Listen to Mozart, it will make you smarter : You've gotta be kidding me, Mr. Shaw

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——You've gotta be kidding me, Mr. Shaw——

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Introduction

In 1993, Gordon L. Shaw, a physicist, at the University of California at Irvine and his colleagues published an article in which they claimed that students' intelligence increased as much as 10 points as a result of listenig to sonata for two pianos, in D major (K448) by Wofgang Mozart. He eventually published a tome (500 pages), "Keeping Mozart in mind," and he elaborated on "the Mozart Effect." In the US, this "Mozart effect" has become a "fad" in that, as one mignt expect, there are many Mozart CD's in the market place and it is advertized that one will get smarter. Not surprizingly, expectant mothers have started listening to Mozart pieces in the hopes of creating offsprings with higher IQ's.

Is this just a passing fad or is there scientific evidense to support Gordon's claim? Ever since, in 1799, when a boy raised by a pack of wolves, was found in the deep woods of Aveyron in the Saint Sernant district of France, the controversy of nature and nurture has continued unabated. Gordon's studies rekindled this controversy and added fuel to the more inflammatory issue of the Black's lower intelligence.

Specifically, the Bell Curve by Herrnstein of Harvard and Murray of the American Enterprise Institute (1994), has stirred up bitter controversies since it claimed: (1) the black's intellingence is 15 points lower than that of whites (2) most social ills such as poverty, crime, lower educational achievement etc stem from their lower intelligence, and (3) the difference is genetic. The point (3) virtually shuts down the hopes of improving cognitive functioning of minority children since it is genetically determined and little can be done. The federally-funded programs such as the headstart program was under fire by genetecisits for its inefficacy. The outcome of the nature and nurture controversy carries enormous implicatons for social life and education (Hisama, 1997 and Hoover, 1997). In this article, I will attempt to address the issue by

examining data from both sides, genetic and environmental, and finds an answer to the great controversy, although I am painfully aware of the weight of the task laid out in front.

Genetic determinants of intellingence

In 1999, an anonymous couple in the US ran an ad in the Harvard Crimson, "We will pay $ 50,000 for a human egg if the donor meets the following conditions: (1) a score of 1400 or more on the Scholastic Aptitude Test (the highest score in the verbal and quantitative sections on SAT is 1600), (2) the donor's height must be over 6 feet. and (3) she must be in excellent physical condition. The anonymous couple ran similar ads in the campus papers of leading universities in the US and this made worldwide news.

Not to be outdone by the anoynimous couple, an ex softpornographer-turned photographer named Ron Harris, started running ads on internet, "human eggs by beautiful models for sale ; price ranges from $16,000 to $160,000. If the sale is consummated, the buyer agrees to pay 20% of the sale price to Harris for his commision." Harris unabashedly advertizes on internet, "For your beautiful offsprings, start right with beautiful human eggs." He makes no bones about his stance, "human evolution starts with genes."

The public reactions range from those who criticize his new venture as "nothing but an extension of his old soft porn business" to "it is an attempt equal to Hitler's Arian nation which was based on the notion of genetic purification."

In a rerun of 60 Minutes in 1999, CBS reported a case of a deathrow inmate named Jeff Landgren. He was handed down the death sentence for his murdering police officers in a botched up bank robbery in Texas. Landgren's biological father is also waiting for execution in a deathrow in an Arkansas prison for murder. Jeff Landgren never met his biological father since he was adopted soon after birth by a middle class family. The adopting parents produced a girl after Jeff was adopted. The girl completed her college education and holds a respectable job. Jeff, on the other hand, started stealing at the age of 6, was caught for burglary when he was 11 years old, and "graduated into" a career criminal, execution waiting for him for murdering 2 police officers in a shoot out. His father, 58 years of age, committed similar crimes and was sentenced to death for murders. Jeff maintains, "I was born to be a criminal since I have never met my real father. He never had a chance to influence me. My stepsister is a college graduate, married, and a law abiding citizen. We grew up in the same family. What determined my destiny was my genes, not my environment. The US constitution guarantees an equal and fair right to its citizens. My constitutional right is violated. Therefore, the death sentencing in my case is

an outright violation of my constitutinal right. I do not deserve to die at the hands of the law. At least, I should serve a life sentence in prison, not to be executed." It is crystal clear in the cases above that genes are the one mainly responsible for his/her fate, not environment.

Besides items from media reports, what "hard data" are available to support the genetic organic views? First, a Canadian report that Einstein's genius was based on his unique brain structure was made by Sandra F. Witelson of McMaster University of Ontario in 1999. Witelson and her colleagues at Mcmaster University reexamined the brain of Einstein, which was kept by Dr. Thomas Harvey, who performed the autopsy when Einstein died at the age of 76 at Princeton Hospital in 1955.

Witelson found that the brain which formulated the revolutionary theory of relativity showed an unusual structure compared to the 35 brains in the control group. His had short sylvian fissure, compared to those in the controll group, and the operculum was underdeveloped. This allowed the parietal lobes to grow 15% wider. This area is believed to affect math, music, and visual images. According to Witelson, this may be related to his formulating the theory of $E=mc^2$. Witelson, (1999). Figure 1 shows Einstein's brain, as shown by Witelson, which is different from the normal brain.

A report from the Department of Neurology at the University of Iowa does not directly deal with the issue of intelligence. However, it supports an organic basis of human behavior to some extent. Anderson and his associates report 2 clinical cases (Anderson et al, 1999). The first case is a 20-year-old woman who was run over by a vehicle at age 15 months, thereby sustaining prefrontal cortex lesion. Her parents noticed that she was not responsive to verbal and physical punishment when she was 3 years old. Her behviors got progressively worse in that she started stealing, lying, and ran away from home and treatment facilities. She was pregnant at age 18 and was unable to hold jobs due to her unreliable behaviors. In other words, she never developed a sense of morality and had no remorse for what she did.

The 2nd case was 23 years old. He had undergone resection of a right frontal tumor at age 3 months. He was reported to be normal until age 9 when he started showing occasional outbursts of anger. He then started engaging in impulsive thefts and showing other irresponsible behaviors. He was also reckless in financial management, resulting in large debts and was unable to hold steady jobs due to his lack of moral judgement. Anderson and his associates did not conclude that human behavior is predetermined by lesion in the brain. However, they cite cases in which lesion occurred after reaching adulthood. In those cases, they did develop abilities in moral judgment unlike those 2 cases reported above. The implication in this report is that the

roots of human behavior can be neurological.

A classic case of the relationship between the brain and human behaviors was reported in 1845. Phineas Cage was a foreman of a railroad construction gang, who was using some blasting powder and tamping iron. Blasting powder exploded and the tamping iron tore through his cheek and severely damadged his frontal lobe. Figure 2 shows the skull of Cage preserved at the Medical School of Harvard University. Amazingly, Cage was able to walk to an infirmary on his own power and there was no discernible difference in his intelligence. However, his friends reported that, after the blast, he was a "changed man." He became awfully irritable and touchy. Consequently, his interpersonal relationships deterioted to the extent that he was unable to hold jobs. He also started lying and became unrelible, which were not his characteristics before the accident.

In a tradional sense of intellingence, his intelligence seems to be intact. However, if we focus on his social intelligence, the lesion he received in his prefrontal lobe did create changes which suggest that some aspects of human intelligence can trace their roots to certain parts of the brain, particularly, the prefrontal lobe as evidenced in the case of Cage (Hisama, 1996).

Figure 1

(Source, Time, Pp. 54, 6-29-99)

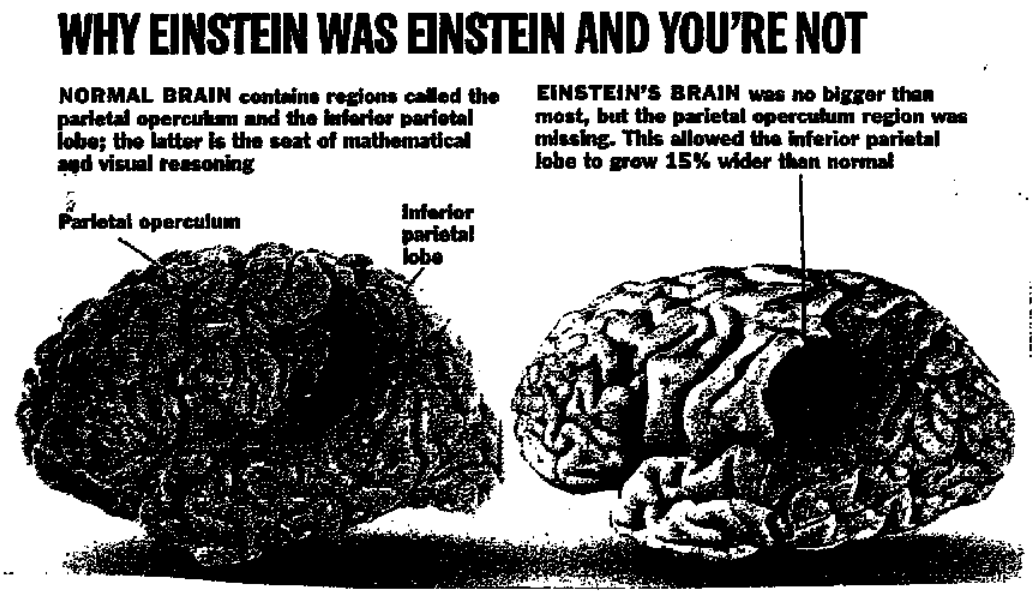


Figure 2

(Source, Morris, Pp. 51, 1993)

The Skull of Phineas Gage, showing where the tamping iron passed through it.

Studies of kinship and identical twins

A method to investigate the impact of genes and environment on intelligence is to investigate the IQ relationship between parents and children, biological and adopted. A report was made as early as in 1928. Table 1 below summarizes the reports:

Table 1

IQ relationship among biological, adopting and offsprings

biological parents & children	Adopting parents & adopted children	year of report	researcher
.60	.18	1928	Burks
.52	.20	1928	Freeman
.57	.26	1935	Leehigh
.32	.02	1949	Skodak & Skeel

(source ; Kamin, 1976)

As expected, Trable 1 above indicates that the magnitude of correlations gets lower when there is no blood relationship. It is as low as .01 in the report by Skeel and Skodak. On the

other hand, the correlations get higher when there are blood relationshiops.

Another classic method of research in this case is to investigate the magnitude of IQ's of identical twins reared apart. Table 2 shows the results of investigations reported so far. The underlying assumption is that the higher the correlations the higher the impact of genes. The opposite is true for the inverse relationship.

Table 2

Correlational coefficients of IQ's among identical twins reared apart

researcher	N	year	coefficients
Newmann et al.	19	1937	.87
Shield	38	1962	.78
Juhl & Nielsen	12	1965	.68
Burt	53	1968	.88

(source; Kamin, 1976)

Cyril Burt of England was known for his studies of identical twins as well as for his contiributions to statistical psychology. Table 3 shows results of his studies. Conway in Table 3 was one of his researdch "assoicates."

Table 3

IQ correlations of identical twins reared together and apart

researcher	N	year	reared apart	reared together
Burt	21	1955	.771	.944
Burt	"over 30"	1958	.771	.944
"Conway"	42	1958	.778	.936
Burt	53	1966	.771	.944

(source; Kamin, 1976).
Note; the reason why Conway is in quotation marks will be mentioned later.)

As seen in tables 2 and 3, the identical twins who grew up in different environments produced correlation coefficients ranging from .68 to .88. The data by Burt are more consisitent in that they centered around .771 with the exception of .778 by "Conway," which is a miniscule defference of .007. The data on twins reared in the same household, on the other hand, produced correlattions of .944 with the exception of .936 by "Conway."

These data appear to point in one direction, i. e., identical twins reared together do show a strong tendency of showing an almost identical level of intellingence. According to Burt, in particular, this tendency is salient even in the cases of twins reared separately. Although they were brought up in different environments, the magnitude of coefficients was the same, .771.

Kamin of Princeton, a fervent environmentalist, cast doubt on the credibility of data by Burt, however, Kamin, (1974). He noticed that Burt's data showed identical coeficients of .771

in '55, 58, and '66. In research, it is highly unlikely that correlations are identical to the third decimal point. On subsequent investigation, Kamin found that Burt did not conduct research and faked data which supported his genetic theory of intelligence. In the process of fakery, he created a "Mr. Conway" who was an author in a pscyhological journal of statsitics Burt edited. Hernshaw of England, a journalist, followed up on Kamin's lead to find that Burt's assistants who collected data did not exist or resided in Australia at the time of reseach conducted. Burt was bestowed knighthood for his "outstanding contributions" to the field of psychology but this was revealed after his death. Gould (1981) is rather sympathetic in that Burt used the name of Conway to write articles himself since there were not many contributors to the journal he presided and he was suffering from congenital ills obscuring his judgement. Does this mean that all data Burt produced are not worth paying attention? Not necessarily so. Data produced by other researchers support coefficients of about 70. This means that, in my view, Burt's data were in "the ballpark," and all of his contributions should not be discredited because of incidents which tarnished his career in later years.

To sum up this section, some conclusions can be drawn:

(1) there is a biological and anatomical basis for certain types of intellectual deficiency, macro-and-micro-cephaly and cretinism are only a few examples.

(2) the report from Iowa confrims the fact that there is an anatomical basis to form moral judgement, although Einstein's case may not be generalized.

(3) the twin studies generally support the notion that there is a 70% variance of heritabiity in intellingence, although 30% of environmental factors vs 70% of heritability is still in dispute. Jensen (1980), for example, is adamant in his insistence that heritability of intelligence is a minimun of 70%, perhaps, as high as 80% and he maintains that the lower intellingence of Blacks is because of their genetic makeup (Hismam, 1997).

Children reared in extraordinary circumstances——the wild boy of Aveyron, the abused, those reared by deaf and mute mother, and the case of Helen Keller.

In 1799, a boy was "captured" in the woods of Aveyron in France. The boy was given the name of Victor and was trained by Father Jean Marc Gaspart Itard after he was brought back to a human environment. The only environment he had known was wolves. To Itard, this was an "experiemnt by nature" since, it was surmised, Vicotr would have been able to restore his humanness, language, and intelligence, given intense deaf education, for which Itard had been known at that time.

When captured, Victor was about 12 years old and had no language skills. He learned his survival and communicative skills from wolves, running on his 4 limbs and showed his fondness for uncooked, raw meat til the end. His language skills never fully developed even with Itard's devotion. He could say "lait (milk)" but could not express his wishes in full sentences. It was surmised that his language and intellecutal skills were about the level of 5-6-year-olds. Victor died at the age of about 40.

In 1920, similar cases of 2 girls reared by wolves were found in the Bengal area of India. Both were believed to be abandoned by their parents, which was not unusal at that time if the infant was a girl. Kamala and Amala were believed to be 8 and 2 years of age, respectively. When "captured," they tried to escape running toward bushes and hide there.

Amala died 1 year later and Father Singh was the major educator for Kamala, It was reported that, as in the case of Victor, she never fully developed language skills and intelligence. Before she died 4 years later when she was 12 years old, she developed about 100 words in vocabularry but relied more on nonverbal mode of communication such as bringing dishes for food and pulling Mrs. Singh's sleeves for attention.

Luke was found in 1903 in South Africa and believed to be snatched and reared by a pack of baboons. Luke also showed behavioral charcteristics of his captors when he was found. He preferred raw cacti and corn to cooked food and showed many apelike behviors. However, unlike those raised by wolves, he was reported to be a smart boy who developed skills in language communication and became a relibale worker for a farmer who adopted him.

There are several cases of "attic child," those reard by a deaf-mute mother, and a child whose communication skills were cut off from outside as a result of abuse. Anna was found in Ohio by a case worker in 1938. She was confined in an attic by her grandfather who did not approve of his granddaughter born out of wedlock. Anna was about 6 years old when she was found and an IQ test revealed that the developmental level of her intelligence was 2 years of age. Anna was physically emaciated when she was found and took a long time for recovery. Anna, like the wild children of Aveyron and India, never developed full communicative skills.

Genie was about 13 years old when she was found locked up in a room by her own father. She had been kept naked except for a harness which held her to an infant toilet seat. Her father committed suicide before he was tried for child abuse. Unlike Anna and despite the longer time of confinement, she reached a higher level in her language development. But her sentences were characterized by ungrammatical expressions such as "Father take piece wood hit cry." Isabelle was confined to a small room with her mute mother for the first 6 and a half years. Mar-

ie Mason, head of the Speech Correction Department at the Colombus State Hospital in Ohio, took over education of Isabelle. This was a successful case of rehabilitation in that Isablelle reached the normal level in her communication skills in about 20 months of training by Mason.

The case of Helen Keller is well-known and need no further explanations. She was born normal in a small town in Alabama. She lost her auditory and visual sensations due to a disease when she was 19 months of age. It was Annie Sullivan, recommended to Keller's parents by Graham Bell, who changed her life. Keller showed behaviors akin to the wild boy due to her inability to hear and see when Sullvan met her the first time, indicating the effect of complete shutdown of human communication. However, Keller went on to graduate from Radcliff College with honor and to lead education for the handicapped in the world.

Table 6

Summary of developmental stages of special children

Victor	Kamala	Luke	Anna	Genie	Isa-	Keller
France	India	S. Af	US	US	belle	US
1799	1920	1903	1938	1970	1938	1880
(1)12	8	12-14	6	13	6&1/2	7
(2)12	8	12-14	6	13	6&1/2	6
(3)40	12	over 40	?	?	?	88
(4)wolf	wolf	baboon	grand father	father	mute mother	parents
(5)Itard	Singh	employer	special education	?	speech therapist	Sullivan
(6)5-6	100 words	good memory	2	severe deaf	normal	college

Note;
(1) age when child was found
(2) time period of isolation
(3) age at time of death
(4) adopting parents or abuser
(5) educator
(6) age level of deelopment or accomplishment

(source; compiled from Steinberg, 1993 and Zingh, 1978)

It can be summarized in this section, in conjuntion with the influence of heredity and environment on intelligence, that the crucial factors to be taken into consideration are: (1) the period of isolaton, (2) the age when isolation took place, (3) and who raised these children and how? Factor (3) can be critical in supporting the critical age hypothesis, i. e., if one misses this period, the damage is irreparable and permanent.

Environmental determinants of intelligence

The Mozart Effect

The premise in this area is that one's intelligence increases when his/her surrounding environment is manipulated, i. e., when we listen to music our intelligence increases accordingly. But, not any piece of music. It must be sonata for 2 pianos, D Major (K488), according to Gor-

don L. Shaw of the University of California at Irvine. How did he get an idea that Mozart makes one smarter?

In 1978, Vernon Mountscale, a famed neuroscintist, devised a model of neural structure of the brain's cortex. It represents the firing patterns of groups of neurons. Based on Mountscale's model, Shaw's colleague, Xiaodan Leng, used a synthesizer to translate these patterns into music and brain wave activities are built on the same sort of patterns. Another colleague of Shaw, Frances Rauscher, a former concert cellist himself, sorted through hundreds of Mozart's compositions and settled on the piece mentioned above. (Marsh, 1999.)

Rauscher, Shaw, and Ky (1993) divided students into 3 groups: (1) Ss who listened to Mozart's sonata for 2 pianos, D major (K488) for 10 minites, (2) Ss who listend to a relaxiation tape for 10 minutes, and (3) silence. All 3 groups were given IQ spatial reasoning tasks afterward. The results indicated that Ss in Group 1 achieved an IQ equivalent of 119 while other 2 groups' IQ equivalents were 111 and 110. The one-way analysis of variance indicated that the results were significant at the .002 level.

This experiment shows a few flaws in that (1) they did not specify the pretest level of IQ's of Ss; (2) they mentioned only that Ss were students and did not specify Ss' characteristics which could affect the results; (3) a random assignment of Ss into 3 groups was not mentioned. This may have affectd the results, also. Nonetheles, Shaw insisits that the Mozart Effect exists, but not Beethoven Effect, neither Stravinski, nor Warlock Effect.

Support for the Mozart Effct in subsequent studies are sporadic in that some studies confirmed it and others did not. Botwinick (1997), for example, had students listen to Mozart, Vivaldi, and symphonic music arranged in Dizney style prior to giving Ss spelling tests. There were statistically significant differences among 3 different kinds of music in increasing Ss's spelling skills, Mozart being the most effective. Some took a ride on the Mozart effect, claiming that listening to Bach enhances spiritual development (Marty, 1998). Winner and Hetland (1999) blastd the Mozart Effect in New York Times, that there is no scientific evidence thus far to support the existence of the Mozart Effect. Conceding its existence, the evidence presented is weak in research designs and does not stand the rigorous scrutiny. In principle, I agree with this assessment that there is too much media hype without hard data to support the hypothesis.

The Rosenthal Effect

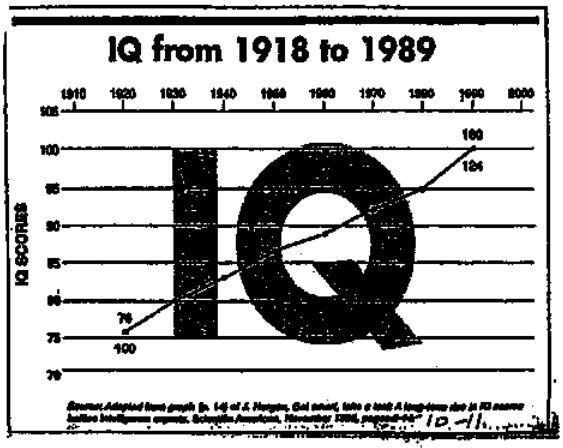
In 1973, Robert Rosenthal reported that the Pygmalion Effect, after Bernard Shaw's Pygmalion, exists when teachers' expectations are manipulated. He told teachers that, bsed on

sophisticated-looking, psychological tests, he found "sleepers" in their classes whose IQ can be boosted since their potential was just uncovered and untapped. In reality, he picked those children on a random basis. The results indicated that, in comparison with the controls, the "Pigmalion group" gained an average of 7 points on a nonverbal IQ test and 2 points on a verba IQ test. There was an overall 4 points increase which was a statistically significant gain. This study was touted as the Rosentahl Effect. Teachers, based on their expectation level, paid closer attention, gave more proper feedback, and learning opportunities to certain children since they were "sleepers," The results were "voila!, I created smart kids." The lesson here is: "If you think these are dumb kids, you create dumb kids and vice versa." The Rosenthal Effect gave great hopes for the headstart program which is designed for children from lower socioeconomic class and known for their low achievement. The Rosenthal Effect met its critics, however, in that his experimental groups were classes, not individual Ss. Therefore, the statistically significant gains he claimed may not have been significant after all. Also, it is possible that a 4 points gain can be a natural gain children attain in a 1 year period. Some subsequent studies confirmed this suspicion that there were some gains in IQ but not as much as Rosenthal originally claimed.

The Flynn Effect

The Flynn Effect was named after Richard Flynn, a political scientist in New Zealand, who discovered this phenomenon. Flynn was investigating how the Army Alpha and Beta Test evolved in the United States and discovered that the IQ score on IQ tests have kept rising from 1918 through 1989 when it was published. The average IQ in 1920 was 76 and it reached 100 in 1990. Figure 3 below shows the trend.

Figure 3



(Source: APA Monitor, June 1996).

Flynn also found that the rise in IQ was seen not only in the US but it was common in European countries where records were kept. For example, it rose by 10 points in 30 years in Israel and Canada and 20 points in Denmark. It should be kept in mind that when considering the Flynn Effect, these records are mostly based on records of army recruits in the countries surveyed.

Granted that the Flynn Effect exists, an obvious question is: what are the causes for the IQ rise? Why are people getting smarter? Does it come from nature or nurture? A conference was held in Atlanta, Ga under the sponsership of the American Psychological Association, where the Flynn Effect was discussed.

First, it was acknowledged that the nutritious status in the world has gretaly improved since the end of WW II. It is known that an extreme lack of specific elements in foods, for example, iodine, iron etc., cause mental retardation. Right after WW II, there was a period of time when an extreme shortage of foods struck Holland, although this one lasted only a short period of time. The number of MR children born during this period was greater than at other times.

Second, people are getting test-savvy since the world is full of media stimuli such as TV progrms and video games, and personal computers. Flynn's survey uncovered the fact that scores on culturefair tests such as Raven's Progressive Marix are rsising. Raven's Matrix relies heavily on visual figures and reasoning stimuli. It is conceivable that children growing up in these environments can get test-savvy.

Finally, the opportunities for people for education are improving worldwide. For instance, in the United States, a heavy commitment was made by the federal government to promote education of the minority groups. As a result, there was a 70% increase of students who attended colleges among whites while it rose by 350% among the minority group members. The results of achievement tests administered to 9, 13, and 16 years olds showed that the gap between blacks and whites in math, reading, science narrowed by as much 50%. Compared to the situation 100 yars ago, changes in society have greatly improved and they may be reflected on IQ test scores. What does Flynn himself say as to the causes? He says, "no definite causes can be pinpointed, It is a mystery." (APA Monitor, 1996)

The Miracle in Milwaukee

Perhaps, the most convincing data in favor of the environmentalist came from Milwaukee, Wisconsin where Rick Heber and his associates at the University of Wisconsin launched an am-

bitious program in which they attempted to raise IQ of children who resided in the impoverished areas. The basic premise in this project was that mental retardation is manmade, not hereditary since many adults in the area scored lower than an IQ of 80 and had no education to speak of.

In 1966, the Infant Education Center in the inner city part of Milwaukee was established and a group of 40 mothers whose IQ was below 75 was selected. The experimental group consisted of 20 mothers and the rest served as a control group. The new born babies of these mothers were visited by teachers and, after 3 months, babies and mothers went through education and training at the Center. The infants were given training to increase cognitive-motor-perceptive abilities. Mothers went through training in baby care, homemaking, and vocational education. The children and mothers were given training 4 days a week, 7 hours a day by teachers specialized in language development and expression, reading, and math/problem solving. The results were stunningly successful in that, after 66 months of training, the average IQ of the experimental group was 124 compared to an average IQ of 94 for the control group. When compared with the average IQ of below 75 of mothers, this was a remarkable result and it was a triumph for the environmentalist. (Whimby, 1975)

Ellis Page of the University of Connecticut had different views on the results of the Milwaukee Project (Page, 1972). He questioned the validity of the results: (1) little information was given on the content of training, (2) it was doubtful if the experiemental and control group were adequately matched at the beginning to claim that IQ increase was solely due to the training program, (3) since the experimental group was given tests almost on a weekly basis, the Ss acquired skills in test taking, that is, test sophistication had developed. This could have masked the results.

Burt faked data in England, tarnishing his reputation as a respected intelligence psychologist. The US may have had an equivalent of Burt in that Heber later was indicted and convicted of misusing the federal fund and served time in a minimum security prison in Taxas. No body knows if he faked data or not. If he did, the strong evidence "could go out the window."

Conclusion and discussion

The hypothesis raised at the outset in this article was: "Does listening to Moaart's music make one smarter? " I attempted to preent data from both sides.

The evidence reviewed in the genetic views of intelligence appears to point in two directions: (1) there is no doubt that human traits are inherited to some extent. However, as correlational studies indicate, the magnitude of correltion coefficients is neither 1.00 nor -1.00. If

Burt's and Jensen's views hold water, the variance of heritability is .70 to .80. This view is still not widely accepted and challenged by environmentalists. Still, the variance of .70 and .80 means that .49 and .64 are responsible for genetic basis of intelligence, leaving room for environments to maneuvre within the range of .51 and .36.

The second direction is that the result of correlational studies seem to suggest strong possibilities of interactions from the genetic point of view.

Review of literature in the area of enviromental views of intelligence does not offer "decisive punches," either. There are some studies that strong environmental interventions make differences However, they are not strong enough to alter one's hereditary components. For example, it is well-known in the studies of mental retardation that it is possible to raise an IQ of 80 to 100. But, it is difficult to raise it to 130 or 140. The upper threshold of changeability is about 20%. It is certainly not possible to produce an Einstein out of a mentally subnormal person by environmental manipulations. Since the time Itard failed to educate Victor, suspicion has always been raised: "Victor must have been congenitally low in his intelligence. His capacity must have been at the trainable retardattion level in today's standard."

Recently, there were two reports that suggested genetic determinants of human traits. One, according to an ABC international report, was that men's index fingers are shorter compared to women's. The report also indicated that there are women whose index fingers have men's characteristics. In those cases, they tend to be lesbians. This suggests that there is a strong genetic basis for homosexuality. Likewise, in San Diego, neuroscientists found that, on autopsy of homosexual men who died of AIDS, their hypothalumus was larger than normal men. This finding also suggests a genetic basis for homosexuality. However, there is always a possiblity that the hypothalumus became larger as a result of being infected by AIDS, researchers cautioned.

On the environmental side, Denzel Washington, a noted Black actor, was quoted in an interview with Dotson Rader in Parade (12-22-99) that what changed his career was his encounter with theatre at Fordham Universty in New York City: "It was in acting that I discovered what I meant to be." Before he found acting as his calling there was a time when his mother, Lennis, was afraid that she may "lose him to the streets of New York." Washington himself recounted in the interview: "The guys I was hanging out with at the time, my running buddies, now have done maybe 40 years combined in the penitentiary." If Lennis had not sent him to Oakland Academy in New Windsor, NY, we may not have seen Wasington in Philandelphia, Crimson Tide, or the Bone Collector.

Another cogent point can be a shooting of a 6-year-old, Kayla Roland, by another 6-year-old in Morris Township in Michigan. The boy was too young to be indicted since he did not realize the consequences of his act. The boy's enviroment was as bad as it could be. His father in jail for parole violation and he knew "it could be his son since he was involved in violence." His mother, evicted from her home, sent the boy to a house of drugs and violence. A resident in the crack house flashed a .32 "pocket pistol," the youngster took it to school where he had a scuffle with Kayla the day before. The resident, James, was arrested for involuntary manslaughter. This could be a modern day version of "Victor in the US."

To conclude this article, let me cite the current status of research on Alzheimer's disease which is one of the most feared diseases since there is no cure as yet and its consequences at the terminal stage are devastating.

"Sally Luxon and Diane Schuller were born identical twins 63 years ago. Growing up in Ohio, they dressed alike, slept in the same bed and flashed the same crooked teeth whenever they grinned. Today, Diane enjoys traveling with her husband, keeping up with her kids, grandchildren and her 86-year-old mother. Sally, on the other hand, suffers from advanced Alzheimer's, has not spoken since 1993, or walked since 1994. She shows no sign of recognizing her daughters——even her twin, Diane." Cowly and Underwood, (2000).

It is predicted that 14 million people will develop Alzheimer's by 2050 and 19% of people, 75 to 84, will develop it. If they are over 85, half of them have it. Is it nature or nurture? It is also known that people with 1 afflicted parent are 3 times more likely to develop it than those with no family history.

On the other hand, the Duke University research team on twins with Alzheimers report that there are environmental factors which precipitate Alzheimer's: (1) the history of head injury, (2) the educational level of the patient-those with rural backgarounds and with less than 7 years of schooling suffered 6 . 5 times more than educated city dwellers, (3) those with more than 5 siblings are at higher risk than those from smaller families (presumably more nurturing). Cowley and Underwood, (2000). The point (2) supports an earlier report from New York University Medical School that those people who "keep their neurons firing" tend to develop Alzheimer's less often than those whose profession does not require mental exercises. Truck drivers, gas station attendants, and street sweepers, etc are at risk. The lesson here is that statistics is one thing but individual cases are another. There are interacative activities between the hereditary and environmental factors.

Gordon Shaw's report: "If you listen to Mozart's sonata for two pianos, you will get smart-

er" rasied a great deal of interest and challenged the genetic view of intelligence. On the other hand, geneticists's group led by Jensen and Herrnstein, insist on the genetic determinants.

What is the answer? Thus far, there are pros and cons on the maleability of herediatary and environmental factors. But, the answer appears to be hidden somewhere in the realm of interactions between the 2 factors. A more appropriate hypothesis may be: how much is intelligence determined by nature, nurture, and the interaction between them and how much are they maleable? Or, as Bob Dylan sang it, "Is it blowin' in the wind? "

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