

Dota 2 Exploratory Interviews: Skill Acquisition and the Professional Player

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“Most gamers have a thing....in their head. They are gonna find the best way to do this and do it no matter what, even if it’s not fun. You win by abusing the game design itself, you find some way to take advantage of that.” -- Professional Dota 2 player

Introduction

In recent years, the concept of what it means to “play” video games has gradually transformed. One area that has seen a great deal of growth is the realm of competitive gaming. Competitive video game teams are emerging on college campuses across the United States, where more than 10,000 students compete for tuition money and recognition for their gaming skills (Wingfield, 2014). Professional video game playing in the form of eSports (electronic sports) has been growing steadily in the past several years in the United States (Jackson, 2013), and careers involving professional game play are a reality for an increasing number of expert players. A variety of competitive games, such as Starcraft II, Call of Duty, League of Legends and Dota 2 are played in high stakes tournaments with prize pools up to nearly 11 million dollars (eSportsearnings.com). The players who are able to make it to these highly competitive tournaments are the demonstrated experts in their fields and must distinguish themselves amongst their peers through superior skill and dedication.

Since professional gaming itself has a relatively short history, there has not been a great deal of research on the field of pro-level gaming or on the professional players themselves. Nor has the research, to our knowledge, explored how the players achieve this elite level of success in their game play. In fact, much of the literature referencing video games and time spent playing/practicing focuses more on addictive and/or destructive behaviors associated with video game play (Vandewater et al, 2008; Gentile, D., 2009; Tejeiro, R.A., 2002). We believe that professional video game play, rather than being a destructive mechanism, is more akin to other professional endeavors, notably traditional sports. Studying the characteristics of video game expert players may offer us interesting insights into the process of knowledge and skill acquisition.

Part of the appeal of doing research on learning in a video game environment is the relative ease of recording game-play, tracking statistics in-game, observing the progress of the game, and talking with players about their experiences playing. Not only can game play be recorded with eye-trackers, but the players’ visual attention can be tracked, allowing a deeper view into what components or attributes factor into player skill improvement and growth. As a result, we believe that the study of expertise in video gaming is a ripe area for exploring learning and skill acquisition.

We were intrigued by the idea that individuals who pursue a career in professional gaming are experts in their field and also participate in an inherently track-able endeavor. Therefore, we decided to conduct exploratory interviews on the topics of learning and skill acquisition of 23 expert players of the video game Dota 2. The interviews were held during The International 3 (TI3), the largest professional Dota 2 competition, held in Seattle, Washington in 2013.

Dota (Defense of the Ancients) 2 is a sequel of a multiplayer online battle arena game (MOBA) that originated as a modification of Warcraft III: Reign of Chaos. The object of the game is to control one of 110 unique characters, or “heroes”, alongside four teammates to destroy the opposing team’s stronghold (called their “Ancient”), located on the opposite corner of the map. The map is comprised of three paths or “lanes” between the Ancients, and includes other structures and non-

player characters. Heroes grow stronger by fighting these characters and other players, generating resources to improve strength through progression and purchased items. Dota 2 is a strategy-intensive game and is known for having a very steep learning curve.

Background

Our goal was to begin looking at how the players reflected on their own learning as they moved from inexperienced to highly experienced players. Bloom's (1985) research on human growth and learning was largely grounded in an idea that we used as a model; that by studying the methods of the top performers in their field we could gain a better understanding of how talent develops.

There was very limited literature that pertained directly to expert-level skill acquisition in video game learning. Earlier informal interviews with individuals who worked with and coached professional-level gamers suggested that the literature on professional sports skill development might have some analogous ideas. In particular, we were interested in the psychological traits of high-level competitive athletes that might also be present in expert-level gamers. Orlick and Partington (1988) studied Canadian Olympic level athletes and identified eight traits that impact their performance: the ability to focus and sustain attention, utilization of performance imagery, a commitment to the pursuit of excellence, the setting of goals for practice, simulated competition, mental preparedness, detailed plans for competition, and finding ways to minimize distraction. Their work was focused on the mental readiness and control exhibited by the athletes. Of key importance was the idea of "quality training" which involved a great deal of mental imagery. As they point out, "Even the best athletes did not initially have good control over their mental imagery. They perfected this mental skill through persistent daily practice." (Orlick & Partington, p 113).

Along these same lines, Williams and Krane (2001) found that key elements for peak sports performance included: having a well-developed competitive routine, high levels of motivation, coping skills for dealing with distractions and problems, elevated concentration, strong self-confidence, control of arousal, the ability to set goals, and incorporation of techniques for visualization. Traits that are well-developed in athletes are also cited as being the types of traits that make for successful employees in business environments (Williams, 2013). We theorized that many of these high-level focal and organizational elements would also be present in competitive Dota 2 players. If so, that would suggest additional similarities between eSports and traditional sports and other competitive activities. So, in the expert video gaming world, we were interested in looking at where these types of traits emerge, how they develop and whether or not they are transferable into other domains.

Even within the professional sports literature, Gould and Dieffenbach (2002) point out that although there is research on the psychological characteristics of highly successful versus less successful athletes, "less is known about how these skills are cultivated and developed." Bloom's (1985) research on the stages of learning (which was based on Whitehead's work from 1929) shed some light on this and included different phases: the Romance phase, the Precision phase and the Integration phase. The Romance phase is the initial state when a younger person develops a love for a particular activity. In the Precision phase increased exposure to a teacher or a mentor helps a talented individual develop more technical skills. The Integration phase still involves work/support from a master-level coach, but also incorporated large amounts of practice to merge the training and technical skills into what they called "optimal level performance." It seems plausible that

professional video game players would also reference similar stages in their development. We were particularly interested in whether or not mentorship/coaching played a large role in their mid and higher-level skill acquisition.

An interesting finding to note with regard to professional athletic development is the external influence of family environment on performance. Although a “positive” familial influence was cited as being important to the athletes in Gould’s study, even more notable is the fact that the exact opposite could also be true. “A dysfunctional family environment and financial issues were also indicated as being methods of influence on athlete’s development within the family environment that helped athletes develop the psychological characteristics necessary to succeed.” (Gould & Dieffenbach, 2002). We include this finding in the theoretical background because the literature on learning in traditional education references both the positive and negative impacts of familial influence on school performance. In some cases, school actually provides a mechanism of escape for students who are dealing with detrimental home lives (Bancroft, 1997), and it appears that competitive sports may as well. Although our focus was more on the cognitive aspects of skill acquisition, given the plethora of literature on the negative impacts of gaming, we were curious if the professional players might connect any sort of positive or negative social/emotional element to their learning process.

Another potentially relevant area of the professional athletics literature has to do with visual processing. Faubert (2013) explored the idea that the brains of athletes may anatomically function differently with regard to their ability to rapidly learn and process complex and dynamic visual scenes. It is suggested that this type of processing may impact interactions in the athlete’s everyday lives such as walking through crowded streets as well as on the playing field. The results of her study showed that there was a clear difference between professional athletes, elite-amateurs and non-athletes in their capacities for learning in an abstract and dynamic visual task. She theorized that this is also related to the athlete’s ability to sustain intense levels of attention for brief periods of time in both selective and distributed ways. Given that Dota 2 is a complex visual environment with a great deal of input, we wondered whether the professionals would directly reference visual attention in their overall reflections on skill development.

Visual attention aside, we were also intrigued by the quantity and type of practice with which professional level players engaged. Informal conversations with individuals who play video games, often revolve around the idea that the best way to get better at a game is to simply play it. However, to the contrary, research suggests that expert performance requires a type of practice known as “deliberate practice.” Simply engaging in a large quantity of practice, regardless of how that practice is structured, does not necessarily (nor is it very likely to) lead to expert level performance (Ericsson et al, 1993). Trowbridge and Cason (1932) found that without consistent feedback during practice it is not possible to efficiently learn. Simply repeating an activity will thus not automatically promote improvement in performance.

In addition, experts store and retrieve cognitive information differently than non-experts and can retrieve it more efficiently and reliably (Ericsson, 2000). We theorized that part of what differentiates a novice from an expert is the ability to identify those aspects of performance that specifically need to be improved. What types of practice did the experts engage in, specifically, when they were at the point where they really wanted to get better? Could they articulate this? Would they be able to identify key elements that they believe influenced their skill development?

There are many other interesting lines of thought surrounding the way experts organize and access their knowledge (French & Thomas, 1987), amount of time experts devote to learning (Ericsson, 1993), processing limitations/cognitive load (Kalyuga & Sweller, 2005; Mayer & Moreno, 2003; Schnotz & Rasch, 2005; Sweller, 1988), and motivation and optimization of performance (Paas et al., 2005). All of these may have some relevance to the development of skill and expertise within the domain of video game play, and it is hoped that through the examination of these interviews, particular strands of interest may emerge.

Ericsson et al.'s work (1993) demonstrated that experts' attention, perception, encoding, storage and recall of information actually differs from that of novices. The experts had to process information differently than novices in order to bypass processing limitations that might otherwise occur. Jones and Miles (1978) showed that one mechanism through which experts seem to be able to do this is through something called "advance cue utilization." Essentially, the experts are able to predict what an opponent will do based on information received very early on in the sequence of action. Using examples from tennis they illustrated how experts are able to predict the type of shot that will be played based on the position of the opponent and the movements the opponent makes prior to hitting the ball. Thus, the player is able to circumvent the limitations of physical reaction time because he can already predict where the ball will go before it is hit. Novices were unable to make these kinds of accurate predictions and thus had to wait longer before making a decision.

Salthouse (1991) demonstrated a similar anticipatory action set in professional typists. Expert typists were found to actually be attending to letter locations up to seven spaces ahead of their current position. Essentially, they were looking further ahead when completing their task than non-expert counterparts. Eccles (2008) showed similar findings with expert orienteers. Eccles' work is particularly relevant because the expert orienteers were referring to maps as they progressed through their courses, and expert Dota 2 players are also referring to a map as they progress through the game. In Eccles' work, novices actually used their map in a less efficient way and planned their routes ineffectively. Experts in orienteering learned to effectively "run with the map" as a result of specific types of practice and coaching. Although Dota 2 players aren't physically running while using the mini-map, they are indeed using a map to extrapolate information while they are also managing and organizing a great deal of additional external information. Would the experts in our interviews allude to this type of forward-thinking or planning? Would they talk about being able to "anticipate" movements by their opponents?

Sweller's (1988) work on expert versus novice chunking and schema differentiation during problem solving highlights the ability of experts in a field to remember realistic problem-state configurations and thus categorize problems differently than novices. Although his work was in mathematics, not specifically on video games, there may be some interesting connections between complex problem solving in different domains.

Through in-depth, exploratory interviews we wanted to see what types of thinking, learning, organization, practice and external influences the professionals referenced when given the opportunity to answer a broad series of questions and reflect on their game play. Our goal was that through the exploratory interviews in conjunction with a literature review on expert learning and performance we might begin to gain a better initial understanding of whether and how expert learning in video games might be similar or have transferable or useful attributes for other areas of learning and cognition.

Method

During the week of TI3, professional players were interviewed individually during off-times in their practice schedule. Twenty-four expert level players were interviewed. Twenty-three are included in this analysis as one recording did not function properly. Interviews were conducted at a hotel near the competition site. Players were selected based on their availability, willingness to participate, and ability to speak English without a translator (with the exception of one participant with a translator). In addition, two broadcasters who were also expert level players were included. Interviews lasted between 20 minutes and one hour and were recorded and then transcribed. In order to protect the players' privacy, their names and any identifying characteristics from the interview were removed from data prior to sharing internally. They understood that the information would be used to guide development of a more specific follow up study.

Since this was an exploratory study, we decided to focus our questions in four broad categories in an attempt to look for interesting trends in the responses that might lead us to develop a more concrete follow-up study. Questions were grouped by these categories: *Game exposure and experience*, *elite level performance*, *concrete skills*, and *traditional learning and support structures*. Given the dearth of previous studies on skill development in gaming, we used research from other areas for novice versus expert learning to help with question development.

Game exposure and experience questions explored the players' initial exposure to Dota, time spent playing, frustration level during skill acquisition, and where they decided to expend energy to advance most rapidly in skill. *Elite level performance* questions examined the progression from casual player to professional, habits of mind before/during/after game-play, and the players' reflections on how novices might differ in their perception of the game than experts. *Concrete skills* questions asked players to reflect on particular skills/strategies, transferability of skills, and team functioning. *Traditional learning and support structures* questions referred to their lives outside of Dota 2: school, family support, and plans for after playing professionally.

Results and Discussion

Given the large amount of data, and the previously cited research on expertise, strands of particular relevance to the topic of skill acquisition were identified for further analysis in this paper. In addition we noticed several new areas that emerged from the interviews in the realm of collaboration and interpersonal skills. The themes from the interview data that we chose to examine in more detail were: *skill acquisition*, *novice to expert transition*, *practice patterns*, and *external influences*. We examined the following questions specifically to look for trends that might inform future work:

What other games or types of games do you play well?

Were you frustrated when learning the game?

How did you decide where to spend your energies to advance most rapidly at skill?

What things really helped you to get better?

What role does analysis play in your game?

Can you describe how elite level players think differently about the game than novice players?

Did you receive support from friends or family to pursue this path? Emotional impact?

What other games or types of games do you play well? Were you frustrated when learning the game?

"I did get very frustrated at times, but that motivated me to get better; it was the fuel to get better, it led to me practicing harder, wanting to train better."

"I don't get frustrated and just quit and uninstall it."

This pair of questions was initially designed to look at skill development through related games, and at how players became interested in Dota 2 to begin with. We were curious as to whether players actively played similar games, and wanted to know more about what drew them to Dota initially. It turned out that eleven of the 23 players answered the first question by saying they do not play any other games or rarely play other games. Those players often referenced a high level of commitment to the game, and an intense level of focus was apparent in their responses. Comments representative of that sample are, "I dabble around a bit but I am quite focused on Dota 2" or "I play a lot of games, but if I play other games I'm not practicing Dota." Other comments in this group highlighted the competitive nature of the professional level player, "I don't play any other games. I wouldn't stick with another game, I play to compete and be the best. I want to do something that I feel is relevant and that not everyone can do."

Several players referenced they are good at many other types of games, but even these comments ended up highlighting their intense focus on Dota 2. For example, "Of course, I've always had a quite easy time to get into games. The more seriously I play Dota the less I play others." Given the high level of performance these players have, it makes sense that the majority of their time would be dedicated Dota.

Interestingly, there were patterns to the types of games in which the players felt skilled. Games that were variations on the Dota design, such as Heroes of Newerth (HoN) and League of Legends (LoL) were referenced by five players. Other strategy games such as Starcraft II were mentioned by four players. Seven players referenced Warcraft 3 which essentially served as the foundation for Dota, so play in that game represents skill development in a similar environment.

Five players mentioned games that were not video games. Chess and poker were mentioned and one player explained, "Dota is similar to chess, I have to think ahead and predict moves." Another referenced the idea that much like chess, Dota 2 is a game where one needs to understand the game very deeply. A third also made a chess reference, but his response went a very different direction. "This is not chess where you have time to think; you miss a move and you are already in trouble; you have to think quickly." Overall, the games players mentioned were primarily games that involved a high level of strategic thinking.

Another interesting finding here was that several players referenced that they are weak first person shooter (FPS), sports game or racing game players. As one player commented, "To me, (FPS), they are a lot about having good timing and reflexes or more precise mouse movement; I'm better with strategy, thinking, planning and teamwork." Five of the pros referenced Counterstrike as a game in

which they were skilled and which they enjoyed, yet it was surprising to us to hear that multiple players felt their micro-level mechanical skills were what held them back in other games. We wonder, relative to the average players of most games, if these players' mechanical skills are truly deficient. Dota 2 would seem to require at least a moderate level of micro-level skill in order to play effectively and perhaps their perceptions of their own skills were not accurate. "Micro" (derived from the term micromanagement) refers to skills that relate to mechanical proficiency and tactical awareness. These are typically small, reflex-oriented skills like clicking accurately and quickly, queuing up commands to one or more on-screen elements, or consistently checking map elements. It is a common belief that these skills reach their peak potential in teenage years, and decline as a player ages into their twenties and beyond. At high skill levels, players have mentally automated much of the spectrum of micro skills, and believe focusing on them is a distraction from larger strategic skills that have a heavier impact on the overall game.

Players consistently referenced that they began playing the game for "fun" and were often introduced to it by friends. Many felt it was a "natural transition" from other games with which they had previous experience. Even though the game has what many consider to be a "steep learning curve" only three players out of the 23 described their initial learning period as "frustrating." Of the players who did not experience frustration, some attributed this lack of frustration to their experience with similar games, while others describe the learning curve as just "a process" but not a "frustrating one," and still others stated that at the time they started playing they thought it was easier to learn than it is for people joining the game now. Several specifically said they just thought it looked "fun" and had no intention of going professional when they started, they just enjoyed the game and they wanted to invest the time to get better.

How did you decide to where to spend your energies to advance most rapidly in skill? What things really helped you to get better?

"There is a phase where you need to get better technically. You get better by playing and losing over and over again. This is the first phase. It wasn't the most interesting and it wasn't the part I enjoyed. Then you have the phase where you need to understand the game deeply. That is very interesting."

"What helped me to get better was that when I didn't know how to do something, I would just go practice it and hammer it out. Repetition."

The majority of players felt that focusing on individual skill development (versus team development) was really important at the beginning of the game. However, as their skill levels increased, there was a definite shift in how they thought about the game and themselves as players. Individual skill only gets one so far. As the players' skills developed, it became less about their individual talent but more about the overall functionality of the team. One expert, who was also an expert in Starcraft II, remarked that in Starcraft he would notice huge leaps in his skill progression. That game is more repetitive, and as a result he would look for his own mistakes, take notes and then go back over his errors so he did not repeat them in the next game. He commented that, "I don't do that in Dota. I can be the best in the world, but if my teammate sucks, I can't do anything with that." The implication being that the same type of reflection in Dota 2 would not be worthwhile because the team aspect is far more influential in his success than further individual improvement at this level.

Playing with or watching people who were better than themselves and seeking advice from better players were perceived by the pros as important in the acquisition of skill. Several commented that the most growth they experienced was when working with mentors. Thirteen plainly stated things like, “You gain the most from finding someone you enjoy playing with who is better than you.” When playing with better people, several players pointed out that they sought specific feedback from these individuals. Nearly half of the players (11) named playing someone better than themselves as a key component of their development.

There was also a curiosity and willingness to explore early on in their game play. Some players played all the heroes early on and others purposefully picked heroes that they knew other people weren’t typically playing. This display of curiosity is interesting in light of their general lack of frustration from the previous question. What they didn’t know seemed to be an invitation to investigate further rather than a barrier to their continued skill acquisition. We are struck by the similarity to the “growth mindset” described by Carol Dweck.

Another interesting strand of thought within these responses had to do with attitude. For example, one player stated, “I was never afraid to play against better people. I was always excited to play against someone that I knew about, even if I got trashed, I would want to just play it.” This mentality was common among the pros even though in other video game studies we have done, we have seen less of this type of willingness to put oneself out there amongst the novices. It is possible that this trait or mindset is a pre-existing feature of the experts’ mentality which allows them to rise above other players. Along those same lines, players commented that part of what enabled them to develop expertise came from personality characteristics such as determination, self-confidence, believing you are good, not giving up, not second-guessing yourself, and dropping your ego. Of these, confidence was referenced the most.

Other players strategically used HoN and LoL as ways to both build and supplement their skills in Dota 2. This strategy backfired on some of them, however, as they found the games were not similar enough that they could easily transition between the two. Others were able to find enough similarities, particularly within the realm of mechanics, to transfer across the two and felt the skill development was compatible across related games.

Though the experts did reference sources such as online guides and videos, they were quick to point out that one can’t just read about the game. To become good, one must develop “a feel” for the game. Even in the earlier stages of game play, when they would have been less-experienced, there is a definite intensity to their answers to this question. One player explained that he forced himself to play all the heroes ten times a-piece when he was first learning so that he could get a better sense of the differences between them. Another told us that the only way to get better is to blame yourself for every mistake in the game. He further explained that if you blame your team instead of learning to reflect on yourself, then you will make the same mistakes again. “I blame myself every time we lose; that is motivation to not repeat mistakes.” This same point was brought up by another player who said, “It is important you learn to recognize your own mistakes. If you think you are doing everything correct and you lose, you will quit playing.” This sort of intensity or pressure combined with self-assessment seems to be a key aspect of their learning experience. It was extremely common for players to reference the pressure or high level of stress in the game as a driving force in their development.

Dota 2 uses a player ranking system based on an algorithm that analyzes how players perform in each match. One player stated that his relative position in the ranking system made him want to get better and better. He, too, commented that, “You need to get punished by making mistakes; you need to compete against better people.” Seeking out these more skilled players seemed to serve a dual function. On one hand, it keeps one both humble about their ability yet forces them to confront increasingly challenging situations, driving their skill-level up.

At the early stages, repetition was also key. “Play, play, play to get experience” was a common theme. There was a strong sense that one can only get better fast if they put in a lot of time and hard work. One player decided to play for 52 hours straight in the earlier stages so that he could really start to see the game more objectively.

It is vitally important to note that for these experts “playing more” may look significantly different than additional time spent playing for the “average” person. For many of these players, the time they invested to get better was significant. Even prior to reaching their advanced level, some of the players were investing upwards of five hours a day just to learn. In addition some, even among those players who initially just referenced a need to “just play more” in order to improve, had responses that were often qualified by more specific elements of practice. These included time spent reflecting, thinking about what they were doing, analyzing their mistakes and identifying/targeting areas to focus in on for future practice. The focus was on more than just practice and exposure. There seemed to be much specificity in their practice. Even when the pros would start an answer with, “I got better because I played a lot” they would often immediately go into more depth. For instance, one player stated, “Playing a lot is really important. Trying out everything. Memorization. Spell-timings. Knowing what everyone else is doing...looking at what everyone else is doing. Analyzing the specifics.”

Research on experts in various fields has shown that it can be very difficult for experts to articulate what it is that made them good in the first place. This sort of phenomenon seemed evident in the interviews. On multiple occasions, when asked something specific such as, “How did you advance most rapidly in skill?” the experts would initially give a very vague response such as “play more.” However, the same expert would mention later in the interview, often when reflecting more generally on their game play, something highly distinctive, such as that they purposefully put themselves with people who were stronger players so that they would improve just to keep up. This is not the same as playing games in random public matches. There is a strategic level of thinking about *how* to play when practicing evident in their responses, even if they don’t articulate it immediately.

Another player started his answer by saying, “I don’t think anybody knows this (how people get better); people just get better...you don’t know why you are getting better.” He talked for a few minutes about his micro-skills and self-confidence before completing his answer with this very specific reflection:

“You can always get mechanically better...You need to not have the mindset that one way is gonna keep you going the whole time; some person is going to play on a different level and is going to make everything you just did useless. You need to have multiple strategies that you know will work; you gain knowledge this way.”

Even though he initially stated that he has no idea how he got better, the complete answer highlights some key aspects that probably contribute. Earlier in the interview he stated that he is recognized as having a very strong micro-game with his mechanics. Yet, he openly admits that he can always get better with his mechanical skill. He articulates that one must have the proper mindset and multiple practiced strategies on hand to be effective. We would argue that the mindset, reflection on mechanical skill, and broader ability to think strategically are key aspects that contributed to his ability to play better over time. Later, he also mentions that good players have to analyze constantly (another key component that likely makes him a skilled player). He commented later, in passing, that a key element of his game play is to “argue in his head” which he says he does so he can progress. This mental arguing seems to be a form of mental reflection/analysis for the player.

A limitation of this question is that many of these players have been playing the game for several years. Some have as many as 15,000 hours of play-time logged. In light of that, it may be that some of their reflection on their early game development may not be an accurate depiction of the types of things they actually did. However, the types of responses they gave were similar in nature to that of experts in other fields. This indicates that, thematically, there are valuable strands of ideas to pursue in future work.

Can you describe how elite level players think differently about the game than novice players?

“Beginners don’t see the bigger picture...That takes a very long time to learn, it’s very noticeable. What separates better beginners is that they more quickly understand the mechanical advantages of the game; if I time this, or position myself here, there are some options available to me.”

“For beginners, there is the phase they need to pass to get to the part where you start to enjoy the game. The phase is the basics. Dota is full of basics. Before you pass this phase you can’t use your brain in different ways. You have to get this automatic...when I see someone who can think while they are learning, I know that is a good player.”

One of the challenges of this question was that we asked the experts to think from a broader perspective about what might differentiate novices and experts. We were pleasantly surprised, however, that many of the experts had direct experience working with novices in their recent past. This experience likely allowed them better insight into the novice to expert process than can be obtained with expert recall of their own experience alone (Feldon, 2006). As a result, the experts were able to give us very detailed and specific responses.

In fact, one expert player had himself just recently started playing League of Legends, a different but related game, and thus was somewhat of a novice in that environment. When he answered, he did so from the perspective of being a novice in LoL. The experience was in stark contrast to what he described from his skill-level in Dota. His response indicates a definite challenge in focusing on the relevant aspects of what is occurring on the screen in LoL: “Tunnel vision. You have to learn slowly, so you have to focus, using spells and abilities. It’s very hard to see what your opponents are doing, you have to be able to multitask.” He further discussed how he was not as able to multitask in LoL.

This multi-tasking element was a common theme in the responses. Dota 2 is an incredibly complex game with many components that must be understood and integrated in order to succeed. The

ability to take in all of the varied information, process it, make decisions quickly, and then react is a lot to ask of novice players. One respondent said, “Things move too fast for novices to think,” another, “Beginners focus on individual skill.” A third stated, “What you learn the entire time you play the game is decision making.” There was a consensus that there is a great deal happening at any given time on-screen, and beginners may be distracted and not be able to focus in on the more relevant actions that are occurring.

One of the more interesting responses to this sort of overwhelming input for the novice player came from another player who remembered when he switched over from HoN to Dota. His response is cited in its entirety because it was such an articulate description of the visualization of the screen with regard to novice vs. expert differences:

“When I started playing Dota from HoN, the graphics were so nice. This almost looks like art to me. I didn’t pay as much attention to what was going on, I looked at the effects. A kill happened and it was beautiful to look at. When you play a game for a long time, it becomes more of a chessboard to you. It becomes more two-dimensional, you see what is actually winning you the game. It is more about you working toward the goal to gain an advantage to get the win. You don’t notice the effects in the game, you just need to know the basics. What is moving, what spells are you doing, where they are at. It’s 2D to you.”

This response is particularly relevant since we also informally spoke with several novice players during this time period. One of the first things they all mentioned was that there were so many eye-catching things to look at that they constantly found themselves visually distracted by the colors and varied movements on-screen. One commented that there were, “Just these ghostly things flying around.” Another pointed out that they would literally lose their hero on the screen because there were so many other things happening that they could not focus their attention on their own hero.

It was stated by the experts, in several different ways, that even when beginners were focused on something, *that* something was not the appropriate thing. “Often beginners notice the wrong types of mistakes, things that are not relevant to overall game play.” This sentiment was shared by several who felt beginners seem to get distracted by or hung up on things that really don’t matter within the larger context of game-play. Likewise, novices might know one aspect, say a particular spell, but they won’t know the situations in which to apply the spell.

Even as players begin to gain skill and learn more about appropriate positioning, item builds, and spells, there is the larger strategic component that is missing in the beginners’ perspectives. In particular, the experts pointed out that the beginners do not know where the boundaries lie or where they can push things. One player stated, “High level players are always trying to push the limits.” Beginners don’t yet know the limits, and this inhibits their strategic potential.

Part of this ability to push boundaries also seemed to be related to the capability to handle the pressure of the game more effectively, in order to time their actions for maximum effectiveness. Experts perceived themselves to be able to handle things like waiting for better opportunities. They referenced their better timing in general and therefore did not feel pressured to act ahead of time just to “do something.” The experts perceived that the novices, often had an overriding fear of “not doing something” and this caused them to “crack under the pressure” in-game. Several experts referenced that beginners want to feel useful. Therefore, they may become very focused on the wrong things at the incorrect times and just take action in order to do something visible. For

instance, they may feel a need to try to kill, even if that strategy is not particularly useful or helpful to the team. One player stated, "Experts know when to hold off in order to be useful." We wondered if beginners would have any concept of how not doing something could be more important than actually doing something.

Related to this is the idea that experts can think further out and not stop and act at only at the first action or solution, therefore optimizing in-game more effectively. For instance a player said, "Low level players might be satisfied with the kill, but higher level players, they see that yeah, you can get the kill, but actually, you can get another one, too." In other fields requiring strong visualization and spotting skills, such as radiology, this is called "satisfaction of search," meaning that once an object is found, the observer may stop searching for other findings or objects too early.

Another strategic ability the experts saw in themselves but not in beginners is a better sequential strategic plan for the game. "Elite players have a more complex plan...every step should lead to the next one, it's overarching." One expert gave an example of the types of language one might hear from a novice versus an expert. "I hear novices say things like, 'Let's push this tower so I can get gold.' Experts will say, 'I need to wrap around the tower so I can secure it.'" The first example suggests a simpler, less sophisticated action. The sample expert answer demonstrates a more strategic approach to taking the tower. Experts talked a great deal about their ability to "know" or "predict" what was going to happen next and how much of what they did in-game was automatic. In line with the circumvention of processing research, the experts spoke about the necessity of automaticity and familiarity with a wide array of problem scenarios. This granted them the ability to not just react, but predict the types of scenarios they were going to encounter. The implication here is that more advanced players can hold more information in their minds, and thus make better decisions to optimize the use of this information. Given the research on cognitive load theory, this makes perfect sense. Since experts are more automated in their game-play, they are able to hold and process an increased amount of higher-level information than the lower-level players.

Along the more competitive aspects of game-play, it was interesting to note that the experts could win a match and still feel like they did not play well. Clearly missed, solid opportunities within-game were detriments to overall satisfaction in the game for the experts. As one player stated, "Playing a lot is not the same as playing smartly. You must be able to differentiate between winning a game and playing well. Just because you won doesn't mean you played well." Yet, at the same time, the experts definitely had a competitor's mentality. One reminded us, "Second place is the first to lose." That is why this player would go back and watch his replays so that even in games when he "won", he could understand what he could have done better. Another, still, pointed out there is such a thing as a "good win" versus a "win".

The harshness with which the experts judge themselves against their own standards was apparent throughout the interviews. It was not uncommon to hear things like, "I want to win, it doesn't matter what it is, it's what I care about." It would have been interesting to hear if this kind of language was present in the game-play of these experts when they were first playing the game. Perhaps that is another inherent distinguishing characteristic between the novices who persevere to reach a higher skill level?

Many of the experts cited focusing on individual skill as an important component of in-game improvement. However, they were also equally quick to point out that this focus on the individual is part of the downfall of the novice player. Sample responses that illustrate this were: "Beginners

underrate the importance of working together” “Beginners focus on individual movements,” “Pro-players are able to remove themselves from the picture,” “Novices don’t see their allies or the bigger picture.” One expert who says he plays with beginners frequently stated, “I see the game differently than they do. The team that makes the most mistakes loses.” This awareness of collaborative team effort or perhaps how to achieve it was an implied weakness of the beginners. One pro commented that, “An elite player knows how to control the other nine players so that they do what he wants them to do.” There were constant references to overall team performance and relationships throughout the interviews with the experts.

Several players linked the idea of novices being more nervous, as individuals, to the fact that when they start to feel-pressured they “tunnel in” and forget about the rest of the team. The language experts used about this team aspect was very specific. At the higher level, it is about group performance. As one player put it:

“You have to make sacrifices to make your team better; everyone has a weakness, if you can fill a weakness in what someone else has, fill each other’s gaps, at the cost of your own performance, that’s good. If you can bring everybody up, it’s mental, that’s what you want.”

It would be interesting to try to pinpoint the development of this larger group mentality. It is less common in a traditional learning setting to think openly about the strengths and weaknesses of group performance in this way. Another player commented, “Superstar players win games, but not championships.” This was a sentiment echoed repeatedly with regard to expert individual vs. team performance. The responses in these interviews were in stark contrast to the stereotype of video game players being necessarily isolated from one another, particularly in a team game like Dota.

With regard to teamwork and the overall functioning of the group, other experts spoke about the need in a team game setting to predict and estimate certain factors in-game. Based on previous experience they had ideas of the limitations of the other players in the game and what sacrifices would need to be made in order to effectively impact/control/influence them. These seem to be some of the areas where increased and refined play-time and experience really become factors. In order to get a sense of the “limitations” of a given scenario, one needs to be exposed to enough similar examples to be able to practice various responses and strategies.

Another expert had a sibling who also played Dota 2. He observed the following about his sibling:

“We are playing two different games. The reality is totally different. I see all these opportunities he doesn’t see. What is he thinking? Why is he doing that? Even how you move the screen, where your eyes are moving. As a pro, you pay much more attention to the mini-map and fine details; you know you will survive, you can figure it out.”

Mini-map awareness was another key area that the experts felt differentiated them from novices. The mini-map is a small square map in the lower left-hand corner of the screen which shows the location of players and status of the game in real time, to provide a snapshot of what is actually occurring. Experts felt that novices mostly kept their eyes on the main screen (if not specifically on their own hero). Knowing how to use the mini-map to one’s advantage during game play is a higher-level skill. The experts felt that the novices really either didn’t pay attention to the map, or if they did, were not able to properly utilize it to assist in their game play. Experts discussed how the mini-map is often their main point of focus and referenced their ability to extract large quantities of information from the mini-map.

Being able to gauge the status of the game, in general, is clearly something that develops through time and exposure in-game. With regard to overall positioning, a pro commented, “Experts instinctively know how far away they can stand; what the other players can see.” Another player remarked, “Experts are able to gauge how close to death they are.” Many of the experts referenced their feelings or intuitive sense of how the game was progressing. They also explained that this sort of “sixth sense,” as one player put it, is something that only develops from the repeated exposure. Several pointed out that one cannot read it or study it online, it is something one has to feel, and that feeling comes from exposure and practice.

This “sense”, or larger intuitive understanding of the game, was a quality a few of the experts thought they could identify in some beginners. Experts felt that those who had it, or exhibited signs of it, would “ultimately become good.” A beginner who can think beyond basics, or demonstrated good instincts, was a stand-out beginner. On a more concrete level it was stated, “Better beginners more quickly understand the mechanical advantages of the game. If I time this, or position myself here, there are some options available and if I use them in a decent way, that is an advantage.” Timing and positioning are key aspects of the overall intuitive understanding.

It appears evident that visual attention is a key area of challenge for novices, both in terms of what to attend to and what to ignore. Being able to mentally prioritize what is most important at a given point, and recognizing that one’s own health and well-being may not actually be the priority at a given time may be a key aspect with which novices struggle. It is theorized that novices generally have a harder time coordinating with a team and gauging position, nailing their timing and determining the boundaries of what is possible within the game setting. Novices also may not properly utilize the mini-map or, at the very least, may not extract as much meaningful information from it. Experts at the professional level are very critical of their game play performance, even when said performance results in a “win” for the team.

***Did you receive support and encouragement from friends or families to pursue this path?
Emotional impact?***

“It took my life in a different direction. Good or bad, I don’t know. I’m enjoying myself, so I hope it is for the better.”

“Playing Dota 2 has changed my life. A lot is from the game, a lot is from myself just growing as a person. I’ve learned a lot of lessons.”

This line of questioning brought up an array of comments ranging from the basic to very in-depth reflections on emotions and teams. As mentioned in the introduction, we wanted to include a section about these emotional elements because they were brought up throughout the interviews. The intersection of emotion, collaboration, and external influence seems to impact the overall experience of what it means to be a professional in Dota 2.

With a few players, there was an underlying theme of sadness or difficulty driving their progression into game-play. One example was, “Gaming was a niche where I can get into silence. Before that, I was dodging my family...now I think about how I did stuff as protection. Gaming brings you that escape. You get outside of the world that you are in. It is very reflective.” There were several references to depression prior to playing the game or feeling overwhelmed or just unhappy in other

life situations (high school, college). Their progression into professional-level gaming seemed to mitigate those feelings. Another player referenced that, "Some of the top players have a very hard life and they are highly motivated to play."

With regard to familial support, eight players said they had no support. Another eight said that the support was either "so-so" or was not there initially but has leveled out over time. Five players said that, yes, they received support from their parents in pursuing this path. Two players made no reference to family. Many players inherently understood why parents would be skeptical about professional gaming. One even remarked, "Support and encouragement...now, yes. They questioned my decision at first, any parent would do it, even myself. I wouldn't let my kids play that much." Another pointed out that family members were concerned about the player's overall health and well-being, given the amount of time they spent playing and their odd sleep schedule.

With regard to friends, the responses were very mixed. Some felt that playing professionally actually caused them to develop closer bonds with their friends (both those who played and those who did not). Others felt that playing competitively brought out aspects of their personality that actually negatively impacted their relationships with friends, such as impatience and a lower tolerance for frustration. The challenges of playing in a team environment was generally regarded as an asset to the interpersonal and school/work relationships the players had outside of gaming. The fact that individuals could stay connected to teammates and external friends via actual game-play was another factor cited as having a positive emotional aspect.

There were many in-depth reflections about support and functionality within the team. Some players were quite open about weaknesses in their team's relationships. A player talked about his ability to tolerate almost anything now, including, "yelling, screaming and arguing" as a result of exposure to these on his team. Other players specifically cited the challenges of team strife and the emotional difficulties of working through that. One stated, "Relationships are important...you have to have the awareness of how to make a five person team game work."

There were also very positive reflections on the emotions and connections within the team. For instance, "The people I surround myself with (on my team) are reflections of myself...mirrors. You need to surround yourself with people who bring you up...I am the average of those five people. I want to reflect their best attributes."

Other players drew parallels to everyday life and emotional interactions. One mentioned that, "(Playing) makes you think about why and how you feel certain things." There were reflections on everyday abilities to handle frustration and sometimes an impatience in everyday life that they attributed to their time playing the game. With regard to social interactions, another remarked that "You can learn a lot in general, you can understand a lot from being a Dota 2 player."

One of the most highly-referenced emotional skills directly attributed by the experts to in-game experiences was the ability to separate their thinking from their emotions. One player who had recently experienced a negative life-event said, "I can separate emotions from decision making...a lot has happened in my life; I can think through it, separate things. It is essential to not hesitate and doubt." A similar comment was made by another player with regard to mistakes in his life, "You must remove yourself, like chess. You see what was bad and what was good. You detach yourself from what was good and what was bad. I can consistently do this." When pondering emotions,

another player pointed out, “The part people see is how we play, they don’t see how we work on a personal level which is really important.”

The players were generally able to reflect on the emotions involved with family, friends and teammates. Comments from players in this realm demonstrate a level of personal reflection that perhaps is not always immediately evident in popular culture when thinking about gamers. There also appeared to be transferable elements from the social/emotional realm, from the game to everyday life situations for the majority of players. Collaboration, management of challenging situations, emotional regulation, ability to function under duress, and a better understanding of human nature were oft referenced transferable elements.

Also of note, several of the players commented after the interviews that they found the experience of being interviewed very cathartic and personally illuminating. Many said that no one had asked them these types of questions before. A couple stated that they wished they could come back and be interviewed again because they really enjoyed the process of thinking about their game-play. Those who had highly emotional experiences related to their game play, either related to struggles within team or personally, remarked that it was helpful to be able to articulate and examine their feelings. It is possible that the players are participating in such a relatively novel, intense, immersive sport, with large demands on social-emotional and self-regulation skills, that there is a useful role for study and self-reflection.

Conclusion

*“You have to be willing to adopt and adapt. **** is an old school player...he’s changed a lot. Some players stay stagnate and don’t adapt like him. Even if you are good, you have to keep on improving to advance your level cause everyone else is, too.”*

“At some points, you don’t feel like you are getting better; but when you enjoy the game that much, you just keep playing. Even though it’s hard, you just keep playing.”

From these exploratory interviews, there does seem to be evidence that there are parallels between the research on competitive athletes and professional Dota 2 players. In addition to this, expert Dota 2 players also appear to go through similar skill phases to those described by Bloom. Without directly calling their practice “deliberate” the elaborations made by players about what “practice” entailed suggests that this is exactly what they do that leads to skill acquisition. Visual attention was a common theme cited as an area of difference between novices and experts. The ability of experts to think more broadly about more important strategic objectives was also common. In addition to the more concrete, skills-based learning, emotional and collaborative learning, the ability to handle stress, have a growth mindset and intensity of purpose were also areas of skill either required to excel and/or acquired as a result of game-play. This was a very broad, exploratory sample with a small sample size meant to highlight areas of possible interest. Further investigation into interest areas in a more controlled study will be fruitful.

Much of the literature on metacognition and performance demonstrates that people are particularly bad at accurately recalling why they do the things they do. This is especially true of experts who may very be very inaccurate or inadvertently omit key information that is relevant to their expertise (Feldon, 2006). Nevertheless, it is still important to ask experts to reflect on their game-play and skill development as it can give us initial starting points for further investigation.

Pairing expert reflections with a more quantitative approach to monitoring their actions may help us to catch some of their omissions and thus present a more accurate picture of what the experts are actually doing. In addition, it may provide an examination into the possible misconceptions of experts with regard to the action they take in-game.

As mentioned previously, video games offer a unique platform for gathering multiple strands of data simultaneously. These interviews only involved expert-level, professional players. It would be interesting to investigate a wider skill-range. Perhaps when talking with novices, intermediate and expert players, we will find differences in how they articulate their thinking about their skill-level and game-play.

Many players referenced their sense that experts and novices look at the game screen very differently, and in fact, may be looking at entirely different things. Further studies should include measures to help confirm if this is, in fact, the case. Even asking players where they thought they paid attention and then comparing their perceived attention versus their actual attention could shed some interesting insight in the ability of individuals to accurately reflect on their own attentiveness. It would also be informative to look more in-depth at the types of training and strategies individuals utilize to improve their in-game skills. How well do people accurately assess their skill level?

Further inquiry into how various levels of players think about skill acquisition and training could also offer interesting insight into learning. In a more traditional classroom setting, research has demonstrated that individuals generally make very poor judgments about the types of training that will improve their learning (Bjork et al, 2012). The professional level players had some very specific commonalities (mentors, playing with people who were better than them, analyzing mistakes) and it would be interesting to see if less-skilled players even consider these things important when pondering in-game improvement. How do novices reflect on their game play relative to more experienced players? Is there a way to help novices improve skill faster as a result of a better understanding of how experts think?

The social development and improved collaborative skill transfer is another intriguing aspect. There has also not been much research in the area of collaborative team games and improved social skill. Recently there has been some initial work looking at video games as a mechanism for helping people to overcome things like depression. A few players mentioned the game as a way for them to cope with external-life challenges, and there was some alignment with the professional athletic literature on challenging home situations positively impacting the competitive aspects of game play. Further investigation into these areas could have wider reaching implications for mental health and social/emotional learning.

The exploratory interviews illuminated some interesting pathways for future research on expert level gamers. This research could have an impact on the overall understanding of learning. Through the triangulation of game play video, game statistics, quantitative data, and player interviews, learning in video games may provide an important avenue for examining knowledge acquisition in a more expansive way. It is clear from the interviews with the players, that in numerous areas of their lives, the process of becoming a professional Dota 2 player has had a profound impact on their lives and thinking.

“Dota 2 has directly changed my life. It made me the person I am now.”

"I am a big fan of learning...Dota 2 has helped me like that."

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