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From Baby Steps to Giant Leaps: Deliberate Practice and *Baby Steps*

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Abstract

Fiction is often a reflection of different aspects of life and as such offer a unique opportunity to both educators and academics to explore topics and provide examples that are accessible. A popular debate among educators and academics is nature vs. nurture. This debate is especially popular in the discussion of talent and the development of expertise in a specific profession or hobby, such as sports. One prominent name in the debate of expertise development and the role of talent is K. Anders Ericsson, who is credited with the development of the expertise-performance approach. This approach focusing on training and expert performance but there are discrepancies in regard to effective practice and the role of talent. Using examples found in *Baby Steps*, a sports manga about a young man's journey to becoming a professional tennis player, we discuss some of the problems with Ericsson's approach.

Introduction

The journey from novice to heroic savior is a common one in literature and film, as well as more interactive mediums such as video games. Whether in a *Harry Potter* novel, a *Star Wars* film, or video game series like *Fable,* we are often treated to a specific type of story: The journey of an untrained or inexperienced novice into a formidable protector or villain. At the end of these tales, we often encounter a protagonist at the height of their power and occupying a level of eminence in their fictional realm. Often unasked is the following question: Do these characters ultimately become eminent figures because of some inborn talent or aptitude for the journeys they must undertake, or do the experiences of those journeys and the training often undertaken forge them into these eminent individuals? In fiction we see different representations of a debate that has raged within the academic literature, the question of nature or nurture.

Many fields have contributed to this debate starting in philosophy where the question of what makes a man who he is has long been debated, to genetics where the interactions between genes and environment are investigated, to fields such as agriculture (Lila, 2006; Coll et al., 2014; Eagly & Wood, 2017). The field where this debate seems to occurring most frequently and with the most fervor is in psychology, however. Long have psychologists investigated and debated the roles of genetic versus environmental factors in human development and behavior. Psychology is a wide domain however, with many fields and subfields. While each of these different sections of psychology addresses the nature-

versus-nurture debate, the field of expertise research is home to a particularly interesting and heated exchange. Much like the different narratives mentioned above, lines have been drawn and there are heroes on each side.

On one side we find the late Dr. K. Anders Ericsson, originator and advocate of the expert-performance approach. Ericsson championed an approach focused solely on the role of consistent training and dedication in the development of expertise for a given domain, such as chess or sport. The expert-performance approach, or perhaps more accurately Ericsson, finds opposition from the rest of the field of expertise research which seeks to incorporate other factors, such as innate talent, into the discussion.

As with any science, psychology turns to research and discussion to answer its many questions, including the role of nature and nurture in the development of expert performance. So what do these differing psychological theories and their supporting data tell us about the development of expertise? To this end, we offer an examination of the sport manga ベイービステップ or *Baby Steps* by Hikaru Katsuki with the goal of illustrating the difficulties facing Ericsson's approach, and the data supporting his perspective. Using a fictional story to analyze the deliberate practice approach affords three specific benefits.

First, fiction is often a reflection of the world, influence by the author's perspective and accumulated knowledge. Second, analyzing products of popular culture such as manga (Japanese comics) can offer an opportunity to generate scientific theory and provide common ground for audiences to engage in the scientific discourse. Finally, characters in fiction can be used by psychologists by providing representations of human behavior and thought which can then be contrasted to scientific evidence.

Baby Steps and Expertise Development Approaches

Baby Steps follows the life of a Japanese teenager Maruo Eiichiro as he trains to become a professional tennis player. Eiichiro enrolls at a tennis club in order to get some exercise at the strong suggestion of his mother. After learning some of the basics of tennis, and developing a crush on one of the club members, Eiichiro decides to pursue tennis regularly. The trainers at the club notice that Eiichiro has some traits that would be useful to the game of tennis, specifically his ability to analyze information quickly and his impeccable eyesight, and encourage him to try a local competition. Eiichiro experiences some success against far more experienced players and is quickly labeled as talented due to his performance and lack of experience. Over time, his ability grows quickly and he decides to pursue a career as a professional tennis player. During the course of the series, Eiichiro is depicted as undergoing extensive training, both physically and mentally.

Eiichiro's early identification as talented is useful as a starting point for discussing the field of expertise research in psychology. The literature concerning expertise can be understood as being split between two approaches: the absolute approach and the

relative approach (Chi, 2006). The absolute approach is characterized by an assumption of innate talent or natural ability for a specific domain such as music or sports. Researchers from the absolute approach study experts or exceptional performers within a domain in isolation or in comparison to one another. The absolute approach does not downplay the importance of practice and training, but does investigate what factors beyond training may influence why some top performers are more prominent than others. This is in contrast to the relative approach, which dismisses, or at least minimizes, the role of natural ability and operates with the assumption that novices, or newcomers to a domain, can achieve the same level of performance as those recognized as experts, provided they have the proper training. Ericsson's expert-performance approach would be classified as a relative approach to expert development. Both of these approaches would evaluate a story like Eiichiro's differently.

The absolute approach assumes that there are certain characteristics, individual differences, that strongly contribute to expert performance. These individual differences, sometimes considered talents, are essential components of experts. Eiichiro is repeatedly remarked by characters within the series that he has exceptional eyesight, a trait important at professional levels of tennis where a ball can travel in excess of 120 mph on a fast serve. At a later point in the series Eiichiro even undergoes training to further improve his eyesight. It is recognized throughout the series that Eiichiro has traits or talents that will serve him well as a professional tennis player and is encouraged to pursue training that strengthens his natural abilities. Important to keep in mind though, is that the series also goes on to emphasize the importance of quality training and practice, which brings us back to the relative approach and Ericsson's deliberate practice approach.

As previously remarked, relative approaches to expertise focus on the training methods undertaken by experts and dismiss the importance of individual differences between experts, or at minimum, argue that such difference become irrelevant after sufficient training (Ericsson & Lehman, 1996). Viewing *Baby Steps* through the lens of a relative approach suggests that while Eiichiro may display some traits that are advantageous to the sport of tennis, it is the training he undergoes that makes him a dominant performer in his age group. Within the series, training is depicted as consuming Eiichiro's life and being targeted at areas where he is lacking. This is similar to Ericsson's expert-performance approach which relies heavily on a concept called deliberate practice.

Training and Deliberate Practice

The term "deliberate practice" is first coined in Ericsson et al. (1993) to denote a specific type of activity the authors claim to be essential to the development of expert performance. Ericsson et al. (1993) describe deliberate practice as goal-directed activities designed to improve or refine specific aspects of domain skills and performance. Experts in the domain suggest these activities and the learner engages in this

practice outside of their normal work time (Ericsson & Moxley, 2012).

Deliberate practice is contrasted to two other types of activity that individuals engage in within a domain: Work and play. Work is defined as any activity that is required in the standard performance of a profession; examples used to illustrate this include performing in concerts or competing in competitive sporting events such as tournaments. Ericsson et al. (1993) maintain that the nature of work inhibits experimentation, rather requiring the performer to reproduce previously trained behaviors. Play is defined as any domain-specific activity with no specific goal and is inherently enjoyable. A major contention of Ericsson's approach is that all differences between experts are explained by the amount and type of deliberate practice they undertake.

These distinctions between deliberate practice, work, and play are the bedrock of Ericsson's approach but they are not without their criticisms. Luckily, *Baby Steps* offers a good framework to discuss some of these criticisms. In the beginning, before Eiichiro commits to tennis as a profession, really before he even chooses tennis as a hobby, he engages in some practice hitting a ball repeatedly against a wall. The goal of this practice is to replicate the feeling of returning a ball that he had experienced earlier during an altercation with another player at the club. Basically, what Eiichiro does is continuously hit a ball against the wall and when it comes back tries to replicate that previous moment and noting all of the ways in which his most recent attempt falls short. He then repeats this, adjusting until he eventually can replicate that return on demand. At first glance this seems to meet many of the requirements for deliberate practice outlined by Ericsson: the practice takes place outside Eiichiro's normal work, it is designed by Eiichiro to address a specific skill (the motion required to return a tennis ball), and there is a specific goal (understand how he needs to move his body to return the ball and to be able to reproduce this perfectly).

Importantly, Eiichiro designed this practice activity himself. This highlights a controversial aspect of deliberate practice. Ericsson (Ericsson, 2016; Ericsson, 2021; Ericsson et al., 1993; but see Ericsson 2007a; Ericsson & Lehman, 1996) argues that deliberate practice must be designed by an instructor or coach who also provides immediate feedback. While Eiichiro's activity meets many of the qualifications for a deliberate practice activity, it fails to incorporate the use of a coach.

Another example taken from Eichiro's beginnings is the intermingling of work and deliberate practice. Before Eichiro begins seriously training to become a professional player, the coaches at his training facility recommend he attend a prefecture tournament to get a taste of competition (Katsuki, 2008). Ericsson notes that competition or tournaments are not a time for experimentation or development (Ericsson et al., 1993). He does not make any further distinction between competition and work that one is paid for, merely a blanket statement precluding the possibility of work or competition being a component of deliberate practice. This section of Eichiro's development poses as a reasonable

suggestion that Ericsson's view may be too narrow. Engagement in work and competitions provide potentially valuable opportunities for review and feedback. Ericsson argues for the importance of immediate feedback during deliberate practice (Ericsson et al., 1993) but also highlights the value of other, more delayed feedback, such as viewing video footage with a coach (Ericsson et al., 2009). In his view, a trainee needs to be evaluated and directed towards new areas of improvement or encouraged to refocus by a teacher or expert within the domain. Participation in lower risk or rank competitions could be seen as prime opportunity for one of these review and analysis sessions. Indeed, a common theme throughout the series is the growth seen by testing the results of practice in competition and adjusting subsequent training in light of the newly acquired information. In terms of actual research, Ericsson and Lehman (1996) found that the best predictor of sight reading performance among professional pianists was not the number of cumulative hours of practice, as Ericsson has elsewhere suggested, but instead the number of concerts they had performed. Likewise, Sonnentag and Kleine (2000) found that the number of cases an insurance agent had handled was a better predictor of performance than was deliberate practice. Such anecdotal and experimental evidence would support Eichiro's engagement in tournament play as a supplement to deliberate practice.

A final event from the series relevant to this discussion takes place only after Eichiro has fully committed to becoming a professional tennis player. This event concerns Ericsson's claim that play is an activity totally separate from deliberate practice and that it does not contribute to an expert's superior performance. While training in America at an institute for those aiming to go professional, Eichiro engages in what Ericsson would consider play activities, in this case beach tennis, with no express goals or skills to refine (Katsuki, 2013). During these play activities Eichiro observes elements of his play that could use improvement, such as judgment of ball movements in environments different from the concrete courts he is accustomed to playing on. After completing these activities, he considers what he has learned and successfully applies it during normal practice activities improving his general performance (Katsuki, 2013). That is, by engaging in novel activities related to tennis, Eichiro discovers new ways to improve his skills, albeit through later deliberate practice. This is a distinct departure from Ericsson's deliberate practice theory, which would seem to argue that innovation and creativity occur only during deliberate practice (Ericsson et al., 1993). Ericsson has elsewhere argued that creativity itself stems from deliberate practice within the domain in which one is attempting to be creative (Ericsson, 1998; 1999).

The ambiguity of what qualifies as deliberate practice is neatly demonstrated by the preceding examples. This ambiguity is often a source of criticism for the expert-performance approach. Ericsson et al. (1993) claims that deliberate practice offers a complete explanation as to how experts become experts. Concepts such as talent or special characteristics do not play a role in

the development of expert performance. This tenet of the expert-performance approach has received much criticism and debate (Macnamara et al., 2014; Ericsson, 2016; Macnamara et al., 2016a; 2016b; Macnamara, et al., 2018). Another issue often brought up with the expert-performance approach is the claim that deliberate practice explains all differences between experts. Most researchers agree with Ericsson on the point that deliberate practice is an important component of expertise development. However, many disagree that it is the only, or even most powerful, predictor of future proficiency (Taylor et al., 2005; Ruthsatz et al., 2008; Meinz & Hambrick, 2010; Campitelli & Gobet, 2011; Tucker & Collins, 2012; Detterman, 2014; Macnamara et al., 2014; Mosing et al., 2014; Plomin et al., 2014; Simonton, 2014; Wai, 2014; Ullen et al, 2015; Macnamara et al., 2016a; 2016b; Macnamara et al., 2018).

Individual studies sometimes find conflicting results. One technique for dealing with inconsistencies is to combine and mathematically analyze the results from numerous studies. This procedure is known as a meta-analysis. Meta-analyses of the expertise literature have found issues with the claim that deliberate practice explains individual differences in expert performers. In one meta-analysis of the expertise literature in the domains of chess and music, Hambrick et al. (2014) found that while deliberate practice explained a portion of the variance in performance between experts, it did not account for the majority of this difference. They found that deliberate expertise explained close to 30% of performance in music experts and 34% in chess experts. Similarly, a large meta-analysis looking at the effect of deliberate practice in fields as varied as games, sports, education, and professions, Macnamara et al. (2014) found that deliberate practice explained a portion of the variance. However, this portion ranged from 26% (for games) to less than 1% (for professions) depending on the domain in question. This runs directly counter to Ericsson's claims that deliberate practice accounts for the majority of individual differences in human performance (Ericsson, 1995; 2007b; Ericsson et al., 2009).

A third meta-analysis provides even more evidence of deliberate practice's important but limited contributions to expertise development. Macnamara et al. (2016) analyzed the literature concerning sports and found only 18% of individual differences was accounted for by deliberate practice. Furthermore, they found deliberate practice only accounted for 1% of the differences between elite level athletes (a finding well outside what the expert-performance approach would predict). That is, at early levels of sports participation, practice (in part) helps determine who is better. However, as athletes advance, the role of deliberate practice gets smaller and smaller. At the most elite levels, the difference between a professional player and an All-star has almost nothing to do with who practices more.

Ericsson and others have responded to many of the meta-analyses described here. In response to the meta-analyses conducted by Hambrick et al. (2014) and Macnamara et al. (2014), Ericsson (2014) called into issue

their selection criteria for many of the studies they included in their meta-analysis on the grounds that they did not meet his requirements for deliberate practice. In addition, a reanalysis of the data presented by Hambrick et al. (2014) was conducted which discussed potential methodological issues with the previous analysis (Platz et al., 2014). This new analysis found data in support of a strong predictive relationship between deliberate practice and expert performance in the domain of music.

In response to the second, more focused meta-analysis by Macnamara et al. (2016), Ericsson once again draws attention to the inclusion of studies that do not meet the requirements for deliberate practice, as well as, their use of accumulated practice hours rather than solely hours spent in deliberate practice. Specifically, he draws issue with their inclusion of studies that included learner designed deliberate practice, stating that a coach or some kind of instructor needs to be involved. In a direct response to his commentary, Macnamara et al. (2016) draw attention to the varying definitions of deliberate practice Ericsson has used throughout the years. In previous work, Ericsson (2007a) allows that deliberate practice can be designed and engaged in by the learner without outside input from a coach or instructor.

Filling in the Gaps

Deliberate practice explains less than 35% of the variance in performance, and far less than that when comparing elite performers (Macnamara et al., 2014; Macnamara et al., 2016). What then, explains why Eichiro and his many real-life counterparts outperform their peers? The answer may well lie in the very "talent" explanations Ericsson so readily dismisses. Talent comes in many forms. When we think of athletes and talent, we often think of those who are taller, stronger, or more coordinated. Even Ericsson allows for differences in height and body type as determinants of performance (Ericsson & Ward, 2007). Depending on the task, the ideal height and body type varies.

Sometimes being taller is better, and sometimes being shorter is better. Taller basketball players have an advantage on jump balls and rebounds. Power lifters with short arms literally do less work (in physics work = force times distance) when lifting the same amount of weight as an athlete with longer arms. Gymnasts also benefit from being on the shorter side.

Height is never mentioned as a factor that makes Eichiro special. According to Roser et al. (2019), the average height for males globally is 171 centimeters or 5 feet, 7.5 inches, with large variation by country. In comparison, the average height of a male player in the top 500 of the Association of Tennis Professionals (ATP) is 185.5 centimeters or 6 feet, 1 inch. This gap between the average height and high ranking tennis players is even more distinct when you look only at the top 10 players in the ATP rankings with the average height of males being 190.9 centimeters or 6 feet, 3 inches (Hadlich, 2021). By contrast, Eichiro is possibly quicker, with a height of 175 centimeters or 5 feet, 7 inches.

Athletes also vary in the proportion of quick and slow twitch muscle fibers they

contain naturally (Komi et al., 1977; Bouchard et al., 1986). Although training can increase alter these proportions somewhat, they remain partially genetically driven (Komi et al., 1977; Bouchard et al., 1986; Goldspink, 2003). It is possible that Eichiro has not only trained himself to move quickly, but that he has a natural advantage with a greater than average proportion of quick twitch muscle fibers. Note however, that such an advantage would come at the expense of slow twitch "endurance" muscles.

Perhaps Eichiro's talents are better captured, not in psychical gifts, but psychological gifts, more formally known in psychology as individual difference variables. Notably, people differ in their cognitive abilities. Individual differences in fluid intelligence allow some people to more easily solve novel problems and identify patterns. Eichiro may benefit from superior logic and reasoning which allows him to better identify which training activities are having the greatest impact, or identify the tendencies of his opponents and use them against them.

Working memory capacity, the ability to hold multiple pieces of information in memory at once, has also been implicated in superior performance across a myriad of tasks, with strong evidence for reading comprehension (Daneman and Carpenter, 1980), situational awareness in pilots (Cak et al., 2019), general problem solving ability (Engle et al., 1999), and generally staying on task (Kane et al., 2007). Superior working memory capacity may help Eichiro maintain his focus and attention. Additionally, Eichiro may utilize superior working memory capacity to both think about his current move, and the next move he is setting his opponent up for.

Although Eichiro may have above average intelligence and working memory, what was explicitly mentioned in the manga as setting him apart, was his vision. Although individual differences in perceptual abilities has minimal impact on performance, the ability to processes sensory information *quickly* is an important individual difference, particularly early in training (Ackerman & Woltz, 1994; Ackerman & Cianciolo, 2002). Eichiro's superior vision is an important asset early in his training. Likewise, the ability to quickly perceive, mentally process, and respond to stimuli is an important predictor of performance on speeded tasks—at least early in training. For example the ability to quickly determine if two numbers or pictures are the same or different is related to typing speed for novice typists (Salthouse, 1984; Bosman, 1993), performance speed on visual search tasks (Ackerman & Woltz, 1994), and even performance on an air traffic control task (Ackerman & Cianciolo, 2002). However, with practice, basic processing speed ceases to differentiate accomplished typists (Salthouse, 1984; Bosman, 1993). In fact, older, slower typists type as fast as younger typists (Salthouse, 1984). This is because older typists can use their experience anticipate the next word before they actually perceive it (Salthouse, 1984; Bosman, 1993).[1] When given random word lists or

[1] Note that the difference between typists in these studies was their work experience. Thus, Ericsson

letter strings, the younger, faster typists, retake the typing trophy (Salthouse, 1984; Bosman, 1993). The same phenomenon has been shown in visual search task in the laboratory. In a series of studies, participants were asked to verify whether a series of noun pairs (e.g., ivy-bird) were matched in a table. Initially those who are faster can look up the answers and respond quicker. However, when the pairs were consistently mapped (i.e., ivy is always paired with bird), then all participants became extremely fast after memorizing the pairs. Importantly, processing speed differences no longer predicted performance. By contrast, when the pairs were inconsistently mapped (i.e., ivy was sometimes paired with bird and other times with frog, or doll), participants had to continue to look up the answers and faster scanners continued to outperform their slower colleagues (Ackerman & Woltz, 1994). As an analogy, the young child who counts fastest will finish his math homework first. However, after all of the children have memorized their math facts, this child's "talent" for counting fast no longer provides an edge.

Consistent mapping is not the only task feature that dictates whether talent or practice matters most. Even in a consistently mapped air traffic control task (the pilots do as they are told versus occasionally refusing orders in the variably mapped version), performance never became automatic and people with better processing speed and logic and reasoning continued to be the best performers even following extensive practice (Ackerman & Cianciolo, 2002). More recently, researchers have suggested that various other task features that may increase the importance of cognitive abilities (Hoffman et al., 2014; Macnamara & Frank, 2019; Frank & Macnamara, 2020). Theoretically important task features include whether a task is static or dynamic (always changing), sequential or simultaneous (does it involve multitasking), and whether the task involves discrete categories or a full continuum of stimuli and/or responses (Hoffman et al., 2014; Macnamara & Frank, 2019). It is difficult to know whether Eichiro's area of expertise, tennis, ever shows the stimuli multiple times (do you ever see the same serve twice?). However, we can safely say that tennis is a dynamic sport with constantly changing stimuli. If Eichiro were instead playing chess, it is unlikely that his superior vision would give him the same edge over his opponents. Tennis is also a sport where one must deal with an entire continuum of angles, trajectories, and rotations. Only one study has looked at the effect of categorical versus continuous stimuli on skill acquisition, and it found that while participants performed well even when dealing with continuous stimuli, their decision times suffered (Frank & Macnamara, 2020). Thus, it is likely that Eichiro's superior processing speed would give him an edge when making more nuanced decisions about the precise angles and rotations of the serves he is facing.

Limitation to this Analysis

There is limitation to the previous discussion, which should be addressed: The fictional nature of the manga *Baby Steps*.

would not consider this a difference in deliberate practice (Bosman, 1993).

The story of Maruo Eichiro's ascent towards a career as professional tennis player is fictitious and not based on any specific individual, meaning there is no biographical account to reference for actual hours amassed in deliberate practice or a list of professional achievements. The use of an example from comics limits what conclusions may be drawn from the analysis.

However, this is an exercise in applying an established theory to a representation of a novice's progression towards expert status to demonstrate issues existing within the deliberate practice approach. As such, a fictional account of expertise acquisition benefits from the lack of the issues facing over avenues of inquiry. In short, we know exactly what activities Eichiro engages in, how long he engages in these activities, and his motivations for engaging in these activities. In contrast to the previously detailed work which relies mainly on self-report accounts of amount of deliberate practice, a reader of *Baby Steps* can verify the exact amount of time Eichiro spends engaging in deliberate practice, work, and play. It also allows an opportunity to examine common activities in the life of an aspiring athlete and examine the difficulties in applying some of Ericsson's definitions to these activities.

Conclusions

Ericson's expert-performance approach and its major contribution deliberate practice have been influential in the study of expertise development. It has been repeatedly demonstrated that deliberate practice is important to the development of expert performance in a variety of domains. Indeed, many elements of Eichiro's story are inline with many of Ericsson's descriptions of deliberate practice. However, there is significant literature to suggest that it is an important piece of the expertise picture and not the most central element. By using examples from the extant literature and a fictional accounting of a professionals development that in many ways mirrors real world developmental trends I have attempted to illustrate some of the issues with Eriscsson's use of deliberate practice.

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