third law states that the squares of the periodic times are to each other as the cubes of the mean distances. Incidentally, Newton's theory of gravitation grew out of Kepler's third law and not a falling apple, as suggested by myth.

Bridge Across Disciplines

The numerous examples of truly eminent thinkers given above represent a unique sample of individuals who made remarkable contributions to theology, science, and mathematics, and who also happened to be astronomers, theologians, and scientists. These individuals are best characterized as *polymaths*. The current tension between the disciplines that came out of the Renaissance, namely natural philosophy–art–alchemy (metallurgy/chemistry) theology during the post Renaissance continues today in the modern-day antipathy between the ever-increasing numbers of subdisciplines within the arts, science, mathematics, and philosophy. Many of the thinking processes of astronomers who unified numerous disciplines are commonly invoked by artists, scientists, mathematicians, and philosophers in their craft, albeit the end products are invariably different. These disciplines explore our world for new knowledge. Literature is an excellent medium for gifted students to study to understand the frequent shifts in perspective that occurred in the development of astronomy. Motion paradoxes can easily be investigated by exploring geometry and spherical geometry motivated by problems in astronomy and art. After all, art suggests new possibilities and pushes the limits of our imagination, whereas science verifies the actual limitations of these possibilities using mathematics. Both are driven by the need to understand reality, with philosophy and theology often serving as the underlying framework linking the three. Models and theory building in astronomy lie at the intersection of art–science–mathematics. The history of model building in science, particularly astronomy, conveys *epistemological* awareness of domain limitations. The study of astronomy creates natural bridges across disciplines in the humanities, science, mathematics, and art. Some of the research literature in gifted education indicates that the study of astronomy is ideal for bright students who prefer independent, self-directed, or autonomous learning involving extended projects that lead to advanced concepts and that are interdisciplinary in nature. By building bridges between disciplines today, the greatest benefactors are the potential innovators of tomorrow.

Bharath Sriraman

See also Eminence; Imagination; Multiple Intelligences; Polymaths; Visualization

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Asynchrony

Giftedness is not mere precocity—getting "there" sooner. There is some evidence suggesting a qualitative difference in the inner experience and awareness of the gifted. A young child with the emotional development of his or her age peers but with advanced cognitive awareness of the perils in

the world can sometimes feel helpless and afraid. It is known that developmental discrepancies can create vulnerability: We recognize the vulnerability in the experience of having a 17-year-old body and a 9-year-old mind. Yet to be grasped, however, is the magnitude of the challenge of a child who has a 17-year-old mind trapped in the body of a 9-year-old. Societal support is offered to families of children with developmental delays, but those whose minds are many years ahead of their bodies typically do not arouse much sympathy.

Asynchrony literally means being out-of-sync. The gifted are out-of-sync both internally and externally. The clearest example of this unevenness is the rate at which mental development outstrips physical development. Studying young gifted children, Wendy Roedell observed that rather than demonstrating high abilities in all areas, they had peaks of extraordinary performance as well as valleys. Their intellectual development usually surpassed the development of their physical development and social skills. They were likely to excel only in those physical tasks that involved cognitive organization.

Background

Asynchrony is a relatively new way of looking at giftedness, but it has deep historical roots. Leta Stetter Hollingworth, the foremother of gifted education, viewed giftedness as a set of complex psychological issues arising out of the disparities between children's mental and chronological ages. She established that the farther removed the child is from average in intelligence, the more pressing the adjustment problems become. Many contemporary researchers have documented that adjustment difficulties increase with IQ.

Hollingworth suggested that to have the intelligence of an adult and the emotions of a child combined in a child's body is to encounter certain difficulties. She stated that the younger the child, the greater the difficulties, and that the years between 4 and 9 are probably the most likely to be beset with problems.

Giftedness as asynchrony highlights the internal experience of the gifted, their vulnerability, the difficulties that increase with IQ, and the important role of parents, teachers, and counselors in gifted children's optimal development. The practitioners and parents who gathered to construct this new vision were deeply concerned with the emphasis on products, performance, and achievement in modern conceptions of the gifted and talented. The construct of giftedness as asynchrony builds upon the child-centered insights of Leta Hollingworth, Lev Vygotsky, Kazimierz Dabrowski, Jean-Charles Terrassier, and Annemarie Roeper. The concept of asynchrony was developed in 1991 by the Columbus Group, which created the following position statement:

> Giftedness is *asynchronous development* in which advanced cognitive abilities and heightened intensity combine to create inner experiences and awareness that are qualitatively different from the norm. This asynchrony increases with higher intellectual capacity. The uniqueness of the gifted renders them particularly vulnerable and requires modifications in parenting, teaching, and counseling in order for them to develop optimally.

Mental Age Versus Chronological Age

Alfred Binet constructed *mental age* as a means of capturing the degree to which a child's mental abilities differ from those of other children his or her chronological age. The concept of mental age has been enormously helpful in our understanding of the discrepancies in children with developmental disabilities. Mental age predicts the amount of knowledge mastered, rate of learning, sophistication of play, age of true peers, maturity of the child's sense of humor, ethical judgment, and awareness of the world. In contrast, chronological age predicts height, physical coordination, handwriting speed, emotional needs, and social skills, according to Linda Kreger Silverman. Although unpopular for several decades, mental age is beginning to make a comeback in the testing industry. "Test ages" are reported for subtest scales on the *Wechsler Intelligence Scale for Children, Fourth Edition* (WISC–IV). The test publisher is currently working on extended WISC–IV norms that will extend the maximum IQ and index scores up to 210 points. Rasch-ratio IQ scores can be derived on the *Stanford-Binet Intelligence Scale, Fifth Edition* (SB5), based on the disparity between the child's test age (mental age) and chronological age, and an extended norm table generates scores up to

225, as explained by G. H. Roid. Extended norms on both scales allow a better picture of the degree of asynchrony in highly, exceptionally, and profoundly gifted children.

The intelligence quotient is simply the ratio of mental age to chronological age multiplied by 100. Binet viewed intelligence as a rich, complex, multifaceted Gestalt—a myriad of dynamically interrelated abilities, including emotion and personality. He believed that intelligence is highly influenced by the environment, and can be improved through appropriate instruction. From Binet's developmental perspective, intelligence is a continuously evolving process, not a static amount of raw material that stays the same throughout life. Consistent with Binet's philosophy, the IQ should be seen as a *minimal estimate of asynchrony*—the extent to which cognitive development (mental age) diverges from physical development (chronological age).

Asynchrony cannot be thought of as static; it is dynamic, constantly changing. At age 6, a moderately gifted child with an IQ of 135 has a 6-year-old body and an 8-year-old mind; at 9, the child has a 9-year-old body and a 12-year-old mind; at age 12, the child will be mentally 16. By comparison, an exceptionally gifted 6-year-old, with an IQ of 170, has a 10-year-old mind; at 9, the child has a 15-year-old mind; and at 12, a 20-year-old mind. The situation becomes even more complicated when it is understood that psychologically the child is an amalgam of many developmental ages and may appear to be different ages in different situations. Uneven development is mirrored in external adjustment difficulties because the gifted child often feels different from, or out of place with, others. External asynchrony is the lack of fit with other same-aged children and with the age-related expectations of the culture. The greater the degree to which cognitive development outstrips physical development, the more out-of-sync the child feels internally, in social relations, and in relation to the school curriculum. Age is not an appropriate ruler for either a gifted child's social or academic needs: Degree of asynchrony must also be taken into account.

Implications

Defining giftedness as asynchrony enables twice-exceptional children and underachievers to be recognized as gifted. The most asynchronous children are those who are both gifted and learning disabled. Silverman, a psychologist specializing in asynchrony, has noted a remarkable number of gifted children who have learning disabilities, such as central auditory processing disorder, sensory processing disorder, Asperger's syndrome, writing disabilities, visual perception weaknesses, spatial disorientation, dyslexia, and attention deficit hyperactivity disorder. Giftedness masks disabilities and disabilities depress IQ scores, so that the child may appear average. Asynchrony can be seen in the scatter of subtest scores on IQ tests. Twice-exceptional children tend to obtain high scores in subtests richly loaded in abstract reasoning and to demonstrate significant weaknesses in subtests measuring processing speed and working memory. Underachievers often have extraordinary visual–spatial strengths, combined with auditory–sequential weaknesses in reading, writing, spelling, and calculation that prevent them from being identified for gifted programs. Many underachievers are actually twice exceptional.

The gifted not only think differently from their peers, they also feel differently. Asynchrony implies greater complexity. Complexity affects all aspects of one's development throughout the life span. Kazimierz Dabrowski and Michael Piechowski observed five realms of heightened intensity and complexity: psychomotor, sensual, imaginational, intellectual, and emotional. Neural activity substantially beyond the norm in any of these five dimensions is called *overexcitability* and represents an abundance of physical, aesthetic, creative, intellectual, or emotional energy.

Vygotsky elucidated the inextricable relationship between cognition and emotion. Children respond emotionally to information they receive cognitively, and this inner awareness has an impact on the course of their development. John Gowan likened precocious cognitive awareness to premature rupturing of the protective placental shell during the prenatal period. Too-early exposure to environmental realities can be as precarious in postuterine as in prenatal development. Gifted children need child-centered parents, teachers, and counselors who are willing to listen to them and understand them, who appreciate their fragility, and who are not trying to mold them to fit better into society or to produce more.

The idea of asynchrony was partially derived from the experiences of parents who made statements such as the following:

> We were told that at age 9 he displayed "cognitive reasoning skills way beyond his years.... I wish he came with a blinking sign on his forehead to let me know just who I am dealing with: the 3-year-old, the 14-year-old, or the 25-year-old. It's the tension of being caught between all those ages I just mentioned....I live by it every day in order to give some organized definition to what's going on." (Estes, cited in Kearney, 1992, pp. 1, 8)

This perspective is very useful in attempting to gain support for the gifted. It bypasses the perennial concern about elitism. Most other definitions equate giftedness with high achievement; therefore, special programs often sound like more advantages for an already-advantaged group. Since asynchrony is not a competitive concept, it is less likely to invite envy. More asynchrony is not better. Giftedness becomes atypical development—a set of qualitative differences that need to be addressed at home and at school. It occurs in all cultures, all ethnic groups, and all socioeconomic levels. Whereas giftedness as the potential for recognized achievement is gender-biased, giftedness defined as asynchrony is gender-fair.

Asynchrony is gaining in popularity because it offers a pathway to understanding the inner experience of the gifted child. It reminds us that gifted children are vulnerable and at risk, and that we are obliged to respond to their differences with supportive parenting, teaching, and counseling.

Linda Kreger Silverman

See also Academic Self-Concept; Guidance; Personality and Intelligence

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Athletic Giftedness

Athletes who are exceptionally talented evoke discussion about factors that contribute to athletic success. Athletes such as Michael Jordan, Tiger Woods, and Mia Hamm go down in history books as extraordinary talents. Understanding what helps world-class athletes succeed is the first step in knowing how to identify gifted athletes and promote the development of athletic talent. Athletic giftedness results in success at the highest level of competition through a combination of natural physical attributes, a serious dedication to training,