Systemic Gifted Education

(Draft)

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1 Introduction

In Charles Dickens's eponymously titled novel, the main character Oliver Twist starts out life in an orphanage and moves from there to a poorhouse where he feels the visceral pinch of hunger. Having finally made it to London, he unwittingly falls in with a pack of thieves and is coerced into earning his keep through thievery. After a harrowing escape, Oliver breaks away from the thieves and, finally, is adopted by Mr. Brownlow, a wealthy and educated Londoner who is passionate about books and education.

As the novel makes clear, Oliver is a bright boy with a quick wit. Whether he might be deemed gifted according to today's standards is thus a reasonable question. If we think of giftedness as an individual's potential for high achievement along the lines of Heller (1989), for instance, answering this plausible question becomes difficult, as we are suddenly posed with a case of *now you see it, now you don't*. While confronted with highly adverse circumstances (biding his time in the orphanage and the poorhouse and fending for his life in a pack of thieves), Oliver's potential probably would not have sufficed for achieving domain-specific excellence. However, Mr. Brownlow's care might turn out to have been a game-changing event in this respect.

The notion that one and the same person is gifted in one context and not in another contradicts the dominant view of inherent and stable gifts (Dweck, 1999). Those advocating a nativist perspective would thus arguably point out that while Oliver does not exactly demonstrate excellence, his accomplishments are at least above average when compared with those of other boys his age. Environmentalists would be equally justified in pointing out that just about any boy who enjoys the highly privileged circumstances afforded by Mr. Brownlow would soon begin to surpass his materially and socially less fortunate peers in various areas. So where is such excellence situated? In Oliver? In Mr. Brownlow's home?

Systemic approaches to giftedness such as the actiotope model (Ziegler, 2005; Ziegler, Vialle, & Wimmer, 2013) transcend models that focus on personality traits and contextual models by defining giftedness as a certain probability that domain-specific excellence will be achieved. On the one hand, this definition is within the pale of Heller's (1989) definition, in which he defines 'gifts' as potentials for domain-specific highest achievement. On the other hand, the definitions do not coincide in the sense that Heller's notion of potentials applies exclusively to the individual. In this sense, traditional models of giftedness would predicate an evaluation of Oliver's gifts upon knowing enough about *him*.

The actiotope model envisions a different next step at this conceptual juncture that fundamentally changes the way giftedness and talent development are conceptualized. In

addition to the person (i.e., the personal component of each actiotope), an actiotope also comprises the material, social, and informational environment (i.e., the environmental component of the actiotope) in which a person acts and interacts (Ziegler, 2005; Ziegler & Vialle, 2013). So if we return to little Oliver, we need to consider three aspects in order to decide whether he possesses any specific gifts: We need to look at (a) Oliver as an individual, (b) his environment, and, most importantly, (c) the way in which Oliver interacts with his environment, how he uses the resources available to him in his environment, and how these resources 'use' (i.e., act upon) him.[1] In other words: A well-informed answer to the giftedness question requires detailed knowledge of the entire actiotope and of the dynamics of the interdependencies among the components within the actiotope.

2. The actiotope model of giftedness

The term *actiotope* borrows from the term *biotope*. In a biotope, organisms both respond to and actively influence their environment and in doing so, evolve over time. In contrast to the biotope, the actiotope focuses on individuals and their actions within a certain environment. Thus an actiotope is a segment of the world with which an individual interacts and to which an individual adapts by carrying out actions (for an overview, cf. Ziegler, 2005). When identifying gifted persons and providing gifted education on the basis of the actiotope model it is important that educators consider the individual components of the actiotope (cf. 2.1) as well as the theoretical perspectives underpinning them: The *dynamic perspective* (cf. 2.2) means that the actiotope components continuously evolve; and the *systemic perspective* (cf. 2.3) means that the components are individually and collectively characterized by systemic interactions.

2.1 Actiotope components

In the actiotope model, four components of sentient behavior are delimited: (1) the action repertoire, (2) goals, (3) the environment, and (4) the subjective action space (cf. Figure 1). As will be shown later, these components cannot be viewed as disjunct elements, as they are interdependent and constitute a complex system. Furthermore, each component has its own subsystems and thus its own internal systemic composition.

[1] It is important to keep in mind here that the number of people who were, at some point in time, theoretically capable of achieving a certain type of domain-specific excellence is certainly much greater than the number of individuals who actually do accomplish such a feat. This consideration reminds us of the fact that individual–environment interactions that are suitable for leading to excellence require an adequate fit between the two entities.

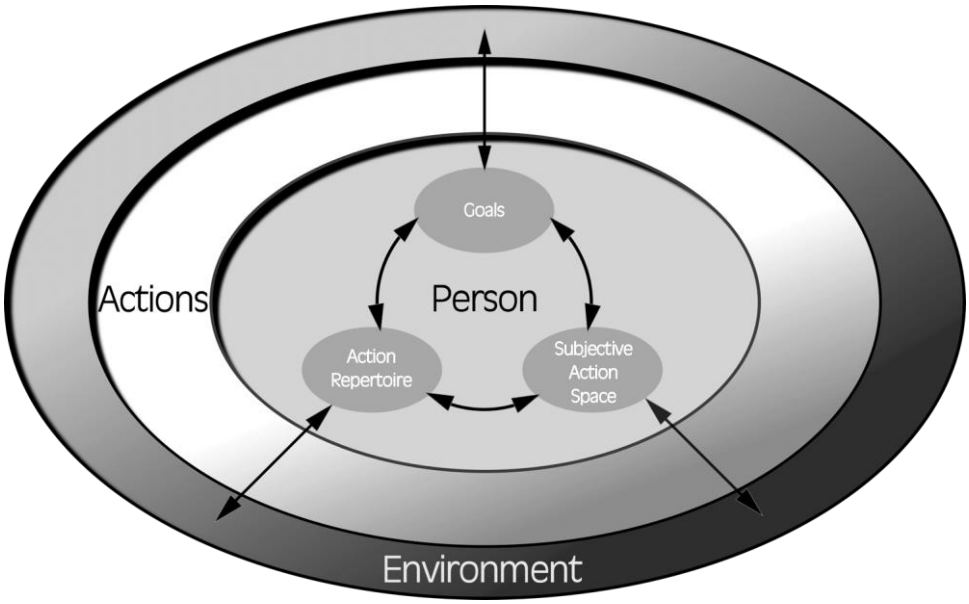

Figure 1: The Actiotope Model of Giftedness

2.1.1 Action repertoire

The *action repertoire* denotes all the actions that a person can, in theory, execute at a given point in time. Of these many possible actions, an individual will only implement a tiny fraction. A person who has mastered multiplication, for instance, can theoretically carry out an almost unlimited number of multiplications. In reality, of course, this individual will only calculate a very small subset of all potential calculations.

The breadth and depth of an action repertoire varies considerably from person to person, and an individual's action repertoire expands over time. The mathematical action repertoire of a kindergartner, for instance, is typically limited to a few numerical operations within a narrow number range. During elementary school, pupils expand their action repertoire to include basic arithmetic operations, and then, during middle school and high school, they add basic algebraic and geometric operations. Among other things, gifted education is responsible for supporting individuals as they expand their action repertoire and thereby work towards developing an action repertoire that can facilitate excellence.

2.1.2 Goals

Goals fulfill four important functions. They determine the choice of action alternatives; they have an energizing function and thereby motivate the implementation of actions; they shape the direction of behavior; and they provide orientation for regulations during action implementation.

This has clear consequences for gifted education. First, learners need to focus on goals that are functional for expanding their action repertoire. Second, these functional educational goals need to be commensurate with the larger system of goals that an individual possesses. Otherwise, the recipient of gifted education might reject the support in the long run. Third, the long-term development of an individual's overall system of goals needs to become a concern of gifted education, too, as this goal system must evolve in concert with the expanding action repertoire. Each expansion of the action repertoire leads to new possible goals that need to be pursued on a path towards excellence.

2.1.3 Environment

Systemic approaches to education assume that individuals and their action context cannot be analyzed independently but can only be meaningfully understood as an analytical entity. From this perspective, the *environment* is thus not merely important, but essential. For gifted education, the segment of an individual's environment that reflects individual talent domains is an important aspect, because the developmental process towards excellence is understood as a progressive adaptation of the leaner within and to this environment. At the same time, however, other segments of an individual's environment (e.g., systems such as the family and school) also play different complementary roles in the development of domain-specific excellence. As a means of evaluating the developmental contributions made by various segments of an individual's environment, the actiotope model uses the concept of *sociotopes*. We will describe just how sociotopes are defined and used as an analytical categorization tool for the identification and education of gifted pupils in section 4.

2.1.4 Subjective action space

The fourth principal actiotope component is *subjective action space*. Modeled in analogy to the construct of problem space as traditionally employed in research on problem solving, the subjective action space is conceived of "as the universe of all possible steps to solve a problem that an individual can theoretically navigate" (Ziegler, 2005, p. 423). In this space, an individual can envision actions and then decide whether to execute them. As the number of actions which an individual can potentially execute is limitless, it is important that an individual induct those actions from the action repertoire into the subjective action space that he or she views as being the most appropriate actions for achieving set goals within a given environmental context.

In some cases, individuals possess actions within their action repertoire of which they are either unaware or for which they fail to fully comprehend the applicability for achieving certain goals. An example of such a situation is the case of math and science and gifted girls. Despite showing evidence of having competencies comparable to those of their equally gifted male peers, some of these girls will, as a result of detrimental environmental influences, fail to choose the goals necessary for becoming successful in these subjects (Stoeger, 2004). For gifted education, this means that expansions of an individual's action repertoire also need to be effectively integrated into her subjective action space.

2.2 Dynamic perspective

We have thus far considered the individual actiotope components more or less as static concepts. Achieving domain-specific excellence requires the progressive development of an actiotope and this, in turn, requires a continuous series of adaptations. The actiotope model of giftedness specifies five hallmarks of successful adaptation. These hallmarks constitute the determinants of successful learning and can also be understood as the requirements for increasingly effective interactions within a talent domain, which in turn pave the way to more efficient actions in a domain.

For an individual to behave effectively in a talent domain, she or he must, first, be capable of *recognizing successful actions* in that domain. These successful domain-specific actions can be repeated, and they can also be used as a means of acquiring additional, even more successful actions. In many cases, however, individuals lack an understanding of just when an implemented action was successful. If a student does not use appropriate learning strategies and does not notice that he is studying in an inefficient manner, for instance, then his learning gains will remain slight.

Second, individuals must be able to *recognize situation-appropriate actions*, that is, to recognize the specific context(s) in which the implementation of certain actions will lead to success. If a pupil prepares for a written test as she normally would for an oral presentation, it is likely that she will discover during the test that she lacks the level of detailed knowledge necessary for written answers and solving test problems.

Third, the progressive adaptation of an actiotope requires that individuals permanently *create additional action variations*. If a learner aims to improve the effectiveness of her or his domain-specific actions and thus to expand her actiotope, finding additional action variations is essential. The behavior of chess experts illustrates the importance of developing new action variations (Gobet & Charness, 2006). While average chess players typically stop expanding

their action repertoires early on, chess experts permanently expand their repertoire of opening moves and of moves for certain situations. Chess experts thus illustrate how excellence is, among other things, predicated on the ceaseless search for additional action variations. In other words, possessing knowledge of a highly effective set of chess moves is always a temporary state and thus does not obviate the expert player of continuing her or his search. Remaining an expert means remaining a learner who is permanently searching for ever better action variations.

As our description has already indicated, developing an actiotope towards excellence is a long-term process. Thus it comes as no surprise that the process will be accompanied by unexpected developmental barriers. Hence, an actiotope must, fourthly, be *sufficiently anticipative* to ensure that it can overcome barriers and setbacks. If, for instance, a school councilor recommends that a remarkably advanced tenth-grader transfer to an out-of-state university, it is important that the councilor help the pupil and her family assess whether she possesses the social competencies she will need to deal with the separation from her family at a young age. The anticipatory nature of the actiotope is, however, by no means limited to social competencies. If a highly successful theoretical physicist working on postdoctoral research runs into a massive conceptual problem in her work, then a careful analysis of the nature of her problem might, for instance, find that her failure to attend to a certain area of advanced mathematics skills during her undergraduate work is preventing her from developing certain types of task-essential action variations.

Fifth, successful development in a given talent domain depends on *an effective system of feedback.* As the levels of expert performance are remarkably high in many talent domains, finding teachers and mentors capable of providing meaningful feedback is often difficult. Furthermore, even the feedback of a highly appropriate expert is of little or no use if offered only once or sporadically. Effective adaptations within an actiotope depend on the availability of appropriate, regular feedback over an extended period of time. In many competitive sports disciplines, for instance, an individual will work for many years with the same trainer on succumbing minute technical shortcomings.

2.3 Systems perspective

The actiotope model conceives of developing domain-specific excellence not as the result of the parallel development of disjunct components. Instead, it understands excellence as the result of the adaptation of a complex system in which the action repertoire, goals, the subjective action space, and the environment co-evolve in an interdependent and concerted

manner. The interactions among the components are manifold. From the perspective of systems theory, an effectively co-evolving actiotope will, ideally, be *metastable*. Achieved states will be constantly replaced by new states. A successful development from one stable state among the actiotope components to a new, more effective stable state depends on the co-evolution among the components.

The most conspicuous hallmark of long-term learning processes leading to domain-specific excellence is the co-adaptation of the actiotope components. The interactions among action repertoire, subjective action space, goals, and environment are most certainly not a matter of chance in the case of highly successful individuals. Indeed, experts distinguish themselves through the effectiveness of the expansions of their action repertoires that occur as they proceed through intensive phases of learning. Each expansion of the action repertoire leads to numerous new co-adaptations. For example, successful individuals will typically have a history of working with mentors or coaches on making systematic adaptations to learning goals. When necessary, they seek out new mentors or coaches who are able to support them at ever more advanced levels as their skills increase. These examples represent just a small portion of all potential co-adaptations.

This web of complex co-adaptations within an actiotope depends on sufficient levels of modifiability *and* stability. First, complex long-term co-adaptations are only sustainable when an actiotope is sufficiently *modifiable*. For those working in gifted education, this realization has a clear consequence: Once a learning path has been identified for an individual, gifted educators must remain constantly vigilant about whether that individual's actiotope can sustain the co-evolutionary processes which will be required by the chosen learning path. Will an individual, for instance, succeed at adapting his goals at the juncture of each mastered learning step such that he will set himself on the right course for the next learning step? If, for example, stakeholders in an individual's learning process should realize that the current learning environment is no longer appropriate, then the question arises as to whether there are other, better suited trainers, mentors, training partners, or teachers for this person. Therefore, helping to ensure the long-term modifiability of an actiotope is a key responsibility of gifted education and counseling.

Second, long-term co-adaptivity also depends on the simultaneous presence of a sufficient amount of *stability* within an actiotope. If sufficient stability is lacking, an actiotope cannot evolve towards domain-specific excellence. An example of a detrimental sort of destabilizing process with a particular relevance for gifted education is that of jealous peers and/or unconfident teachers. Should a pupil rapidly expand her action repertoire and then

experience jealousy on the part of her peers or unhelpful reactions on the part of her teachers (for whom her success might represent a threat to their self-esteem), it is plausible that this negative experience may hinder her continued development. Peers and teachers are an important part of this person's environment and, as such, also an integral part of her actiotope. If friends' feelings of jealousy or teachers' feelings of inadequacy prevent them from providing constructive support and encouragement as friends and teachers, they may very well destabilize the pupil's actiotope in a manner which will prevent or decrease further learning development. In the context of an individual's family, a detrimental destabilizing factor frequently arises when domain-specific talent development engenders new financial challenges for a family: The added expense of paying for a wooden rather than a plastic clarinet, of paying for a private magnet school with a focus on math and science, or of paying for additional weekend trips to a remote archery practice facility are examples of the sorts of money-related consequences of talent development which, when not successfully overcome by a family, can lead to a dramatically negative destabilization of a gifted individual's evolving actiotope. Such common situations have the potential to prevent essential adaptive processes.

As this brief introduction to the basic components and central theoretical premises of the actiotope model of giftedness illustrates, studying and practicing gifted education from the actiotope perspective demands a decisive shift of focus towards the resources with and the environments within which learning pathways towards domain-specific excellence unfold. In the following two sections, we will familiarize readers with analytical systems designed for describing and studying these resources and environmental factors from the actiotope perspective and thereby offer insights into just how researchers and educators can apply the actiotope model to current and future challenges in gifted identification and education in various contexts.

3 Resource orientation in the actiotope model

Despite various differences, most identification procedures identify gifted individuals on the basis of their personality traits. Among these, intelligence is, by far, the most frequently used. Intelligence and achievements are the two criteria traditionally given the most diagnostic credence (Dai, Swanson, & Cheng, 2011). The actiotope model rejects such an exclusively trait- and achievement based focus and instead prefers a resource orientation (Stoeger, 2013).

For the actiotope model, resources are defined as all material and immaterial means that can be used to achieve goals. Indeed, in the field of gifted education these goals are

predominantly learning goals (Ziegler & Baker, 2013). In the case of gifted identification and education, the consideration of resource orientation leads us to two questions:

1. Does an individual possess personal resources sufficient for taking advantage of the learning opportunities present within her or his actiotope? These personal resources are termed *learning capital*.
2. Does the actiotope's environmental component provide sufficient resources for facilitating successful individual learning processes? These environmental resources are termed *educational capital*.

The terms *resource* and *capital* are, to a certain extent, synonyms. We prefer the term *capital* in most cases because it reflects common usage of the term *capital* and, as such, accounts for the existence of negative values (e.g., when discussing debt) and, in some cases, for the conversion of one form of capital into another. Furthermore, *capital*, unlike *resource*, connotes more clearly that it generally must be created and that it can increase.

There is, in theory, no limit to the number of kinds of resources or, as we shall refer to them now, 'capitals' which can be used to the end of improving learning processes and outcomes. Thus, the question of categorization is crucial. On the one hand, a meaningful categorization needs to allow for an all-inclusive systematization of all potential learning resources. On the other hand, such a categorization scheme needs to be both theoretically plausible and readily comprehensible such that it can be helpful to educators in gifted education in need of guidance for real-life situations. A categorization of educational and learning capital comprising five subtypes for each type has received considerable attention in recent years (Ziegler & Stoeger, 2011; Ziegler & Baker, 2013). Table 1 presents the names and definitions of these ten types of educational and learning capital. We will present each of these capital types and use a series of examples to illustrate their importance for understanding and improving educational and learning processes.

Table 1: Forms of Educational and Learning Capital and their definitions (cf. Vladut & Ziegler, in press)

Type of Capital	Definition
Educational Capital (comprising the environmental component of an actiotope)	
Economic educational capital	… includes every kind of wealth, property, and money as well as any other valuables that can be used in a society to initiate and/or sustain educational and learning processes.
Cultural educational capital	… includes values, ways of thinking, larger outlooks, and other such resources that can facilitate or hinder the achievement of learning and educational goals.
Social educational capital	… includes all people and social institutions that have a direct or an indirect influence on learning and educational processes.
Infrastructural educational capital	… includes all physical resources (e.g., buildings, desks, computers, books) that allow for learning and education.
Didactic educational capital	… includes all procedural and declarative knowledge pertinent to improving educational and learning processes.
Learning capital (comprising the individual component of an actiotope)	
Organismic learning capital	… includes a human organism's physiological and constitutional resources.
Telic learning capital	… includes all those goal states that an individual can anticipate to the end of satisfying her or his needs.
Actional learning capital	… includes a person's entire action repertoire (i.e., all actions that a person could, in theory, carry out).

3.1 Educational capital

3.1.1 Economic educational capital

Economic educational capital comprises every kind of wealth, property, and money as well as any other valuables that can be used in a society to initiate and/or sustain educational and learning processes. Although economic educational capital does not play a direct role in learning and educational processes (i.e., you can pay for access to knowledge, but you cannot

literally purchase cognitive knowledge), it is nevertheless highly relevant in the sense that it can (and is demonstrably) used as a means of acquiring additional resources. Individuals are making use of economic educational capital when they purchase learning materials (e.g., books, educational apps), pay for educational experiences (e.g., seminars or community college classes), or invest in certain forms of social capital such as trainers or private tutors. A wealth of studies illustrates the strength of the link between parents' economic educational capital and the scholastic achievements of their children (cf. Ditton & Krüsken, 2009). When compared with their more well-to-do peers, children from families with low socio-economic status (SES) attain lower overall levels of scholastic achievement, profit comparatively less from an equal amount of scholastic instruction, and achieve lower secondary and tertiary educational outcomes.

3.1.2 Cultural educational capital

Cultural educational capital refers to values, ways of thinking, larger outlooks, and other such resources that can facilitate or hinder the achievement of learning and educational goals. Numerous studies have shown that parental and peer attitudes regarding learning and education are relevant as cultural educational capital for learners. The more positive the attitudes among family and friends are regarding learning, studying, and education in general, the better pupils' achievements tend to be (Fuligni, 1997; Ryan, 2000). This relationship has been documented in various talent domains. Parents who value music tend to have children who are particularly successful in musical endeavors—even when the parents do not play an instrument (Davidson, Howe, Moore, & Sloboda, 1996).

Cultural educational capital influences the development of excellence at the societal level, too. Studies show that Confucian-heritage societies emphasize education and effort, and this perspective has been described as one explanatory factor behind the above-average performance of East-Asian pupils in international scholastic testing (Phillipson, Stoeger, & Ziegler, 2013). The connection between cultural educational capital and domain-specific achievement is also evident at the societal level. The more value a society places on a certain domain at a certain point in time, the more likely it becomes that individuals hailing from this society will achieve excellence in that domain. One might think, for example, of the dramatic blossoming of high-quality visual, sculptural, and architectural arts in Florence during the reign of the House of Medici starting in the fifteenth century, or of the contributions made to Western music by European composers and musicians working at various German-speaking courts during the eighteenth and nineteenth centuries.

3.1.3 Social educational capital

Social educational capital, which can directly influence learning and educational outcomes, consists of all people and social institutions that influence learning and educational processes. As such, it includes individuals like mentors, trainers, child-care workers, and teachers (e.g., Gruber, Lehtinen, Palonen, & Degner, 2008). Findings showing that individuals who achieve domain-specific excellence are more likely to have had a mentor during their formative years (Stoeger, Ziegler, & Schimke, 2009) substantiate the theoretical role of social educational capital. Studies also indicate that the parents of children working towards domain-specific excellence tend to adapt their adult lives to the learning and training needs of their children (Davidson et al., 1996).

Social educational capital can also indirectly influence excellence development. This is for instance the case when social educational capital ensures access to learning and practice opportunities. Typical examples are the sponsors who pay for a sporting event for school-aged children or the soccer moms (and dads) who drive their children to soccer games on Saturdays. An interesting example of indirect social capital in tertiary education was reported by Rehrl, Palonen, Lehrtinen, and Gruber (in press): They showed that the networking within the scientific community had a significant influence on the professional success of researchers, even if no direct collaborations were reported.

3.1.4 Infrastructural educational capital

Infrastructural educational capital is composed of all physical resources that allow for learning and education. This category includes things such as libraries, playgrounds, athletic facilities, and universities. The ways in which infrastructural educational capital influences the development of domain-specific excellence are as varied as the material objects which fit into the category. Whether or not a certain type of facility is available can, in some cases, almost single-handedly determine whether or not certain individuals have access to certain domains and whether they shall have potential interests in such domains. Children who grow up near ski slopes are more likely to ski, for instance. There is a predictive relationship between the number of books in a family household, on the one hand, and reading motivation and scholastic achievement, on the other hand (McElvany, Becker & Lüdtke, 2009; Suchan & Bergmüller, 2007).

Taking advantage of infrastructural resources leads individuals to new opportunities for learning and domain-focused skill acquisition. For example, in the context of the German

system of selective college-preparatory secondary education, Anger et al. (2012) showed that the likelihood that a child in primary school would go on to attend college-track secondary school increased significantly when children and their families took advantage of the non-mandatory educational support offerings available within their school systems.

3.1.5 Didactic educational capital

Didactic educational capital comprises all the procedural and declarative knowledge pertinent to improving educational and learning processes as it is used, demonstrated, and imparted by teachers, mentors, and trainers, for example. Indeed, the development of excellence is only possible once sufficient didactic educational capital is available. In the area of scholastic achievement, for instance, both qualitative and quantitative studies make clear that pupils' performance is influenced by the quality of their teachers' qualifications and by their instructional quality. Darling-Hammond (1999) showed, for instance, that teacher training and certification were the best predictors of pupils' achievements in reading and mathematics, even when the pupils' socio-economic status and language competence were statistically controlled for (cf. also Hattie, 2008).

Didactic educational capital has proven particularly effective in the form of one-on-one learning processes such as mentoring or individual coaching (Stoeger et al., 2009). The teacher–learner ratio of 1:1 allows for a careful calibration of learning activities to a pupil's foreknowledge, substantial individualized feedback, and careful consideration of individual weaknesses. Bloom (1984) compared a number of instructional methods and showed clearly that individual instruction provided by a pedagogically trained tutor or mentor (an important caveat) was the most effective instructional option.

3.2 Learning capital

3.2.1 Organismic learning capital

Organismic learning capital refers to a human organism's physiological and constitutional resources. For various reasons, as much as a third of children in industrialized societies show deficient levels of physical activity (Ekelund et al., 2012). This is a pertinent finding for considerations of organismic learning capital, because the links between physical activity and fitness, on the one hand, and cognitive performance and learning activities, on the other hand, are well established. Correlations have been observed between fitness and memory (Chaddock, Hillman, Buck, & Cohen, 2011) and between fitness and IQ (Aberg et al., 2009). Evidence has even been presented on how individuals on a path to excellence in a music

domain regularly made reflected decisions on how best to optimize physiologically relevant parts of their daily routines to the end of maximizing the effectiveness of their instrumental practice routines (Ericsson, Krampe, & Tesch-Romer, 1993).

3.2.2 Telic learning capital

Telic learning capital consists of all those goal states which an individual can anticipate to the end of satisfying her or his needs. Here, 'goals' describe future states that need to be achieved through actions. It is important, however, to note that not every future state that a human being may attain will require learning progress. This is where the notion of *telic* learning (from the Greek *telos*, meaning goal) capital actually comes into play. If a primary goal for carrying out an action lies in the action itself (e.g., as may be the case when going to the movies), then learning is likely a byproduct at best. If, on the other hand, an individual is focused on learning, then often the potential pleasure of the experiential aspects of many activities plays a less central role. This is clearly the case when one invests an enormous amount of time and energy in improving a small technical aspect in a particular skill domain (Ericsson, 1996).

The goals that an individual pursues can, over the long term, dramatically influence the trajectory of the development of skills or competencies. A fascinating case in point is provided by scholastic outcomes. The sixteenth Royal Dutch Shell–sponsored survey of German adolescents and young adults documents a clear influence of social background on the academic elective intentions of the survey participants. High–SES children see themselves earning higher-level degrees and are more optimistic about their chances of succeeding (40% vs. 17% of the low–SES study participants). Thus, from the actiotope perspective, the high–SES children enjoy more effective telic learning capital.

3.2.3 Actional learning capital

Actional learning capital is composed of a person's entire action repertoire (i.e., all the actions which a person could, in theory, carry out). This type of learning capital typically expands as individuals develop. Salient aspects of human development have been described and evaluated extensively. Norm values are well established for the development of various actional competencies in areas such as gross motor skills (e.g., crawling, walking), fine motor skills (e.g., coordinated grasping, holding writing utensils), language competencies (e.g., word comprehension, phonological awareness), or cognitive development (e.g., three-dimensional perspective perception, categorization ability). Whether or not an individual possesses certain

action competencies can have far-reaching consequences for the success or failure of certain learning processes. Textbook examples include learning strategies (Mandl & Friedrich, 2006), knowledge structures that facilitate the organization and comprehension of new information (Chi, Glaser, & Farr, 1988), and athletes' levels of flexibility, which may pose limits on the execution of certain sequences of movements. A more dramatic example with consequences that extend across various domains is that of the language competency difficulties encountered by pupils with non-native language backgrounds. Pupils whose schooling occurs in a language different from the one(s) they have encountered at home may be less effective at expressing themselves in the language of their schooling and may indeed be less effective at executing mental operations than they otherwise would be barring the existence of school–home language differences. IQ tests for the same person conducted in different languages typically produce results differing by an entire standard deviation (Sotelo-Dynega, Ortiz, Flanagan & Chaplin, 2013).

3.2.4 Episodic learning capital

Episodic learning capital refers to all the simultaneously goal-oriented *and* situation-relevant behavioral patterns that a person possesses at any given point in time. It differs from actional learning capital in that episodic learning capital always involves making a connection between actions selected from the action repertoire, on the one hand, and goals and circumstances, on the other hand. In other words, episodic learning capital denotes cognitive, often experientially gained resources that help an individual to choose the right actions for achieving desired goals in a given situation.

Developing an amount of episodic learning capital that is sufficient for carrying out excellent actions in any one of many domains involves a considerable investment of time. Simon and Chase (1973) estimated that world-class chess players look back on anywhere between 10,000 and 50,000 hours of chess practice at that point in time at which they achieve the status of a grandmaster. Ericsson et al. (1993) refined our understanding of the process of becoming an expert by showing that achieving domain-specific excellence is a function not only of the quantity but also of the quality of learning activities. In general, the observation appears to hold for many domains that acquiring the sorts of experiential knowledge necessary for achieving and maintaining excellence in a given domain requires about a minimum of ten years' of effective, consistent practice.

3.2.5 Attentional learning capital

Attentional learning capital encompasses all of those quantitative and qualitative attentional resources that an individual can focus on the execution of learning activities. With regard to quality, attentional learning capital denotes the resources an individual possesses for learning, studying, or practicing in a concentrated and thus effective manner. Some researchers have concluded that attentional learning capital is the single most important contributive factor when it comes to making improvements in a given skill or learning domain. Ericsson (2006) aptly sums up the role of attentional learning capital: "The requirement for concentration sets deliberate practice apart from both mindless, routine performance and playful engagement, as the latter two types of activities would, if anything, merely strengthen the current mediating cognitive mechanisms rather than modify them to allow increases in the level of performance" (p. 794). Indeed, the empirical evidence is in line with this interpretation (e.g., Ericsson, 2001, 2003).

From a quantitative perspective, attentional learning capital refers to the amount of time an individual has available for learning activities. Pupils with chronic overscheduling of extracurricular activities provide a case in point. For example, 12-year-old DeShawn, is in seventh grade. When school ends at 2:55 p.m., DeShawn finds time for ballet class, horse riding, soccer practice, and community service over the course of each week. His only time for homework is in the 60 minutes after family Wii game time (8:00 to 8:30 p.m.) and before bedtime at 9:30 p.m.

Or think of 13-year-old Amy. She is in the ninth grade and loves social media and several popular multiplayer online games. Amy's passion for online social interaction and the development of online skills leaves her frequently consumed by Justin Bieber's recent Tweets or arguing with her mom about Grandma Reena's unfair usage of www.scrabblecheat.com when playing *Words with Friends*. For both children, it is clear that the development of negative attentional learning capital is a real possibility.

4 Categorizing different types of environments: Sociotopes

Certain environments (e.g., cities, schools, a child's bedroom, a playground) tend to have relatively stable influences on the persons who act in them. Indeed, most of the environments in which humans act and interact are products of civilizations and designed with specific intentions. The question thus arises as to whether actiotope theory allows for a meaningful categorization of these environments. From a heuristic perspective, the answer is a clear 'yes.'

In systems theory, the stable influences that environments have on their inhabitants are understood as control variables, as they are more or less permanent factors confronting humans within a given context (Thelen & Smith, 2006).

In actiotope theory, stable influences within a given setting are grouped into those constituting an objective action space and those constituting a normative action space. The objective action space includes all the actions that are theoretically possible in a given situation. In a rehearsal room in a high school music facility, for instance, students typically practice musical instruments; and in a high school physics lab they typically conduct experiments. It is theoretically possible, of course, to practice an instrument in the physics lab. This brings us to the concept of the normative action space. Here, possible actions are specified as being either desirable or undesirable for each specific setting. Let us come back to our example above: Although practicing an instrument in the physics lab is possible (objective action space), it is not desired (normative action space). Other examples of normative action spaces are a classroom, in which traditional forms of academic learning are sanctioned and generally desired, or a nightclub, in which skilled dancing is generally desired, whereas solving quadratic equations on paper would not be desired.

We define stable constellations of objective and normative action spaces as *sociotopes* (Latin *sozio* = of or pertaining to the group or community; Greek *topos* = a locality) (Ziegler & Phillipson, 2012). Humans react to the constant demands in these sociotopes by adapting and accumulating learning capital. The learning capital that individuals collect follows clear patterns. Consider, for instance, a boy who grows up in a family steeped in the lore and love of baseball. It is plausible that he will …

- begin to show signs of increased musculature in his upper arms due to regular baseball practice (organismic learning capital).
- lie in bed before going to sleep and dream of being next season's most valuable player (telic learning capital).
- develop a complex repertoire of various pitching techniques (actional learning capital).
- develop an acute sense of just which pitching techniques are most effective for different batters from other local teams (episodic learning capital).
- structure his homework, study, and socialization times around his practice schedule during baseball season to ensure that he does not miss a single practice (attentive learning capital).

Once an individual has acquired learning capital in a particular domain, this individual may be noticed by another person because of her or his talent. In turn, this may lead to opportunities to enter new sociotopes (e.g., a gifted magnet school, a summer music camp).

4.1 Types of sociotopes

Each theoretically possible action contained within an objective action space has a particular valence in a normative action space from the perspective of the individual who is carrying out the actions: An action is either desirable, undesirable, or lacking in normative valence.[2] This leads us to the following types of sociotopes (cf. Ziegler & Phillipson, 2012) as summarized in Table 2.

Table 2: Types of Sociotopes

The objective Action action space …	Normative action space *When the learning is …*		
	… desirable	… not encouraged	… rejected
… allows for learning and studying activities	Learning sociotope	Infrastructural sociotope	Avoidance sociotope
… prevents learning and studying activities	Thematic sociotope	Competing sociotope	Antagonistic sociotope

The aforementioned scheme envisions three types of sociotopes in which learning is possible and three in which learning is not possible. However, each of these offers a fundamentally different learning environment. In the *learning sociotope* learning is possible and desired. Learning sociotopes include, for instance, a classroom during instruction, school band practice, or a community-college French class. *Infrastructural sociotopes* also allow for learning activities and performance improvements, but in this type of sociotope learning activities are not generally expected of individuals but rather optional. Examples here might

[2] As our general focus is on learning activities, the desirability is with respect to learning. Depending on the context in which the concept is being applied, various concepts of learning may be considered (e.g., scholastic learning, learning in musical skill acquisition, learning in mnemonic training).

include an idyllic park bench that affords a graduate student a quiet moment to review notes from a lecture. Generally speaking, however, one does not readily associate benches in parks with graduate students reviewing lecture notes. The third type of sociotope that might potentially provide learning opportunities is the *avoidance sociotope*. Here learning is theoretically possible, but it is also not desired. Students can, of course, choose to use recess time for studying or reviewing newly learned concepts, and they can choose to spend their holiday break reading ahead in their *World Civilizations* textbook. Such choices will, however, in many cases, elicit critical responses from peers and parents. Such events can even create situations in which a student interested in investing energy in facultative learning activities might have to defensively justify her or his behavior. An archetypical example of an avoidance sociotope can, under certain circumstances, be found in a classroom originally designed as a special offering for high-achieving students. What was envisioned as a learning sociotope can be turned into an avoidance sociotope if a process of social ostracism leads to some students being singled out as overachievers, nerds, or "teachers' pets."

On the other side of the sociotope categorization scheme are the three aforementioned sociotopes in which learning is not possible. In a *thematic sociotope* learning is not possible, but learning success and learning outcome gains are valued. If a conversation between individuals turns on positive aspects of attending school, then the participants are enjoying a thematic sociotope. Such conversations can take place, for instance, during lunch time among school-aged peers or between a basketball coach and her players. If parents show an interest in their children's experiences at school, then they are providing their children with a thematic sociotope and thus indirectly encouraging their children to become more involved in learning or infrastructural sociotopes.

Antagonistic sociotopes actually endanger learning processes, because they contribute to the stigmatization of learning activities. In antagonistic sociotopes, learning is not possible and the idea of learning is also rejected. As a case in point we envision a scene at a party in which adolescents carry on about how much they detest their teachers or their learning and school activities.

In *competing sociotopes* learning is also not possible. Here, activities other than those involving learning simply stand at the fore. Competing sociotopes include listening to music, watching TV, or dancing (inasmuch as such practices are not carried out in the pursuit of learning or educational goals). The question of whether such activities are to be valued or rejected is not dealt with here.

4.2 A case in point: The sociotope approach in research on girls and educational achievement

The sociotope approach has proven effective as a theoretical approach for studying educational interventions designed for girls in STEM (Stoeger, Duan, Schirner, Greindl, & Ziegler, 2013; Ziegler, Reutlinger, & Hering, 2012).[3] In an empirical study, 28 teachers of ninth- and tenth-grade students enrolled in college-preparatory secondary education in Germany[4] were asked to each nominate two of their pupils. In particular, they were asked to nominate one pupil with the best record of achievement and one pupil with an average achievement record but in whom they saw the potential for the highest levels of achievement. The teachers nominated almost equal numbers of girls (n = 13) and boys (n = 15) as the best student.

We will now take a closer look at what we learned about the girls with the best records of achievement and the girls who demonstrated average achievement but had the potential for the highest levels of achievement according to their teachers (n = 10). The pupils' report card data confirms the teachers' assessments with respect to scholastic performance: The girls they identified as having the best academic records had a German grading system[5] GPA of 1.54 on a scale of 1 to 6 and the girls with average achievement and high potential had an average German GPA of 3.60.

The study's main concern was finding out in which sociotopes the girls typically spent time and whether the differing characteristics of the more commonly frequented sociotopes helped explain the girls' realization or non-realization of their potentials. To this end, the study participants received an empty hour-by-hour schedule covering one week. The girls were asked to use the schedule to document their daily activities outside of regular school hours. The study authors stressed that the participants should also note the time spent on activities such as eating, waiting, and traveling from one place to the next as well as time invested in rather irregularly occurring activities such as hobbies or hanging out with friends.

Once the participants had completed and returned the schedules, the study authors reviewed them and calculated the amount of time spent in each of the aforementioned

[3] The acronym STEM stands for **s**cience, **t**echnology, **e**ngineering, and **m**athematics.
[4] In Germany, roughly one-third of schoolchildren are tracked, on the basis of their grades in certain subjects, into college preparatory secondary education as of, in most cases, fifth grade. College-preparatory secondary schools in Germany are known as *Gymnasien* (singular *Gymnasium*).
[5] In Germany, school grades range from 1 (highest possible grade) to 6 (lowest possible grade). Passing grades are those above 5. An A in the American system is thus equivalent to a 1 in the German system, and a B corresponds with a 2, and so on.

sociotopes. In some cases, the activities described by the participants could not be clearly identified as representing one of the sociotopes. In these cases, the study authors provided the participants with standardized instructions with which they were to append remarks to their filled-out schedules that further qualified the nature of the activities they had documented. One such set of clarifying instructions asked participants, first, to mark all of the activities they described during which they were able to learn about or study for STEM subjects. It then asked them to indicate which of these activities positively sanctioned STEM and which of them negatively sanctioned STEM. Activities that implied neither positive nor negative sanctioning of STEM activities were then classified as belonging to an infrastructural sociotope. Furthermore, when the participants' activities excluded STEM learning, we assessed whether these activities were taking place in thematic, competing, or antagonistic sociotopes.

Figures 2 and 3 show just how much non-sleep time outside of regular school hours the participants spent in sociotopes that had the special potential for fostering STEM-related learning and just how much time they spent in sociotopes that were potentially discouraging of STEM-related learning. The results indicate that the female study participants spent roughly three-fourths of their non-school, non-sleeping classifiable time in competing sociotopes that (a) do not offer learning opportunities and (b), from the girls' perspectives, neither positively nor negatively sanction STEM-related learning. The time spent in other sociotopes varied between more than 10 percent spent in learning sociotopes and less than 1 percent spent in avoidance sociotopes. Indeed we observed statistically significant differences in the time spent in various sociotopes between the high-achievement girls and the girls with average achievements and high potential according to their teachers. These differences were neither in the area of learning sociotopes, nor in the area of competitive sociotopes. Indeed, the high-achieving girls even spent a little bit less time in learning sociotopes and a little bit more time in competitive sociotopes although neither difference reached statistical significance. However, high-achieving girls spent significantly *more time* in infrastructural sociotopes (e.g., libraries) and in thematic sociotopes. In contrast, they spent significantly *less of their time* in contexts which were not germane to and even counterproductive for STEM learning (i.e., in avoidance and antagonistic sociotopes).

In a subsequent step, we conducted a discriminant analysis to determine whether times spent in different sociotopes were predictive of whether a study participant belonged to the high-achievement group or the group defined by average achievement and high potential. Eleven of the thirteen high-achieving participants could be correctly grouped into the high-

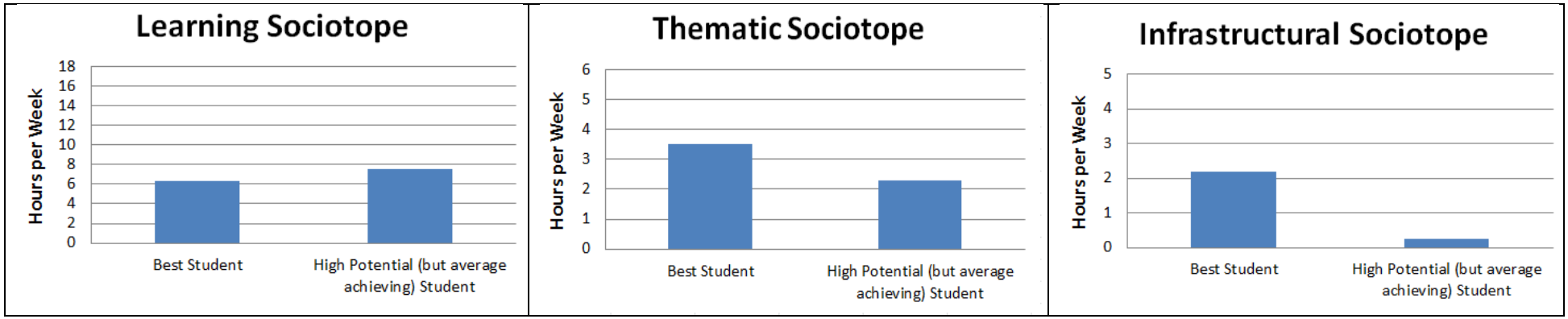

Figure 2: Time (hours per week) spent by girls with above-average and average scholastic achievement records in three (learning, thematic and infrastructural) sociotopes that are *beneficial* in effecting increases in STEM participation.

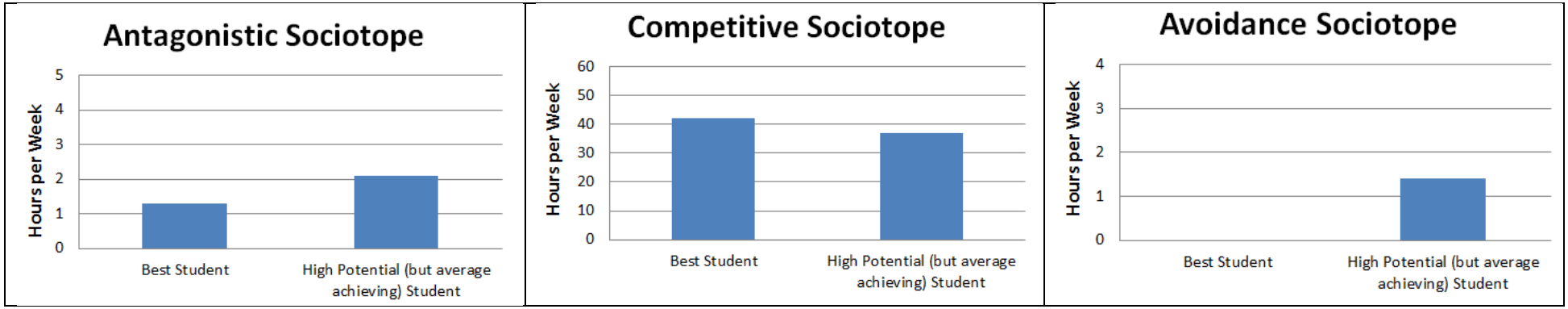

Figure 3: Time (hours per week) spent by girls with above-average and average mathematics achievement records in three (antagonistic, competitive, and avoidance) sociotopes that are typically *counterproductive* for effecting increases in STEM participation.

achievement group; however, also one of the girls with average achievement but high potential was mistakenly assigned to this group. Out of the ten average students with high potential, nine girls were correctly assigned to this group, together with two high-achieving girls who were wrongly assigned to this group. All in all, the analysis correctly classified participants' group membership in 87% of cases, which can be viewed as satisfactory for an analytical procedure of this sort.

What do we learn from the results of such a study? First, the study shows that two groups of pupils who fall into the categories of either (a) high achievements or (b) average achievements with special potential according to teacher assessments actually do spend significantly different amounts of non-school time in different sociotopes. Interestingly, however, the significant time differences were not located in the *learning* sociotopes. This observation has an important implication for designing effective educational interventions: Creating *optimal educational* environments is an incomplete solution. Furthermore, it is remarkable that the high-achieving girls did not show lower levels of distractions from learning activities: In fact, the time they spent in competing sociotopes was unexpectedly greater than that of the girls with average achievement and high potential. Distractions and temping, non-scholastic pleasures are, apparently, not *per se* really the problem. Rather, the meaningful differences had to do with the attitudes towards STEM and scholastic learning that these non-learning sociotopes transported. Thus it was not surprising that the high-achieving girls spent significantly more time in infrastructural and thematic sociotopes in which they could do things with a connection to STEM or in which positive attitudes about STEM were prevalent. The cardinal role of a STEM-friendly environment is substantiated by the fact that the high-achieving girls spent significantly less time in antagonistic and avoidance sociotopes.

5 Actiotopes, sociotopes, and educational and learning capital

We view the considerations presented thus far as justification for the need to fundamentally redefine the traditional focus of gifted education on the individual. In our view, furthermore, even a consideration of giftedness, which *also* heeds learning environments to some extent fails to do justice to the interdependent basis of human achievement (Barab & Plucker, 2002). For this reason, we advocate a redefinition of giftedness which replaces the theoretical point of departure for conceiving of or constructing giftedness: The basic conceptual unit for gifted

education and giftedness research should neither be the individual nor a given environment, but rather the actiotope—the indivisible nexus of individual and environment.

The concepts of educational and learning capital specify the exogenous and endogenous resources within an actiotope that are prerequisites for developing gifts into excellence and for learning developments in general. The *raison d'être* of gifted education is, accordingly, ensuring a well-coordinated supplemental development of both types of resources within one actiotope.

The perennial giftedness question needs to be reformulated accordingly: How can an educational intervention facilitate the optimal development of an actiotope towards a condition in which excellent actions in a given talent, skill, or knowledge domain become possible? A concrete answer to this question involves three analyses:

- Which forms of educational capital (exogenous resources) and learning capital (endogenous resources) does an actiotope contain?
- Is it possible to identify a learning pathway that—with the help of optimal future learning resources—can lead to domain-specific excellence?
- Can the identified supplemental learning resources be developed and/or provided?

The sociotope approach offers a heuristically effective means of examining the environmental component of a given actiotope. We advocate establishing three environmental concerns as areas of standard interventional practice in gifted education:

- How can all sorts of sociotopes be created which impart learning-friendly attitudes and outlooks?
- How can institutional efforts help direct gifted learners towards precisely those types of sociotopes?
- What steps can be taken to reduce the amount of time that gifted individuals spend in sociotopes that impart anti-learning attitudes and outlooks?

6 Concluding remarks

It is difficult to say with any meaningful amount of conviction whether Oliver Twist could have attained excellence in a domain. We sought to show how the development towards excellence depends on the complex interdependent development of numerous factors. We introduced the constructs of the actiotope, the sociotope, and educational and learning capital in an attempt to provide a means of coming to terms with the complexity of these interrelated factors.

Traditional approaches to gifted education focus first and foremost the individual who has either demonstrated some sort of exceptional achievement in the past or who earns a high mark on an intelligence test. The first approach is more plausible: If a person has demonstrated *ecologically valid* (i.e., performing a piano concerto at ten years of age or patenting an invention at 15 as opposed to earning a very high score on an intelligence test) high achievements, then we can be sure that the necessary resources for a given achievement must have been available prior and up to the time at which the achievement occurred. In this sense, a demonstrably high-level of achievement provides an indirect but very clear indication of the resources and the sociotopes to which the achieving person had access.

One important and easily overlooked detail must be kept in mind, however: This knowledge does not predict whether these resources and sociotopes will be available in the future. This is where gifted identification and gifted education become important. The purpose of gifted education is to provide and augment educational and learning capital and to facilitate processes in which individuals progress through a long series of ever more potent sociotopes and thereby acquire more and more effective actions in a talent domain. The overarching aim is to establish a process whereby there is an increasing alignment between the individual and environmental components of her or his actiotope, enabling achievement excellence within a given domain.

How far could Oliver's actiotope have taken him under ideal circumstances? Dickens puts it this way on the closing page: "How Mr. Brownlow went on, from day to day, filling the mind of his adopted child with stores of knowledge, and becoming attached to him, more and more, as his nature developed itself, and showed the thriving seeds of all he wished him to become […] these are all matters which need not to be told." Here, Dickens's narrator avoids poetic justice by not explaining what Oliver goes on to do or become. Nevertheless, we have ample opportunity to see clearly how Oliver's various endogenous and exogenous resources are being increasingly aligned. For Oliver this pathway might perhaps led him to greatness.

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