was readministered with graded help. For Practice Problem 2, feedback was given on every second trial; for Test Problems 1-6, on every third trial. The child was credited with a hypothesis each time he chose the same animal across a block of three trials. Across the six test problems, hypothesis scores could thus range from 0-18.

Using the standard procedure of dividing children according to median splits on latency and errors, 33 were reflective and 35 impulsive at Testing 1 and 38 reflective and 39 impulsive at Testing 2. Of the 54 who fell into one of the extremes at both testings, 80% remained at the same extreme ($r_{phi} = .59$, $p < .01$). For these 54, a stepwise regression showed that classification as impulsive or reflective at Testing 1 (IR_1) uniquely accounted for 10.9% ($p < .01$) of variance in IR_2, while MA_1, MA_2, and IR_1 combined accounted for an additional 33.5% ($p < .001$). (Subscripts denote Testing 1 and Testing 2.) Thus, while IR_2 shared some unique variance with IR_1, much more of the variance in IR_2 was also shared with mental age. The figure of 10.9% should probably be considered a maximum, since the regression included only the 52.9% of children classified into one extreme or the other at both testings.

That mental age was more appropriate than IQ as an index of developmental variance in impulsivity-reflectivity was shown by the fact that all 12 correlations of MA_1 and MA_2 with impulsivity-reflectivity, errors, and latency at both testings were higher than the corresponding correlations of IQ with the impulsivity-reflectivity variables. Eleven of the differences in correlations were significant at the .05 level or better. Furthermore, MA_1 predicted $errors_2$ and $latency_2$ about as well as did $errors_1$ and $latency_1$ ($r = -.63$ for MA_1-$errors_2$ versus $r = .59$ for $errors_1$-$errors_2$; $r = .32$ for MA_1-$latency_2$ versus .33 for $latency_1$-$latency_2$, all $p < .01$).

The power of IR_1 to predict hypothesis behavior at Testing 2 was assessed with a 2 × 2 × 2 (Sex × IR_1 × Socioeconomic Status 1–3 versus 4–7) unweighted-means analysis of variance on all 68 children who were classified impulsive or reflective at Testing 1. Reflectives used more hypotheses than impulsives, $F(1, 60) = 6.18, p < .02$; boys used more than girls ($p < .05$); upper socioeconomic status used more than lower socioeconomic status ($p < .05$). The latter two effects were due to a Sex × Socioeconomic Status interaction whereby lower-class girls used fewer than the other three groups ($p < .05$). However, covarying MA_1 caused the effect of IR_1 to disappear ($F < 1$) and the other effects to become nonsignificant. Multiple regression showed that MA_1 contributed 14.5% ($p < .01$) of unique variance in hypothesis scores, IR_1 contributed no unique variance, and 5.9% was common to MA_1 and IR_1.

Because the greater stability of mental age ($r_{MA_1-MA_2} = .82$ versus $r_{phi} = .59$ for impulsivity-reflectivity) might partially account for its superiority as a predictor over 6 months, a 2 × 2 × 2 (Sex × IR_2 × Socioeconomic Status) analysis of variance was performed on hypothesis scores for the 77 children classified as impulsive or reflective at Testing 2. The apparent effect of IR_2, $F(1, 69) = 10.11, p < .01$, became nonsignificant when MA_2 was covaried ($F = 3.06$). Multiple regression showed that MA_2 contributed 5.1% and IR_2 2.3% of unique variance to hypothesis scores (both *ns*), while MA_2 and IR_2 together contributed an additional 9.5% of shared variance.

The minimal amount of independent trait variance in impulsivity-reflectivity over a 6-month period and its lack of independent contribution to hypothesis behavior carry a warning not only for research on impulsivity-reflectivity, but also for research on other variables that correlate with development. In numerous studies, behavioral differences between impulsives and reflectives have been attributed to their differences in cognitive style. However, the possibility that differences in impulsivity-reflectivity primarily reflected developmental differences has been acknowledged, at most, merely by reporting relations between impulsivity-reflectivity and age or IQ, with no attempt being made to determine whether *levels* of cognitive functioning accounted for the differences attributed to impulsivity-reflectivity.

The use of impulsivity-reflectivity to *account for* developmental changes in behavior also deserves scrutiny. Katz (1971), for example, proposed that the change from color to form as a preferred attribute reflects preschoolers' increasing tendency "to go beyond perceptually dominant stimulus characteristics and to analyze, reflect over, and use alternative dimensions" (p. 746). On color-form tests, Katz found that reflectives made more form choices, more glances at the stimuli, and had longer latencies than impulsives. But was color-form sorting derived from a trait of impulsivity-reflectivity that was separable from cognitive development? Katz's impulsives were significantly younger than her reflectives and age correlated significantly with MFF errors, MFF latency, and form responding. Since mental age was not controlled, the correlation of impulsivity-reflectivity with color-form sorting may simply divert attention from what was already known, that is, that children become less impulsive *and* change from color to form sorting as they mature, perhaps because of changes in a third variable such as their concept of the identity of stimuli. Thus, before valid inferences can be drawn from relationships between two variables that correlate with mental age or chronological age, it must first be demonstrated that their relationship remains significant *after* their common correlation with mental age or chronological age is controlled.

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