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Where Does Knowledge Come From? Specific Associations Between Print Exposure and Information Acquisition

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In a study of 268 college students, measures of exposure to print predicted individual differences in knowledge in a variety of domains even after individual differences on 4 indicators of general ability (high school grade point average, Raven Advanced Progressive Matrices, Nelson-Denny Reading Test—Comprehension subtest, and a mathematics ability test) had been statistically controlled. Although correlational, our results suggest that print exposure is an independent contributor to the acquisition of content knowledge. The data challenge the view that knowledge acquisition is determined only by the efficiency of cognitive components that encode and store information. Instead, the results indicate that differences in exposure to information—particularly, written sources of information—is a significant contributor to differences in knowledge across individuals.

Recent theories of cognitive development have strongly emphasized the importance of domain knowledge as a determinant of information processing efficiency (Alexander, 1992; Bjorklund, 1987; Ceci, 1990; Chi, 1985; Hoyer, 1987; Keil, 1984; Scribner, 1986). Research has amply demonstrated that it is difficult to accurately gauge information processing efficiency without some knowledge of the subject's depth of familiarity with the stimulus domain (Ceci, 1990; Charness, 1989; Chi, Hutchinson, & Robin, 1989; V. C. Hall & Edmondson, 1992; Recht & Leslie, 1988; Schneider, Korkel, & Weinert, 1989; Walker, 1987; Yekovich, Walker, Ogle, & Thompson, 1990). Some basic processes can become so dependent on prior knowledge of the stimulus domain that "basic" seems almost a misnomer (see Ceci, 1990).

Given that the knowledge dependency of cognitive functioning is a central tenet of many contemporary developmental theories, it is surprising that more attention has not been directed to a question that such theories seem to naturally prompt: Where does knowledge come from? This question seems to be addressed only implicitly by theories emphasizing knowledge dependency, the most common implication being that individual differences in domain knowledge are, for the most part, a product of experiential differences (e.g., Ceci, 1990; Scribner, 1986). In contrast, some investigators have explicitly argued against the experiential assumption implicit in the domain knowledge literature. These alternative hypotheses can be illustrated by using vocabulary knowledge as an example.

It is not difficult to show that more highly differentiated lexical knowledge can facilitate processing in a wide variety of psycholinguistic and cognitive domains. Vocabulary is thus a knowledge base that is important for certain aspects of cognition, and it is certainly tempting to attribute variability in vocabulary size to experiential differences. For example, there is considerable evidence indicating that children's vocabulary sizes are correlated with parental education and indicators of environmental quality (W. S. Hall, Nagy, & Linn, 1984; Mercy & Steelman, 1982; Wells, 1986). Thus, it has been argued that vocabulary differences of the type revealed by standardized IQ tests are primarily the result of differential opportunities for word learning (e.g., Block & Dworkin, 1976). This conjecture might be termed the "environmental opportunity hypothesis."

The environmental opportunity hypothesis is countered by theorists who contend that differences in vocabulary are caused primarily by variation in the efficiency of the cognitive mechanisms responsible for inducing meaning from context. Proponents of what might be called the "cognitive efficiency hypothesis" argue that experiential factors are not implicated—or at least are of secondary importance—in explaining vocabulary differences. For example, Sternberg (1985) has argued, "Simply reading a lot does not guarantee a high vocabulary. What seems to be critical is not sheer amount of experience but rather what one has been able to learn from and do with that experience" (p. 307). Jensen (1980) stated the cognitive efficiency hypothesis in even stronger form:

> Children of high intelligence acquire vocabulary at a faster rate than children of low intelligence, and as adults they have a much larger than average vocabulary, not primarily because they have spent more time in study or have been more exposed to words, but because they are capable of educing more meaning from single encounters with words. . . . The vocabulary test does not discriminate simply between those persons who have and those who have not been exposed to the words in

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> context. . . . The crucial variable in vocabulary size is not exposure per se, but conceptual need and inference of meaning from context. (pp. 146–147)

Although there are many theorists who endorse a more interactive view of environmental opportunity and cognitive efficiency (e.g., Estes, 1982), the quotes given above indicate that some major theorists do endorse a strong form of the cognitive efficiency hypothesis.

It is important to realize that cognitive efficiency explanations of this type are generic. They are not necessarily restricted to the domain of vocabulary acquisition. In theory, they could apply to knowledge acquisition in virtually any domain. For example, Ceci (1990) discussed the observation that advocates of the cognitive efficiency hypothesis, in an attempt to undermine developmental theories that emphasize the importance of knowledge structures in determining intelligent performance, argue that "intelligent individuals do better on IQ tests because their superior central-processing mechanisms make it easier for them to glean important information and relationships from their environment" (p. 72). The cognitive efficiency hypothesis thus undercuts all developmental theories that emphasize the importance of knowledge structures in determining intelligent performance (e.g., Ceci, 1990) by potentially trivializing them. According to the cognitive efficiency view, these differences in knowledge base may affect certain cognitive operations, but the knowledge differences themselves arise merely as epiphenomena of differences in the efficiency of more basic psychological processes. According to this view, knowledge differences may become implicated in performance, but as explanatory mechanisms they are less interesting than basic cognitive processes because knowledge differences are too proximal a cause of developmental change.

Ceci (1990) noted that one extremely important background assumption of the cognitive efficiency view is that "the information is available to individuals in all but the most seriously deprived environments" (p. 72). This assumption seems deceptively plausible at first glance, but more careful consideration reveals its weakness. Information availability is not a discrete variable. Information is available to an individual as a matter of degree. Different individuals are more or less exposed to stimulation. This background assumption becomes much less plausible in the more realistic form, "Information is available to an equal extent to individuals in all but the most seriously deprived environments," or in the form, "Beyond a minimal threshold of availability, individual differences in exposure to information have no cognitive consequences." We tested the latter hypothesis in this investigation through examination of an experiential variable that presents perhaps the most serious challenge to any cognitive efficiency hypothesis: reading.

Cultural anthropologists and historians have long argued that reading is a very special type of interface with the environment, providing literate persons access to the cumulative wisdom and knowledge built by previous generations and freeing the literate from reliance on less reliable oral transmission of information (Goody, 1977, 1987; D. R. Olson, 1977; Ong, 1967, 1982). However, most of these cultural analyses have concentrated on eras prior to the current electronic media age. It remains an open question whether exposure to printed information still provides readers with unique opportunities to acquire declarative knowledge. For example, some communications theorists have argued that "by bringing the entire world into the living room, television has created a brighter, more aware generation, with greater knowledge of the world and its people, with an expanded sense of history and culture" (Morgan, 1980, p. 159).

In this study we examined whether individual differences in print exposure—and differences in exposure to other media—can account for individual differences in acquired declarative knowledge. Our test of the cognitive efficiency hypothesis occurs in the context of a research program in which we have explored the cognitive consequences of individual differences in quantity of reading (Cunningham & Stanovich, 1991; Stanovich, 1993; Stanovich & Cunningham, 1992; West & Stanovich, 1991). In this project, we have developed sensitive but easily administered measures of differences in exposure to printed material. Testing the cognitive efficiency hypothesis is an ideal application of our techniques.

The present investigation contains controls for confounds that always must be considered when studying an experiential variable: confounds between experience and ability (so-called organism–environment correlation; see Scarr & McCartney, 1983). As will be made clear, we structured our investigation to provide extremely stringent controls for these confounds. We used a hierarchical regression logic to partial out variance in general abilities before examining linkages between exposure to print and declarative knowledge. In many cases, the abilities partialed out before print exposure was entered into the regression equation were abilities that were probably themselves influenced by print exposure (e.g., reading comprehension ability; see Stanovich, 1986). Entering such variables first strongly biases the analyses against the contribution of print exposure (see Stanovich, 1993; Stanovich & Cunningham, 1992).

Method

Subjects

The subjects were 268 undergraduate students (90 men and 178 women) recruited through two introductory psychology subject pools. One hundred and six subjects were recruited from a large state university in the western United States, one of the most selective public institutions in North America, and 162 subjects were recruited from a less selective (according to Peterson's Guides, 1990), medium-sized, state university in the midwestern United States. Although the sample from the large, selective state university outperformed the sample from the less selective state university on most measures, all of the relationships to be described were replicated in each of the samples considered separately. In Table 2, described below, an example of the comparability of the relationships in the two samples is presented. The remaining analyses involve the combined sample. The mean reported high school grade point average (GPA) of the subjects was 3.40 (SD = 0.44).

General Ability Measures

Reading comprehension. Subjects completed the Comprehension subtest of the Nelson-Denny Reading Test (Form F; Brown, Bennett, & Hanna, 1981). To cut the administration time from 20 min to 14 min, we omitted the long initial passage of Form F (lengthened to allow assessment of reading rate) and one other passage, along with their 12 questions. Thus, subjects completed six of the eight passages and answered the 24 questions associated with those six passages. The split-half reliability of this shortened version of the test (.70, Spearman-Brown corrected) was only slightly lower than the alternate-form reliability of .77 reported in the test manual (Brown et al., 1981). Raw scores were used in the analyses that follow. The mean score on the comprehension subtest was 19.1 (SD = 3.3).

Raven Advanced Progressive Matrices. Subjects completed 18 problems from the Raven Advanced Progressive Matrices (Set II, Raven, 1962), a task tapping general problem-solving skills and commonly viewed as a good measure of analytic intelligence (Carpenter, Just, & Shell, 1990). The respondent is required to solve problems presented in abstract figures and designs. The test consists of a booklet containing pictures of a pattern with a section missing and eight options from which to choose in replacing the missing portion of the pattern. Subjects completed one practice problem with the experimenter, as the experimenter explained the test. The subjects then were given 15 min to complete the 18 items on the test. By eliminating 12 of the easiest problems, on which performance in a college sample is near ceiling (Carpenter et al., 1990; Raven, Court, & Raven, 1977), and 6 of the most difficult problems on which performance is nearly floored (Carpenter et al., 1990; Raven et al., 1977), we tried to achieve a cut-time version of the Raven Advanced Progressive Matrices that would retain adequate reliability and discriminating power. A previous investigation used a 16-item version of the Raven Standard Progressive Matrices for cut-time administration and achieved reliabilities of greater than .75 in samples of children (Cahan & Cohen, 1989). The split-half reliability of our 18-item measure (.72, Spearman-Brown corrected) was similar. Raw scores were used in the analyses that follow. The mean score on the test was 9.1 (SD = 3.5).

Mathematics test. We constructed a 15-item mathematics test by selecting Scholastic Aptitude Test–type items from publications such as *The Princeton Review: Cracking the System—The SAT* (Robinson & Katzman, 1986) and *How to Ace the SAT* (Kelly & Rosenberg, 1981). A range of concepts was covered by the set of problems, including fractions, decimals, algebraic equations, solving, scientific notation, percentages, ratios and proportions, and short story problems. The split-half reliability of the test was .80 (Spearman-Brown corrected). Raw scores was used in the analyses that follow. The mean score on the test was 8.3 (SD = 3.8).

Print Exposure Measures

Author recognition test (ART). The ART was explicitly designed to circumvent the problem of questionnaire contamination by tendencies to produce socially desirable responses (see Stanovich & West, 1989). The ART is a checklist on which respondents indicate whether they are familiar with the name of a particular popular author/writer by putting a check mark next to the name. There are 40 names of writers/authors on the ART. The subject is precluded from simply checking all of the names by the presence of 40 foils: names of persons who are not popular writers/authors. The measure thus has a signal-detection logic that allows for the control of differential response bias by taking into account the number of foils checked. The recognition checklist measures of print exposure used in this investigation have shown convergent validity with other indicators, such as daily activity diaries (Allen, Cipielewski, & Stanovich, 1992), and these measures have been shown to predict reading behavior in natural settings (West, Stanovich, & Mitchell, 1993).

The version of the ART used in the present investigation was similar to that used in earlier investigations in which the measure was introduced (see Stanovich & Cunningham, 1992; Stanovich & West, 1989), except that some target items were replaced by other candidates. The 40 authors' names appearing on the ART are listed in Appendix A, along with the percentage of times that the item was checked. The list is dominated by popular authors as opposed to "highbrow" writers who would be known by only the most academically inclined readers. Many of the book authors regularly appear on best-seller lists, and for most, hundreds of thousands, if not millions, of volumes have been sold (for sales statistics see Maryles, 1990; Stanovich & Cunningham, 1992; Stanovich & West, 1989). Several of the authors were on best-seller lists at the time the study was conducted.

Although no statistical sampling of authors was carried out, we made an attempt to mix writers from a wide variety of genres. Thus, most major categories of nonfiction (e.g., science, politics/current events, humor, religion, history, biography, business/finance, travel) and fiction (e.g., mystery/detective, romance/Gothic, spy/intrigue, occult/supernatural, historical novels, Westerns, short stories, science fiction) were represented. In constructing the list, we selected authors who were most likely to be encountered outside of the classroom, so that the ART would be a proxy measure of out-of-school print exposure. Thus, an attempt was made to avoid authors who are regularly studied in the school curriculum. None of the authors appears in Ravitch and Finn's (1987) survey of the high school literature curriculum.

The 40 foils in the ART were names taken from the Editorial Board of Volume 22 (1987) of *Reading Research Quarterly*. Full names for both foils and targets were used in all cases except in cases in which the individual habitually uses initials (e.g., S. E. Hinton). On the response sheet that the subjects completed, this measure was labeled, "Author Recognition Questionnaire," and was referred to in this manner by the experimenter. The instructions to the subject read as follows:

> Below you will see a list of 80 names. Some of the people in the list are popular writers (of books, magazine articles, and/or newspaper columns) and some are not. You are to read the names and put a check mark next to the names of those individuals who you know to be writers. Do not guess, but only check those who you know to be writers. Remember, some of the names are people who are not popular writers, so guessing can easily be detected.

These instructions resulted in only a few foils being checked. The mean number of foils checked per subject was 0.7. The mode (n = 185) was 0, and 246 of the 268 subjects checked 2 or fewer foils.

Scoring on the task was determined by taking the proportion of the 40 target items that were checked and subtracting the proportion of foils checked. This is the discrimination index from the two-high threshold model of recognition performance (Snodgrass & Corwin, 1988). Other corrections for guessing and differential criterion effects (see Snodgrass & Corwin, 1988) produced virtually identical correlational results. The mean score was .238 (SD = .145). The split-half reliability of the number of correct items checked was .86 (Spearman-Brown corrected). There was no time limit on the task, but it took most subjects less than 5 min to complete.

Magazine recognition test (MRT). The logic and structure of the MRT was analogous to that of the ART, but the MRT was designed to tap a possibly different type of out-of-school reading. Although the ART contained names of writers whose work sometimes appears in magazines and newspapers, it was nevertheless heavily biased toward authors of books. Thus, the MRT was designed to balance the ART by sampling magazine reading exclusively.

The 80 items on the MRT consisted of the names of 40 magazines and 40 foils. The 40 magazines appearing on the MRT are listed in Appendix B, along with the percentage of times that the item was checked. The sampling of titles was deliberately biased toward popular publications. Highbrow or low-circulation small-press publications that would be known by only the most academically inclined readers were avoided. The list includes some of the most well-known publications in the United States (e.g., *Newsweek, Sports Illustrated*). Statistics taken from the *The Standard Periodical Directory* (Manning, 1988) indicated that 14 of the 40 publications on the MRT had circulations of greater than 1,000,000 and 32 had circulations of greater than 500,000. The mean circulation of the items on the MRT was 1,314,755, and the median circulation was 782,650. The percentage recognition of the MRT items in this study was correlated .70 with the natural logarithm of the magazine's circulation.

Although no statistical sampling of magazines was carried out, we made an attempt to attain a mix of genres. Thus, most major categories of publications (sports, current events, music, gossip, science, politics, humor, finance, homemaking, outdoors, fashion, technology, cars) were represented. The 40 fictitious foil names (e.g., *Future Forecast, Neuberger Review, Wellington's Home Digest*; see Appendix C of Stanovich & West, 1989) did not appear in the 60,000 listings in *The Standard Periodical Directory* (Manning, 1988). The 80 names were listed in alphabetical order, with targets and foils mixed.

On the response sheet that the subjects completed, this measure was labeled, "Magazine Recognition Questionnaire" and was referred to as such by the experimenter. The instructions for the MRT were as follows:

> Below you will see a list of 80 titles. Some of them are the names of actual magazines and some are not. You are to read the names and put a check mark next to the names of those that you know to be magazines. Do not guess, but only check those that you know to be actual magazines. Remember, some of the titles are not those of popular magazines, so guessing can easily be detected.

These instructions resulted in only a few foils being checked. The mean number of foils checked per subject was 2.4. The mode (n = 81) was 0, and 178 of the 268 subjects checked 2 or fewer foils. Scoring on the task was determined by taking the proportion of the 40 correct items that were checked and subtracting the proportion of foils checked. As with the ART, alternative corrections for guessing produced virtually identical results. The mean score was .486 (SD = .162). The split-half reliability of the number of correct items checked was .86 (Spearman-Brown corrected). There was no time limit on the task, but it took most subjects 5 min to complete.

Newspaper recognition checklist (NRT). This instrument was logically analogous to the other recognition measures. Twelve names of high-circulation, nationally visible newspapers (e.g., *Washington Post, Christian Science Monitor, Chicago Tribune*) were mixed with 12 fictitious foil names (e.g., National News Chronicle, Washington Tribune). Instructions, administration, and scoring were analogous to those of the other checklist measures. The mean score was .302 (SD = .177). The split-half reliability (Spearman-Brown corrected) of the task was .68.

In some of the analyses reported below, we used a composite index performance on the ART, the MRT, and the NRT because these three measures displayed relatively high correlations among themselves (.67, .60, and .58, respectively) and displayed similar relationships with other variables in the study (see Table 1). For each subject, scores on the ART, the MRT, and the NRT were converted to z scores. The print exposure composite was then formed by averaging these three z scores.

Television Exposure Measures

Television preference questionnaire. The instructions for the television preference questionnaire were as follows:

> Below you will be given a choice between engaging in one of two activities. Please put a check mark next to the one that you prefer. Please mark only one. That is, even if you like both activities, please mark only the one you like best. Similarly, even if you dislike both activities, mark the one that you would prefer to do. For each item, please mark only one choice.

Twelve forced choices for the subject followed, in this format: "I would rather: a. listen to music of my choice, b. watch a television program of my choice." Five of the questions concerned television (the other 7 served as fillers to disguise the focus on television). In these 5 items "watch a television program of my choice" was pitted against "play an outdoor sport of my choice," "listen to music of my choice," "talk with friends of my choice," "read a book of my choice," and "spend time on my hobbies." The subject's score on the task was simply the number of times that television was chosen over one of the other activities. Scores thus ranged from 0 to 5. The mean score on the measure was 1.9 (SD = 1.2).

Television recognition checklist. To create the television recognition checklist, we mixed 18 names of network television programs (15 from the three major networks and 3 from the Fox television network) with 12 fictitious foil names. All programs had aired recently. Several of the 18 programs were currently running at the time the study was conducted, and several had recently been discontinued. Instructions, administration, and scoring were analogous to those of the other checklist measures. The mean score on the task was .797 (SD = .183). The split-half reliability of the number of correct items checked was .86 (Spearman-Brown corrected).

Three popular shows questionnaire. This questionnaire queried the subjects about three of the top-rated television shows that were airing at the time that the study was conducted: *Roseanne, The Golden Girls*, and *A Different World*. Subjects were asked if they watched each program *regularly* (3), *sometimes* (2), or *never* (1). The sum of the scores on the three items was the frequency measure from this questionnaire (M = 5.3, SD = 1.3). Additionally, for each of the three programs, the subjects were asked to name as many of the characters in the show as they could. The sum of the characters named across all three programs was the characters measure from this questionnaire (M = 4.4, SD = 3.7).

In some of the analyses reported below, we used a composite television exposure measure that combined performance on the television preference questionnaire, the television checklist, the three popular shows frequency measure, and the three popular shows characters measure, by averaging z score transforms of these variables. The results of a factor analysis (see Table 6 presented later) supported the use of a composite variable.

General Knowledge Measures

Cultural literacy test (CLT). Subjects were administered the CLT, a 45-item, multiple-choice test devised for this study. Forty items were selected from Form A of the Cultural Literacy Test (Riverside Publishing, 1989), an instrument designed to assess the general cultural literacy of Grade 11 and Grade 12 students. Seventeen of these items were from the Science subsections (Which of the following concepts is part of Darwin's theory of evolution? In what part of the body does the infection called pneumonia occur? Which of the following is a cause of acid rain?), and 23 of the items were from the Social Sciences subsections (e.g., Who was the American president who resigned his office as a result of the Watergate scandal? What is the term for selling domestic merchandise abroad? What is the term for the amount of money charged for a loan and calculated as a percentage of that loan?). The remaining 5 questions were true–false items (e.g., The oxygen we breathe comes from plants; Lasers work by focusing sound waves) drawn from the survey of scientific literacy conducted by the Public Opinion Laboratory of Northern Illinois University (Miller, 1989). There was a 12-min time limit on the task. The mean score on the task was 29.6 (*SD* = 6.9). The split-half reliability (Spearman-Brown corrected) of the task was .84.

Practical knowledge test. The practical knowledge task was composed of 19 open-ended questions requiring short single-word or single-sentence answers. Although the CLT described above contains many items of practical relevance to life in a technological and multicultural society (e.g., Which of the following is a type of radiation? What did the Supreme Court rule in the Brown decision? What is the holy book of Islam?), other questions were much more academic in nature (Where did General Sherman's famous march to the sea during the Civil War take place? What was the name of the first artificial satellite? Where is the Panama Canal?). To contrast with items such as the latter, the questions on the practical knowledge test were chosen to indicate knowledge directly relevant to daily living in a complex technological society (e.g., What does the carburetor in an automobile do? If a substance is carcinogenic it means that it ________? After the Federal Reserve Board raises the prime lending rate, the interest that you will be asked to pay on a car loan will generally ________? What vitamin is highly concentrated in citrus fruits? What is the type of food preparation that is similar to baking except that only one side of the food at a time is exposed to the heat source? When a stock exchange is in a "bear market," what is happening?) or to indicate access to the information necessary to fulfill the role of an informed citizen in a democracy (e.g., Name the two legislators from this state currently serving in the United States Senate). The questions can be roughly classified into the following categories: politics and current events (3 items), daily living technology (1 item), nutrition (1 item), personal finance (2 items), health (2 items), cooking (2 items), religion/language/multicultural knowledge (3 items), economics (3 items), and major 20th-century historical events (2 items). There was a 13-min time limit on the task. The score on the practical knowledge test was simply the number of items answered correctly. The mean score on the task was 6.1 (*SD* = 3.3). The split-half reliability (Spearman-Brown corrected) of the task was .73.

Acronym test. We devised the acronym test in an attempt to construct a brief test that would tap the same types of knowledge as were tapped on the practical knowledge test: the real-world knowledge necessary for productive citizenship in a technological democracy. The subject was shown a list of 10 common acronyms and asked to write down what the acronym stands for. The acronyms used were the following: NATO (North Atlantic Treaty Organization), GNP (gross national product), NOW (National Organization for Women), EEC (European Economic Community), FDIC (Federal Deposit Insurance Corporation), IUD (intrauterine device), DNA (deoxyribonucleic acid), UHF (ultrahigh frequency), OPEC (Organization of Petroleum Exporting Countries), and PAC (political action committee). The items did not have to be spelled correctly. Indeed, an extremely liberal criterion for counting an item correct was adopted. For example, responses such as "dioribo acid" for DNA were counted correct, as were responses such as "inside uterus device" for IUD. The mean score on the task was 2.7 (*SD* = 2.3). The split-half reliability (Spearman-Brown corrected) of the task was .74.

Cultural knowledge checklist (CKC). The CKC was a recognition measure designed to tap familiarity with some of the historical events that have formed modern society and some of the individuals who have shaped modern society. Like the ART and MRT, the CKC is a proxy measure that samples a much larger domain. It is not intended to measure cultural knowledge in any absolute sense but only to reflect relative individual differences in cultural awareness. This measure was modeled directly on the recognition checklist tasks described above. Names of well-known individuals in six different categories were compiled from Hirsch (1987). The six categories were the following: artists, entertainers, military leaders/explorers, musicians, philosophers, and scientists. Twelve names were chosen from each of the six categories of names. These names were then mixed with an equal number of foil names drawn from the Acknowledgment of Ad Hoc Reviewers list in the November 1987 issue of the journal *Developmental Psychology*. The names of the 24 stimuli in each category were then listed in alphabetical order and preceded by instructions appropriate to that category. For example, the instructions for the artist recognition checklist were the following:

> Below you will see a list of 24 names. Some of the people in the list are famous artists and some are not. You are to read the names and put a check mark next to the names of those individuals who you know to be artists. Do not guess, but only check those who you know to be artists. Remember, some of the names are of people who are not artists, so guessing can easily be detected.

Similar instructions preceded each of the other five checklists. Thus, the complete CKC had a total of 72 correct items and 72 foils. The names of the 12 individuals in each of the categories and their percentage recognition are listed in Appendix C. Foil checking was relatively rare. The mean number of foils checked per subject on the entire test was 1.4 (*SD* = 2.0). The mode (121 subjects) was 0 foils, and 225 of the 268 subjects checked 2 or fewer foils. Scoring was analogous to that of the other checklist measures. The mean score on the task was .377 (*SD* = .152). The split-half reliability (Spearman-Brown corrected) of the task was .85. There was no time limit on the task.

Multicultural checklist. The multicultural checklist was designed as a companion measure to the CKC. The 30 target items on this checklist were drawn from the Appendix of Multi-Cultural Literacy items compiled by Simonson and Walker (1988) to illustrate the male and European bias in Hirsch's (1987) list. The items appearing on the multicultural checklist are listed in Appendix D, along with the percentage of times that the item was checked. The 30 target names were mixed with 15 foil names drawn from the Acknowledgment of Ad Hoc Reviewers list in the November 1987 issue of the journal *Developmental Psychology*. The names of the 45 stimuli were listed in alphabetical order and were preceded by the following instructions:

> Below you will see a list of 45 names. Some of the names in the list are those of people who are well known in various fields and some of the names are made up. You are to read the names and put a check mark next to those that you know to be the names of well-known individuals. Do not guess, but only check those who you know.

Scoring was analogous to the other checklist measures. The mean score was .384 (SD = .172). The split-half reliability (Spearman-Brown corrected) of the task was .83. There was no time limit on the task.

In some of the analyses reported below, we used a composite general knowledge measure that combined performance on the five knowledge measures (cultural literacy test, practical knowledge test, acronym test, CKC, multicultural checklist) by averaging z-score transforms of these variables.

Procedure

Subjects completed all of the tasks in one 2-hr session. The order of tasks was the same for all subjects: recognition checklists (MRT; television recognition checklist; CKC: entertainers; CKC: musicians; ART; NRT; CKC: military/explorers; CKC: scientists; CKC: artists; CKC: philosophers; multicultural checklist; three television shows questionnaire; television preference questionnaire), cultural literacy test, mathematics test, Nelson-Denny Reading Test—Comprehension subtest, practical knowledge test, and Raven Advanced Progressive Matrices. The acronym test appeared in the middle of the practical knowledge test.

Results

Table 1 presents a correlation matrix displaying the relationships among all of the major variables in the study. Reported high school GPA has been added to the table as a general ability measure. The three composite measures of print exposure, television exposure, and general knowledge are included in the table. In general, most measures displayed modest within-construct validity. For example, the mean intercorrelations were .62 for the three measures of print exposure, .40 for the four measures of general ability, .37 for the four measures of television exposure, and .66 for the five measures of general knowledge. The general knowledge measures were moderately to highly correlated with the print exposure measures (.50s to .70s), weakly to moderately correlated with indicators of general ability (.20s to .50s), and not correlated with television exposure. There was some variability in the correlations involving the knowledge measures. For example, among general ability measures, the Nelson-Denny Reading Test—Comprehension subtest and the mathematics test were more

Table 1
Intercorrelations Among the Primary Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Print exposure measures																			
1. Author recognition test	—																		
2. Magazine recognition test	.67	—																	
3. Newspaper recognition checklist	.60	.58	—																
4. Print exposure composite	.88	.87	.84	—															
Television measures																			
5. Television preference questionnaire	−.18	−.11	−.12	−.16	—														
6. Television recognition checklist	.28	.30	.21	.30	.11	—													
7. Three popular shows—Frequency	−.08	−.12	−.15	−.14	.35	.37	—												
8. Three popular shows—Characters	.13	.05	.03	.08	.27	.47	.66	—											
9. Television exposure composite	.05	.04	−.01	.03	.60	.67	.82	.83	—										
General ability measures																			
10. High school GPA	.33	.20	.26	.30	−.17	−.02	−.16	.00	−.12	—									
11. N-D Reading Test—Comprehension	.44	.44	.34	.47	−.09	.16	.10	.04	.00	.34	—								
12. Raven Advanced Progressive Matrices	.30	.29	.23	.31	−.20	.11	−.10	.03	−.05	.36	.34	—							
13. Mathematics test	.34	.30	.35	.38	−.16	−.06	−.21	−.04	−.16	.51	.41	.46	—						
Knowledge measures																			
14. CLT—multiple choice	.65	.66	.61	.74	−.14	.18	−.19	−.01	−.06	.40	.57	.33	.52	—					
15. Practical knowledge test	.53	.56	.57	.64	−.17	.04	−.27	−.14	−.19	.31	.39	.30	.48	.71	—				
16. Acronym test	.59	.60	.57	.68	−.15	.15	−.20	−.04	−.08	.25	.43	.32	.47	.69	.70	—			
17. Cultural knowledge checklist	.78	.70	.62	.81	−.20	.27	−.14	.08	.01	.36	.48	.35	.42	.73	.60	.63	—		
18. Multicultural checklist	.73	.62	.55	.73	−.17	.33	.00	.20	.12	.27	.39	.25	.29	.65	.54	.56	.78	—	
19. General knowledge composite	.77	.74	.68	.85	−.20	.23	−.19	.02	−.05	.37	.53	.36	.51	.89	.83	.84	.88	.83	—

Note. GPA = grade point average; N-D = Nelson-Denny; CLT = cultural literacy test. Correlations greater than .15 in absolute value are significant at the .01 level.

strongly related to general knowledge (.40s and .50s) than were high school GPA and the Raven Advanced Progressive Matrices (.20s and .30s). Among the television measures, the television preference measure and the three television shows frequency measure displayed small negative correlations with the general knowledge measures, whereas the television checklist measure displayed a small positive relationship.

The correlations in Table 1 indicate that all of the measures of print exposure correlated at least moderately with the general knowledge measures. However, the zero-order correlations do not address the issue of the specificity of the relationship between print exposure and general knowledge. As Table 1 clearly shows, print exposure is correlated with many things. Individuals who are avid readers also have higher grades in high school, are better comprehenders, solve nonverbal problems better (the Raven Advanced Progressive Matrices), and are even better at mathematics. Advocates of the cognitive efficiency hypothesis would argue that facets of these other correlated abilities are the true determinants of the differences in knowledge. Thus, we carried out a series of hierarchical regression analyses to examine whether correlations between print exposure and the knowledge measures were spurious. The analyses were structured to indicate whether the measures of print exposure could account for variance in general knowledge after variance due to all of the measures of general ability were partialed out.

The first such analysis focuses on predicting variance in the general knowledge composite variable. Table 2 presents the results of a hierarchical regression analysis conducted on the entire sample in which high school GPA, Raven Advanced Progressive Matrices performance, mathematics test scores, and scores on the Nelson-Denny Reading Test—Comprehension subtest were entered as the first four steps, as measures of general cognitive ability. Each, in turn, accounted for significant additional variance when entered in that order, and as a set, they resulted in a multiple correlation of .630. The television composite variable was entered as the fifth step; this variable accounted for no additional variance. The print composite variable was entered as the sixth variable and accounted for 37.1% of the variance not accounted for by the other variables. Thus, print exposure accounted for a hefty proportion of variance in the general knowledge measure, even after four indicators of general ability were entered into the equation. On the right-hand side of the table are the standardized beta weights and final *F* values for all of the variables in the final simultaneous equation. Print exposure dominates the final equation, but the mathematics test and the Nelson-Denny Reading Test—Comprehension subtest were also significant independent predictors. The latter two hierarchical regression analyses present the results separately for the two samples. The analyses display largely parallel results, with the exception that the Nelson-Denny Reading Test—Comprehension subtest measure appears to be a more potent predictor in the less selective university sample.

Table 3 presents the results of similar hierarchical regressions carried out on each of the five general knowledge tasks separately. The top half of the table indicates the R^2 change as each variable is sequentially entered into the equation, and the bottom half of the table presents the standardized beta weight for each variable in the final simultaneous equation. It is clear that print exposure dominates each of the five equations. Although the print exposure variable accounts for more unique variance on the two general knowledge tasks that share the response requirements of

Table 2
Hierarchical Regression Analyses Predicting General Knowledge Composite

Step/variable	*R*	R^2 change	*F* to enter	Final β	Final *F*
Combined sample (*N* = 268)					
1. High school GPA	.372	.139	42.82**	.020	0.32
2. Raven Advanced Progressive Matrices	.447	.061	20.30**	.016	0.20
3. Mathematics test	.542	.094	35.07**	.165	18.19**
4. N-D Reading Test—Comprehension	.630	.103	45.11**	.112	9.87**
5. Television exposure composite	.630	.000	0.06	−.039	1.68
6. Print exposure composite	.876	.371	417.63**	.720	417.63**
Selective state university sample (*n* = 106)					
1. High school GPA	.297	.088	10.06**	−.011	0.42
2. Raven Advanced Progressive Matrices	.423	.091	11.38**	.002	0.01
3. Mathematics test	.532	.104	14.83**	.156	7.63**
4. N-D Reading Test—Comprehension	.586	.061	9.33**	.060	1.30
5. Television exposure composite	.586	.000	0.01	−.019	0.16
6. Print exposure composite	.889	.446	209.75**	.788	209.75**
Less selective state university sample (*n* = 162)					
1. High school GPA	.038	.001	0.23	−.016	0.09
2. Raven Advanced Progressive Matrices	.211	.044	7.20**	.025	0.20
3. Mathematics test	.285	.036	6.34*	.137	5.55*
4. N-D Reading Test—Comprehension	.524	.194	41.78**	.215	13.50**
5. Television exposure composite	.527	.003	0.76	−.044	0.73
6. Print exposure composite	.776	.324	126.42**	.635	126.42**

Note. GPA = grade point average; N-D = Nelson-Denny.
* $p < .05$. ** $p < .01$.

Table 3
Unique General Knowledge Variance Accounted for by Print Exposure After Nonverbal Abilities Are Partialed Out

Step/variable	CLT	Practical	Acronym	CKC	Multicultural
			Dependent variable		
	R^2 change				
1. High school GPA	.157**	.099**	.060**	.130**	.074**
2. Raven	.040**	.038**	.063**	.058**	.028**
3. Mathematics test	.101**	.107**	.116**	.039**	.015*
4. N-D—Comprehension	.130**	.038**	.063**	.087**	.072**
5. Television exposure composite	.000	.016*	.001	.002	.023**
6. Print exposure composite	.226**	.206**	.230**	.368**	.337**
	Final β				
1. High school GPA	.059	.000	−.105*	.072	.063
2. Raven	−.032	.000	.034	.055	.013
3. Mathematics test	.196**	.234**	.247**	.045	−.018
4. N-D—Comprehension	.211**	.046	.090	.080	.052
5. Television exposure composite	−.038	−.166**	−.070	.001	.105*
6. Print exposure composite	.562**	.536**	.568**	.717**	.686**

Note. CLT = Cultural literacy test—multiple choice; Practical = Practical knowledge test; Acronym = Acronym test; CKC = cultural knowledge test; Multicultural = Multicultural checklist; GPA = grade point average; Raven = Raven Advanced Progressive Matrices; N-D = Nelson-Denny Reading Test.
* $p < .05$. ** $p < .01$.

the print exposure tasks (the CKC and the multicultural checklist), it also accounts for substantial unique variance in the three other general knowledge tasks that have very different response formats (22.6%, 20.6%, and 23.0%, respectively). Performance on the mathematics test was a significant independent predictor in three of the five cases, and the television composite was an independent predictor in two cases (in one case, however, the significant beta weight was negative). In short, each of these five measures of general knowledge is linked to exposure to print, and the linkage cannot be explained in terms of differences in general ability or exposure to other knowledge sources (television).

Print exposure was such a potent predictor of general knowledge in the analyses presented in Tables 2 and 3 that one might wonder whether the measures would display discriminant validity. Hence, we conducted the analyses displayed in Table 4; the results contrast with those in Tables 2 and 3, illustrating that print exposure is not such a robust predictor of performance in nonverbal domains. In the first analysis shown in Table 4, the criterion variable is performance on the Raven Advanced Progressive Matrices: a nonverbal problem-solving task requiring little prior knowledge. High school GPA, mathematics test performance, and comprehension performance are entered first, collectively removing variance due to general ability. Print exposure is entered last, as in the previous analyses. However, unlike the case in which general knowledge was the criterion measure, we would not expect print exposure to account for variance in nonverbal problem-solving once variance in

Table 4
Hierarchical Regression Analysis Predicting Raven Advanced Progressive Matrices and Mathematics Test Performance

Step/variable	R	R^2 change	F to enter	Final β	Final F
Raven Advanced Progressive Matrices performance					
1. High school GPA	.355	.126	38.38**	.127	4.04*
2. Mathematics test	.479	.104	35.63**	.306	21.73**
3. N-D—Comprehension	.500	.020	7.03**	.120	3.60
4. Print exposure composite	.507	.007	2.61	.101	2.61
Mathematics test performance					
1. High school GPA	.512	.262	94.52**	.333	38.77**
2. Raven	.591	.088	35.63**	.249	21.73**
3. N-D—Comprehension	.617	.031	13.46**	.142	6.27*
4. Print exposure composite	.629	.014	6.07*	.138	6.07*

Note. GPA = grade point average; Raven = Raven Advanced Progressive Matrices; N-D = Nelson-Denny Reading Test.
* $p < .05$. ** $p < .01$.

general ability has been partialed out. Indeed, unlike the outcomes in Tables 2 and 3, print exposure was not a significant unique predictor. The mathematics test was the dominant predictor of Raven Advanced Progressive Matrices scores in the final equation. A second, analogous regression was conducted with mathematics scores as the criterion variable. Again, mathematics test performance should be relatively independent of the knowledge and skills developed by print exposure. In this analysis, high school GPA, Raven Advanced Progressive Matrices performance, and comprehension scores were entered as measures of general ability prior to print exposure. Unlike the analysis with Raven scores as the criterion measure, in this analysis print exposure was a significant unique predictor at the .05 level, but the proportion of variance that it explained (1.4%) was markedly below the proportions of unique variance it accounted for in the knowledge tests (20% to 35%). Thus, we have a rather strong indication of discriminant validity. The print exposure measures are very potent predictors of verbal declarative knowledge but do not account for much variance in either mathematics knowledge or nonverbal problem solving (Raven Advanced Progressive Matrices) when other indicators of general ability are partialed out.

Print Exposure Versus Ability as Predictors of General Knowledge

Our sample size was sufficiently large to allow an analysis examining the consequences of a mismatch between general cognitive abilities and print exposure. For example, although print exposure is positively correlated with Nelson-Denny Reading Test—Comprehension subtest performance, the relationship is far from perfect. There are persons who, despite having modest comprehension skills, seem to read a lot (at least according to our indicators), and there are others who, despite very good comprehension skills, seem not to exercise their abilities by engaging in reading activities. Without losing sight of the correlational nature of the data, we may ask, for example, whether print exposure can compensate for modest levels of comprehension ability, at least in a statistical sense.

The comparisons presented in Table 5 address this issue. Two groups that were mismatched on print exposure and comprehension ability were formed in the following manner. The sample was classified according to a median split of performance on the Nelson-Denny Reading Test—Comprehension subtest and on the print exposure composite variable. The resulting 2 × 2 matrix revealed 77 subjects who were discrepant: 44 subjects who were below the median ("low") in print exposure but scored above the median ("high") on the Nelson-Denny test (LoPrint/HiAbility) and 33 subjects who were high in print exposure but were low on the Nelson-Denny test (HiPrint/LoAbility). These two groups were then compared on all of the variables in the study.

Not surprisingly, the two groups were different on all three measures of print exposure because the print composite was one of the variables that defined the two groups. Likewise, the LoPrint/HiAbility group was significantly superior on the Nelson-Denny Reading Test—Comprehension subtest measure because this variable was also used to define the two groups. However, there were no significant differences on the television variables. The groups appear to be similar in exposure to this medium. There were no sig-

Table 5
Differences Between Subjects With High Comprehension Ability and Low Print Exposure (Lo Print/Hi Ability) and Subjects With Low Comprehension Ability and High Print Exposure (Hi Print/Lo Ability)

Variable	Lo Print/Hi Ability (n = 44)	Hi Print/Lo Ability (n = 33)	t (df = 75)
Author recognition test	.164	.269	5.63**
Magazine recognition test	.399	.567	6.18**
Newspaper recognition test	.196	.389	7.14**
Print exposure composite	−.546	.402	10.63**
Television preference questionnaire	1.93	1.79	−0.52
Television recognition checklist	.756	.805	1.09
Three popular shows—Frequency	5.2	5.4	0.70
Three popular shows—Characters	4.0	5.1	1.34
Television exposure composite	−.098	.051	0.93
High School GPA	3.48	3.31	−1.86
N-D Reading Test—Comprehension	21.5	16.6	−12.49**
Raven Advanced Progressive Matrices	9.8	8.8	−1.13
Mathematics test	8.9	8.2	−0.92
CLT—Multiple choice	28.5	29.3	0.60
Practical knowledge test	5.3	6.8	2.61*
Acronym test	2.2	2.8	1.31
Cultural knowledge checklist	.325	.403	3.27**
Multicultural checklist	.314	.439	3.87**
Knowledge exposure composite	−.267	.144	3.19**

Note. GPA = grade point average; N-D = Nelson-Denny; CLT = cultural literacy test.
* $p < .05$. ** $p < .01$.

nificant differences on the other three ability measures (high school GPA, Raven Advanced Progressive Matrices, mathematics test); however, the means on these three variables were all in the direction favoring the LoPrint/HiAbility group. Nevertheless, the differences on each of the five general knowledge measures were in the other direction. That is, the HiPrint/LoAbility group scored higher on each of the five tasks, significantly so in three of the five cases. Finally, there was a significant difference between the groups on the knowledge composite measure. Although inferences from this correlational analysis must be tentative, the results suggest that low comprehension ability does not necessarily lead to low levels of knowledge as long as an individual has considerable print exposure. However, it could be argued that the superiority of the HiPrint/LoAbility individuals extends only to surface knowledge, a conjecture supported by the fact that two of the three significant differences were on checklist tasks that reflect only cursory knowledge. Contradicting this conclusion is the finding that the third significant difference occurred on the measure (practical knowledge test) that demanded the most in-depth knowledge.

An additional analysis that pitted print exposure against reading comprehension ability was conducted with the entire sample. The scores on the print exposure composite and the Nelson-Denny Reading Test—Comprehension subtest were standardized, and the latter z score was subtracted from the former. The resulting difference score, which reflected standing in the print exposure distribution in relation to the reading comprehension distribution, was correlated with the five general knowledge measures. Positive correlations would indicate that higher levels of knowledge are more strongly related to print exposure than to comprehension ability, whereas negative correlations would indicate that higher levels of general knowledge are more closely associated with comprehension ability than with print exposure. All five correlations were positive, and all were significant at the .01 level: .17 for the CLT—Multiple choice, .24 for the practical knowledge test, .24 for the acronym test, .32 for the CKC, and .33 for the multicultural checklist. Thus, an analysis that used the data from the entire sample converged with the extreme-groups analysis reported in Table 5.

Factor Analysis

As a further method of exploring the relationships among the tasks, the variables listed in Table 1 (minus the composite variables) were subjected to several methods of factor analysis. Different techniques of communality estimation (including principal-components solutions) were tried, and several orthogonal and oblique rotations were computed. The results of a typical solution are displayed in Table 6. This solution is the result of a principal-components analysis with an eigenvalue > 1 criterion and a varimax rotation.

The three factors retained accounted for 63.9% of the total variance. Table 6 lists all factor loadings greater than .300. The first factor appears to be a Print/Knowledge factor, the second is clearly a Television factor, and the third appears to be a General Ability factor. The variables in this solution conformed to simple structure reasonably well. Only three variables were complex. The television checklist task had its primary loading on the Television factor but also had a minor loading on the Print/Knowledge factor, perhaps because the task shares response characteristics with the print measures and two of the knowledge measures. The Nelson-Denny Reading Test—Comprehension subtest had moderate loadings on both the Print/Knowledge factor and the General Ability factor. The CLT had a small loading on the General Ability factor, perhaps because it was the general knowledge measure that required the most reading. The fact

Table 6
Component Loadings for All Variables After Varimax Rotation

	Component		
Variable	1: Print/Knowledge	2: Television	3: General Ability
Author recognition test	.820	—	—
Magazine recognition test	.828	—	—
Newspaper recognition checklist	.755	—	—
Television preference questionnaire	—	.467	—
Television recognition checklist	.356	.659	—
Three popular shows—Frequency	—	.849	—
Three popular shows—Characters	—	.872	—
High School GPA	—	—	.762
N-D Reading Test—Comprehension	.456	—	.489
Raven	—	—	.709
Mathematics test	—	—	.763
CLT—Multiple choice	.791	—	.361
Practical knowledge test	.716	—	—
Acronym test	.757	—	—
Cultural knowledge checklist	.850	—	—
Multicultural checklist	.818	—	—

Note. GPA = grade point average; N-D = Nelson Denny; Raven = Raven Advanced Progressive Matrices; CLT = cultural literacy test. Dashes represent component loadings lower than .300.

that the print and the knowledge measures loaded on the same factor reinforces the finding from the regression analysis that variance in general knowledge was strongly predicted by the print measures and that the ability measures did not exhaust the reliable variance in the knowledge tasks.

The Cognitive Anatomy of Misinformation

Several questions on the practical knowledge questionnaire produced patterns of responses that were so inaccurate that they seemed to deserve closer examination. One such question concerned the sizes of the world's major religions and was designed to assess awareness of the multicultural nature of the modern world. Additionally, it served to assess knowledge of the rough demographics underlying one of the world's major religious conflicts. The question was phrased as follows:

> The 1986 *Encyclopedia Britannica Book of the Year* estimates that there are approximately 1,000,000,000 (one billion) people in the world (not just the United States) who identify themselves as Christians. How many people in the world (not just the United States) do you think identify themselves as ________?

Space was then provided on the form for the subjects to make estimates of the number of Moslems, Jews, Buddhists, and Hindus. Two items were derived from these estimates. One concerned the subjects' knowledge of the ratio of Moslems to Jews in the world: a comparison of immense historical importance and of continuing relevance to world affairs in which the United States is intimately involved (hence, its appearance on the practical knowledge questionnaire).

Although the median estimate in our sample of the number of Jews (20 million) was quite close to the actual figure (17 million according to the 1987 *World Almanac*, Hoffman, 1987, and 18 million according to the 1990 *Universal Almanac*, Wright, 1990) the number of estimated Moslems (10 million) was startlingly low (555 million is the estimate given in the 1987 *World Almanac*; 817 million is the estimate in the 1990 *Universal Almanac*). For each subject, we calculated the ratio of Moslems to Jews to see how many subjects were aware of the fact that Moslems outnumber Jews by an order of magnitude (the actual estimated ratio is approximately 33:1 according to the 1987 *World Almanac* and 45:1 according to the 1990 *Universal Almanac*). The estimated median Moslems/Jews ratio in our sample was 0.5. A surprisingly high percentage (60.6%) of our sample thought that there were more Jewish people in the world than Moslems, and 69.3% of the sample thought that the number of Jewish people was equal or greater than the number of Moslems.

This level of inaccuracy was surprising given that approximately 40% of our sample were students at one of the most selective public institutions of higher education in the United States. We explored the correlates of this particular misconception in a variety of ways. For purposes of the practical knowledge questionnaire, we scored this item "correct" if the subject's ratio was 1.0 or greater—admittedly a ridiculously liberal scoring criterion, but one necessitated by the fact that only 8.2% of the sample produced a ratio of 20:1 or greater. Table 7 presents a breakdown of the scores on this question by print and television exposure. The sample was median split on the basis of the print composite and television composite variables. There is a clear effect of print exposure on the scores on the Moslems/Jews question and a lesser effect of television viewing, but the effects were in opposite directions. Print exposure was associated with higher scores on the question, and television exposure was associated with lower scores. A log-linear analysis revealed a significant contribution of print exposure to the overall chi-square value of the full model, likelihood ratio (LR) $\chi^2(1, = N = 231) = 15.13, p < .001$, and a contribution of television that just failed to reach significance, LR $\chi^2(1, N = 231) = 3.81, p < .06$. The contribution of the interaction effect was not significant, LR $\chi^2(1, N = 231) = 0.81$. Scores among the group high in print exposure and low in television exposure were highest (61.4% of this group got the item correct), and the lowest scores were achieved by those high in television exposure and low in print exposure (only 23.6% of this group attained the liberal criterion for correct).

To ascertain whether the relationships with print and television exposure were mediated by differences in general ability, we conducted a hierarchical regression analysis in which performance on the Raven Advanced Progressive Matrices and performance on the mathematics test were

Table 7
Proportion "Correct" on Several Practical Knowledge Questions as a Function of Print and Television Exposure

	High print exposure		Low print exposure	
Item	Low TV exposure	High TV exposure	Low TV exposure	High TV exposure
Moslems/Jews	.614	.419	.298	.236
Hindus/Buddhists	.554	.417	.298	.111
Military/NASA	.600	.453	.349	.203
USSR/WW II	.333	.225	.085	.032
Japan/WW II	.333	.211	.099	.127
Latin	.476	.338	.127	.095

Note. NASA = National Aeronautics and Space Administration; USSR = Union of Soviet Socialist Republics. WW II = World War II.

entered before television and print exposure as predictors of performance on the Moslems/Jews question. (All of the analyses reported below were rerun with Nelson-Denny Reading Test—Comprehension subtest as an additional covariate and were not appreciably changed; Nelson-Denny performance did not emerge as a significant predictor in the final equation.) The top half of Table 8 indicates the R^2 change as each variable is entered into the equation, and the bottom half of the table presents the beta weight for each variable in the final simultaneous equation. The print composite score is the only variable with a significant beta weight in the final equation (.247), indicating that the linkage between print exposure and performance on this question was not accounted for by differences in general ability. Television exposure had a negative beta weight in the final equation (−.110), but it was not significant. The results of an analogous logistic regression produced converging results. Only the print composite variable made a significant contribution to the overall chi-square value of the full model, LR $\chi^2(1, N = 231) = 11.45, p < .001$.

The second item that was constructed from the religion demographics question concerned the estimates of the prevalence of Buddhism and Hinduism in the world (respective estimates according to the 1987 *World Almanac*, Hoffman, 1987, and the 1990 *Universal Almanac*, Wright, 1990, are Buddhists: 248 or 296 million, Hindus: 464 or 648 million). The estimated prevalence of these two major religions was startlingly low in our sample. The median estimate of the number of Buddhists was 5 million and the median estimate of the number of Hindus was 4 million. The median estimated total of individuals adhering to these two religions was 11 million, which contrasts markedly with the actual figure of at least 712 million. Only 26.4% of our sample made estimates that totaled greater than 500 million. For purposes of the practical knowledge test, we scored this item correct if the subject's total estimate for the two religions was greater than 100 million, again, a liberal criterion but one attained by only 34.8% of our sample.

The results presented in Table 7 indicate that, as on the previous question, print exposure was associated with higher scores on the question and television exposure was associated with lower scores. A log-linear analysis revealed a significant contribution of print exposure to the overall chi-square value of the full model, LR $\chi^2(1, N = 227) = 21.70, p < .001$, and a significant contribution of television, LR $\chi^2(1, N = 227) = 8.18, p < .01$. The contribution of the interaction effect was not significant, LR $\chi^2(1, N = 227) = 1.13$. As on the Moslems/Jews question, scores among the group high in print exposure and low in television exposure were highest (55.4% of this group got the item "correct"), and the lowest scores were achieved by those high in television exposure and low in print exposure (only 11.1% of this group attained the liberal criterion for correct). The regression analysis in Table 8 indicates that both mathematics test performance and the print exposure composite had significant beta weights in the final equation. Television exposure again had a nonsignificant negative beta weight in the final equation. Thus, the linkage between print exposure and performance on this question was not accounted for by differences in general ability. The significance of the coefficient for the mathematics test may be due either to its status as an indicator of general ability or to the fact that this question reflects, in part, numeracy (see Paulos, 1988). However, mathematics performance was a significant independent predictor on other items having no numerical component (see below). The results of an analogous logistic regression produced converging results. The print composite variable, LR $\chi^2(1, N = 227) = 15.16, p < .001$, and mathematics performance, LR $\chi^2(1, N = 227) = 8.99, p < .01$, both made a significant contribution to the overall chi-square value of the full model.

Another question on the practical knowledge test concerned knowledge of the budget of the U.S. Federal government—knowledge critical for a citizenry faced with a budget deficit of unprecedented magnitude—one that will affect U.S. political and economic life for years to come (hence, its appearance on the practical knowledge test). The question was phrased as follows: "The *Statistical Abstract of the United States* indicates that the Federal government spent 10.6 billion dollars on the food stamp

Table 8
Multiple Regression Analyses Predicting Performance on Several Practical Knowledge Questions

	Dependent variable					
Step/variable	Moslems/Jews	Hindus/Buddhists	Mil/NASA	USSR/WW II	Japan/WW II	Latin
		R^2 change				
1. Raven	.026*	.019*	.019*	.029**	.016*	.036**
2. Mathematics test	.040**	.080**	.054**	.074**	.058**	.059**
3. Television exposure composite	.010	.007	.014*	.001	.009	.002
4. Print exposure composite	.050**	.062**	.052**	.058**	.036**	.107**
		Final β				
1. Raven	.020	−.054	−.010	−.014	−.030	.004
2. Mathematics test	.134	.222**	.149*	.215**	.187**	.150*
3. Television exposure composite	−.110	−.105	−.149*	−.055	−.111	−.080
4. Print exposure composite	.247**	.274**	.253**	.267**	.211**	.360**

Note. Mil = Military; NASA = National Aeronautics and Space Administration; USSR = Union of Soviet Socialist Republics; Raven = Raven Advanced Progressive Matrices. WW II = World War II.
* $p < .05$. ** $p < .01$.

program in 1986. Estimate how much you think was spent on ______" (U.S. Bureau of the Census, 1988). Space was provided on the form for the subjects to give estimates of the size of "the military budget" (actually $273.4 billion in 1986) and "NASA (the space program)" (actually $7.4 billion in 1986). A focus on knowledge of the military budget was deemed particularly important given the political context at the time the study was conducted, which was marked by the sudden end of the Cold War following an extended period of growth in military spending.

Estimates of the military budget were markedly too low (median response = $50 billion), and estimates of the NASA (National Aeronautics and Space Administration) budget were markedly too high (median response = $28 billion). For each subject, we calculated the ratio of the estimate of the military budget to the estimate of the NASA budget to see how many subjects were aware of the fact that the military budget is 36.9 times as large as the NASA budget. The estimated median military/NASA ratio in our sample was only 1.6; fully 24.5% of our sample actually thought that the NASA budget was higher. Only 8.3% of our sample thought that the military budget was at least 10 times as high as the NASA budget. For purposes of scoring the practical knowledge questionnaire, we scored this item correct if the subject's ratio was 2.0 or greater, as with the other questions of this type, a very liberal scoring criterion.

The results presented in Table 7 indicate that, as on the previous questions, print exposure was associated with higher scores on the military/NASA item and television exposure was associated with lower scores. A log-linear analysis revealed a significant contribution of print exposure to the overall chi-square value of the full model, LR $\chi^2(1, N = 241) = 16.31, p < .001$, and a significant contribution of television, LR $\chi^2(1, N = 241) = 5.83, p < .05$. The contribution of the interaction effect was not significant, LR $\chi^2(1, N = 241) = 0.07$. As on the other items, scores among the group high in print exposure and low in television exposure were highest (60.0% of this group got the item correct), and the lowest scores were achieved by those high in television exposure and low in print exposure (only 20.3% of this group attained the liberal criterion for correct). The regression analysis in Table 8 indicates that the print exposure composite, the mathematics test, and the television exposure composite all had significant beta weights in the final equation. The latter coefficient was significantly negative (−.149). In other words, after print exposure and general ability are controlled for, exposure to television is significantly associated with the acquisition of misinformation about the relative sizes of the military and NASA budgets. Exposure to print, on the other hand, was positively associated with knowledge of the actual ratio, even when general ability was controlled. An analogous logistic regression yielded converging results. The print composite variable, LR $\chi^2(1, N = 241) = 13.57, p < .001$; mathematics performance, LR $\chi^2(1, N = 241) = 4.25, p < .05$; and television composite, LR $\chi^2(1, N = 241) = 5.9, p < .05$, each made a significant contribution to the overall chi-square value of the full model.

Two questions on the practical knowledge test concerned historical events of continuing relevance. The first was phrased, "At the time of the Normandy invasion (1944), which two countries fighting on the side of the United States were sustaining the most casualties?" The question was followed by two blank lines for the subject to produce the answer. The item was scored correct if, as one of the two choices, the subject listed the Soviet Union. Anything remotely resembling the spelling of Soviet Union, Union of Soviet Socialist Republics, USSR, or Russia was accepted as a correct answer. This question was designed to probe knowledge of the fact that the Soviet Union suffered by far the largest number of casualties in the Allied cause in World War II (25 times more battle casualties than the United States; Esposito, 1965; Snyder, 1982; counting civilian casualties would, of course, only increase this ratio), a fact that played a major role in postwar world history. The companion question "At the time of the Normandy invasion (1944), what country was Germany's primary ally?" was designed to probe knowledge of the fact that the United States fought against Japan in World War II. The question was followed by a blank line on which the subject was to produce the answer.

As Table 7 indicates, performance on both of these items was surprisingly low. The best performance (33.3% correct) was achieved by the group high in print exposure and low in television exposure. Only 3.2% of those low in print exposure and high in television exposure named the Soviet Union as one of the two countries in their response. A log-linear analysis revealed a significant contribution of print exposure to the overall chi-square value of the full model, LR $\chi^2(1, N = 268) = 25.19, p < .001$. Neither the contribution of television, LR $\chi^2(1, N = 268) = 3.29$, nor the interaction effect, LR $\chi^2(1, N = 268) = 0.30$, was significant. Results on the Japan item were similarly poor.

The group high in print exposure and low in television exposure was the only one of the four groups in which more participants knew that the Soviet Union suffered the greatest losses in World War II (33.3%) than thought that the Soviet Union was Germany's major ally (9.8%). In each of the three other groups, more participants carried the misconception than knew the actual state of affairs. For example, in the group low in print exposure and high in television exposure, only 3.2% knew that the Soviet Union suffered the greatest losses in World War II, whereas fully 28.1% of this group had the misconception that the Soviet Union was Germany's major ally in 1944. Across the entire sample, more subjects thought that the Soviet Union was Germany's ally in 1944 (21.8%) than were aware of the devastating losses it incurred in fighting against Germany in World War II (16.8%).

The regression analyses in Table 8 indicate that the print exposure composite and the mathematics test had significant beta weights in the final equations for both the USSR and the Japan items. Analogous logistic regression analyses produced parallel results.

The final item that we chose for more detailed analysis asked the subjects, "Name a country in which Latin is currently the primary language." This question was scored correct if the subject indicated that Latin was a dead language or simply wrote "none." Responses of "Vatican" or "Rome" were also scored as correct, the latter of which was consistent with our practice of adopting liberal scoring criteria throughout the study. The inclusion of the Latin question in the practical knowledge test was provoked by an anecdote in Hirsch's (1987) book *Cultural Literacy*, in which he described his son, a high school Latin teacher, explaining to his class that Latin was a dead language (pp. 5–6). One student challenged Hirsch's son's claim by asking "What do they speak in Latin America?" (p. 6). One of us (K.E.S.) had encountered much skepticism regarding this anecdote at (nonfaculty) cocktail parties at which it was related. Thus, the Latin question was included as a more systematic check on the generalizability of the incident.

As Table 7 indicates, performance on the item was quite low. The best performance (47.6% correct) was achieved by the group high in print exposure and low in television exposure. Only 9.5% of those low in print exposure and high in television exposure answered correctly. A log-linear analysis revealed a significant contribution of print exposure to the overall chi-square value of the full model, LR $\chi^2(1, N = 268) = 31.50, p < .001$. Neither the contribution of television, LR $\chi^2(1, N = 268) = 1.87$, nor the interaction effect, LR $\chi^2(1, N = 268) = 0.15$, was significant. The regression analysis in Table 8 indicates that the print exposure composite had the largest beta weight in the final equation and mathematics test performance had a smaller but significant coefficient. The results of an analogous logistic regression produced converging results. The print composite variable, LR $\chi^2(1, N = 268) = 29.81, p < .001$, and mathematics performance, LR $\chi^2(1, N = 268) = 5.00, p < .05$, both made a significant contribution to the overall chi-square value of the full model.

In short, there seems no reason to question Hirsch's (1987) anecdote. The subjects in this study were college students, and 40% of them had been admitted to one of the most selective public institutions in North America; yet 6% of them answered "Latin America," "South America," or "Central America." Other students gave the names of Central American or South American countries (Brazil, with 15 responses, was the most popular guess). Fully 17.1% of the sample either said "Latin America" or named a Central American or South American country. Thirteen different European nations were given as responses (Greece, with 14 responses, was the most popular choice), in addition to responses as diverse as "Africa," "Cyprus," "Jerusalem," and "Lapland."

The generally low level of performance on some of these questions—particularly the questions about World War II—unfortunately appears to be a replicable phenomenon. Spellman and Holyoak (1992) attempted to study real life analogical thinking by investigating how people construct analogies between the Persian Gulf crisis and World War II (e.g., "If Saddam is Hitler who is George Bush?"). Responses of only 42 of the 122 college subjects were analyzed because 80 subjects did not fulfill the criterion of basic knowledge of the participants of World War II. Spellman and Holyoak (1992) noted that "The results of Experiment 1 . . . revealed the general lack of knowledge of the subject population about the major participants and events of World War II" (p. 917).

Discussion

A strong version of the cognitive efficiency account of knowledge acquisition is clearly falsified by the data presented here. Print exposure accounted for a sizable portion of variance in measures of general knowledge, even after variance associated with general cognitive ability was partialed out. There does appear to be differential exposure to information, primarily through the medium of reading, and this differential exposure is predictive over and above general cognitive ability. Not only was print exposure a significant unique predictor, but it was a more potent predictor than the ability measures. When entered after the print exposure composite, the four cognitive ability measures (high school GPA, Raven Advanced Progressive Matrices, mathematics test, and Nelson-Denny Reading Test—Comprehension subtest) collectively accounted for an additional 5.1% of the variance in the knowledge composite scores, considerably less than the 37.1% of the variance accounted for by the print exposure composite after the four ability measures were in the equation.

This pattern was not obtained for exposure to television, which did not predict additional variance over and above the ability measures. In cases in which television did display associations with knowledge measures, the relationships tended to be negative. In light of these results, the following claim seems to be at variance with the facts:

> By bringing the entire world into the living room, television has created a brighter, more aware generation, with greater knowledge of the world and its people, with an expanded sense of history and culture. Television may even stimulate students to read, at least about what they have seen on the screen. (Morgan, 1980, p. 159)

Instead, Neil Postman's (1988) anecdote seems more on the mark. He argued that most people seem to

> know *of* many things; but *about* very little. To provide some verification of this, I conducted a survey a few years back on the subject of the Iranian hostage crisis. I chose this subject because it was alluded to on television *every day for more than a year*. . . . The questions I asked were simple and did not require deep knowledge. For example, Where is Iran? What language do the Iranians speak? Where did the Shah come from? What does 'Ayatollah' mean? I found that almost everybody knew practically nothing about Iran. And those who did know something said they had learned it from *Newsweek* or *Time* or *The New York Times*. Television, in other words, is not the great information machine. (pp. 171–172)

Thus, at least in certain domains, and at least as measured here, individual differences in declarative knowledge bases—differences emphasized by many contemporary theories of developmental growth—appear to some extent to be experientially based, and the experience that has a particularly close link with these individual differences seems to be print exposure. Theories of cognitive growth emphasizing the knowledge dependency of cognitive functioning appear not to be undercut by appeals to basic abilities as the sole source of individual differences. This renders knowledge dependency theories of cognitive growth much more theoretically interesting because the knowledge domains that they emphasize as a source of information processing efficiency are not mere proxies for basic ability differences.

However, we still know very little about the ultimate causes of individual differences in print exposure. Certainly, environmental differences (cultural opportunities, parental modeling, quality of schooling) may be a contributing factor (Anderson, Wilson, & Fielding, 1988). However, personality dispositions toward literacy activities may also play a role, and the environmental and genetic determinants of such behavioral propensities are completely unknown (but see Plomin, Corley, DeFries, & Fulker, 1990). We must be careful to avoid the "sociologist's fallacy" of failing to recognize that a seemingly environmental variable such as print exposure could—through the influence of the child- and parent-constructed home literacy environment—carry genetic variance (Plomin & Bergeman, 1991). Nevertheless, R. K. Olson (1991) analyzed the heritability of the deficit in performance on the print exposure checklist measures shown by dyslexic twins in the Colorado Reading Project and found that the hypothesis of zero heritability could not be rejected. If this result for the heritability of a group deficit generalizes to estimates of the heritability for differences in the normal population (see R. K. Olson, Rack, Conners, DeFries, & Fulker, 1991), then it may well be correct to interpret print exposure as primarily an environmental variable.

The tasks used in this study were of course not an exhaustive representation of content knowledge. However, the measures, taken collectively, did tap a wide range of information. In particular, the practical knowledge test was designed to rebut the criticism that print is only associated with elitist or academic domains of knowledge that have no practical implications in the real world. Responses to this questionnaire indicated that the more avid readers in our study—independent of their general abilities—knew more about how a carburetor worked, were more likely to know that Vitamin C was in citrus fruits, knew more about how lending rates affect car payments, were more likely to know who their U.S. Senators were, knew more about broiling food, were more likely to know what a stroke was, were more likely to know what a capital-intensive industry was, and were more likely to know who the United States was fighting with and who it was fighting against in World War II. One would be hard pressed to deny that at least some of this knowledge is relevant to living in the United States in the late 20th century.

Finally, the practical knowledge test indicated certain domains of knowledge in which the responses offered by the college students in this study were startlingly out of kilter with reality. Despite the fact that there are at least 33 times as many Moslems in the world as Jews, only 8.0% of the sample appears to know this. Indeed, 60.6% of the sample thought that there are more Jewish people. There are 65 times more Hindus and Buddhists in the world than these subjects think there are. The U.S. defense budget, in relation to the costs of the space program, is an order of magnitude larger than most subjects think it is. Most subjects were unaware of the Soviet Union's role in World War II as the Allied nation that suffered more battle casualties than all of the other Allied countries combined (Esposito, 1965; Snyder, 1982). Bearing in mind the correlational nature of the data, we have developed here a cognitive and behavioral profile of the correlates of these startling discrepancies. The cognitive anatomy of misinformation is one of too little exposure to print; to a lesser degree, of deficiencies in general ability (as indicated primarily by mathematics test performance); and to a small degree, of overreliance on television for information about the world.

In summary, cognitive theories in which individual differences in basic processing capacities are viewed as at least partly determined by differences in knowledge bases (e.g., Ceci, 1990) indirectly provide a mechanism through which print exposure influences cognitive efficiency. Print exposure is simply a more distal factor that determines individual differences in knowledge bases, which in turn influence performance on a variety of basic information processing tasks (see Ceci, 1990). This link explains why some of the relations found in our studies between print exposure and criterion variables, such as general knowledge (the present study) and vocabulary (Stanovich & Cunningham, 1992), should not be criticized or dismissed as representing "narrow" effects. If the theories of cognitive development in which domain knowledge is emphasized have some truth to them, then demonstrating effects on such knowledge structures is an important finding because whatever causal power accrues to content knowledge in these theories also partially accrues to print exposure as a mechanism of cognitive change. Thus, when speculating about variables in people's ecologies that could account for cognitive variability—in an attempt to supplement purely genetic accounts of mental ability (e.g., Ceci, 1990)—researchers should find print exposure worth investigating, because such variables must have the requisite potency to perform their theoretical roles. A class of variables that might have such potency would be one that has long-term effects because of its repetitive or cumulative action. Schooling is obviously one such variable (Cahan & Cohen, 1989; Ceci, 1990, 1991; Morrison, 1987). However, print exposure is another variable that accumulates over time into enormous individual differences. We have shown here that these individual differences are associated to a strong degree with individual differences in general knowledge.

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Appendix A

Percentage Recognition of Authors on the Author Recognition Test

Author	% recognition	Author (cont'd)	% recognition (cont'd)
Maya Angelou	13.4	Stephen King	91.8
Isaac Asimov	47.0	Dean Koontz	10.1
Judy Blume	87.7	Judith Krantz	45.5
Erma Bombeck	57.8	Louis L'Amour	31.0
Barbara Cartland	8.2	Robert Ludlum	21.6
Carlos Castaneda	3.4	James Michener	19.8
Tom Clancy	32.5	Sylvia Porter	10.1
Arthur C. Clarke	18.7	Sidney Sheldon	67.2
James Clavell	17.5	Danielle Steel	65.7
Stephen Coonts	3.0	Paul Theroux	6.7
Ian Fleming	53.7	Avlin Toffler	2.2
Dick Francis	4.5	J. R. R. Tolkien	51.1
Stephen J. Gould	18.3	Barbara Tuchman	1.1
Andrew Greeley	5.2	John Updike	31.3
David Halberstam	0.7	Leon Uris	8.2
Alex Haley	39.2	Irving Wallace	19.4
Frank Herbert	6.7	Alice Walker	24.3
S. E. Hinton	31.7	Joseph Wambaugh	3.4
John Jakes	11.6	Tom Wolfe	27.2
Erica Jong	6.7	Bob Woodward	12.3

Appendix B

Percentage Recognition of Magazines on the Magazine Recognition Test

Magazine	% recognition	Magazine (cont'd)	% recognition (cont'd)
Analog Science Fiction	4.9	*Ebony*	78.0
Architectural Digest	42.5	*Esquire*	82.8
Atlantic	23.5	*Field & Stream*	68.7
Business Week	80.6	*Forbes*	69.0
Byte	30.2	*Gentlemen's Quarterly*	58.6
Car and Driver	58.2	*Harper's Magazine*	43.3
Changing Times	26.1	*House & Garden*	64.2
Consumer Reports	86.2	*Jet*	45.9
Discover	82.1	*Ladies Home Journal*	53.7
Down Beat	3.4	*Mademoiselle*	88.4

(Appendix B continues on next page)

Appendix B *(continued)*

Magazine (cont'd)	% recognition (cont'd)	Magazine (cont'd)	% recognition (cont'd)
McCall's Magazine	85.1	*Psychology Today*	67.9
Mother Earth News	3.7	*Redbook*	76.1
Mother Jones	7.5	*Road & Track*	44.4
Motor Trend	58.6	*Rolling Stone*	94.8
New Republic	13.1	*Scientific American*	32.5
New Yorker	51.5	*Seventeen*	96.6
Newsweek	97.4	*Sports Illustrated*	98.5
Omni	71.6	*The Sporting News*	29.1
Personal Computing	17.9	*Town & Country*	53.7
Popular Science	72.0	*Travel & Leisure*	20.5

Appendix C

Percentage Recognition of Items on the Cultural Knowledge Checklist

Name	% recognition	Name	% recognition
Artist items		Entertainer items	
Alexander Calder	3.4	Fred Astaire	95.5
Paul Cezanne	22.4	Lionel Barrymore	19.4
John Constable	5.6	Sarah Bernhardt	32.5
Paul Gauguin	19.8	Humphrey Bogart	95.1
Winslow Homer	16.4	Charlie Chaplin	97.0
Henri Matisse	25.4	Greta Garbo	76.1
Jackson Pollack	9.3	Katherine Hepburn	94.8
Diego Rivera	16.4	Harry Houdini	77.6
Norman Rockwell	74.6	Vaslav Nijinsky	5.2
Auguste Rodin	14.9	Paul Robeson	6.7
Jan Vermeer	7.5	Will Rogers	81.0
Andrew Wyeth	13.8	Mae West	86.6
Military leader and explorer items		Musicians/composers items	
Omar Bradley	11.6	Louis Armstrong	50.6
Francis Drake	69.8	Irving Berlin	47.2
David Farragut	11.9	Duke Ellington	50.9
Robert E. Lee	87.7	Stephen Foster	16.2
Douglas MacArthur	85.8	George Gershwin	64.5
Ferdinand Magellan	66.4	Woody Guthrie	32.8
George C. Marshall	34.3	Scott Joplin	34.7
Horatio Nelson	16.8	George Harrison	50.9
George Patton	78.0	Francis Scott Key	58.5
John Pershing	36.2	Gustav Mahler	8.7
Marco Polo	86.2	Cole Porter	17.4
Walter Raleigh	59.0	John Philip Sousa	34.7
Philosopher items		Scientist items	
Edmund Burke	17.5	Neils Bohr	40.7
Rene Descartes	45.5	Marie Curie	61.6
Friedrich Hegel	11.9	Michael Faraday	34.3
Thomas Hobbes	23.5	Enrico Fermi	23.9
David Hume	13.4	Werner Heisenberg	12.3
Immanuel Kant	22.4	James Clerk Maxwell	12.7
John Locke	57.5	Isaac Newton	94.8
Friedrich Nietzsche	23.5	J. Robert Oppenheimer	33.6
Jean Jacques Rousseau	42.5	Linus Pauling	21.3
Bertrand Russell	8.6	Max Planck	29.9
Jean Paul Sartre	27.6	Edward Teller	4.1
Baruch Spinoza	7.1	James Watson	58.2

Appendix D

Percentage Recognition of Items on the Multicultural Checklist

Name	% recognition	Name (cont'd)	% recognition (cont'd)
Yasir Arafat	72.4	Billie Holiday	68.7
Roger Bannister	6.3	Langston Hughes	38.4
Ingmar Bergman	56.0	Jack Kerouac	8.6
Steve Biko	22.4	Nelson Mandela	53.4
Simon Bolivar	27.2	Joseph McCarthy	45.1
Al Capone	94.8	Margaret Mead	36.9
George Washington Carver	72.8	Kate Millet	0.7
Miles Davis	58.2	Georgia O'Keeffe	35.1
Amelia Earhart	82.8	Charlie Parker	17.2
Medgar Evers	6.0	Rosa Parks	67.2
Aretha Franklin	94.0	Sylvia Plath	14.9
Betty Friedan	10.1	Margaret Sanger	6.7
Carlos Fuentes	14.2	Bruce Springsteen	98.9
Marvin Gaye	89.2	Francois Truffaut	7.5
Allen Ginsberg	20.9	Sojourner Truth	31.0

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