

Gyarmathy E. (2014) The talent's netting way of thinking. *Gifted Educational International Online*. 2 December. 1-17

Gyarmathy E. (2016) The talent's netting way of thinking. *Gifted Educational International*. May 32, pp. 48-164 <http://gei.sagepub.com/content/32/2.toc>

Éva Gyarmathy

Institute of Cognitive Neuroscience and Psychology of the Research Centre for Natural Sciences,  
Hungarian Academy of Sciences

## The talent's netting way of thinking<sup>1</sup>

### Abstract

*In the 21st century, gifted education and talent support, just as many other earlier values and solutions, is undergoing reassessment. In the age of rapidly changing values, the way to keep provision up-to-date is through the continual rethinking, reviewing and challenging the concept of giftedness and talent.*

*The perception and our understanding of what is described as 'talent' is a social product, that is, it is culture-dependent, but it does have some basic characteristics which are universal and which help us understand what is meant by the nomenclature 'talent' both in the past and the present. However, talent is not a homogeneous concept, even though it is often depicted as such in talent support, scientific studies of talent and talent models alike. Talents with different development histories have different needs and the environment necessary for development can differ substantially by age and talent forms. Consequently, provision should not be homogeneous, either.*

*In the present study, through a rethinking of the talent concept, I aim to propose an approach which favours network-based functioning, an approach better suited for use in today's culture.*

Keywords: talent, concept of giftedness, identification methods, types of giftedness

### Talent groups

Talent is a generic umbrella term. Talented individuals differ from each other and from everyone else along an immense number of variables, like abilities, interest, needs. Therefore, different dimensions of heterogeneity need to be taken into account beside the key common characteristics in talent provision and popular understanding of the concept of Talent.

The scientific study of talent which flourished in the 20th century was hampered by two basic problems:

1. Due to the heterogeneity of the talent concept, it is far from obvious whether different studies are actually about the same phenomenon.

We can identify differences of definition and description in historical approaches. The geniuses described by Lombroso (1891) were physically disabled, and could be considered neurologically and mentally at best unstable, while in the study of Terman (1926), only a few decades later, geniuses not only had outstanding intelligence, but were also strong and healthy, as well as highly mature from a social and even moral point of view. It is impossible to believe that the two studies

---

1 Supported by the Literacy Project (7th Framework programme, Nr. 288596).

are about the same population without entertaining a suspicion of some serious error. Later we come back to this point.

2. The experimental scientific approach to talent, and generally any study of talent that focuses on assessments, is unable to handle multiple aspects of talent.

The studies carried out under controlled conditions in the laboratory of Sir Francis Galton and later his followers revealed several important aspects of talent (Galton, 1869). These very same conditions, however, made the study of several other important aspects of talent impossible.

A quantitative definition of talent as used by Galton fails to provide an explanation for a number of phenomena without a description of the thinking processes and an understanding of the qualitative characteristics inherent in the development and functioning of talent.

The first problem, therefore, is an approach that significantly reduces the efficiency of talent provision, namely, one that is about "talent" in general and according to which talent provision is designed for the "talented" in general. This problem is in some way similar to cancer research. Hundreds of billions of dollars have been and are still consumed by studies in which researchers are seeking a cure for malignant tumours or in the case of mental health research, seeking to match 'cause and effect' and cure mental health issues. However, the more medicine knows about tumours, the more certain it appears to be that there will not and cannot be any generic cure for cancer which is able to cure each and every tumour. In a similar vein, it is impossible to provide for "talent". Talent is heterogeneous, and so should its provision be.

By today, talent support has started to reach the level where, similar to cancer research, it has abandoned universal solutions and, based upon the accumulated knowledge, looks upon the issue in a more differentiated way. So what remains is for us to put this into practice.

Research and practice alike reveal that there are well-discernible groups of talents and that these require different provision for their development. Talents linked to specific areas of ability and interest must receive area-specific provision, but over and above that, there are also talent groups which can be set apart on the basis of other criteria and who differ substantially in their developmental characteristics. The development of a child prodigy is very different from the development of a late-blossomer talent and both differ from a harmonically evolving talent. A gifted child with specific learning difficulties or highly able persons with autism show very different developmental patterns.

We generally think of a differentiation in terms of ability levels, and talk about talents, outstanding talents and geniuses. This is also a valid approach, but it is not a substitute for taking the difference in the development and needs of these talent groups into consideration. An outstanding talent for example in Hockey or Economic Analysis may mask other talents worthy of support and development. There will be students who with double exceptionality have multiple talents and double exceptionality which will present complex, and multi-agency, solutions.

Confucius (552-479 BC) classified outstanding individuals as follows (Harsányi, 1994, p. 18):

- the dull, who gain knowledge by overcoming difficulties through the devotion of great effort,
- the mediocre, who primarily gain knowledge through learning,
- the intelligent, who are born with knowledge, and
- those with marvellous abilities who can outstrip ten thousand others.

This classification has reached us through the intervention of several translation steps. Just as there is still a debate about whom we call talented, it is not evident whom Confucius called 'outstanding'. If we believe our sources, Confucius lists "dull" and "mediocre" individuals even

among the outstanding. One clear conclusion can be drawn that from the categories offered by Confucius indicated in his categorization that there are at least four kinds of groupings leading to high achievements.

In the 19th century, Sir Francis Galton (1869) characterised the level of talent with its prevalence. On his statistical view, outstanding individuals are those who represent a small percentage of the population. In his examples, judges and bishops reached the level that only one in four thousand could, geniuses were one in a million.

Lombroso (1864) chose fine descriptions as the basis for the distinctions. He believed that talents are conscious, and know why and how they can arrive at certain principles and conclusions, while geniuses are unconscious, and are unaware of the "why" and "how". The higher the mental ability, the higher the sensitivity, as well.

These two outstanding thinkers of the 19th century captured all that science has since worked out by today: that some forms of talent are more frequent, while others are more rare, and these forms exhibit different, complex and interwoven mental and emotional functioning. As a result of this complexity, they also have different needs. What is worth making a note of at least is that in order to ensure suitable provision, we need to know the differences in the manifestations and particular needs of talent.

### **Talent forms based on statistics**

When talking about talent provision, we are not thinking about an elite, but wide layers of the population. Renzulli (1986) characterised 20-25% percent of the population as the "talent pool", while Gagné (1999) labelled 10-15% of the population as gifted on the basis of their ability. If we accept these ratios, we can see that at least 4-7 children in each kindergarten or school class will enter the talent pool.

If, for the sake of simplicity, we only consider intellectual abilities at present, then this roughly means an intelligence quotient of 110-130, the above-average individuals. These children have the potential to become talents such as Albert Einstein, Marie Curie, or outstandingly achieving individuals who manifest themselves in some other way. Their development is not promoted by singling them out and isolating them. All the more so because at this level, a potential for the development of talent is not clear-cut, and the identification of talent itself is certainly not feasible, so serious mistakes can be made (Ziegler, Stoeger, 2004; Freeman, 2006).

The next, higher level of ability, however, involves a qualitative difference. Hollingworth (1926) calls the intelligence quotient range 125-160 as the "socially optimal intelligence". In her studies, she found that these children are balanced, assertive and are able to build up a good social situation for themselves.

They can be the "ideal talents", that is, the individuals who are easiest to identify by virtue of their outstanding performance and relative pliability. This is the talent Terman (1926) targeted with his IQ-based study at Stanford University. 5-7 % of the population falls into this category, which indicates 1-2 such children in a school class.

The integration of children with an intelligence quotient above 160-180 is, however, greatly hampered by the inordinate difference in their thinking in comparison to the intellectual capacity of their environment (Hollingworth, 1942).

This problem is strongest at the age of 4-9 (Hollingworth, 1931). These are the exceptional or outstanding talents and their unconventional way of thinking, attitude and reactions can be the source of much misery to them in a social environment. Outstanding talents comprise not more than 1% of the population, but are of immense significance. At this level of ability, talent is

unquestionable, but what is questionable is whether and how the individual can turn it into achievement.

This outstandingly talented population can be classified as special talents due to its special situation, and differs significantly in its provision from the populations at the other two levels of talent and ability.

It is primarily this population that Lombroso writes about in his studies. He writes about geniuses who struggle with bigger difficulties than the other two groups as regards integration. Beside these outstanding talents, Lombroso also describes another group of talents at a disadvantage with respect to integration, namely, multiple exceptional talents.

Multiple exceptional talents, or put perhaps more suitably, talents in a special situation, are those who have to cope with some special situation or condition over and above talent.

Talents have an exceptional attitude and personality, which is an exceptionality in itself and thus gives rise to what can be regarded as a minority situation. This may be coupled with other exceptionalities of different natures combined in many cases with lack of opportunity or exposure to pathways to realise a talent or potential in a talent areas, such as

1. socio-cultural situation,
2. ethnic-minority situation,
3. neurological differences,
4. behavioural and emotional exceptionalities,
5. sensory-kinaesthetic differences.

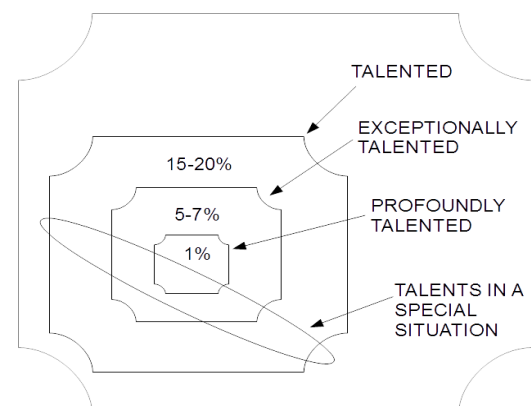
All of these exceptionalities can also be regarded as a minority situation, and due to the difficulties in the integration to the society of the majority, they often lead to disorders and difficulties, giving rise to

- socio-cultural disadvantage,
- ethnic-minority situation,
- neurologically-based achievement disorders, most frequently with a diagnosis of learning difficulties, dyslexia, dyscalculia or dysgraphia,
- behavioural and emotional disorders, most frequently with a diagnosis of attention deficit, hyperactivity disorder, autism or Asperger's syndrome,
- sensory-kinaesthetic disorders, most frequently with a diagnosis of blindness, visual impairment, deafness, or reduced mobility.

Multiple exceptionality therefore stems from the special situation of these individuals, who can thus be referred to with the working expression talents in a special situation.

*Figure 1 Talent groups and their estimated ratio in the population*

*In a wide talent pool, we can establish ability levels which make the manifestation of talent more probable. At the same time, there are some factors which give rise to special situations and cases in talent development. We are unfamiliar with the size of this latter talent population.*



Irrespective of the strength of the talent aspect, we can find individuals at all levels who start out from an atypical position owing to their special situation. The position of outstanding talents is exceptional even within the talent population, because their way of thinking and reactions radically differ from that characteristic of what may be described as regular talents. They usually get labelled as having behavioural and emotional disorders in areas where institutions and existing expertise can be brought in to 'treat' such children and thus often become talents in a special situation in a similar way to people classified historically as 'lunatics', being recognised as having mental health issues rather than learning needs.

Professionals working with talent and giftedness describe the manifestations of talent in different ways and different ratios, but groups of talents with different needs are discussed in the literature.

Gross (1993) was one of the authors to call attention to the difference in the needs of children with an IQ between 130 and 180, which should be taken into account in designing their provision. She gave the following classification of outstanding individuals based on the level of their intelligence quotient:

- moderately gifted 130-144
- highly gifted 145-159
- exceptionally gifted 160-179
- profoundly gifted 180+

The four categories bear an uncanny resemblance to the categories of Confucius, as if these were the 20th century psychometric projections thereof. As such, it is also apparent that the use of ratios and numbers in capturing degrees of talent provide much less information about its development than the perhaps wiser, ancient designations.

Gagné (2000), also following the Galtonian statistical tradition, regards an individual as outstanding if, with reference to the normal curve of natural abilities, the individual is among the top 10% of his or her age peers in the domain of the relevant ability or activity. The top 1% are moderately, the top 0,1% highly, the top 0,01% exceptionally, and the top 0,001% are extremely gifted or talented in his classification. This classification seems compatible with the system of Gross based on the intelligence quotient, although Gross spoke of intelligence level rather than giftedness and talent.

If we think in terms of Gagné's system, the total number of talents can exceed 10% of the population, since even though overlaps are possible, it is mostly not the same individuals who are talents in different domains. For example, the individuals who make it into the top 10% in the domain of musical abilities are not identical to those in the domain of language abilities, and so in total we may arrive at Renzulli's 20-25% as an estimate for the talent pool.

### **The basic attitude of talents**

Notwithstanding the heterogeneity of talent, a common basis thereof can be identified: an attitude combining sensitivity, obsession, effectiveness and productivity, which many authors have described, but which is always worth re-examining.

*„There is no great genius without some touch of madness.“ – Seneca*

The question asked by talent is not *"Can it be achieved?"*, but *"How can it be achieved?"*. This attitude unites the internal drive, which is responsible for motivation and supplies the energy for the efficient activity, and creativity, which seeks out options and alternatives. This attitude can be manifest in diverse domains, and so even *a modest* degree of above-average ability can be sufficient for outstanding performance. This is what Renzulli's (1978) by now classical three-circle

model is about, but it is also illustrated by a number of outstanding achievements and their originators.

In his book Ben Mezrich (2009) a former friend and colleague of Mark Zuckerberg the social network founder, formulated the following statement in connection with Zuckerberg, a man who became a billionaire at a young age, and who hacked into the information database of the university when creating Facemash, a system that can be regarded as a forerunner of Facebook:

*"Kind of an extension of the hacker's creed: if there's a wall, you find a way to knock it down or crawl over it. If there's a fence, you cut your way through. The people who built the walls, the "establishment" - they are the bad guys. The kid is the good guy, fighting the good fight. Information is meant to be shared. Pictures are meant to be looked at."* (Mezrich, 2010, chapter 6)

The components of talent are intimately intertwined. While Renzulli' (1978) three-circle model diagram and the text itself treat the components of talent separately, these components are clearly connected and fused inseparably. Perhaps the best way to visualize the components would be as a ball made up of several smaller parts, twisting and twirling. For the sake of analysis, human thinking picks and highlights its components and isolates pieces and characteristics.

Science, true to its paradigm, studies talent and its components through an approach of categorization, and gathers information for use in practice this way. In gifted education and talent provision, however, the categories themselves are no longer valid, it is only the information that can be utilized. There are merely situations in which the processes described as lying behind the oft-described characteristics are set off and lead to effective and productive activities.

### **The vectors of the talent force**

Abilities, creativity and motivation can be studied in isolation, but they are not pertinent without each other. In what follows, I will establish the inseparability of these relations in development.

The ABILITY-CREATIVITY vector: Creativity forms an organic unit with its subject at which it is directed.

Creativity is not simply fantasy at work, but the joint manifestation of logic, learning, knowledge and fantasy (Landau, 1974). Knowledge in itself is not sufficient beyond some point in the creative process, which is the point where fantasy sets in, seeking, and in fortunate cases finding, new solutions. After that point, once again, methodical knowledge is needed; that is, working it out is what will make a new piece of knowledge usable.

A model set up quite some time ago now to understand the relationship between intelligence and creativity is the so-called "threshold" conception. A moderate correlation has been found between intelligence and creativity up to an IQ-level of about 120, but above this point, neither the intelligence quotient, nor academic results can predict the degree of creativity (MacKinnon, 1962).

According to McNemar (1964), should the most intelligent 1-5% be selected as the talent population, then quite a sizeable percentage of creative individuals would fail to make it into the group. In other words, high IQ is no guarantee for creativity, though low IQ, in turn, leaves no possibility for it.

The CREATIVITY-MOTIVATION vector: Research from very different domains show that creativity also has an immensely large motivational content.

Many years of empirical investigation proved that extrinsic motivation reduces creativity, and the intrinsic motivation is conducive (Amabile, 1985).

Questionnaires targeting creativity often identify motivated children (Gyarmathy, 2007). According to Barrett and Morgan (1995), the 'mastery' motivation is multidimensional and self-rewarding, and incites the individual to persevere in situations presenting at least a minor degree of challenge in which skills need to be mastered and tasks need to be solved. The two chief components of the mastery motivation are:

1. the instrumental component, and
2. the expressive or affective component.

The instrumental aspect may be manifest in cognitive tasks, social relations and motor activities.

The strong connection between creativity and mastery motivation is indicated by the fact that in the study of the creative climate by Péter-Szarka Szilvia (2012a,b), mastery motivation was a much better predictor of the effect of the creative climate than creativity test results.

Talents have a very strong mastery motivation, a power to achieve, a power to create, the creative power.

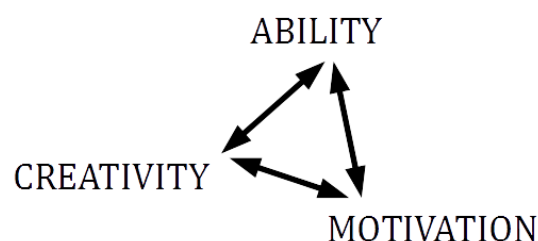
The MOTIVATION-ABILITY vector: Ability development is engendered by persevering action, which is in turn sustained by interest, and learning-directed energy.

Most talent models, like the classical model from Renzulli' (1978) or Tannenbaum (1986) describe intelligence and motivation as two separate components of talent, even though they are not independent of each other. The force and the direction of effort depends on the level an individual is capable of achieving in the particular domain.

Ericsson and colleagues (1993) showed in most diverse domains that outstanding achievement requires at least ten years' grounding and exercise. They did not find a single case in which someone reached the top without exerting effort. It seems that what distinguishes outstanding individuals from others is that they work much harder. According to their results the difference between those who achieve remarkably and those who achieve merely well lies primarily in the amount of time dedicated to practice.

Gladwell (2008) found that the foremost deciding factor is for our work to completely fill our personality and cause us pleasure. People are highly motivated to carry out sensible work, talented people even more strongly so. Sensible work is interesting for the individual, it is complex and provides autonomy. We can call this the optimal challenge and we arrive at the sense of flow as described by Csikszentmihályi (1990).

*Figure 2 The attitude characteristic of talent is not simply the result of three characteristics, but the interplay of three vectors, three directions of force.*



Productivity can be described as an energy field which incorporates creative energy, motivational strength and mental efficiency, thereby making achievement possible. Each factor is connected with the others, and the whole thus forms an organic unit. Additionally, this organic form operates

through the utilization of the environmental factors.

### **Task makes talent**

The slogan, "*I don't care if it's impossible*" intrinsically unifies the mastery-directed internal drive, the search for solutions and the knowledge necessary for it. All of this is steered towards creative directions by the challenges the individual encounters. The optimal degree of challenge is highly person-dependent, but is definitely a necessary condition of development. Challenges determine the direction of talent development:

- The internal drive finds itself a subject and grows into interest.
- The optimal level of difficulty presented by the task and the search for solutions provide an opportunity for further development.

*The Beatles would play in a small local club in Hamburg for years as a minor, unknown and underpaid band under rather poor circumstances. They played and thereby practised and thereby improved more and more, and so received more and more invitations to play and started becoming successful. Soon, they would be playing eight hours each night every day of the week. By the time they hit the international stage, they had given over 1200 concerts. Today's bands never play as much put together during their career (Gladwell, 2008).*

The Beatles used their initial bad streak to practise. They were motivated by a complex set of needs and imperatives. It is often such forced situations that present the individual with opportunities. If you have to work overtime to make a living, it will detract the time from your development, and you will not have enough time left to practise. Where the outstanding differ is that they turn everything to the benefit of their development. Even working overtime.

The productivity at work in a talent will surface whatever it takes, because the tension inherent in the internal drive makes it impossible for a gifted individual to while away the time doing nothing. Mastery motivation, creative power, however we describe it and from whichever way we approach it, strives for and seeks activity. Once it finds its subject, the challenges it is faced with will broaden its domain.

The leading talent models capture all this in different ways, but we often lose sight of the simple details and confuse different concepts exactly because of scientific accuracy.

The model of Gagné (2000; 2003) makes a distinction between giftedness as a potential and talent that is actually realized. He makes several attempts to bring order to the chaos prevalent in the relevant literature.

The issue he raises is that the term „giftedness“ is most frequently used to denote high cognitive abilities, while the word „talent“ is used to refer to other forms of giftedness (such as those in the domain of sports or art). In other cases, „giftedness“ and „talent“ signify potential and realized talent, respectively. Gagné himself favours this latter usage.

Gagné, in his "Differentiated Model of Giftedness and Talent" eventually applies the term „giftedness“ to those superior natural abilities which put the individual into the top 10% of the relevant age group in at least one domain of abilities. He uses the term „talent“, in turn, for individuals who make it into the top 10% of the relevant age group by virtue of systematically developed skills and activities. A considerable number of factors mediate superior ability during this development.

It is obvious that the 10% of gifted and the 10% of talented won't be the same population, as the



catalysing factors designate the development. Similarly obvious that the '10%' is just an arbitrary statistical statement. There are far more gifted persons by nature, and a network of the necessary inner and external factors affect the development. Optimal task and challenge is a key.

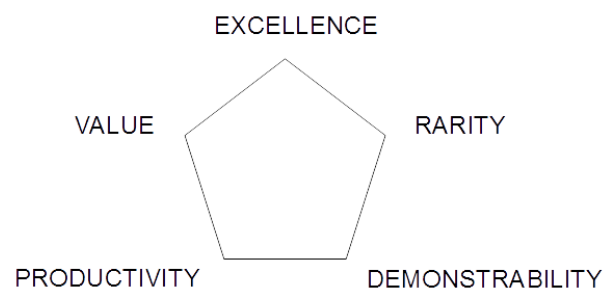
Practice shows that talent manifests itself and environment takes notice of talent in situations in which the degree of challenge is exactly right to set off productivity. An excellent example is the primary school in Hejőkertes, Hungary.

This school at first examination does not appear to be a stronghold of talent with 70% of its students having multiple disadvantages and/or special education needs, and so indeed the craze for talent identification missed it entirely. Even so, through the use of optimal tasks, the school as a whole achieves better results than comparable populations, and talents have automatically surfaced and continue to reap successes (Kovácsné, 2000; 2005; 2007).

Problems are often caused by the failure of the social environment to provide a suitable challenge for the internal drive, as a result of which productivity will find ways in undesirable, perhaps downright antisocial directions, rather than toward realising talent. The result may be empty, obsessive and/or destructive activities. These do not conform to the "value criterion" of giftedness set down by Sternberg (1993), although productivity may be apparent even in criminality.

*Figure 3 The pentagonal model of Sternberg (1993)*

*Sternberg described the criteria of giftedness in a pentagonal model. Based on this, talent is manifest in rare, excellent, demonstrable and valuable productivity.*



The gifted individual's pursuit of activity often leads to behaviour that is unacceptable for the community if the individual fails to find a suitable challenge. In the case of outstanding talents this can be outstandingly overwhelming, manifesting itself as a disorder, as a result of which the individual will become a talent in a special situation.

The social environment conveys social values to the gifted and talented through tasks. Values change, and so does, therefore, giftedness that turns into achievement, that is, talent.

Talent is something we invent rather than discover. It is what one society or another wants it to be, and the concept therefore regularly changes with the needs of the particular society. Having a usable definition of talent has beneficial consequences for both the society and the individual. However, if the definition is not usable enough, valuable talents will be lost and the support and encouragement will benefit less valuable ones. This is why it is important for us to understand what the concept of talent means to us and others (Sternberg, Davidson, 1990).

The value system of the culture and the society serve as filters. If the gifted are presented with challenges along the lines of these values, then those talents will emerge who represent a value for the relevant society. Efficient gifted education is therefore inclusive, and offers tasks and challenges suitable for development, thereby providing an opportunity for as high-level achievements as possible.

Social values, that is, the way of thinking characteristic of the community, govern the manifestation of talent, not only with respect to its domain, but its associated personal characteristics, as well. If, for example, society does not regard achievements easily attained as a value, then it will have a preference in gifted education for the "dull", who achieve talent through struggles, and will regard the "intelligent", who were born brilliant, with suspicion. However, each kind of talent is valuable.

What is more, heterogeneity itself is valuable.

A society which offers only a limited number of possible routes and ignores or even penalizes other achievements will severely limit and stunt the talent pool it educates. A talent-friendly society makes a variety of tools accessible for development and tolerates heterogeneous routes of development. If however a society treats the dimensions of achievement and effort as contrary to each other, it will continue to keep the population capable of outstanding achievements through outstanding abilities in a disadvantaged position.

The founders of Microsoft, Bill Gates and Paul Allen, left college to found their company. Does this mean that it is not worth going to college and study?

Avoiding college is not necessarily a key to success, but learning and studying definitely is. Education and learning are not the same, even if society often believes so, and values certificates of qualification instead of knowledge.

"The only thing that interferes with my learning is my education", said Albert Einstein.

Talent development is made possible by the challenge and of course the tool necessary for an intensive activity. Then all is needed is an internal need, the touch of madness mentioned by Seneca. When the environment fails to present talents with a suitable task, their drive will compel them to search for it and they will thus not rest until they find the suitable challenge and the tools for that task.

*Bill Gates spent thousands of hours programming. He attended an elite private school, which had a computer already in 1968. The school purchased the computer terminal for 3000 dollars for its computer club. In those days, even universities offering access to a computer were rare. Gates was lucky to live near such a university with his parents, and so he could gratify his obsessive programming desires by sneaking into the university by night. He gained an immense advantage there through (Gladwell, 2008).*

Several thousand other students grew up under the same conditions as Bill Gates, but they never became "billgates", either because this was not their route, or because they were not insistent enough on their route. Talent is best characterised by an overwhelming internal force. This is what makes it different and this is what will not let it be diverted from its activity, which is what happens to others. This internal force compels the talent to grasp everything for the sake of its development.

Talent is not pliant, and it is not easy to accept and like. The autonomy of a talent capable of performing at outstanding levels can be unpleasant for its environment, but may also be highly profitable from the point of view of achievement. A talent builds a network for itself using elements of its environment and adjusts and harnesses them to support the attainment of its goal, as Bill Gates did.

### **The attitude characteristic of talent is embodied in network thinking**

The basis for outstanding achievements is never a single ability or a single type of knowledge. New solutions are always born of new combinations of old possibilities.

Beside the internal drive, talents also have the ability to mobilize knowledge and even the ability to acquire knowledge from somewhere else. The key to success lies not only in recognising problems and incongruities, but also in creating new connections.

Creative thinkers connect what appear to be unconnectable, because their knowledge makes it possible to approach the situation from different angles and they are also able to mobilise mutually distant functions within themselves.

Talent is characterised by a strongly network-based functioning. This does not necessarily appear in the social activities of a talented individual, since network thinking has several levels.

The essence of network-based functioning is captured by what Csikszentmihalyi (2008) wrote about creative elements:

- they have significantly more transient weak links than average,
- they are in the overlaps of multiple modules, and change modules by virtue of their transient links,
- they can have a key role in the new integration of disconnected modules following stress.

A problem situation can be regarded as a crisis or a stress situation, in which old solutions are no longer functional, and so new solutions are needed. In this case, it is not sufficient to know any of the old solutions well enough. The situation calls for several old and new solutions and their integration.

Talents thus regard each situation as a learning situation, but they retain what they learn in a way that it can be mobilized and changed, and so they are able to employ it easily in a new context.

Thomas Alva Edison, for example, did not invent the light bulb, but merely found the solution for a usable bulb by learning from the deficiencies of earlier attempts. Albert Einstein did not invent anything new, but simply integrated existing pieces of knowledge in a novel way. Both people developed insights and actualised others research and work to in turn create new insights for others to build upon.

Siegler and Kotovsky (1986) described two major forms of giftedness decades ago. One is the schoolhouse or test-taking talent, an excellent professional, the user of knowledge, the "consumer". Such individuals are easy to identify, because they can be outstanding at academic tasks at school and they can solve tests dependably. Creative-productive giftedness, however, is characteristic of creative thinkers, the "producers", whose identification is neither easy, nor fast.

It is open to debate if we can truly call individuals gifted who merely use knowledge but do not create it.

Naturally, academic success does not preclude someone being a "producer". On the contrary, knowledge is very important and indispensable. Not even "producers" can create new links without the knowledge of the old elements, but even the most profound knowledge is insufficient in itself in solving an as yet unsolved problem, or in reforming some domain. A characteristic of creative-productive giftedness is network thinking, which makes it suitable for such tasks.

Network-based thinking is often manifest in interdisciplinarity, the transition between different scientific domains. The opportunities for interdisciplinarity are continually growing, because scientific disciplines themselves are starting to become interdisciplinary. For quite a few decades now, proficiency in a single domain has not been sufficient for outstanding achievements.

In our digital age, work tends instead to be organized around problems, projects and tasks to be solved. The number of hybrid areas is increasingly growing. For example, staying with the questions of human learning/development, we have today psychopedagogy, pedagogical psychology, neuropsychology and psychophysiology, sociopsychology and sociopedagogy beside simply physiology, pedagogy, psychology and sociology (Gyarmathy, 2013).

Interdisciplinary associations and organizations are also becoming more and more frequent, an example being the "International Society for the Interdisciplinary Study of Symmetry", whose members include, beside several other distinguished scientists and artists, the *engineer* Dan Shechtman, who won the Nobel Prize in *chemistry* for proving the existence of quasicrystals. Symmetry and interdisciplinarity played a great role in his thinking about crystal structures, but so did the fact that he approached an issue in chemistry and mathematics as an engineer. Because,

according to theory, the crystal he found could not have existed. That is why he called it a "quasicrystal". Using his engineer's way of thinking, he transcended pure theory and took the small errors of nature into consideration when calculating the possibilities, which led him to his discovery.

Researchers often adapt the results of one discipline in another. Péter Csermely (2008) applied their results about networks in natural science to sociological processes, among others.

Talents often create professions for themselves when going in new directions, as did, for example, dr Bertalan Meskó, a medical doctor showing outstanding thinking abilities already in childhood, who engaged in the study of the tools and communications of the digital age and created the profession of a "medical futurist" for himself.

The inconceivably intensive grounding of talent involves exploiting everything for the sake of its development. It discovers opportunities related to its subject everywhere, "*associates everything with it*". Thus, a composer would think of a tune at the back of his mind when taking a shower, inspired by the sound of water, or it may only take an apple falling from a tree for a scientist to work out a theory.

The network-based functioning of talent is multilevelled, and forms an activity network composed of elements which are difficult to isolate. It can be realized as

- interdisciplinary thinking,
- joint artistic and scientific approach,
- organization of information,
- organization of resources of information and tools,
- linking of distant ideas and elements,
- linking of professional groups,
- organization of social relations,
- the touching of other minds and other forms of thinking.

## Summary

When considering the education opportunities for the gifted and talented education, it is important to take into account that giftedness and talent is heterogeneous, and different forms thereof require different provision. At the same time, a basic attitude common to all talents is what Seneca called "a touch of madness" which appears as the 'network power', and roots in the "I don't care if it is impossible" attitude.

Giftedness and talent is an extraordinary natural force which keeps this specific attitude in motion. This attitude stimulates the individual to persevere in activity, search and effort. Experience gained through search activities grows into knowledge, which opens up increasingly greater opportunities for achievement. Talents achieve the inordinate amount time necessary for grounding through network-based functioning. They integrate the available factors and use them to help them achieve their goals. The key is whether there are available factors at all in the social dimension or the talent should turn to the asocial or antisocial directions to find what the inner drive urges.

Talent is the result of a highly efficient and active network-based functioning emerging in a network of diverse factors. Understanding and promoting it can best be achieved through a network of provision. Thus, gifted education and talent support itself should strive for a network-based structure.

## Acknowledgement

I am grateful to the kids, young and adult talents, their parents, teachers and mentors, because I got my knowledge mostly from the work with them. My special thanks to John Senior for his valuable advices to this study and to Anna H. Nagy, the Associate Professor of the Eotvos Lorand University, for her continuous support of my professional work.

## References

- Amabile, T. M. (1985) Motivation and Creativity: Effects of Motivational Orientation on Creative Writers. *Journal of Personality and Social Psychology* Vol. 48. No. 2, 393-399.
- Barrett, K. C., Morgan, G. A. (1995) Continuities and discontinuities in mastery motivation during infancy and toddler hood: a conceptualization and review. In: MacTurk, R. H., Morgan, G. A. (eds.): *Mastery motivation: Origins, conceptualizations and applications*. Vol. 12. Advances in applied developmental psychology. Ablex Publishing Corporation, Norwood, New Jersey, 57-94.
- Csermely Péter (2008) Creative Elements: Network-Based Predictions of Active Centres in Proteins, Cellular and Social Networks. *Trends in Biochemical Sciences*. Vol. 33, No. 12. 569-576.
- Csikszentmihályi M. (1990) Flow: The psychology of optimal experience. Harper& Row, New York.
- Ericsson, K. A., Krampe, R. T. H., Tesch-Römer, C. (1993) The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, Vol. 100, No. 3. 363-406.
- Freeman, J. (2006) 'Giftedness in the Long Term'. *Journal for the Education of the Gifted*, Vol. 29, No. 4. 384-403.
- Gagné, F. (2000) "Understanding the Complex Choreography of Talent Development through DMGT-Based Analysis." In: Heller, K. A., Monks, F. J., Sternberg, R. J., Subotnik, R. F. (eds.): *International Handbook of Giftedness and Talent*, Oxford, UK: Pergamon. 67-79.
- Gagné, F. (2003) Transforming Gifts into Talents: The DMGT as a Developmental Theory. In N. Colangelo & G. A. Davis (Eds.), *Handbook of gifted education* (3rd ed.) Boston: Allyn and Bacon. 60-74.
- Galton, F. (1869) Hereditary Genius. Macmillan, London.
- Gladwell, M. (2008) Outliers. Little, Brown and Company, New York.
- Gross, M.U.M. (1993) Nurturing the talents of exceptionally gifted individuals. 473-490.
- Gyarmathy Éva (2007) *A tehetség – Háttér és gondozásának gyakorlata. [Giftedness - its background and treatment in practice]* ELTE Kiadó, Budapest.
- Gyarmathy Éva (2013) Diszlexia, a tanulás/tanítási és a tudományok a digitális kultúrában. Egy tranziens korszak dilemmái. [Dyslexia, learning/education and the sciences in the digital culture. The dilemmas of a transient age.] *Magyar Tudomány*, Vol. 174, No. 9. 1086-94.
- Harsányi István (1994) Tehetségvédelem. [Talent protection.] Magyar Tehetségvédő Társaság, Budapest.
- Hollingworth, L. S. (1926) *Gifted children: Their nature and nurture*. New York: Macmillan.
- Hollingworth, L. S. (1931) The child of very superior intelligence as a special problem in social adjustment. *Mental Hygiene*, 15 (1), 3-16.
- Hollingworth, L. S. (1942) *Children above IQ 180*. New York: World Book
- MacKinnon D W. (1962) The nature and nurture of creative talent. *Amer. Psychol.* 17. (4) 84-95.
- McNemar, A. (1964) Lost: our intelligence? Why? *American Psychologist*, 19, (12) 871-882.
- Mezrich, B. (2009) *The Accidental Billionaires*. Doubleday, Random House, New York.

- Kovácsné dr. Nagy Emese (2000) Komplex Instrukciós Program. [Complex Instruction Programme] In: Klein Sándor – Soponyi Dóra (szerk.): A tanulás szabadsága Magyarországon. EDGE 2000, 357-367.
- Kovácsné dr. Nagy Emese (2005) A társas interakció mint tudásgyarapító tényező a heterogén osztályokban. [Social interaction as a knowledge-promoting factor in heterogeneous classes.] Iskolakultúra, 15, 5:16-25.
- Kovácsné dr. Nagy Emese (2007) Integrációs modell. [Integration model.] Fókusz. 9, 1:36-56.
- Landau, E. (1974) A kreativitás pszichológiája. [The psychology of creativity.] Budapest, Tankönyvkiadó.
- Lombroso, C. (1891) The man of genius. Walter Scott, London.
- Péter Szarka Szilvia (2012a) Creative climate as a means to promote creativity in the classroom. Electronic Journal of Research in Educational Psychology. 10 (3): 1011-1034.
- Péter Szarka Szilvia (2012b) Kreatív klíma az iskolában. [The creative climate in school.] Tehetség 19 (2): 5-7
- Renzulli, J. (1978) What makes giftedness? Reexamining a definition. Phi Delta Kappa, 60, (3) 180-184, 261.
- Siegler, R.S. & Kotovsky, K. (1986) Conclusions and integration. In: (Eds.) Sternberg, R. & Davidson, J.E. (1990) Conception of Giftedness. New York, Cambridge University Press. 417-426.
- Sternberg, R., Davidson, J.E. (1990) Conception of Giftedness. New York, Cambridge University Press.
- Sternberg, R.J. (1993) Procedures for identifying intellectual potential in gifted: A perspective on alternative "Metaphors of Mind". In: (Eds.) Heller, K. A., Monks, F. J., Passow, A. H. International Handbook of Research and Development of Giftedness and Talent. Pergamon, Oxford. 185-208.
- Tannenbaum, A. (1986) Giftedness: a psychosocial approach. In: (Eds.) Sternberg, R.J. & Davidson, J.E. (Eds.), Conceptions of giftedness. Cambridge: Cambridge University Press. 21-52.
- Terman, L.M. (1926) Mental and Physical Traits of Thousand Gifted Children. Genetic Studies of Genius. Vol. I. (2nd edition) Stanford University Press, California.
- Ziegler, A., Stoeger, H. (2004) Identification based on ENTER within the conceptual frame of the Actiotope Model of Giftedness. *Psychology Science*, 46, (3) 324-342.