CRAFTING THE METAGAME:
Connected Learning in the Starcraft II Community

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INTRODUCTION

We believe that our game, *StarCraft*, is the chess of our generation. *StarCraft* requires the dexterity of a pianist, the mind of a chess grandmaster, and the discipline of an Olympic trainee.—"E-Sports Manifesto," by Day[9] (N.d.)

A StarCraft II *tournament hall, DreamHack 2011.*
Image courtesy of Arthur Lee at http://www.flickr.com/photos/artr/6404108455.

The two jobs to which Sean "Day[9]" Plott commits most of his time—competitive gaming commentator and host of an online daily TV show devoted to the art and strategy of the video game *StarCraft II* [1]—did not exist 10 years ago. As a commentator for professional gaming events such as the Global *StarCraft II* League tournament in South Korea, a role also known as *screencaster*, the 25-year-old from California has to draw on his deep expertise as one of the top *StarCraft* players in the world to create live commentary on professional matches.[2] As host of *Day[9]TV*, he mines his experience with the game to provide tips and tricks to a community of players hungry to improve their craft.

StarCraft, a real-time strategy game developed by Blizzard Entertainment, has been labeled by many of its participants as the chess of the twenty-first century. Combining strategic problem-solving with fast reflexes has made players such as Day[9] experts in a game that many think takes years for anyone to really master. "I love *StarCraft* because you always feel like there is a way to improve, a way to get better," says Day[9]. The sheer pursuit of expertise drives many players to stick with the game for years and to share what they know with others. Because of this, *StarCraft* feels like a game supported not only by the company that developed it, but also by a community of twenty-first century learners intent on leveling up their collective expertise.

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1 *StarCraft® II* is the property of Blizzard Entertainment, Inc., and is used with permission.
2 *StarCraft II* (2010) is the sequel of another Blizzard Entertainment game known as *StarCraft* (1998). Note that even though *StarCraft* and *StarCraft II* are two different video games, they share the same community of gamers and therefore share many community sites, tournaments, and social practices. In other words, the *StarCraft II* community is a continuous development of the original *StarCraft* community. When we use the term *StarCraft* instead of *StarCraft II*, we are referring to this long-standing *StarCraft* community and its social traditions.

While some players of *StarCraft* pursue competitive play through a ladder system that matches players of relatively equal skill, others interact with the game through its robust modding community. Modding is a practice in which players use tools to modify a video game, changing its look and feel, gameplay, or story. A wholly creative endeavor that requires players to either program their own tools or use those released with the game, modding provides players with a chance to play around with the game world to express their own ideas and interests. Many mod makers develop deep technical skills in computer programming as a result, as well as the collaborative skills required to complete ambitious designs combining artwork, audio, and level design.

The game has several modes, which tend to attract different kinds of players. Campaign mode is highly narrative and takes the player through a series of scripted missions. Multiplayer mode is almost pure gameplay, with little narrative, and includes the possibility of a hard-core ladder style of play, in which players are matched with players of relatively similar skill. The best players, or those at the top of the ladder, often go on to compete professionally, participating in game tournaments for prize money. In the third mode, players may choose to download and participate in one of the custom games developed by modders.

We chose *StarCraft II* as a research site because of its intellectual demands, academic relevance, and networked peer support driving players to strive to learn and achieve higher levels of gaming skills. We interviewed players, as well as members of the game-development team at Blizzard Entertainment, as we were interested in understanding both the design and uptake of the game within the context of connected learning. This dual focus on developer and player was critical to our understanding of how and why connected learning is enabled by the sets of tools and experiences making up the *StarCraft II* universe. The notion of learning is so salient, in fact, that both the developers and players we interviewed invariably brought up the term in different forms. For example, "I learn on my own [through Internet media]" or "I learned really well when I was having conversations [with others]." More important, at the core of learning that takes place within *StarCraft II* is a model in which players are connected by media content developed by players themselves, using the game editing tools or other social network tools, as well as an active and peer-supported social network.

DESCRIPTION OF RESEARCH STUDY

Unlike in classroom-based learning environments, a *StarCraft II* learner will find no syllabus in the community. There is no teacher who will provide instructions, and no scripted answers to problems. *StarCraft II* players ask questions because of gaps encountered in their knowledge, which are keeping them from becoming a better player, modder, or mapmaker. Driven by interest, they will seek out answers from peers. In doing so, players practice skills critical to the new economic environment, such as self-direction, self-reflection, and communication (Pellegrino and Hilton 2012).

We performed an ethnographic study of the *StarCraft II* community between September 2011 and July 2012, and we kicked off our work by learning to play competitive *StarCraft II* games. From there we identified a set of contexts in which to gather data on the connected learning practices emerging from the play of the game. The sites of study included the online forums and *StarCraft II* wikis for strategies and news, on-site gaming conventions such as BlizzCon 2011 in Anaheim, California, and the *North American Star League* Finals 2011 in Ontario, California, online broadcasts of live professional games, and BarCraft events, or organized events where *StarCraft II* players gather in a restaurant or a bar to watch a *StarCraft II* tournament live on TV.

We also conducted in-depth interviews with 23 *StarCraft II* participants. They include 11 working adults, 1 graduate student, 4 college students, and 7 high school students. Our interviewees ranged in age from 15 to 30 years old, with an average age of 21.8. Of the 23 interviewees, 21 are male and 2 are female, and 4 participants have experience in professional gaming. About 90 percent of our interviewees are either white or Asian American. Our interview sample is comparable to a public online survey performed at the *StarCraft II* online forum site, Teamliquid.net, except that ours has a higher proportion of students (81 percent compared to 62 percent) (sYz-Adrenaline 2012). Names of all minor participants are pseudonyms. For adult participants, names are pseudonyms except in cases where their identities and activities are already widely known in the community (e.g., every player knows that Sean "Day[9]" Plott owns *Day[9]TV*). In these cases, we obtained informed consent to use their real names in this report.

In addition to interviews with players involved in the competitive play side of *StarCraft II*, we interviewed 12 members of the game's core development team at Blizzard Entertainment, as a strategy for understanding the ways in which design decisions made by the creators of the game might lead to or discourage connected learning practices. Would the matchmaking functionality, and clear ladder structure within multiplayer mode, for example, provide the right kind of scaffolds for players to build relevant expertise? Did the development team's decision to leave all of the game's maps "unlocked," so that they could be studied by players and even copied using the game's level editing tools, serve as learning supports for new players? Developer interviews were conducted on-site in Blizzard Entertainment's offices in southern California over the course of two days, and they were videotaped. We then edited the footage into a series of stand-alone clips, organized around key connected learning design principles.

At its heart, the study sets out to link a set of sociotechnical design concerns expressed by the game's developers with a set of observed learning practices taken up by its players. The player environment in *StarCraft II* represents a subset of participatory cultures of young geeks and how they are seen in practice in an openly networked environment. Understanding the ways in which such practices might be better enabled from a design perspective is a critical strategy for moving a theory of connected learning forward.

A BRIEF OVERVIEW AND HISTORY

In the campaign and multiplayer modes, *StarCraft II* is a real-time strategy game in which players control armies to engage in intergalactic warfare. Like chess, these modes of *StarCraft II* are matches played between two players, but unlike chess, *StarCraft II* is played on a computer with high-resolution graphics. In each match, two competing players clash with their sci-fi armies. The scene of a *StarCraft II* match is easy to imagine if you have seen the movie *Starship Troopers* (1997).

A *StarCraft II* match is played on a virtual battleground: a map containing terrains such as resource patches, inaccessible cliffs, and choke points. In a match, players have to mentally process a complex web of relationships between combat units, such as the Marines, production facilities, and map terrain in real time (see battlefield image below). A player wins when he has eliminated his opponent from the map, or when his opponent admits defeat. Each player starts at a different location on the map, and he has a few minutes to build up his army.

A StarCraft II *match tests players' ability to manage a battlefield in real time.*
Image courtesy of Blizzard Entertainment.

A starting location is a mineral patch containing a limited amount of resources (see image below). Players collect and allocate these resources to make buildings and units. Players have to carefully deliberate on the allocation of these limited resources to approximately 15 different types of buildings and the 15 types of units that are available. Different unit types can do a combination of different things, such as collect resources, fly over terrain, or fight in combat. The buildings that players have already constructed determine the units they can make. Thus, a player's *StarCraft II* strategy as a whole requires preemptive planning and foresight in resource collection, building construction, and unit making. Players often develop these strategies after months of extensive analysis of the game mechanics.

A starting location sitting on a plateau with a narrow ramp.
Image courtesy of Blizzard Entertainment.

StarCraft, like the other games developed by Blizzard Entertainment, including *Diablo*, *Warcraft*, and *World of Warcraft*, has a large modding and mapmaking scene. The company actively supports custom game development and modding, and it ships the game with a robust level editor and set of custom mapmaking tools. These software tools have been taken up by players from around the world to make their own versions of the game—many with little in common with *StarCraft*. These mods include a version of *Guitar Hero*, a remake of *Warcraft 3*, and a slew of team-based games. *StarCraft* players also have access to Battle.net, Blizzard's online gaming service. Battle.net connects all of the players of Blizzard games across the Internet, allowing them to play any of their games with other players. It includes common social features such as friending and chatting, but it also enables competitive gaming. Relative to our discussion here, the site also allows players to talk across games, so that players in the *World of Warcraft* community can also speak with *StarCraft II* players.

Whether *StarCraft II* is played in campaign, multiplayer, or custom mode, players help each other develop their expertise. Competitive players use in-game communication tools to find practice partners and to chat and make friends. Many players watch streaming video of professional matches or the individual streams of high-level players while they practice. As one of the game's developers noted:

> With *StarCraft*, you're able to just log in to the stream of a professional player, as he's playing all day long and just passively watching over his shoulder and seeing what he's doing, and that's really cool for the sport. So a lot of fans and players who might want to be professionals, they do that and they improve their skill and they'll learn tricks and they'll talk to each other on forums via Reddit or the *Team Liquid* forums. Any of the social networks. And it just creates this amazing feedback loop of players watching fans and fans—and professionals learning from the players. And on Twitter it's great, because you can now directly talk to the major professionals. You can say, 'Hey, I watched your stream. What did you do with this unit?' And they'll respond back; that's not something that you typically see in professional sports where any random fan can go up and be like, 'What did you mean when you took that shot?' In *StarCraft*, because it's such a grassroots kind of a sport at this point, they still have a lot of connection between the fans and the professionals.

Online tools are an important resource for players and have contributed to the formation of an openly networked environment in the gaming community. In both competitive gaming and modding, many players are also connected through social media such as Facebook, Twitter, Skype, and online forums.

In the following sections, we will discuss our findings under the connected learning framework (Ito et al. 2013). The principles we will cover include interest-powered, peer-supported, academically oriented, production-centered, openly networked, and shared purpose. Finally, in the reflections and conclusion, we discuss how *StarCraft II* players adapt their learning approaches to an intellectually demanding and competitive environment and then draw on cross-thematic findings across the principles, ending with final remarks on the *StarCraft II* community.

CONNECTED LEARNING IN STARCRAFT II

Connected learning—learning that is socially embedded, interest-powered, and oriented toward educational, economic, or political opportunity—occurs when a young person is able to pursue a personal interest with the support of a network of peers, and who is then able to link this learning and interest to academic achievement, career success, or civic engagement (Ito et al. 2013). The connected learning framework seeks to integrate three spheres of learning—peer culture, interests, and academic content—that are often disconnected for young people. Many times their school learning has little overlap with their personal interests and their associations with their peers. Connected learning seeks to remedy that disconnection, instead encouraging an overlap among these three spheres of learning. It looks "to digital and networked media for potent new ways of building connections and access to knowledge and information" (Ito et al. 2013).

INTERESTS

CONNECTED LEARNING

ACADEMIC
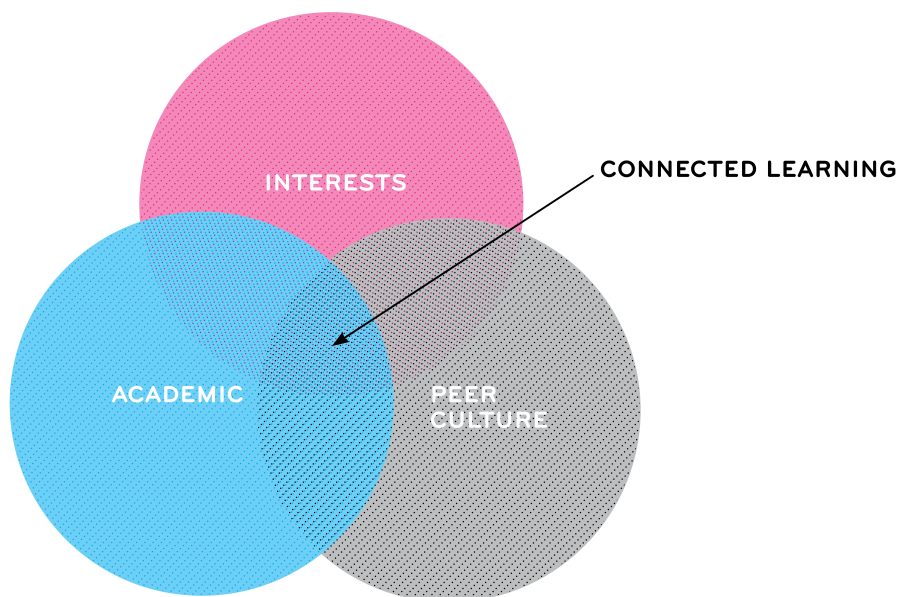
PEER CULTURE

Figure 1
Connecting the Spheres of Learning, from Ito et al. 2013

The connected learning model calls on interactive and networked media to create an environment where a connection between peer culture, interest, and academic content can occur, one that values equity, social belonging, and participation. Such connected learning environments generally are production-centered, have a shared purpose, and are openly networked. The digital tools available in online communities provide opportunities for young people to experiment and produce a wide variety of media, knowledge, and cultural content. Such communities encourage cross-generational and cross-cultural learning and connection around common goals and interests. And online platforms and digital tools make resources abundant, accessible, and visible to all participants (Ito et al. 2013).

This case report introduces one of a number of case studies from the Connected Learning Research Network that explore the learning ecology of interest-centered youth contexts. In particular, as we describe in the report on the Playstation 3 game

LittleBigPlanet 2 (Rafalow and Salen Tekinbaş 2014), this case and the one on *LBP2* are inspired by the theory of the *metagame*, a framework developed from the study of role-playing and collectible card games (Salen and Zimmerman 2004). Designers of fantasy role-playing games such as *Dungeons & Dragons* and *Magic: The Gathering* first modeled an approach to game design that took into account a game's relationship to outside elements—player attitudes, play styles, social reputations, social contexts, and so forth. Kids poring over *Pokémon* strategy guides or discussing the configuration of their decks are activities considered part of the metagame, a term that refers to the way a game engages with elements outside its formal play space. *LittleBigPlanet 2* players sharing custom costumes for Sackboy between bouts of play are engaged in *LittleBigPlanet 2's* metagame, as are the four DS-equipped 10-year-olds who trash-talk each other during a networked round of *Mario Kart*. In the case of the study at hand, players preparing strategies for an upcoming match represent a core piece of *StarCraft's* metagame. We use the framing of the metagame for this report because of the strong way in which it connects shared purpose in interest-driven activity to learning and expertise development around that activity.

SHARED PURPOSE

Shared purpose helps create a learning environment in which both adult and youth participants work together on the same activity. This sense of common purpose creates multigenerational learning environments that may provide opportunities for youth to interact with others, and with more experienced participants. Esports (electronic sports) are organized as a set of leagues that "compete through networked games and related activities" (Jin 2010; Taylor 2012). In *StarCraft II*, shared purpose can be found in the competitive electronic sports scene. In this environment, players of all ages participate in writing, modding, organizing, and competitive activities around highly publicized tournaments.

StarCraft's development into an esport was initially catalyzed by players' desire to compete. In 1999, South Korean youth commonly frequented Internet cafés. Imagine that in one of these Internet cafés, groups of two to eight young people sat together in clusters of personal computers. Each group was a clique consisting of friends from school. The other cliques were from neighboring schools. These different cliques began to compete with each other in *StarCraft*. Internet café operators saw how much attraction lay in youth competition and rivalry. These operators started organizing mini-tournaments with prizes. Soon Korean broadcasters witnessed this emerging peer culture, and they began to invest in national tournaments that were broadcast over TV. *StarCraft* had become a sport.

In *StarCraft* as an esport, players who are successful winners rise to become celebrities. One of *StarCraft's* most well-known celebrities is the legendary player Lim "BoxeR" Yo-Hwan. Between 2001 and 2003, he remained unbeaten for 17 consecutive months and became the first international *StarCraft* superstar.

Lim "BoxeR" Yo-Hwan, the first StarCraft legend. Image courtesy of David Zhou (http://www.flickr.com/photos/nodnod/6000976105/in/set-72157627213956671/).

But why do so many players admire celebrities such as BoxeR? One reason is due to their shared fascination with the *StarCraft* metagame.

In *StarCraft II*, players see the metagame as consisting of game strategies, and the term "refers to any planning, preparation, or maneuvering that a player does outside of actual gameplay to gain an advantage" (*Team Liquid* 2013). In other words, it is the analysis of game mechanics and shifting social discourses of strategies within the community—and this comes from deep analysis of high-level gameplay and active participation in online forums and video commentaries.

StarCraft players look up to celebrities like BoxeR for several reasons. One, these successful players are able to achieve a deep understanding of the game's complex mechanics. Two, these players are able to innovate—and stay ahead of the competition—even when their opponents (and thousands of gamers) are closely watching and analyzing their every moves. In BoxerR's autobiography (2004), he described his strategy as one in which "even if the opponent had predicted it, he cannot stop me." Day[9], a retired Pan-American *StarCraft* champion and owner of the esports company *Day[9]TV*, often advises learners that "strategy and solid play doesn't revolve around tricks, surprises, or hidden information, but very solid and strong [planning] and crisp execution" (Plott 2010).

The metagame captivates players and constructs a shared purpose of jointly discovering deeply rooted game mechanics, in sharing their thoughts, and in learning from each other. And one context in which this shared purpose can be observed in practice is in the *StarCraft II* tournaments.

Today, there are many well-organized and highly regarded *StarCraft II* tournaments in which players can choose to participate and attend. In the United States at the time of our research, there were international tournaments such as the Major League Gaming and the now defunct *North American Star League* tournaments. Globally, there were the World Championship Series, Global *StarCraft II* League, DreamHack, Home Story Cup, and the Iron Squid. In 2011 and 2012, which saw rapid growth in *StarCraft II* gaming, tournaments such as these awarded $2.5 million and $4 million respectively in total prizes to winners.

The universal draw of these international tournaments to *StarCraft II* players helps bring together multigenerational participants to engage in different activities contributing to the esports scene. Participants in international tournaments are of varying age because they are identified not by their background but by their interest in competitions. Such environments give young players opportunities to learn from older and more experienced players. Some of the players in professional *StarCraft II* teams started quite young. And one of our high school informants, Matthew, was only 15 when he joined the team Insanity. As a result, Matthew is able to progress faster as he receives coaching and instructions from older and more experienced teammates. In 2010, BoxeR, the *StarCraft* legend, at the age of 30 and with wealth of experience in *StarCraft*, had also assumed the role of team coach for many new and younger talents. There are also high school and college level leagues in *StarCraft II*. But in comparison with international tournaments, participants of these school-based leagues are often of similar age because they are grouped according to their organizational identities (i.e., high school or college students).

United by the shared purpose of competitive play, the intergenerational community of *StarCraft* traffics in knowledge and problem solving about game through the metagame. Understanding how to design for the metagame is a key consideration for game designers generally, because it is the strategy by which they can harness the power of player creativity and interest to fuel ongoing play. Generally speaking, game developers tend to think about the play communities that grow up around their game as rich spaces for learning and exchange—a kind of co-development mind-set demonstrative of connected learning's value around shared purpose. Developers use the communities to test out feature ideas and to get feedback; players use the communities to connect with like-minded players around a common interest, often developing tools and supports for fellow players as a way to share and hone expertise along the way. As a result, developers and the multigenerational players see themselves as part of a set of connected communities intent on improving, elaborating on, and celebrating the game.

PRODUCTION-CENTERED

StarCraft II is designed for players to get involved in content production, sharing, and curation, and in the process they become respectable and influential members of the community. The products produced by players represent another important dimension of the metagame. During Blizzard's annual convention on November 8, 2013, David Kim, a Game Balance Designer of *StarCraft II* and employee of Blizzard Entertainment, addressed thousands of players and said, "We believe in the development of *StarCraft II* to be a collaborative process where we will work closely with you guys." The design of *StarCraft II* is intentionally left open so that players can engage in expanding the scope of the game in terms of writing, video production, modding, or by developing organizations that extend the value of *StarCraft II* as an esport.

WRITING

Among all production activities, writing is perhaps the most accessible for players. On the Teamliquid.net online forum, anyone can post. He or she might inform others of an upcoming game, seek recommendations for game strategies, discuss metagame shifts, or even organize events such as school leagues. Teamliquid.net also has an organized writing team. New York–based Waxangel, in his early 20s and the team's chief editor, told us that since anyone can write, writing is one sure way to get players involved in the community. The only difference between general forum posters and Teamliquid.net writers is that writers tend to write longer articles and also receive peer support from the writing team. Here is an example of a formal article published by Teamliquid.net writers.

An article titled "The Marginal Advantage" by Day[9] (Sean Plott) on Teamliquid.net (Plott 2007). Image from Teamliquid.net.

Like forum posters, Teamliquid.net writers can also write on any topic of their choosing. A writer who had just attended a tournament could write a tournament report. If a writer is an adept player, he or she can discuss game strategies. Or, if a player has researched the history of a certain professional gamer, and decided to write an article on that, Waxangel will gladly accept that article. For Waxangel, initiative is an important hallmark of a good Teamliquid.net writer: "You need someone who is very passionate at esports, because a guy who's not that good at writing technically but has a lot of passion for esports, you can definitely tell that in his writing."

Between interest in esports and technical writing ability, Waxangel places importance on the former over the latter. He would rather a writer be self-directed and display strong initiative, rather than be technically proficient but mechanical. As Waxangel

is looking for writers with initiative, he has never had to recruit any of his two dozen writers through open calls for applications. Everyone has to have posted on the forums before he or she can be invited to join the writing team. Waxangel believes that interest and initiative are hallmarks of productive writers.

ONLINE VIDEOS

Online videos are perhaps the most widely consumed media in *StarCraft II*. *StarCraft II* players produce two forms of online videos: video on demand (VOD) and live stream. As the name implies, video on demand is a form of recorded video that players can watch any time over the Internet after the video's release. An example of video on demand is a YouTube video. On the other hand, live streaming is a form of video that broadcast events live over the Internet as they are happening. Live-streaming services are provided by websites such as Twitch.tv and they are available free for players to use.

One developer on the *StarCraft II* team, Patrick Elia, noted that it is impossible to underestimate the impact that video streaming, as a technology, has had on the game, both from an esports and a modding perspective:

> So one thing that I think has been really awesome is on YouTube, actually, now people have the ability to do something in the editor and either record it or even stream it to all of the other mod makers. And so one of the best ways to learn how to make mod now is to watch these videos on YouTube channels, and it's actually been really great for our community, because it hasn't always been the easiest thing to do, to, you know, explain in text or write down all the steps it takes to do something. Versus if you can actually just watch a video of somebody doing that, you can replicate that very easily, and so it's actually been really important, I think, for spreading that knowledge of how our tool works.

Among the most commonly watched VODs are commentaries discussing match strategies. In *StarCraft II*, while viewers can watch what players are doing, it is not easy to tell why players are making certain strategic decisions. Imagine that we are passengers sitting in a cab, and the driver opts to make a detour from a regular route. We may want to ask the driver: "Is there a traffic jam ahead? Is there a shorter path we are not aware of?" In these videos, a commentator will walk through a *StarCraft II* match and reveal the hidden thought processes and the many considerations that led players to make these choices. In the process, viewers are able to learn more about *StarCraft II* than if they were to just watch the matches on their own.

Live streams are used to broadcast live practice sessions. For example, many *StarCraft II* professional gamers stream their computer screen while they are practicing the game (see the list at the bottom right corner of the TeamLiquid.net image in the Writing section). The image below from Twitch.tv shows the live-stream homepage of a professional player known as "Stephano," who has been streaming his live practice sessions so that online viewers can watch him play.
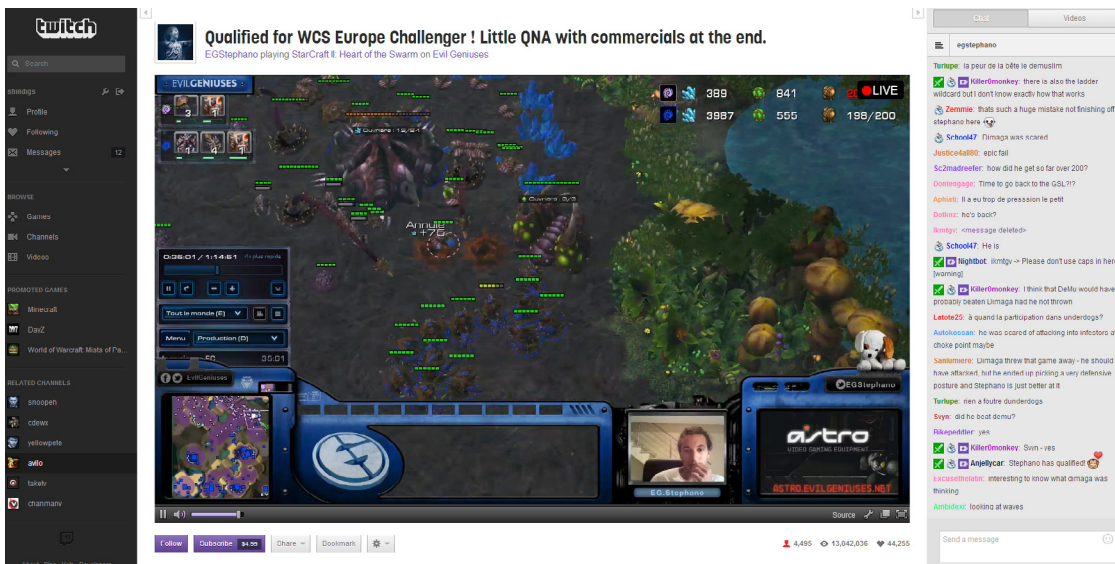
Live streams of professional gamers available on Twitch.tv. Image courtesy of Twitch.tv.
© 2014 Twitch Interactive, Inc.

The figure shows almost 4,500 viewers viewing this stream and that Stephano's streaming channel has been viewed 13 million times previously. Live practice sessions do not include commentary and viewers are typically higher-level players who can make sense of what these players are thinking without additional hep. If needed, live streams may also be recorded for future analysis as VODs. Both live streams and VODs are valuable learning tools produced by players that bring benefits to the community.

MODDING

Among all production activities, modding is perhaps most directly supported by Blizzard Entertainment. There are two forms of modding in *StarCraft II*. In custom mapmaking, modders use the modding tools to create new games independent of the esports and competitive scenes. In another form of modding, known as melee mapmaking, players directly contribute to diversity and development of the esports scene by creating new and challenging maps used in competitions.

According to Alan Dabiri, lead software engineer at Blizzard:

> We treat the outside mapmakers [players] for *StarCraft II* as basically a part of our development team, so everything we do, we consider how this will impact them in addition to our own development team. To the point where sometimes we do stuff for them that our own development team doesn't use—we're thinking just of them and we add functionality that we never even use in our own game.

Another developer remarked that releasing tools for the community to use was "also kind of convenient," since Blizzard was already building the tools for its own designers to use. Exposing them to the end user represented only a little bit more work

and that "with the industry the way it is [in regard to open source]—it just wouldn't make sense anymore to not give them these tools."

From a design perspective, Blizzard did one very interesting thing to encourage both the esport and modding sides of the game. When Blizzard published its maps, even its campaign maps, which contain all of the standard gameplay maps for the game, it left them "unlocked," meaning any player could open the map and see what the designers did. According to Blizzard's Matt Morris:

> We thought that maybe this is part of the bridge to get people familiar with using the editor. Like me, I think a lot of other people first learn by looking at something and dissecting it and figuring out how they do it. So we thought that might be one way for players to learn the editor, so going into *StarCraft II*, we realized, 'Let's not lock this stuff. Let's make it available.'

Meng Song, former modder and now a Blizzard developer, acknowledged the success of this decision for his own learning practice: "I remember when I first started working on my mod, it took a really, really short time for me to understand what they are doing, because I just opened up the campaign map, for example. ... I opened it and I see, 'Oh, this is what they do.'" As we will see, the decision to share the tools openly has led to many different forms of creative production among the *StarCraft II* community.

As on the esports side of the game, players who commit to mastering the practice of modding devote huge amounts of time to the endeavor. Because of this, it is rare to find modders who also compete in the *StarCraft* ladders. As Dustin Browder, game director at Blizzard, remarked,

> I'd be very surprised to run into an esports pro who also has an amazing mod—that would be an incredible set of circumstances. Because the amount of time required for both of those things is nuts. The amount of time required to create a mod is huge—these guys are trying to make products that rival studios in many cases and in some times they're succeeding. That's an incredible amount of work that these guys are putting into this thing, and of course esports players, in many cases, are playing 12 hours a day, right? And that's nuts—that's a huge amount of effort to become one of the best in the world at something that's very, very challenging. So I think being both at once is tough. I think you probably have to make a choice in terms of how you want to engage with the game.

Because games are a form of interactive media driven by player participation—a game does not "go" until a player makes a move in it—they lend themselves naturally to intents and purposes of their users. This quality is important to any discussion of connected learning as it points to the kinds of mental models or dispositions that can be enabled by a particular genre of media participation. Players of games naturally invite productive participation and game modification because of the way they frame the player as the key agent of interaction. Song noted:

It's interesting, because games do seem to be this form—even when you start playing them as a little kid—you understand that you can change the game, it's in your power. But it's not true with other media—I don't think there's the same instinct when you see a film to say, 'Oh, it's not exactly right, I'd like to change it' or an animation or TV show—it's just not like that. ... But with games you do feel like you can.

Browder commented on the fact that many gamers grow up playing *Dungeons & Dragons*, an open-source game, "It's a game that encouraged the player to become part of the creative process."

As an interest-driven platform *StarCraft II* allows players to specialize, produce, and participate in a number of different ways. They might enjoy the competitive side or they might choose to flex their creative chops by joining the modding scene. Choosing either one comes with a strong, distinct community to support the practice. This flexibility might be an important quality to consider in the future design of productive learning environments.

LEAGUES

When we think about production, the word tends to imply our making a "packaged good" that we can distribute in real life or digitally. For example, we can program a software mod and upload it to a website. In the process of making and distributing packaged goods, the producers need not interact with the users at all. Yet, *StarCraft II* presents another form of production—the organization of leagues as key activities in esports—which results in a primary product that is not a stand-alone artifact, but an organization that is fundamentally *social*.

Today, players have numerous opportunities to participate in the many tournaments available in the community. But many of these did not exist before 2011—when the *North American Star League*, the first commercially supported league in the United States, emerged. Duran Parsi, who lives in California, was the commissioner of *North American Star League* at the time of our interview. Duran had many years of experience with *StarCraft* and its community. In 2001, when Duran was only 10, he started playing online with his older cousin, who was a professional gamer. As Duran got older, he began to participate in international league games. Duran came to know players such as Day[9] at these games, and then he started organizing local area network (LAN) events, or a gathering of players who establish a LAN for the purpose of playing multiplayer video games, for these players. In 2005, Parsi organized the first national league, known as *War of the States*. These cumulative experiences, as well as community-building efforts, were foundations of the development of the *North American Star League* and other league games.

StarCraft II leagues, like other forms of production such as writing, online videos, and modding, help set up a focal point in which players can invest time, effort, and skill. As productive activities, they help engage players as collaborators who can directly

participate in the game's development, whether it is building a new mod or creating a new league. These productive activities are also good learning opportunities in which players can develop different skill sets, which are potentially useful for them in the future.

OPENLY NETWORKED

The commercial product of *StarCraft* and *StarCraft II* have evolved in a synergistic way with competitive leagues, and player-produced content, including mods, videos, and community forums. This thriving *StarCraft* scene is crucially dependent on an openly networked online environment. While real life events are important rallying points for player communities, the online world is where competition and the metagame play out on an everyday basis. One example of strategy development illustrates how player engagement, learning, and problem solving happen in this openly networked environment.

Players love new strategies. Players who display novel approaches that blow the mind will receive a great deal of attention from other players. Novel strategies may be a one-off stunt that cannot be repeated once its pattern is learned. However, a new strategy may also be robust and undergo wide adoption within the community, leading to what the *StarCraft II* community calls a "metagame shift" (see section on Shared Purpose). A metagame shift is a point at which players agree that they have learned something new about *StarCraft II* and that has altered most players' fundamental understanding of the game.

Metagame shifts excite players because they happen only when players unravel intricately hidden game mechanics, which feels as if they have just solved a difficult riddle or puzzle. When these mechanics are identified, they can rattle the entire state of play. Excited players pay close attention as players and commentators attempt to rationalize why this new strategy works better. Here we offer the example of "Life," a Korean professional gamer who confounded the *StarCraft II* community when he appeared to have defeated an apparently unbeatable strategy in the game.

On March 12, 2013, Blizzard Entertainment introduced a new combat unit, the "widow mine," into *StarCraft II*. The widow mine is a robot that burrows into the ground and fires a projectile at a target that comes within its "circle of activation." The projectile fires only 1.5 seconds after locking on a target. The widow mine functions like a normal mine, except it can be used multiple times. In no time, players started using widow mines as impregnable defensive walls. Attacking players were at a loss. They could attack and lose their valuable units to the mines, or they could wait and risk losing initiative in the match. This became a dilemma for all players except Life, who seemed immune to the mine's effects during his championship run in a major professional gaming tournament. Life allegedly ran his units through the mines without setting them off—how did he do that?

StarCraft II players quickly came up with rationales to explain Life's strategy. In the official *StarCraft II* forums, a player known as "Indigo" suggested one possible explanation. Because the mine takes 1.5 seconds to set off, if a unit could get out of the

mine's circle of activation in time, the mine would not fire at all. Indigo showed the math to support his theory:

I based my calculations on chord lengths using the following formula:
Chord Length = C = 2sqrt((r^2)-(d^2))
I then solved for d, getting:
d = sqrt((r^2)-(C/2)^2),
Which we can plug r=5 into, so my final formula became:
d = sqrt(25-(C/2)^2),
Where:
d = distance to Mine at closest point on chord (AKA Effective Radius)
C = unit speed*1.5.

Unit speed is calculated as range units traveled over 1 in-game second. So if you take your unit speed and multiply it by 1.5, you get the distance a unit can travel within a widow mine radius before activating the mine.

In short, Indigo argued that if a player could run his unit through chord length C (see image below) within 1.5 seconds, the mine would not set off.

Graphical Representation of Indigo's Math to Explain Life's Strategy, reproduced based on original diagram by "Mitosis" on TeamLiquid.net.

The above is an example of how interest in the metagame motivates players to teach each other by reframing, remixing, and reinterpreting new knowledge they obtain from observing professional play. A rather complex technique developed at high levels

of competition is taught to the community not by the professionals themselves, but by other interest-driven community members.

The metagame is so central to the community that it sets in motion many of the activities within the *StarCraft II* community. For players, the metagame, as an intellectual framework of how to play *StarCraft II*, is a gold standard that they will imitate so as to learn and to understand. For writers and editors, it means moderating online discussions, or even writing articles themselves, about the metagame and its underlying principles. For commentators, it means that they have to shift their rhetoric during live commentaries to match the current understanding of strengths and weaknesses of various strategies. In *StarCraft II*, maps serve as the battlefield that constrain how players can maneuver combat units. A change in the map can radically alter players' strategic choices. Modders, especially those who tinker with competitive maps, have to keep up-to-date with the metagame as they tinker, because these maps will serve to strengthen or weaken standard metagame strategies—resulting in an improved or unbalanced playing field. And Blizzard Entertainment makes software changes from time to time so that metagame shifts do not confer unreasonable advantages to any particular players. This ongoing evolution of the *StarCraft* scene is an example of how shared purpose and player engagement are fueled through the openly networked environment and close interaction between the developers and players.

INTEREST-POWERED

Challenging competition and the metagame powers learning and interest in *StarCraft II*. This means that players are not motivated by grades or fear of failing exams, but out of passion toward the acquisition of expertise in a particular area. These players take initiative to seek out relevant information, network with other players, create custom maps and mods, take part in competitions, or even organize learning partnerships. Interest and learning in *StarCraft II* is inseparable from the compelling competitive goals and shared purpose of the broader community.

In addition to the specific communities and purpose of the *StarCraft* scene, the social networks of geeks revolve around a constellation of related interests. Alex is a 15-year-old high school student from Florida. He and his high school friends do not play just *StarCraft II*, but also chess and *Magic: The Gathering*, and they participate in activities such as robotic competitions (see Sidebar 2). Therefore, if one day *StarCraft II* is no longer popular, it is likely that Alex's social network of geeks will simply move on to something equally challenging. We observe similar situations in other *StarCraft II* organizations. For example, the After Hours Gaming League (AHGL) now also hosts another esports game, *League of Legends*.

We can then posit that the geek network we examined in *StarCraft II* is actually one part of a conglomeration of interlinked geek communities. For example, Sixen, 21, from Arizona is the founder of the *StarCraft II* modding site SC2Mapster.com. Sixen was given the opportunity to develop the website by two *World of Warcraft* modders, who

are also employees of an Internet advertising company. The *Collegiate Starleague* (http://www.cstarleague.com/) is a college-level *StarCraft II* league with 400 participating colleges in the United States. Mona Zhang, 22, is a college student at Princeton University and founder of the *Collegiate Starleague*. But before she had founded the college *StarCraft II* league, she had already developed a social network of friends through organizing a *StarCraft* group at Princeton, and also gathered gamers from two other games, *Super Smash Bros* and *Guitar Hero*, to set up a *SmashCraft Heroes* game club. This network also extends to the IT industry, with Day[9] liaising with IT developers at Facebook to host the first *AHGL* tournament.

When we view a geek network broadly, *StarCraft II* is but one interest in an ecology of shared geek interests. To some extent, participants can migrate from one community to another within this ecology while continuing to build on the same sets of expertise. The path from *Dungeons & Dragons* to *Diablo*, *Warcraft*, and *StarCraft*, with chess or robotics clubs tucked in, is well traveled, both by the players and developers we spoke with. This confers some advantages. Sixen already had nine years of modding experience when he set up SC2Mapster.com. Blizzard developers like Meng were modders before they joined the company. And Kim was previously a professional *StarCraft* player. All of them built on their previous work as they grew into their current leadership roles in geek communities and companies. In other words, interest in *StarCraft* is sustained through a robust community of interest in the specific game as well as a broader network of compatible and overlapping communities.

PEER-SUPPORTED

Peer support is the sharing and exchange of knowledge and expertise among community members. In *StarCraft II*, peers are often cousins, siblings, neighbors, or online friends. Peer support is especially important to *StarCraft II* players because game strategy is not a topic most youth discuss in classrooms or during family gatherings. Therefore, players have to develop peer networks in different social spheres to find others who share the same interest.

For players in general, an important participatory site in *StarCraft II* is the *Team Liquid* community at Teamliquid.net. Teamliquid.net was founded in May 2001 by Dutch *StarCraft* players. But because of the large number of players visiting the online forum, the site was subsequently relaunched as a general community site for English-speaking fans, serving their interests varying from strategy, competition, game modding, and writing pertaining to the game. Until 2010, when Teamliquid.net hired two full-time staff and established headquarters in New York City, it was entirely supported by fans driven by peer-supported interests.

Students also have the opportunity to develop peer-support groups at school. Mona began to organize *StarCraft II* competitions at school when she was in high school. She met like-minded geeky peers when she attended the International Baccalaureate (IB) program, an international educational program for students ages 3 to 19. International

Baccalaureate programs expose students to mathematics, science, and critical thinking, which may explain why Mona found these friends to whom she could relate. "A lot of us were nerds," she said. There, she met three female friends with similar backgrounds—they all had siblings who both loved technology and were interested in *StarCraft*. They became best friends.

In the summer of 2007, Mona and her friends came across a landmark match between BoxeR and an up-and-coming legend, "Flash." Mona was new to the professional gaming scene, which was flourishing in Korea but still relatively unknown in the United States. "[I] realized that there was a Korean pro scene ... and I fell in love with all the Korean players and all the esports that was going on in Korea," Mona said. Upon discovering this professional scene, Mona was captivated by the ingenuity of the players and energy of the community participants. She and her friends wanted to become better players. They helped each other conquer the fear of competing online for the first time. Mona and her friends took turns playing online, with the player cheered on by the others to lend support.

After high school, Mona went to Princeton University. She remained deeply interested in *StarCraft* and looked for like-minded students to form a *StarCraft II* club. At first, Mona recruited members spontaneously: "If I saw an Asian guy who kind of looked Korean, who looked like he might know what *StarCraft* was, I would ask and be like, 'Hey, we should start a *StarCraft* team.' And so I met a lot of people through that process." After she found a handful of students at Princeton who were interested in *StarCraft II*, the group began organizing matches with other schools:

> We were thinking, 'Hey, in two years, if we get 20 schools we will be happy.' What happened was, the Princeton students—I started trying to meet the Princeton team—and someone from MIT who was my friend, he said, 'Hey, we play *StarCraft* here, let's have a show match.' We thought it was great fun so we made a hype video about it and we broadcast it.

> After that, people started emailing us. We did most of this through *Team Liquid*. People were like, 'Hey, we want to play too.' At first, we were just going to do show matches every week, and I would try to organize them. But eventually we got so many sign-ups that we got 26 people in the first season, so we ran a really short first season. Second season, people heard about it and people thought it was a lot of fun and the number of teams doubled to 50-something. The second was only half a semester, so the third season was the next half of the semester and we got 70-something teams. Then we went up to 144, and now we're at 250.

Collegiate Starleague is a peer-supported organization that members join out of shared interest in *StarCraft II* competition and learning. College students use their social networks of similar-aged peers to build a league in which players are identified by the college they are attending. In 2013, participating colleges include the champion University

of California, Berkeley, University of California, San Diego (third place), and University of Washington (sixth place). UC Berkeley won the 2013 grand prize of US $40,000.

Players not associated with schools or universities may participate in public local events such as BarCraft. BarCraft, or watching *StarCraft* matches while at a bar, provides peer support for players living in the same cities. While BarCraft was a novel concept to esports, watching sports with friends and neighbors is nothing new, as noted by BarCraft evangelist Primadog, a 25-year-old from California:

> At the beginning of Barcraft is a very rag-tag group–various people who 'I want to watch it with friends'–and the concept is not new, by itself. ... There are dedicated people who would go to a restaurant—for example Joe's Pizza—they've been watching *StarCraft* in Joe's Pizza in San Diego since 2008, but it's not known as Barcraft back then. ... So back in April of 2011, o_Oskar (screen name)—who organized Seattle, hosted an event like this in a bar and then he got 100 people to show up and it was great. ... Afterwards, in July, me and these four groups of people got in contact with each other. We started to think about how we were going to spread this idea because it's great—it's wonderful—we just need to get people to listen to us and give it a shot because we know it could become huge.

Through a collaborative effort by Primadog and his colleagues, BarCraft has achieved overwhelming success. Newspapers, including the *Wall Street Journal*, reported on the events (Erfrati, 2011). As of now, BarCraft has been held in more than 100 locations worldwide. BarCrafts are open to anyone, not just students. At the BarCrafts held in Orange County, California, Blizzard employees sometimes drop in to join the crowds.

Last, nearly every player is able to find other forms of peer support online. In an online environment, players can watch matches, read and post on forums, and find other players with whom they can practice *StarCraft II*. Even players who are participating in school-based leagues or BarCraft would also have spent a great deal of time on forums and websites related to *StarCraft II*. The *High School Starleague* (http://www.hsstarleague.com/), similar to *Collegiate Starleague*, is another school-based *StarCraft II* organization for high-school-age peers. Victor, 16, a high school student from San Diego, told us of his regular day using media technologies to connect to his friends from *High School Starleague*:

> [At school] we hang out in person. When we're not in person we're on Skype together all the time. Just spend, like, eight hours a day on Skype. {Laughs} People will leave. People will stay. I'll leave for swim practice and they'll all stay online. I'll come back. Some people will be gone going out to eat. But there's almost rarely a time when you're ever—when you can't find someone who you can talk to about games and get on Skype and play games together with, which is pretty cool.

Victor is not alone. Nearly every *StarCraft II* participant reported communicating in such an unstructured, ubiquitous, and spontaneous manner. These *StarCraft II* players, with "rarely a time" they find no one to talk to, are able to learn anytime they like by leveraging the social network they have developed around *StarCraft II*. In other words, this social sphere represents a player's "classroom," where they will conduct their day-to-day learning. However, in this classroom, there is no preassigned lesson time and no teacher. Yet, amid the casual atmosphere is nearly always a friend online who is willing to help. A form of learning that allows learners to reach out to many, to explore niche content, and to learn at their own pace appears to have many merits.

At the beginning of this section, we introduced peer support as a form of learning support that differs from those found in school or at home. It is also important to highlight the dependencies between the two. That is, while parents may not be able to support their children directly by inculcating them with *StarCraft II*, parents may develop a structure at home that lends opportunities for their children to participate in peer-based social spheres of their own choosing.

When we discussed family dynamics with our informants, many of them inevitably mentioned that they pursued their *StarCraft II* interests during "free time," a term roughly understood as the period outside of homework and adult-sanctioned activities, such as sports, in which youth can do what they like. Whatever children do in their free time, parents do not ask, and children need not tell. Free time does not sound like much, but this is in fact the window of opportunity for players such as Matthew to ascend the ladder toward becoming a *StarCraft II* professional gamer.

At home, Matthew is a good kid who does well at school. Not only does he earn straight As, but he also participates in the Advanced Placement program. He is on track to attend a college such as Stanford, just like his brother, and thus is allowed ample free time to do as he pleases. But unbeknown to his parents, Matthew has also joined a professional *StarCraft II* team, Insanity. Matthew's primary interest is to do well at school. But whenever he has time, he practices *StarCraft II*. Matthew practiced enough to become one of the top eight *StarCraft II* online players in the United States. In 2012, Matthew finally disclosed to his parents his interest in professional gaming. In the same year, he represented Insanity in the Major League Gaming tournament, defeated four other competitors, and progressed deep into the tournament rounds.

StarCraft II players can find peer support for learning and development within social spheres centered on the common interest of competition. For *StarCraft II*, players can find support in online sites such as Teamliquid.net. They may also form their own organized competitions or support groups at school or in their neighborhoods. Because peer support often happens during windows of opportunities outside of adult sanctioned activities like school and family time, youth who have earned "free time" on the basis of good academic results may afford more time to participate in this connected learning environment.

ACADEMICALLY ORIENTED

Academic orientation refers to learning that is associated with intellectual growth that becomes relevant in formal educational settings or career contexts, translating to things such as better grades or career opportunities. While the strategy by which *StarCraft* players learn is quite different from learning content at school, many of the *StarCraft II* players we interviewed see themselves as academic achievers. Similarly, *StarCraft II* community members include a number of IT professionals, which suggests that some *StarCraft II* players who have moved on to technology-related careers continue to participate in community activities.

StarCraft II players are not shy about declaring *StarCraft II* an intellectual game. In the community, *StarCraft II* is often described as the chess of the twenty-first century, an association that was perhaps started by Professor Mark Blair, a cognitive scientist studying expertise and learning (Upson 2011). In cognitive science, chess play, because of its intellectual and mental demands, is an activity often analyzed to understand how people think. Blair was quoted in an article in *Scientific American* as saying, "I can't think of a cognitive process that's not involved in *StarCraft*" as he discussed *StarCraft II* as a new platform that can help further scientific discovery (Upson 2011). And Day[9], who sees himself as an "educator" in the *StarCraft II* community, repeatedly recommends that his stream viewers read Josh Waitzkin's book *The Art of Learning*, which describes the child prodigy and chess master's learning principles, such as learning through failure, which propelled Waitzkin to become a National Chess Champion at the age of nine.

An academic association with *StarCraft II*, is exemplified by the number of academic achievers we have seen in our interviews. Among our 13 informants who are still in school, there are a PhD candidate at Stanford University, two graduate students pursuing master's degrees, four college undergraduates, and seven high school students. Among our high school informants, five were in Advanced Placement programs. Mona, the cofounder of the *Collegiate Starleague*, was also in an International Baccalaureate program. And Day[9], the highly influential *StarCraft II* commentator, holds a master's degree from the University of Southern California, proudly wearing his USC T-shirt during some of his video commentaries.

Players' general interests in intellectual pursuits, such as analyzing problems, may also be seen by examining the constellation of interests in which players have participated outside of *StarCraft II*. When we interviewed players they often brought up other hobbies, such as *Magic: The Gathering*, *Yu Gi Oh!*, robotics, and chess. As Alex, who is also an International Baccalaureate student and an administrator of the *High School Starleague*, told us:

> A large population of the IB [International Baccalaureate], at least between the juniors and the sophomores, play *StarCraft* or are interested in various games, or are interested in card games like *Magic: The Gathering* and stuff like that. So, there is actually a large group of us that play games together.

In many schools, video game clubs remain controversial among teachers. However, some schools are able to indirectly support *StarCraft II* activities. For instance, some schools support clubs in which students hold regular and weekly meetings in a room that is booked through a teacher sponsor. During the meeting, students perform some activities together under the supervision of this teacher. Therefore, even if the school club is not a video game club, so long as the teacher sponsor is agreeable to *StarCraft II*, the students can still conduct this activity.

In our interview, Alex told us that he was unable to get his high school to agree to set up a video game club. However, he managed to integrate *StarCraft II* into the programs of a more mainstream and well-established chess club: "We're talking about strategies at chess club. We're making *StarCraft* jokes through chess moves and stuff like that. So—and then one person just brought, one day, *Brood War* [a version of *StarCraft*] on a flash drive, and it just went downhill from there."

In most cases, the purpose of performing well academically is to do well in career and other future endeavors. But how will these *StarCraft II* players perform in the future?

If we look at the number of Blizzard employees who came out of related game communities, such as *Warcraft*, the indications are promising. According to one of the development team's senior engineers:

> A number of the [game] designers that we've hired came from the *Warcraft 3* community, and they made some pretty cool mods. Meng [Song], our technical—senior technical designer—he made basically *Diablo 2* in *Warcraft 3*. Our balance designer, David Kim, he was actually a professional player. Probably eight years ago or something, but—so now he works for us. Matt Cooper [a feature and balance designer] also was a pro *Warcraft 3* player.

As a game balance designer, David Kim has regularly represented Blizzard Entertainment to discuss game design issues in media and during public events. Having been a successful professional gamer himself, he is also highly regarded by the *StarCraft II* community.

Perhaps one reason we see this trajectory from immersion in an online geek game community into a technical or design career in a game-development company is the strong overlap between the types of skill sets needed to be successful in each, as well as the cultural alignment between communities. Working at Blizzard, for example, can be seen as a kind of extension of the real-time strategy game communities in which employees such as David Kim or Matt Cooper earned their status as professional players. And working on the *StarCraft* development team, for someone such as Meng, gives him a chance to continue work around a passion for modding that started with *Warcraft*. Further, many developers consider the learning trajectory that they began by playing games to extend into the workplace. Andy Bond, a senior software engineer, noted:

I played a lot of Blizzard games when I was a kid, including *Warcraft 2*, *Warcraft 1*, *StarCraft*, and ended up making some modding tools for *Warcraft 2* and *StarCraft*, and that got the attention of people here. Thankfully they were really supportive about it, and so they called me out here to do an internship for during my first summer of college. Then I did another one the second summer, and then after that point, I got offered a job and I decided to accept, because I felt like I was learning more on the job and on my own than I was where I was going to school.

Similarly, the skill sets and interests that many players either bring to games such as *StarCraft*, or learn to love through play of those games, are reproduced within professional game-development careers. Every developer we spoke to either had a passion for computer programming or developed one while playing a Blizzard-style game. Many went on to study computer science in college, in some cases inspired by the experiences they had had modding games. When asked about the connection between modding and programming, Meng Song, a senior technical designer at Blizzard, noted:

I think it's pretty accurate to say that—by looking at *StarCraft* editor—it's very, very good environment for new people to learn a programming language. If you ask someone to learn C or C++ for example, it's a big barrier—a very steep learning curve. But if you drop them into the, for example, *StarCraft II* editor or *Warcraft 3* editor, it's very easy to get them into this programming world. And learn the basics, for example, loop, logic, condition, and all the functions and triggers—how to do event-driven programming. All of these topics are wrapped up in this user-friendly, easy to use UI. They don't even know they are doing all this programming while they are using the editor, but actually there is a lot of complicated logic in it.

Even though it is too early to tell whether our youngest interviewees will enjoy future academic, career, and life success, there are signs they are developing intellectually. First, players see *StarCraft II* as part of a spectrum of intellectually relevant interests, such as chess, robotics, and *Magic: The Gathering*. *StarCraft II* players are also likely participants in these other hobbies. Second, most high school and college students we interviewed are doing well at school. Third, companies such as Blizzard Entertainment have recruited community participants based on their core expertise in programming, level development, and gaming. These are skills that students do not generally learn in K-12 education, thus suggesting that *StarCraft II* participation does indeed better prepare students for certain technology-related careers.

Duran Parsi is an important contributor to today's *StarCraft II* scene. Since 2009, Duran has been CEO of the *Collegiate Starleague*. From April 2010 to October 2012, he was commissioner of the *North American Star League*, one of the few major international *StarCraft II* leagues in the United States. When he was a professional gamer, he played alongside celebrities such as Victor "Nazgul" Goossens—the founder of Teamliquid.net and one of the first international players to compete in Korea—and he was a leader of top American teams. His success was integrally linked to the peer support he found in the *StarCraft* community.

When Duran was 10, his cousin introduced him to a new game—*StarCraft*. Duran visited his cousin every weekend to hang out in the basement and play the game. Being so young, Duran did not play as seriously as he would now. He was not competitive, he said. "It was that bond between my cousin and I that really got me interested in the game."

Duran's cousin was one of the top *StarCraft* players in the United States and played on an online team, *I'M*, which included the famous player Nazgul. Through Battle.net, his cousin introduced Duran to his online friends and opened a gateway to participation in *StarCraft's* online community. In most *StarCraft* teams, including I'M, members are divided into *A-* and *B-Teams*. A-Team members represent the team in major tournaments. B-Team players are mostly practice partners for A-Team players. But in return, B-Team players get to practice with the best players in the world—a luxury most *StarCraft* players could only dream of. By the time Duran was 12, he was fairly skilled in the game and was recruited onto *I'M's* B-Team.

Duran had his first taste of organizing a new team when Nazgul left *I'M* to start *Team Liquid*, the professional gaming counterpart to Teamliquid.net. Duran and his cousin likewise started their own team, Crew, which became one of the top teams on Battle.net. After Crew, Duran in 2004 joined another top team, *LighT*, which was named on the Teamliquid.net wiki as "one of the best American teams of all time." Duran became more competitive as he grew older. In 2004, the World Cyber Games (WCG) USA were held in Long Beach, California, a 40-minute drive from his home. Duran and his cousin signed up for the event—the biggest Duran had ever attended.

Duran's participation in WCG USA 2004, an in-person event, further grew his social network in the community. There he met illustrious players such as Day[9], whom he had known online but had never met in person. It was easier to make friends face-to-face. Duran soon began to organize LAN events in California so that top players could continue to interact more closely. In 2005, Day[9], who was already a top U.S. *StarCraft* player, was attending Harvey Mudd College in Claremont, California. Day[9] started coming to the LAN events organized by Duran, and Duran began to practice regularly with him.

During Duran's senior year of high school, his participation in *StarCraft* took another turn. Duran represented his school in the nationwide Academic Decathlon. For six months, he stopped playing *StarCraft* to focus on this competition. But after the Academic Decathlon, he realized that his *StarCraft* skill had deteriorated so much that he was unable to keep up with his teammates on *LighT*. He could not win matches, but he realized that his years of experience participating in *StarCraft* could be invaluable:

> The first thing I thought of was that we had a lot of players who were really active and they wanted to play in matches. I thought since we hadn't been playing a lot of team matches and clan wars—I started organizing them with other teams. That was the first administrative thing that I did—organizing clan wars and having my team be able to play more matches. I was organizing four or five clan wars per week.

DURAN PARSI
Becoming an Esports Commissioner

Clan wars are competitions in which one *StarCraft* team is pitted against another. This is a popular way for players to practice with players outside their own teams. As Duran's role shifted from play to team management, he was promoted to leader of *LighT*. While he was managing *LighT*, Duran also participated as administrator of a European *StarCraft* league known as *WGTour*. Subsequently, he hosted the first *StarCraft* league in the United States—the *War of the States*. Duran received a lot of positive feedback on the *War of the States*, and he has been organizing leagues ever since. Duran reflected on why he became a *StarCraft* event organizer:

> I've competed in tournaments before so I know what were good tournament rules and what weren't good tournament rules, and I was just able to figure out what to do from that standpoint. I think being a former player really helped me because I kind of know, from a player's perspective, what it's like to compete in tournaments and what things would make me frustrated that tournament administrators would do and not do, and what I wished they would do. I was able to take those things and apply them.

In 2010, the growing player community in *StarCraft II* began to attract corporate investors. Duran met Russell Pfister of Gosu Coaching, a company that owns a video game coaching website. Duran persuaded Russell to start a weekly competition, Gosu Coaching Weekly, which drove some traffic to the website. Duran organized a few more successful online competitions with Gosu Coaching, and Russell agreed to sponsor Duran to run a major "$100,000" league. This became the *North American Star League*.

Duran's story, apart from how gaming can lead to positive outcomes, teaches an important lesson. Whatever you would like to do well in life, it is best to start early. And it is important to constantly participate. As Duran told us: "Just like anything— if you want to be a doctor, and you apply to medical school, they encourage you to volunteer at a hospital. It's no different in esports … you get involved, and you volunteer, and you start doing work."

Duran might never have played an important role in the *StarCraft II* community had he not started playing *StarCraft* at 10. Had he not had a caring cousin, he would not have—as a child—participated online so intentionally and with such support. If he had not had examples of pathways to take to increase his expertise, or a community of peers to practice with, who knows if his interest would have been so fully realized in ways that took him beyond the simple play of a game.

REFLECTIONS

In this section, we will first reflect on other findings that are unique to the *StarCraft II* case and have implications for those interested in supporting and creating connected learning environments. Specifically, we found many *StarCraft II* players who embody and practice certain learning approaches that may help inform the connected learning framework. We also found that family supports were critical for many advanced *StarCraft* players and community participants.

LEARNING APPROACHES

When we asked *StarCraft II* players to reflect on what they had learned in the process of gaming, they were quick to point out that in the process of becoming better players and modders, they picked up many fundamental skills, such as their attitudes toward learning and how they work with others—skills they have found useful in other pursuits. In our interviews, Day[9] was among those who pointed out how the game had inspired their learning approach:

> I would [not do as well in school] if I didn't play *StarCraft*. *StarCraft* teaches you important lessons. The most important lesson is that you lose constantly. ... I think it helps a lot with this idea that you're never going to know what the correct decision is. You just have to make the decision.

Therefore, we would like to point out common learning practices we have observed in *StarCraft II*, and then how these practices may be mediated by design features implemented by Blizzard Entertainment.

A commonly discussed attitude toward learning is to embrace and learn from failure. For example, Matthew, our high school professional *StarCraft II* player, explained how the opportunity to fail is a necessary aspect of learning, which good learners have to embrace:

> A lot of people look at their mistakes and see that as [a reflection of] themselves. But it's important to separate [these two]. Every failure is a learning opportunity. There is no point in feeling depressed or guilty. It is more important to be realistic about how we can improve.

Identifying where learners fail is an outcome of the competitive environment in *StarCraft II* gaming. Competitors who outplay us are like teachers who help point out our mistakes. And with a positive mind-set, correcting mistakes serves as a learning goal that players can work toward attaining. In *StarCraft II*, there are established ethics of losing gracefully. At the end of every match, the losing player is expected to type "gg," shorthand for "good game." It is another way of saying, "You are the winner, and thanks for the time." In turn, the winner would also say "gg" as a thank you for the game. The loser may then use the lessons to direct her own learning toward developing higher levels of competency.

The *StarCraft II* community is a site of constant competition and continuous learning. According to Scardamalia and Bereiter (1994), continuous learning is a feature of a

second-order learning environment, such as in businesses and in sports. In first-order learning, learners have to master a predefined set of routines, content, and syllabus. Most school classes are first-order learning environments. However, in second-order learning environments, "what one person does in adapting changes the environment so that others must readapt" (Scardamalia and Bereiter 1994: 266). There is simply no fixed learning content or unchanging best practices.

Likewise, in the learning world of competitive *StarCraft II*, every participant who becomes a better player raises the bar of competition. As a result, many *StarCraft II* players simply say that they do not stop learning. And with new strategies constantly emerging, the competition is never ending. Players who stop practicing regularly will quickly find themselves on the losing end of matches. We interviewed an experienced professional gamer from California, Michael Santos, 29, who competed in multiple esports games, including *StarCraft II*:

> The problem is with *StarCraft II* the competition is so fierce that if I took a week or so off, the same players that I could beat that didn't take a break [would have] gained that much of an edge that it became harder and harder [for me to compete with them].

Social support is critically important for learners who are engaged in second-order learning (Scardamalia and Bereiter 1994). In *StarCraft II*, learners have to learn to engage other learners in order to receive good advice and guidance from peers. What is most interesting in this environment is that there is no permanent status of "teacher." While Day[9] may see himself as an "educator," he has no formal authority over his "students." Learners must motivate themselves to internalize lessons they deem useful. Many players, like Day[9], will share what they know widely, so that others may benefit. And sharing is often performed when players gather socially, such as during a school club or a LAN event.

Many of the best *StarCraft II* players practice together in person. They group themselves into named clans or clubs in a bid to find stable groups of reliable practice partners. We interviewed Sen, a 25-year-old professional gamer from Taiwan, who won third place at the international *StarCraft II* tournament *North American Star League* (NASL) in 2011. He told us:

> If you practice with good players, you will improve very quickly. There are many little things in *StarCraft* that are easy to fix, but you do need a keen observer to tell you. They may say it using only a few words. But if you are working on your own, you may never be able to figure them out.

Practice partners spend much more time with each other than with random players on Battle.net. While practicing with many random players is still good, practice partners are committed to spending a lot of time with each other. Through time, they become sensitized to each other's gameplay and subtle strengths and weaknesses. As such, practice partners will become better equipped to provide personalized and timely advice.

In general, learning in *StarCraft II* takes place in a competitive environment in which players are constantly adapting to each other. In this environment, there is no end to learning, and there is no permanent teacher or master of *StarCraft II*. Oftentimes, the best players will simply share their knowledge with those who want to learn, thus instilling an environment of equity and peer support. Because we found *StarCraft* to offer such a supportive learning environment, we wanted to better understand how certain design features of the game might also support learning. We found features that played important learning-supports roles: matchmaking, replay functionality, and design for discoverability.

StarCraft II players are able to enjoy high-quality competition and a stimulating learning experience partly because of the game's matchmaking mechanics. Blizzard's goal was to get players into really good games as quickly as possible, matched against someone of similar skill. As the development team's lead software engineer Alan Dabiri noted:

> In previous games, we've had situations where you had to just go basically make a game, random people would join, and you hoped that they were of your equivalent level. The result was sometimes you got someone who was way better than you, other times way worse, and you didn't always get a great game.

In *StarCraft*, the developers made a conscious effort to address this situation to ensure the highest number of quality matches. Via the matchmaker, the games a player plays will quickly converge on play with people of similar skill level. Dabiri continued:

> So as a result, even if you're not great at *Star[craft] II*, like me—I'm not an expert at the game—if I go and I consistently play through the matchmaker, I'm going to be matched up against people who I'm going to be winning about half the time and I'm going to be losing about half the time. And then, meanwhile, those really high-end players, they can get matched up against the really high-end skill players.

If we think about *StarCraft* as a practice space that supports players' improvement, maximizing the quality of practice sessions is critical. Matchmaking enables just that. But is finding good matches enough? Are there other features that a player might call on in support of learning?

Another feature that is equally important to players' learning, and that is commonly used in practice partnerships and other peer-supported settings, is the game's replay functionality. The game's replay functionality allows any player to see a recording of any match he, or any other player, played. Say, for example, after a game, you are not entirely sure why you ended up losing, or maybe even why you won in some cases. Using the replay functionality you can go back and watch the game again, stepping through sections at a slower or faster pace. Any good football coach knows the power of having his players watch postgame tapes, analyzing the moments when things went wrong, or maybe really right. Further, as Dabiri said:

In *StarCraft II*, we've actually stepped that up even more than we've ever done in our previous games, so like we've added these leader panels and other kinds of tools that allow you to basically see what all the players are making, what their current stats are, how many units they've lost, and things like that. It's an extremely educational tool in terms of learning why you did or didn't do what you should have done in a game and how you can improve next game.

While esports players tend to get better when they share and analyze a lot of replays, modders get better when they have a chance to see a variety of maps and mods. Here, Blizzard Entertainment provides modders with a large inventory of player-created maps, which are largely discoverable and shareable thanks to Blizzard's design intent to make custom maps "... like a first class citizen of the Battle.net service," according to Dabiri. Here he is again on Blizzard's design for discoverability:

Previously, the mapmaker would make his map, and the way that you would distribute the map is basically by just going into a lobby, and the map would be distributed just to the people in that lobby, and there was no real way to look at all the maps that might have been on the service. With *StarCraft II*, we added a feature where you can now publish your map to Battle.net. As a result, we host the map on our service, and now any player, without even having to find another player that has the map right now can actually go into a lobby, create that game, and play the game. So you could actually play even a single-player game made specifically for *StarCraft II* and not have anyone else actually provide that map for you. That was one of the things we did.

The developers also tried to surface a lot of other features that would expose the most popular maps. They added a popularity system that displays the maps that are currently getting the most play. They also have tried to encourage less popular maps, adding a "fun or not" feature, which uncovers maps that people might not be playing as much. "So you'll just jump into basically a random game, essentially, with other players, try it out, and then afterwards say whether you liked it or not," Dabiri says. A planned update to the game will add an open games list, which will list the maps that people are currently playing. Each of these design decisions increases the ability of players to discover maps relative to their interests.

Learning practices in *StarCraft II* are relevant to connected learning, particularly when examined within an ecology of compatible ethics, learning attitudes, competitive culture, and supported by game features such as matchmaking, replay functionality, and design for discoverability. Within this ecology, players' social practices of learning are reinforced by game functionalities. Esports players can find equally skilled competitors; modders can learn from other skilled modders. And taken together, players' learning is amplified in the well-designed *StarCraft* environment.

StarCraft II participants can find more peer support and information resources within inner circles of the community. However, so far we have found no participants in

such privileged positions who did not have years of gaming and technology exposure. Most of the leaders and active producers were players of the first version of *StarCraft* (released in 1998) and were exposed to computer gaming and technology at an early age. Thus, *StarCraft II* participation may be more aptly described as one step in a journey, through engagement in the diverse interests of the geeks' network, to ascend as privileged and distinctive members of the technological community.

To attain such a privileged position, active participation in productive activities is mandatory. Within public domains such as Teamliquid.net online forums, a producer has to show that she is self-directed and takes initiative to do what she thinks is right, that she is able to listen and learn from criticism, and that she has successfully produced quality content (or an organized event), thus proving herself a worthy member of the community. Technically, no one is excluded as a potential producer, but in practice, participants have to make preparations and take steps to be recognized as valued members. At the beginning of this process, players can choose a form of production, for example, modding or writing, that they feel comfortable doing. But whether they can ascend into the inner circles depends on the quality and extent of their production as well as positive engagement with the community's discourses.

Thus, in the *StarCraft II* environment, participation is critically important to learning. The cost of nonparticipation is limited learning opportunities. Nonparticipating learners may forage information from public forums; however, they will miss opportunities to engage with experts in discussing deep issues in private social spheres. Thus, youth who actively participate in geek communities such as *StarCraft II* can learn substantially more, than those who only halfheartedly participate.

FAMILY SUPPORTS

We interviewed many community leaders, including Day[9], Mona, Duran, Sixen, and Alex. All of them started playing computer games before they entered middle school, with some as early as the age of five. How did they get into gaming at such an early age? And what kind of access to technologies is needed to cultivate such sustained interest in analytical pursuits and deep engagement with communities?

It may be important to note that when we ask the interviewees, "How did you get into *StarCraft*," they did not just say that they have computer and Internet access at home. They also mention access to associated social practices. Most of the time, they will mention a person—usually a parent, sibling, or cousin—whose passion, knowledge, and persistence in technology-related hobbies inspired them to adopt the same interest. Sixen's father showed off a new laptop during a Christmas party. Mona followed her brother's interest for years. As she noted, her high school *StarCraft* friends also learned fundamental gaming skills, such as keyboard controls through their siblings. While family involvement in nurturing geeks mostly turns invisible from middle school onward—our interviewees generally did not discuss parents as part of their *StarCraft II* participation at that point—early exposure to technologies and having role models

in the family environment appear very helpful in preparing our participants to become successful *StarCraft II* learners.

At face value, *StarCraft II*—an interest youth pursue in their free time—appears to be disconnected from parental concerns. However, when we asked our players about growing up, many of them traced their participation in *StarCraft II* to values, people, and adjacent interests that they had encountered during their early years.

Players' experiences while growing up may instill interests that guide them toward productive endeavors in *StarCraft II*. We interviewed *StarCraft* mapmaker IronManSC, a 22-year-old from California, who won second place in the *Team Liquid* map contest in 2011 for creating the famous *StarCraft II* map Ohana. Ohana is a beautiful floating platform with light azure rivers, white shore, and tropical flora reminiscent of a beach resort (see map below). In Hawaiian, Ohana also means "family." Ohana reflected IronManSC's artistic sense, which he told us was supported and influenced by his family members.
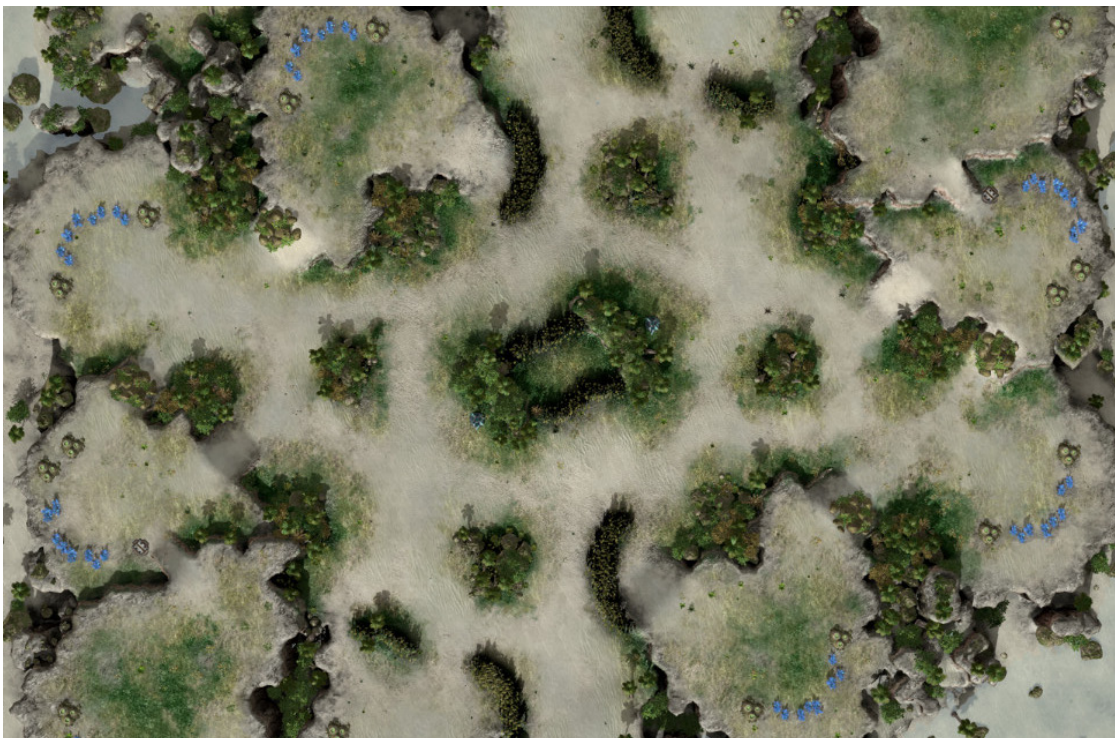
Melee map Ohana, developed by IronManSC. Image courtesy of Blizzard Entertainment.

When IronManSC was 12, he mostly played computer games with his older brother. While he was aware that computer gaming for five hours at one go had always looked absurd to his parents and other siblings, he persisted with that interest. During family time, however, IronManSC did share production-centered interests with his family members:

> Well, my Dad and my brother—they're graphic designers. My—I have one brother and two sisters—well, two—one sister and one sister-in-law. They are teachers. And

yes, I mean, when you look at that, it's just—you kind of just have that creativity in the family. Like, crafts that the teachers would make, and drawings and designs that my Dad and my brother would make. So—and growing up, I always drew stuff with my brother. We had drawing pads and we would just draw stuff all day. You know. We would go to restaurants and draw on napkins and everything like that.

A substantial amount of design and craft work went on in his family, and IronManSC participated by drawing. Then he discovered Galaxy Map Editor, the *StarCraft* mapmaking tool:

Well, I just took a break from playing online one time, and I was just like, well, oh, what's this? A star editor, or a Galaxy Editor, I think it was called. And I clicked on it and I had no idea what it was, because I saw all these weird tools and symbols everywhere. And I was like, I have no idea what this is. But back then, it was like, well, this is the real first game that you can publish something online. ... I just started clicking around and, you know, just started developing it naturally.

Even though IronManSC's family does not participate in mapmaking, he saw his mapmaking interest as a natural outgrowth of the creative culture of his family. He picked up many drawing skills from his parents. And at the start of his mapmaking work, he knew immediately how to create good maps that were distinct from any others. "You know, in graphic design, you make a logo that no other company has. Or, *StarCraft II*, you make a map that no other map has."

Parents who are geeks themselves may be able to channel their children's interest toward computer games more directly. Sixen has been modding *StarCraft* since he was 10. As a young gamer, Sixen was fortunate enough to have a father who not only played computer games but also tinkered with computers at home. In 1996, when Sixen was five, there was a family party at his house; his father had brought home a laptop and played a computer game on it with his uncles and cousins. That scene of a small boy examining a curious gadget for the first time had a lasting impression on Sixen. When he was older, he would watch his father play *StarCraft* late into the night until Sixen needed to go to bed:

I used to stay up and watch my dad play ... [until] it'd be past my bedtime, so I'd have to just go to sleep. And then the next morning my dad would tell us this whole story about how the battle went down because they were each one of the three races so it kind of worked out well. And they just did free-for-alls, so he would sit there and spend the time talking about how the whole battle went down and it was just interesting for me to learn. I don't know. It was cool. {Laughs}

Sixen's father became a mentor for him, explaining strategies so that he could learn even at a young age.

We have mentioned Blizzard's decision to launch the game with unlocked maps, which enable players to "look under the hood" of the game and see what is happening.

Modders or mapmakers can copy, remix, or simply be inspired by the code; competitive players might explore the inner workings of the maps as a way to refine their metagames. This feature allowed Sixen, when he was 10, to explore modding. He asked his parents for the *Starcraft Campaign Editor Guide* published by BradyGames for Christmas, which they found after much painstaking effort. Soon after, Sixen began making his own mods.

At 13, Sixen moved beyond mapmaking only at home. He joined an online mapmaking team that he found on a forum at Staredit.net, which was then the premier mapmaking site for *StarCraft*. At 19, and after years of voluntary participation at Staredit.net, Sixen was contracted by an advertising company, Curse.com, to work remotely as a gaming website administrator. He founded SC2Mapster.com with the support of two Curse.com employees, CKKnight and Kaelten, who were also highly accomplished modders of another online game, *World of Warcraft*. As *StarCraft II*'s reputation grew, many Staredit.net modders and friends of Sixen migrated to SC2Mapster.com.

In Sixen's case, he was able to connect expertise he had learned at home to his work at Staredit.com and then move into a leadership role at SC2Mapster.com. This trajectory is particularly common in game modding, in which skills such as coding and artwork, as well as social networking skills, can easily translate from one community to another. Sixen is now completing his last year of undergraduate study in Information Technology with a management focus. He wishes to use his experience managing the online community at SC2Mapster.com in his future work.

Parents may also help their children connect to online communities by inculcating values of volunteerism. Alex Giovanni, a 15-year-old high school student from Winter Park, Florida, grew up deeply acquainted with values of community service and giving to those in need. Alex's mother, a psychologist for a major Florida hospital, would bring him to volunteer at the hospital every year. For example, in the summer of 2011, Alex attended a program in which children of hospital staff mentored at-risk youth. Alex's mother explained to him how little deeds often go a long way. "She [explained] here're the options of what you can do in the community. This is what the effects of your actions are." Alex's parents would also frequently remind their children where they came from, and why it was important to engage in community service:

> It's always been a huge thing for my family, to volunteer and do community service and things like that. Because my parents came from another country to America, with very little. And there's thousands of stories of them getting— people that are benevolent, and benefactors for their lives. So, it's always been something like, we want to make a difference and pay it forward.

Alex attributed his involvement with the *High School Starleague* and supporting esports to lessons of his family. Alex wants to see esports succeed in the United States, and as a player himself, he believes that he has a part to play.

Apart from parents, our interviewees frequently mention siblings and cousins at home who helped develop their interest in *StarCraft II*. Like many *StarCraft II* players,

Mona Zhang, the student at Princeton, encountered computer games at an early age. She first played *StarCraft* I when she was 11 years old, because she had seen her brother playing it:

> He played a lot of games. We started with *Neopets*, which isn't really a game. He would be on the Internet, and I wouldn't really know how to use the Internet yet, but I would learn from him. And I would be like, 'Oh, this is cool, I'm going to use the Internet now.' I kind of followed along. When he got the Game Boy, I started playing on the Game Boy. This would happen almost concurrently but because I was slightly younger, I didn't necessarily know how to use the technology yet. He would be that source to any type of new technology, like N64 or Game Cube. But then, when he got *StarCraft*, he had to show me—this is how you get on Battle.net—this is the CD key that you use. All this happened when I was pretty young.

Because her brother played computer games, she wanted to do the same. Her relationship with her brother has always been friendly, which motivated her to emulate his interests.

Today, Mona is a masters-level player in *StarCraft II*, which is equivalent to the top 2 percent of the player population in the United States. But Mona might not have come this far without having a geeky older brother: "Because ... I'm not going to say, 'Hi Mom, get me an N64.' That's what my brother did because he was like, 'Oh, all my guy friends are getting N64s. Mom, get me an N64.' That's how it happens."

Mona reasoned that early contact with video games helped her develop many of the technical skills she would need to play *StarCraft II* at a high level. She provided us with an example, "What is WASD [commonly used keyboard buttons for directional control in games]? You move using those controls in a game. If you only use your computer to check your email, it's incredibly difficult ... to get into the gaming scene."

For Mona, having access to a geeky sibling exposed her to the many nuances of technology use. But she also mentioned that access is not just about having technologies at home. It is the development of an optimistic and positive attitude toward technology that is modeled by one or more family members. Technologies at home, which are not restricted to just *StarCraft II*, are important platforms in which family members can engage in technology-related dialogue and for relevant learning to take place (Barron et al. 2010).

But developing a space in which parents and children can share interests may not be a straightforward endeavor. Parents do not typically participate in *StarCraft II* activities, particularly if their children are teenagers. For example, Sixen received a lot of technology exposure from his father starting from the age of five. However, at the age of 13, he began to venture on his own into the online community Staredit.com. At that age, support from parents may take a backseat to that of the youth's immediate

peers. When Day[9] was 15 years old, his mother, seeing how passionate he was about *StarCraft*, accompanied him and his brother to the World Cyber Games tournament in Los Angeles, California. He was immensely grateful to his mother, but he also joked at how it might have gone wrong:

> And ... the problem is that we show up and we're the two kids whose mom came with us. Oh God! Oh! How revolting to be cool at that age, to be [accompanied by your mother], you know? ... But you know, she was really polite, she didn't try to step in, be like, you know, 'I'm ... [Day[9]'s] mom!'... She was very low key and went off, and you know, just like read a book.

Day[9] was grateful for a parent who was quietly supportive of his interest, which created gateways for him to enter a professional gaming career in *StarCraft II*.

The openly networked environment in *StarCraft II* allows players such as Sixen, Alex, and Mona to connect their *StarCraft* learning across home and peer-supported settings. Family members such as parents and siblings can act as role models and can support children in developing useful skills and positive attitudes helpful to long-term online participation. Parents and siblings can also expose children to technologies such as computers and *StarCraft II* as fun, interesting, and exciting tools while gradually introducing them to productive activities such as modding and esports. Our informants, for example IronManSC, suggested that having a family culture that is centered on creative production helped him develop interest in modding—a merger of his interests in gaming and art. Likewise, Alex chose to contribute to *High School Starleague* and esports by drawing upon lessons learned in civic responsibility from his parents. These examples show the critical role that the home environment plays in nurturing interest and expertise in a challenging game like *StarCraft*.

ALEX
Growing Up in a Video Game Family

Alex grew up in what he called a "video game family"—a family environment that was uncommon among those whom we had interviewed. "I was extremely lucky as a kid to have a family that was interested in gaming and that considered it a decent pastime," Alex told us. Not only did Alex have two siblings and a father who would play video games, but they would do so together as regular family activities. For Alex, video gaming is just like prime time TV is to other families—it is decent and it is social.

Alex told us about his daily middle school routine: He and his brothers would come home from school at around 3:00 p.m., do homework, eat dinner at 6:00 p.m., and play video games together from 7:00 to 8:00 p.m. By engaging in video gaming with their children, Alex's parents helped him establish a healthy routine that balanced activities such as playing games with school, family time, and even community service.

Today, Alex is an academic achiever with a 4.0 GPA who participates in the International Baccalaureate (IB) program. At school, Alex helps organize, but also competes in, the *High School Starleague* (HSL), which like the *Collegiate Starleague* organizes competitive leagues for hundreds of high schools in the United States. After school, he completes five hours of homework. After dinner, he spends about an hour playing *StarCraft II*. On weekends, he participates in a weekly video game party organized by his eldest brother, Tom, who now owns a house.

All of Alex's family members supported his video gaming interest in different ways. Tom, now 25 and 10 years older than Alex, may be the most influential in this respect. Tom owns a software company and had long moved out of his parents' house. But when they were living together, Alex looked up to Tom in everything he did—*StarCraft*, anime, and other games. Through shared interests with a caring brother, Alex picked up *StarCraft* when he was just seven years old. Because gaming and being social were synonymous activities in his family, Alex had many opportunities to play games with Tom's friends during LAN parties. "We always were interested in the same things, always participated in a large group of friends."

As part of a video game family, Alex's mother was certainly not out of the picture. While his mother was not interested in gaming herself, she was extraordinarily supportive of her boys. "She's really supportive of pretty much everything that we do. She was always organizing the LAN parties, and getting the food and stuff like that," Alex recalled.

Support from Alex's family was important to him through middle school, where gaming was heavily stigmatized. That is, at his school, most teachers and students thought that if you were playing video games, "you're just melting your brain away." Thus, he had no outlet at school to share something he was passionate about. However, given the opportunities he had at home, he was comfortable just presenting himself as a soccer player at school. "Strangely enough, the majority of my middle school, if you asked them, would probably say, 'Alex is not a gamer,'" Alex told us. As Alex grew older, support for his video gaming gradually shifted to friends at his high school.

Today, the brothers are busier than ever. Tom is running a company. His middle brother is attending college. And Alex is participating in the International Baccalaureate program at his high school, which he acknowledges requires a lot more work than when he was in middle school. To maintain all As for his grades, he studies five to seven hours a day on average:

> IB is so intense sometimes, I do try to—well, I mean, I do very little gaming through the week, but I do have time during the weekend where it's just, this is my dedicated gaming time, and my parents will respect that. But the priority is always, school is more important than gaming. And I recognize that. So, it's a mutual ground. Which is, my grades start dropping, I stop playing computer games.

ALEX
Growing Up in a Video Game Family

Because of how life has changed for the siblings, they have less time for family activities. However, they still make it a point to get together at least once every two weeks at Tom's house for LAN parties.
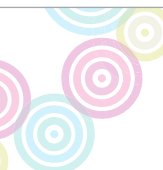
Although he now spends less time with his siblings, Alex is delighted to find friends at high school who are interested in *StarCraft II*: "It's actually pretty awesome people in IB. A large population of the IB, at least between the juniors and the sophomores, play *StarCraft* or are interested in various games, or are interested in card games like *Magic: The Gathering* and stuff like that."

This group of friends, and Alex counted about 10 of them, often gather for LAN parties. And they play not just video games, but also *Magic: The Gathering* and chess. Within the group, Alex found a friend who was interested in robotics, and both of them participated in a robotics club known as Exploding Bacon Robotics. Alex acknowledged that there were probably other video gamers in the school. He told us that console games were extremely popular. But his group of friends took a different approach to video games— they treated games "competitively and seriously."

Thus, until high school, Alex's video gaming interests were mainly supported by his family members. His father, his two brothers, and his mother, directly or indirectly presented computer gaming as a guilt-free and admirable interest. Because gaming is admirable, it becomes open—LAN parties are normal parts of his home and social life. When gamers were stigmatized at his middle school, he continued to receive support at home that ensured that his interests did not wither away. Instead they were extended into his high school years and beyond.

CONCLUSION

By examining the *StarCraft II* community from both player and developer perspectives, we were able to deepen our understanding of the connected learning principles. The *StarCraft II* environment gives participants an opportunity to engage in either competition or mod-based production that is peer-supported and interest-powered. The participants seek to become better players or designers, and they do so within a community filled with openly networked supports. Some of these supports have been made available by Blizzard Entertainment; others by members of the community. These supports include things such as tools to support mod creation, a highly developed matchmaking system that connect peers of similar ability level, a ladder system that helps players see pathways to improved expertise, online forums, social groups, and a robust ecology of shared gameplay videos and analyses. The process of becoming better players requires participants to become students of the metagame and to acquire deep comprehension of the game mechanics and shifting social discourses of strategies. In this process, players commonly identify like-minded peers in different social spheres who can help them. These social spheres can be found at home, in school, in public spaces, or online.

We found that participants were able to grow their expertise and participate more deeply as leaders and insiders in the community, as they shifted from one social sphere to another. This suggests that learning in *StarCraft II*, like learning associated with other geeky interests such as chess or robotics, can progress even if it occurs across a range of social circles and at different times. Further, learning does not start with the game itself—many informants developed an interest in gaming at home from family members. Learning also does not stop with the game—some participants may move on to become IT or gaming professionals or join another gaming community. In the case of *StarCraft II*, many players either came to the community from, or move on to engage with, communities associated with other Blizzard products, such as *Diablo*, *Warcraft*, or *World of Warcraft*. Thus, continuous participation within an ecosystem of technology-centered learning circles can help deepen the participants' expertise and social skills.

We also found that several design features of the game, including unlocked maps, matchmaking, replay functionality, and tools that facilitate discoverability and sharing, enable both the competitive and productive practices at play within the community. The game's developers have thoughtfully considered the ways in which players might more quickly and easily participate in the game. In so doing, they simultaneously fueled its power as a connected learning platform.

Last, *StarCraft II* offers participants a chance to develop soft skills that seem highly relevant to future work environments, characterized by constant competition and nonstop learning. In such environments, actors who are interest-driven and peer-supported are likely to perform better. But in order to galvanize peer support, learners have to learn to participate deeply and congenially, exercising skills, such as openness toward criticism, initiative, and civic mindedness. With participation in the community so closely linked to learning, encouraging youth to actively engage

in communities in the process of their learning is important. Families and educators invested in creating and supporting daily structures of participation of young people are in a position to inspire them toward intellectual and technological pursuits. They have a very big role to play, as do the developers of communities that may be drawing young people in large numbers.

For educators in the twenty-first century, online communities such as those that have been established around games such as *StarCraft* offer exciting models of peer-based learning environments. Players can move at their own pace, take advantage of a diverse set of resources created by other players, and are invited to contribute their own knowledge and expertise. And perhaps most important, they have access to experts such as Day[9] who share their talents for free. "*StarCraft* is a space of inquiry in which to test yourself," says Day[9]. "It is all about asking, 'What works here?' How cool is that?"

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