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Introduction

This volume describes a study of over 200 talented teenagers undertaken in an effort to understand what makes it possible, given similar environmental conditions, for some teenagers to continue cultivating their talent while other equally gifted teens give up and never develop their abilities.\(^1\) It is during adolescence and young adulthood that many individuals who seem destined for great futures in the arts or the sciences seem to lose interest and settle for careers that require average skills.

THE WASTE OF TALENT

Underachievement, or dropping out, on the part of talented youth has been described in fields as different as athletics,\(^2\) art,\(^3\) science,\(^4\) mathematics,\(^5\) mathematics and science,\(^6\) and music.\(^7\) Many reasons have been advanced to explain this phenomenon of disengagement from talent. An obvious one is the possibility that certain neurophysiological changes during puberty interfere with the cognitive organization necessary to perform well at higher levels in mathematics,\(^8\) music,\(^9\) and presumably other fields as well.\(^10\) Thus adolescents will lose interest in their area of talent because they are no longer able to master the required skills. Other explanations place the blame more on the way schools provide information to students.\(^11\) For instance, Stanley and Benbow claim that “boredom, frustration, and habits of gross inattention” are sure to result from the way algebra is taught in high schools, and they conclude that “motivation for mathematics may suffer appreciably in all but those few students devoted to the subject.”\(^12\) But many other reasons may also be
involved. For example, Albert and Runco, Bloom, and Rimm have shown that children need the support of a great number of individuals and institutions to develop their talent. Without dedicated parents, savvy coaches and mentors, good schools, and challenging opportunities to express their gifts, it is very difficult for teenagers to persist in the demanding discipline that the cultivation of a talent requires.

Yet strongly entrenched myths would seem to contradict the position just stated. Many people believe that "talent will out" regardless of external circumstances. In fact, one can find many examples of individuals who have struggled successfully to fulfill their potential despite great odds. Thomas Edison was expelled from first grade because his teacher thought he was retarded, and for a long time the only person who disagreed with this estimate was his mother. Itzaak Perlman, born to an unmusical family in Israel, is said to have heard, at age 3, a broadcast of a concerto being played by Jascha Heifetz. He kept pointing to the radio when the violin was heard, saying "I want that!" until his parents understood; they enrolled him with a private tutor to learn to play the instrument. Despite having become partly paralyzed, Perlman is considered one of the great virtuosos of his time. Manfred Eigen, who won the Nobel Prize in chemistry in 1967, left school at 15 when he was drafted to serve in a German antiaircraft battery. Soviet troops captured him 3 years later, but he escaped and walked across Germany to enroll at the University of Göttingen, which had an excellent reputation in science. Even though he had never finished high school, Eigen obtained his PhD at age 22. These and many similar stories can be told of the single-minded perseverance with which gifted individuals pursue their talent.

But do we know how many geniuses are never recognized because their talents are blighted before they have a chance to be expressed? The fact is nobody does, and in principle the question is unanswerable. Although we are in doubt, the most reasonable assumption seems to be that talent is much more widely distributed than its manifestation would suggest. The proportion of gifted children appears to be much greater than that of gifted adults; what happens to those children during the hazardous passage through adolescence?

Some of the attrition could be the result of social and economic inequalities: A disproportionate number of disadvantaged children lose heart because they believe that after many years of hard training they will still fail to reap any benefit from their talent. Only substantial changes in
the life prospects of disadvantaged ethnic groups will relieve this source of attrition. But privileged children give up developing their gifts as well — and we really don’t know whether the attrition among them is any less. Yet it will make a great deal of difference to our children, and to their children, whether they live in a society where talents are valued and developed to their utmost or in one where potentials are left stagnant and unfulfilled.

To get a better sense of the daily hassles that act as deterrents to the development of talent in adolescence, let us look at the weekend of one of the students who took part in the study on which this book is based. Sandy — her name, like those of the other students who helped us, is fictitious — is a bright and lively 14-year-old whose performance in biology has been so outstanding that several teachers nominated her as being talented in science. Much as she likes to study, however, a great deal of her attention, or psychic energy, is taken up by the problems of surviving among family and peers. We pick up her story on a Friday morning at 8:35. She is sitting on the couch in the family room “planning revenge.” This is what she wrote in the questionnaire booklet when the electronic pager that we used in our research signaled her to respond:

I hate my mom so much. I was leaving for school, where I should be now. My little brother wanted to take his bike to school, so my mom made me give him my lock. I thought that meant she was going to give me a ride to school, when it came time to go I went upstairs to say “let’s go.” She started yelling at me saying, “Why didn’t you take the bus? Why do you hate me so much? Why do you try as hard as you can to ruin my life?” We got into a big fight and then she started to cry. Then she said to walk to school which is about 2 miles; there is no way I could make it on time. So I am still at home and late to school.

The next page of the booklet was filled out when the pager signaled at 10:15. Sandy had finally gotten to school, but she was not in class; she was “walking through halls, avoiding narks, hiding in bathroom stalls crying.” This is what she wrote:

My mom dropped off my baby sister at my grandparents’ house. I called my dad from work and he came home. My mom packed up and left us. I feel guilty, I know it’s my fault. I should have walked to school. Now that I am here I have not gone to my classes because I am always crying. I hope my mom comes back home.

Fortunately, the family crisis is resolved by evening: Dad gets Mom back home and Sandy is more or less reconciled with her parents, although she is “still depressed and angry about my mom.” But the week-
end has barely started. On Saturday, Sandy spends some time raking the yard for a neighbor, goes with the family to watch her brother’s team lose at soccer, goes shopping for clothes, and by 11:00 p.m. is at her friend Sabrina’s house, drinking and “debating the real reason we are here on this planet.” Sandy then skips several signals; the next entry is not until 6:30 on Sunday evening:

It’s 6:30 now — last night at the party I left for a walk with two guys (some of my brother’s friends). We drove down to O’Hare Airport to walk around and do stuff. We got there around 1:00 in the morning. We were having fun, we went to the hotel across the street and we (Eric and me) lost Dennis. Dennis is the one who had the car keys. Anyway we were supposed to get back to my brother by 1:30. So Eric and I were looking around the airport, parking garage, and hotel for a long time. We went back to the car and broke in. Now it was 3:00 a.m. and I knew my parents and my brother must be going crazy by now, I had Eric call them. We then slept in the car. When the sun rose it woke me up. Eric and I did not mean to sleep at all. Eric then went and called my mom. He was supposed to call her at 4:00, and it was about 8:00. So my mom had all the cops out looking for us. My mom came out and got us, I got home by 9:30. I then had to go to church till 11:30, when I got home I slept till 6:00 p.m., then I ate, then I realized I had missed all these beeps, sorry. It was a crazy night.

The last entry for the weekend was made when the pager signaled at 10:00 that evening and Sandy was in the family room watching TV. Her thoughts were concerned with the possibility of catching mononucleosis from having slept so close to Eric in the car. She wrote:

I think I was never up this late before, my first all night out with a boy I did not even know, sleeping together all night, very drunk. I don’t know how to act. I think I like Eric a lot, he is 3rd in State gymnastics, and is smart, the only thing I worry about is that he parties too much. Too many drugs. I have never tried drugs.

So concludes a weekend in the life of a talented 14-year-old. Family drama, love, hate, alcohol, drugs, sex, sports, cops, break-in, getting lost in an international airport — all the ingredients of an exciting prime-time show. Certainly Sandy can’t complain of leading an uneventful life. But to what extent do such events (which were by no means rare in the daily rhythm of the adolescents we studied) interfere with the concentration necessary to develop the discipline that any talent eventually entails? This is the basic question our study was designed to answer. In Sandy’s case the answer is rather clear. Four years after this “crazy” weekend, she
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graduated from high school in the middle of the pack. She had stopped taking advanced classes in science long before, and her outlook for the future included an easy liberal arts college degree, marriage, and perhaps some fun part-time job. Her teachers thought she was performing far below her potential, that is, somewhat below average for her cohort. For many students this would not be by any means a bad accomplishment, but for Sandy it was a far cry from the exceptional promise she had shown at the end of grade school.

As anyone who keeps track of contemporary mores knows, the demands placed on Sandy's psychic energy were by no means unusual. In fact, perhaps a majority of adolescents by now live in circumstances that are even less conducive to the development of talent. At least Sandy came from a relatively affluent and intact family, was reared in a religious atmosphere, lived in a stimulating suburban community, and went to excellent schools. If she could not invest the energy necessary to develop her rare talent, how many other potentially gifted young people are giving up the opportunity to develop theirs?

The present volume is based on a 5-year longitudinal study that tried to answer the question: How do young people become committed to the development of their talent? Or, to take the mirror image of that question: Why do some young people become disengaged from their talent? We hoped that the results might help parents, teachers, and other interested individuals prevent the losses that the underutilization of rare skills entails. After all, unusual talent is a potential benefit for society as a whole; its loss is a loss for everyone.

But the goal of this volume is still broader. By focusing on talented youth, we do not wish to endorse an elitist view of education. We believe that all children are talented in one way or another, even though their gifts may not be ones formally recognized by teachers or school curricula. As Howard Gardner has convincingly argued, the dimensions of giftedness include body movement, empathy, visual acuity, and so forth. One could argue that any channel through which a mind communicates with the environment could develop into a talent, as long as the culture is willing to recognize and support the given skill. The point is that by studying a number of young people with recognized talents in such traditionally accepted fields as math, science, and music, we can learn much that will be useful to all children. The attrition of talent can be most easily studied
among the most talented; but what is learned there will be applicable to every child struggling to develop her or his potential, whatever its level.

**Motivation as the Key to the Development of Talent**

The studies that form the empirical underpinnings of this volume do not cover all possible aspects of the problem of disengagement from talent. Among the most obvious omissions is the cognitive dimension: We did not investigate the contribution of intellectual abilities. The study did not address whether students who continued to develop their talent had a greater facility with formal operations,\(^\text{16}\) peculiar hemispheric preferences,\(^\text{17}\) faster information processing or reaction times,\(^\text{18}\) or superior reasoning skills and intellectual styles.\(^\text{19}\)

There were two reasons for omission of the cognitive dimension. First, the great majority of scholars have focused on the question of how gifted and talented children differ from “average” children along cognitive lines. We were afraid to founder in the sea of ink devoted to this question. In comparison – and this is the second reason – little is known about the other dimensions that may interfere with the development of talent. We had good reason to suspect that among these, emotional and motivational issues may be as important as the purely cognitive ones, or more so. The reason so many talented young persons don’t become skilled scientists and artists – and that so many more with average endowments never learn to read and count – is not so much that they can’t cope with the intellectual challenges as that they simply don’t want to bother putting out the effort required to learn.\(^\text{20}\) The thesis of our work is in agreement with the conclusions of a recent report by the U.S. Department of Education, which claims that high academic achievers are not necessarily born “smarter” than others, but work harder and develop more self-discipline.

Thus the present study deals mainly with the question: What motivates some teenagers to continue in their area of talent while others drop out? It turns out, however, that this question is not a simple one. Motivation is in part a matter of personality: It involves habitual patterns of thought and action that develop over time and remain more or less stable. Thus to
answer the question we had first of all to look at the personality patterns that are characteristic of talented adolescents who become committed to their talent.

These traits are, in turn, related to how persons use their time and invest their psychic energy: Some teenagers as they grow older will spend less and less time studying and more time interacting with friends. Learning to invest attention in difficult tasks is indispensable to the development of any skill. Therefore another answer to our question about motivation directed us to investigate the patterns of activity and time use of talented teens.

The motivation of young people is also deeply bound up with the social environment in which they live. How much time and effort they will devote to study and practice depends in great part on the material and emotional support their parents are able to give. Even though many geniuses have been able to overcome disastrous early family circumstances, it is probable that many more would have flourished if their families had provided a more secure launching pad. How much parents value the development of talent and how supportive they are emotionally seem to be important factors in keeping youngsters focused on their talent. Rathunde has described the kind of family interaction that would best promote children's ability to concentrate their attention on demanding tasks; his conclusions are in line with the results of other researchers in the area.

Later in life, schools also have a great effect on the motivation of students. Occasionally an entire school seems able to arouse in its students a great enthusiasm for learning – for instance, the Bronx High School of Science or the Lutheran and the Model high schools in Budapest, where so many of the great mathematicians and physicists of the first half of this century first became interested in science. Most students who become interested in an academic subject do so because they have met a teacher who was able to pique their interest. Therefore to answer the question of what motivates teenagers' continuing development of those skills that make the growth of their talent possible, we had also to consider families and schools.

But knowing about personality, habits, and families and schools is still not enough to understand motivation. Whether a teenager will want to devote a great deal of time to studying chemistry or music depends also
on the quality of the experience he or she derives from working in the lab or practicing an instrument. The sum of momentary experiences adds up either to enjoyment or to boredom and anxiety; which of these prevails will to a large extent decide a young person's future involvement.

On this score the testimony of individuals who have successfully developed their talent is clear: The main reason they do what they do is that they enjoy it. In 1934 Schlick pointed out how important enjoyment is in sustaining the activity of scientists. Galileo Galilei, one of the first true modern scientists and still considered one of the greatest, used to comment on the fun he was having in setting up his experiments – and this at a time when fun was taken much less seriously than it is now. Similarly, when asked why all through his life he kept experimenting with the measurement of the speed of light, Albert Michelson, who was the first American to win a Nobel Prize in science, is said to have answered, “It was so much fun.” A Nobel laureate closer to us in time, Francis H. C. Crick, codiscoverer of the double helix, along with other scientists and artists interviewed in a recent study, rated “enjoyment of work” as the characteristic most responsible for his success – ahead of 32 other traits, such as creativity, competence, and breadth of knowledge. Skilled athletes, artists, artisans, and scientists tend to describe the use of their talents as highly enjoyable.

All this talk about enjoyment and fun can be misleading, however. It gives the impression that talented people go from one high to the next, immersed in a constant stream of pleasurable experiences. Actually, almost the opposite seems to be the case. What characterizes people who use their skills to the utmost is that they enjoy the hardships and the challenges of their task. It is not that they are more likely to encounter pleasant experiences but that they persevere when they meet difficulties that would daunt others and occasionally succeed in turning experiences that others find meaningless or threatening into highly enjoyable ones. How is this skill that helps in developing talent acquired? It is one of the goals of this volume to answer that question.

In the last few years, several scholars have become interested in how intrinsic rewards help motivate gifted children to stay involved in their work. The studies of Deci and Ryan and Amabile have been especially influential in demonstrating that when people enjoy a given activity and are not distracted by external considerations, they will keep
doing it longer and will approach it more creatively than if the same activity were extrinsically rewarded and not under the person's control. Other scholars have been investigating the role of interest in learning — how personal interest in a subject facilitates the recall and cognitive organization of information; how interest helps involvement in science and mathematics; and how it helps scholastic achievement, especially in the sciences.

It would seem obvious that educators concerned with the cultivation of talent would make it a priority to fuel students' interest in learning and help them discover learning's intrinsic rewards. Unfortunately, this is not the case. The priority among most teachers seems to be to cover as much information as possible without regard to whether the students are becoming interested in learning. For instance, getting students interested in mathematics is one of the least important goals of math teachers — compared with such important objectives as "learning mathematical facts and principles and . . . develop[ing] a systematic approach to problem solving." These are surely worthy goals, but how are they to be achieved if the students are not motivated to learn? Not surprisingly, the proportion of students nationwide who say they are interested in mathematics also decreases with each grade level. Despite our relatively heavy investment in education as a nation, we still do not seem to realize that teaching which does not consider the students' priorities is useless. It is wasteful to teach someone who is not interested and so is not motivated.

One of the reasons motivational issues are rather low on the formal educational agenda is that in the past few decades cognitive psychologists have applied the computer analogy of information processing to human learning a bit too easily. The computer will store and use any information programmed into it, providing the plug is in the wall and the right system is booted up. Hence the main issue concerning computer programs is how clear and rational they are. Pursuing the analogy between computers and the human brain, the same considerations of clarity and rationality have become the main goals of educators designing school curricula and instruction. But the analogy misses the fact that students, as distinct from computers, will not process information presented to them unless they are motivated to do so. It is not enough for the information to be clear and rational; it also has to be interesting. Learning has to be engaging and rewarding for students to learn.
Despite the general tendency to ignore motivational factors at the expense of more purely cognitive dimensions, there is enough evidence to show that certain motivational states interfere with learning. Two adverse conditions are especially dangerous: anxiety and boredom. Anxiety occurs primarily when teachers expect too much from students;\(^1\) boredom occurs when teachers expect too little.\(^2\) When curricular expectations are out of sync with students’ abilities, not only does motivation decrease, but also achievement.\(^3\)

Because we still do not have a very clear idea of how interest and motivation help children become involved in sustained learning, this volume will focus primarily on that aspect of the development of talent. The studies we conducted differ from previous research in this area in that they focus on the ongoing experience of students involved with the development of their talent over the 4 years of high school. We wanted to get a better idea about what happens in the minds of talented teenagers when they are studying — what they think about, how they feel, how much they want to do what they are doing — and whether the quality of their experience predicts the level of their commitment to talent 4 years later, at the end of high school.

THE CONCEPT OF PSYCHIC COMPLEXITY

We were able to measure ongoing experience systematically through the use of the Experience Sampling Method (ESM), a technique developed in our laboratory for the purpose of obtaining accurate measures of thoughts, activities, and mental states.\(^4\) Persons who participate in ESM studies wear an electronic pager and carry a booklet of self-report forms for a week. Each day, at randomly chosen moments, signals activate the pagers, and the respondents then fill out a page of the self-report booklet, describing their behavior and subjective state in minute detail — just as Sandy did over the weekend we summarized earlier in this chapter. In the present study, over 7,000 such self-reports were made, providing a dynamic record of changing moods and motivations.

This effort to develop a systematic phenomenology makes it possible to get a closer view of the subjective events that are important in determining whether or not a teenager will want to continue pursuing a particular