Executive Functions and Moral Reasoning: Results of a Pilot Study

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by
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I. Introduction

In the first decade of the 21st century, most college faculty members have continued the centuries-old tradition of complaining that students come to college unprepared to learn. Thus, as behavioral scientists, we decided to interrupt our complaining in order to obtain some data for analysis. Because of difficulties encountered in teaching ethics to criminal justice students, we identified two variables of interest, namely, scores on a test of moral reasoning and scores on a test of executive functions. The findings from our pilot study suggest that scores on executive functioning predict a significant amount of the variance in scores on a test of moral reasoning. This finding suggests that interventions may be designed to improve students’ academic performance. Since there is evidence that moral reasoning is a developmental process, it is worth investigating the possibility that executive functions are best understood as a developmental process as well.

II. The pilot project (begun AY 2008-2009)

Developmental models of moral and cognitive growth

In recent years, it has become common for students in various disciplines (business, nursing, education, criminal justice, law) to take a course in ethics. Teaching ethics courses and assessing their efficacy has led us to wonder how people learn to reason ethically. We begin with a developmental model of moral reasoning and then proceed to cognitive psychological models.

In 1983, social psychologist Lawrence Kohlberg theorized that children and adults go through a series of developmental stages in moral reasoning. Kohlberg
pioneered a method of assessing a person’s approach to moral reasoning through semi-structured interviews. Later researchers, notably James Rest, developed a paper-and-pencil exercise called the Defining Issues Test (DIT) to evaluate a person’s stage of moral reasoning. Rest’s colleagues, by now calling themselves neo-Kohlbergians, carried on the work. Kohlberg’s model of six developmental stages was replaced by one involving three schemas (in a nod to Piaget’s ideas of mental schemas), and the Defining Issues Test was updated in the form of the DIT-2. Over the past twenty-five years, research based on the DIT and DIT-2 has supported the validity of a developmental model of how individuals progress in their level of moral reasoning, as well as how individuals reason differently from one another. Here we look more closely at the three schemas.

The three schemas in moral reasoning

The neo-Kohlbergian model suggests that people develop their moral reasoning skills in a sequence of mental schemas. In the Personal Interest schema, a person views moral decisions in terms of him/herself: Will I get caught? How severe is the punishment? Or a person may consult only her own values in making a moral decision: If I sell arms illegally on the world market, it’s nobody’s business but my own. As the person begins to develop a more mature outlook, he will begin to focus on the potential conflict between his personal interests and the demands of his role: If I make this decision, will others still consider me a good person /co-worker/member of the group I belong to? He may subordinate his self-centered reasoning to reasoning based on his desire to fill the appropriate social role vis-à-vis important others.
At the second level of moral reasoning, the Maintaining Norms schema, people focus their decision-making on maintaining rules and norms. This schema assumes that laws and rules exist for our own good, that there is a larger society to which we belong and that has the right to demand that we sacrifice some personal interest (e.g., give up some degree of freedom or wealth) to promote the good of society as a whole. People who reason according to the Maintaining Norms schema are interested in seeing that the rules are enforced and rule-breakers punished. In return, they are willing to obey the law (at least some laws) most of the time, and may even be willing to die for their country.

Lastly, a few people reach the third level of moral reasoning, called the Post-Conventional schema. This type of reasoning focuses on the principles that undergird the law (e.g., justice, fairness) or are not expressly contained in the law (e.g., love or mercy). The classic differentiation between people reasoning according to the Maintaining Norms and Post-Conventional schemas emerges when the issue of whether to enforce an unjust law arises. People reasoning at the second level tend to see no choice available: the law is the law, and it must be enforced. People reasoning according to the third schema understand that, while it must be enforced most of the time, on occasion the law must be subordinated to a more important principle or value.

Kohlberg argued, and his successors agree, that a person operating at a lower stage or schema cannot understand the higher-level arguments until she is developmentally ready to do so. Developmental readiness is partly a function of maturity (for example, a person’s score on the DIT-2 tends to rise as he or she grows from
adolescence into adulthood) and level of education attained (thus, a college-educated person will generally score higher than her same-age non-college-educated peer).

Differences in moral reasoning are shown in the following examples from a recent ethics class. Students were asked to consider the following dilemma: A man with a desperately sick wife cannot afford to buy the drug that will keep her alive. Should he steal the drug from the pharmacy? Why or why not? Some students, operating at the Personal Interest level, answered that it depends on whether the husband loves his wife. If not, he should not run the risk of going to jail for a wife he doesn’t love. Others expressed surprise that it should matter whether he loves her or not, because a good husband takes care of his wife (representing a more advanced Personal Interest schema), and therefore he should steal the drug. People at the Maintaining Norms level, however, tended to say no, he shouldn’t steal the drug, because stealing is wrong. What if his wife dies? They looked unhappy but shrugged. Only the few who were comfortable with Post-Conventional reasoning answered that human life is more important than property; the man should steal the drug and go to prison if the legal system doesn’t see this as a valid excuse. In the give-and-take of discussion, some thinkers will see the inadequacy of their position and reconsider, if they are ready to do so. Over the course of a semester, some students acquired new ways to think about these problems, but others did not. In fact, at the end of a semester’s course in ethics, some students were still reasoning according to the Personal Interest schema.

We wondered whether the ability to progress from one neo-Kohlbergian schema to the next might depend on a person’s level of cognitive development.
Executive functions

Executive functions refer to three basic functions thought to be performed in the prefrontal cortex: inhibitory control (the ability to ignore distractions or to overcome one’s unthinking reaction to a situation or person), working memory (the ability to hold several pieces of information in one’s mind in order to perform a cognitive task), and cognitive flexibility (the ability to adjust to changed demands or situations). Executive functions are thought to be the basis for planning, problem-solving and reasoning. The prefrontal cortex is believed to be the last part of the brain to mature. Although it was once thought that at age 20 the average person’s brain had finished developing, newer research suggests that at about age 20 the adolescent brain undergoes its second major episode of synaptogenesis and myelinization that is probably not finished for some time thereafter (Walsh and Ellis 2007, pp. 231-232) (Luna, Garver et al. 2004). Thus, there is reason to believe that executive functioning skills can improve during the college years. But are executive functioning skills teachable? Recent research on preschoolers suggests that the answer is yes.

Cognitive psychologist Adele Diamond at the University of British Columbia has been studying the development of executive functioning in children. A recent paper by Diamond and her colleagues¹ describes their evaluation of a new preschool curriculum called Tools of the Mind, which was designed specifically to strengthen the executive functions.

functions of preschoolers. In the evaluation, Tools of the Mind was compared to a
district-developed Balanced Literacy program. Teachers and students in a low-income
school district were randomly assigned to classrooms based on one of the two curricula.
Within two years, the experiment was halted by the teachers themselves, because it was
clear to all involved that the preschoolers in the Tools of the Mind classrooms were
academically outperforming the children in the Balanced Literacy program. They were
also outperforming their peers on the outcome measure used in the evaluation, a
computer-based cognitive task that measures executive functions. Diamond and her
colleagues concluded that, for youngsters who began with low-level executive
functioning, the program effectively improved those skills.

Our initial hypothesis

We theorize that it might be necessary, as a person moves from a lower-level to a
higher-level moral schema, to engage in more complex thinking that taxes the thinker’s
executive functions. In other words, the ability to move to a higher-level schema may
depend upon strengthening executive functions. The relationship between executive
functioning and moral reasoning has begun to interest psychologists of religion. For
example, researchers at St. John’s University (Cottone, Drucker et al. 2007) theorized
that executive functioning would predict both a person’s score on the DIT-2 and also
their religiosity (measured on both the Scriptural Literalism Scale and the Quest Scale;
“quest” can be loosely understood as the opposite of a literal belief in religious texts).
Using the Stroop Color and Word Test to measure cognitive flexibility and inhibition,

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2 A further description of the Tools of the Mind program can be found in (Tough 2009, September 27).
the Similarities subtest of the Wechsler Adult Intelligence Survey, 3rd edition (WAIS-III), to measure abstract reasoning, and the WAIS-III Comprehension Test to measure social awareness and general reasoning, Cottone and his colleagues found that “Components of executive functioning emerged as significant predictors of post-conventional moral reasoning” (2007, p. 48), although they found the relationship between executive functioning and religiosity less clear. Thus, we found theoretical encouragement for our own pilot study on the relationship between moral reasoning and executive functions.

The pilot study

We hypothesized that scores on a test of executive function (the Wisconsin Card Sort Test, or WCST) would predict scores on the moral reasoning test (DIT-2). Thus, we submitted a proposal to the Fitchburg State College Institutional Review Board in December 2008, and our modified proposal was approved in late January 2009.

Data collection commenced in the spring semester 2009. Fifty-three participants were recruited through the Human Subjects Pool to take both tests. Participants first took the test of moral reasoning (DIT-2). Following completion of the DIT-2, each participant was asked to make an individual appointment to take the WCST-CV4. Fifty-two participants completed both tests. Participants earned either one or two extra credit points for their participation and were offered a debriefing following the second test.

DIT-2 scoring and results

The DIT-2 tests were scored by the Center for the Study of Ethical Development at the University of Alabama (www.centerforthestudyofethicaldevelopment.net). The
size of the sample was reduced by six participants by the scoring process (because their answers were too inconsistent to score).

The sample was scored by educational level and included the following breakdown:

<table>
<thead>
<tr>
<th>Our sample (N=47)</th>
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<tbody>
<tr>
<td>Freshmen</td>
</tr>
<tr>
<td>Sophomores</td>
</tr>
<tr>
<td>Juniors</td>
</tr>
<tr>
<td>Seniors</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>23</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>47</td>
</tr>
</tbody>
</table>

According to the Guide for DIT-2 (Bebeau and Thoma 2003), the following data serve as benchmarks:

*Table 1. Selected DIT-2 Means and Standard Deviations by Educational Level.*

<table>
<thead>
<tr>
<th>N2 Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Sophomores</td>
</tr>
<tr>
<td>Juniors</td>
</tr>
<tr>
<td>Seniors</td>
</tr>
</tbody>
</table>

At a 95% confidence interval, the range of scores for our sample was as follows:

<table>
<thead>
<tr>
<th>National samples</th>
<th>Our sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sophomores</td>
<td>Range: 25.1343—37.3457</td>
</tr>
<tr>
<td>Juniors</td>
<td>Range: 22.1707—43.1293</td>
</tr>
<tr>
<td>Seniors</td>
<td>Range: 28.4079—45.2921</td>
</tr>
</tbody>
</table>

Thus, the average scores for our sample were at the low end of the range. The fact that the juniors scored lower than the sophomores is not implausible, since the literature on the DIT-2 shows that, when the DIT-2 is used as a pre-test and a post-test, some
people’s scores decrease over time. This is consistent with a developmental model of moral reasoning skills.

The Wisconsin Card Sort Test, Computerized Version

The Wisconsin Card Sort Test (WCST) now comes in a computerized version (WCST-CV4), which means that the researcher no longer has to score the test him- or herself. Instead, the computerized test is scored automatically. The test generates a number of subscores, each of which was entered into the analysis. We attempted to find out whether any of the scores on the WCST-CV predicted the variance in N2 scores on the DIT-2.3

Analysis

Forward multiple regression was performed to determine which independent variables in the WCST-CV (Total Errors, Perseverative Responses, Perseverative Errors, and Non-Perseverative Errors) were the predictors of N2 scores on the DIT-2. A preliminary examination for outliers used a regression procedure to calculate Mahalanobis Distance $X^2(8) = 26.125, p < .001$. Examination of the data indicated that no scores exceeded the critical value and no data were eliminated as outliers. The linearity of each variable was examined by developing scatter-plot matrices for each variable. Examination of the scatter-plots indicated no extreme violations of linearity.

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3 The original Defining Issues Test (DIT) reported a subject’s P score, which represents the degree to which the subject prefers postconventional thinking. The DIT-2 reports two scores for each subject, the P score and N2 score. The N2 score represents both the subject’s preference for postconventional thinking and the degree to which Personal Interest items receive lower ratings than the ratings given to Postconventional items. Bebeau and Thoma (2003, p. 19) describe the N2 score as “a new index that generally outperforms the P score on six criteria for construct validity [citing Rest, Thoma, Narvaez & Bebeau 1997].”
Further tests of linearity were examined using histograms and normality tests. These examinations of the data indicated that there were no extreme distributions.

Regression results indicated that the overall model significantly predicted N2 scores, $R^2 = .2$, $R^2_{adj} = .181$, $F(1, 43) = 10.721$, $p< .01$. This model accounts for 20% of the variance in N2 scores. A summary of regression coefficients is presented in Table 1 and indicates that only Total Errors of the four variables significantly contributes to the model.

<table>
<thead>
<tr>
<th>Coefficients for Model Variables</th>
<th>$B$</th>
<th>$B$</th>
<th>$t$</th>
<th>$p$</th>
<th>Bivariate R</th>
<th>Partial r</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Errors</td>
<td>.617</td>
<td>.447</td>
<td>3.274</td>
<td>.002</td>
<td>.447</td>
<td>.447</td>
</tr>
</tbody>
</table>

Discussion

Results of the pilot study indicate that executive functioning scores may help predict 20% of the variance in scores on the test of moral reasoning, the DIT-2. In the fall 2009 semester, we plan to continue to collect data on an additional 50 subjects, in order to make sure our results are robust.
We are encouraged by the results of the pilot study to continue our investigation. If executive functions underlie moral reasoning, then interventions to improve EFs might have several important outcomes, including improvement in other skills important in college-level learning, as well as in moral reasoning.

Limitations

Some limitations should be kept in mind as the results of this study are contemplated. The concept of executive function is of recent origin, and it is not yet well-defined. Cottone et al. (2007) remark, for example, that “Unfortunately, there is little consensus about which cognitive abilities should be included in models of executive functioning, and this quandary represents a general limitation of research endeavors investigating the relationships between executive functioning and other factors [citation omitted].” According to Cottone and his colleagues, however, evidence from case studies of impaired individuals supports the hypothesized link between executive functions and a variety of psychosocial skills such as empathic understanding and moral maturity (2007, p. 39). Thus, it is likely that executive functioning is the basis for both cognitive abilities and moral reasoning, but the details of the relationships have yet to be teased out.

Another limitation is the possibility of a confounding factor in the form of socio-economic class. In their study of executive functions and measures of religiosity, (Cottone, Drucker et al. 2007) noted (p. 50) a limitation on their findings, i.e., “that two of the three measures assessing executive functioning were WAIS-III subtests (i.e., Similarities and Comprehension), and are classic measures of crystallized intelligence
(gC), which tends to correlate with myriad socioeconomic factors. As such, socioeconomic factors should have been assessed, if not controlled.” In our study, we did not assess socio-economic factors either, nor does the literature on the DIT-2 and the Wisconsin Card Sort Test mention these factors. Future investigations should consider the possible role of socio-economic factors.

III. Agenda for future research

The relationship between performance on the Wisconsin Card Sort Test and the DIT-2 needs further investigation. As discussed above, it is likely that performance on both tests is affected by socio-economic factors that have not to date been investigated. Research using the DIT-2 has to date focused on within-group differences, e.g., male-female comparisons or comparisons within an occupational group such as doctors or dentists. Population-wide differences such as those associated with social class have received little or no attention. For example, the DIT-2 provides national norms by age and level of education, but not by family income. Sociologically speaking, it is likely that students at a selective college would score higher on the DIT-2, and possibly also on the WCST, than students at a less-selective college, so this hypothesis could be tested. It is also possible that the amount of variance in DIT-2 scores predicted by WCST scores could be relatively larger for low-income subjects than for high-income subjects.

If the predicted relationships are found between scores on EF tests and the DIT-2, however, the possibility of effective interventions presents itself. Research into improving scores on the DIT-2 has thus far pointed in the direction of experiential
education (Hartwell 1995) and social role-taking (Sprinthall 1994). Like the
preschoolers in the Tools of the Mind classrooms evaluated by (Diamond, Barnett et al.
2007), whose play was directed by teachers toward practicing skills that a cognitive
psychologist would recognize as executive function skills, it may be possible to design
interventions that affect both concerns at the same time.

[end text]

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